(No Model.) 2 Sheets—Sheet 1.

# E. THOMSON & E. W. RICE, Jr.

## ELECTRO MAGNETIC CUT-OUT FOR ELECTRIC LAMPS.

No. 430,326. Patented June 17, 1890.

Fig. 1

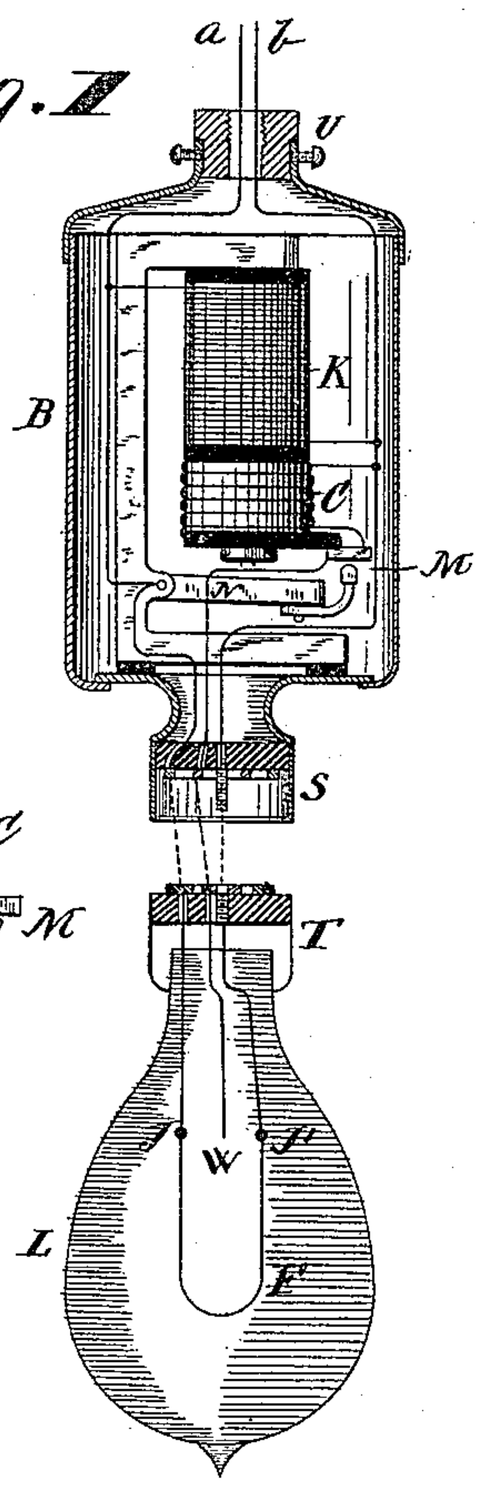



Fig. 2.

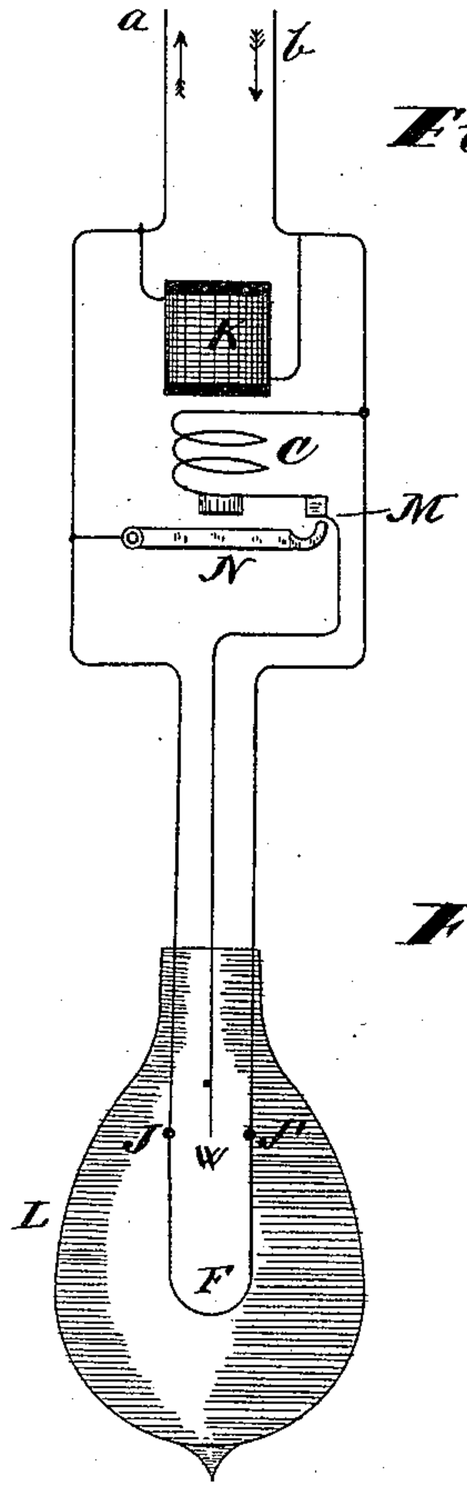



Fig. 3.

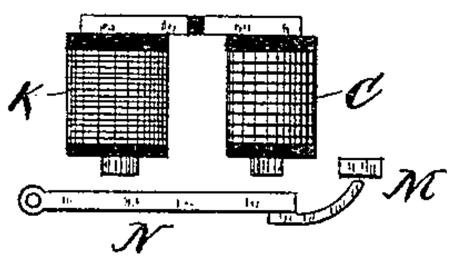



Fig. 4.

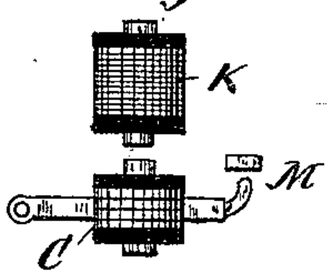



Fig. 5.

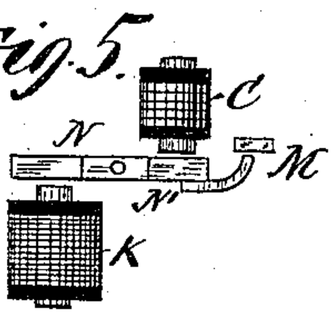



Fig. 7. Fig. 8 Fig. 9. Fig. 10.

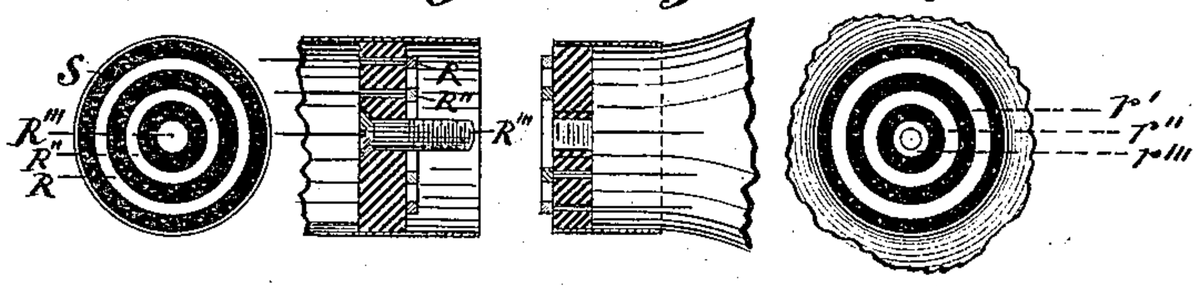
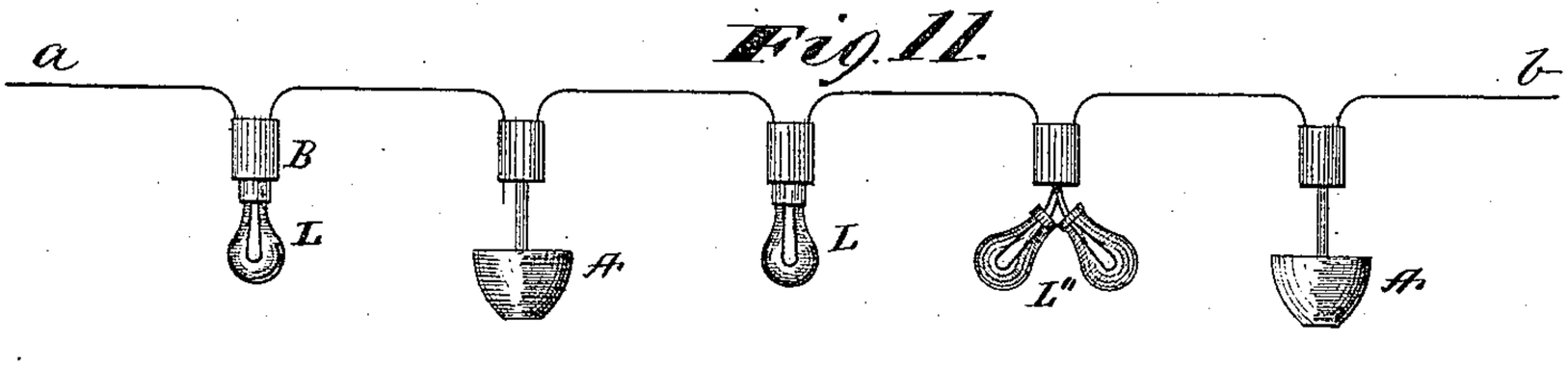



Fig. 11.




WITNESSES:

Gabriel. J. W. Gabster.

Wm. F. Capel

INVENTOR

Elihu Thomson

E. Wilbur Rice Jr

BY

Townsend & Mac Donald

ATTORNEY

(No Model.) 2 Sheets—Sheet 2.

# E. THOMSON & E. W. RICE, Jr.

## ELECTRO MAGNETIC CUT-OUT FOR ELECTRIC LAMPS.

No. 430,326. Patented June 17, 1890.

Fig. 6.

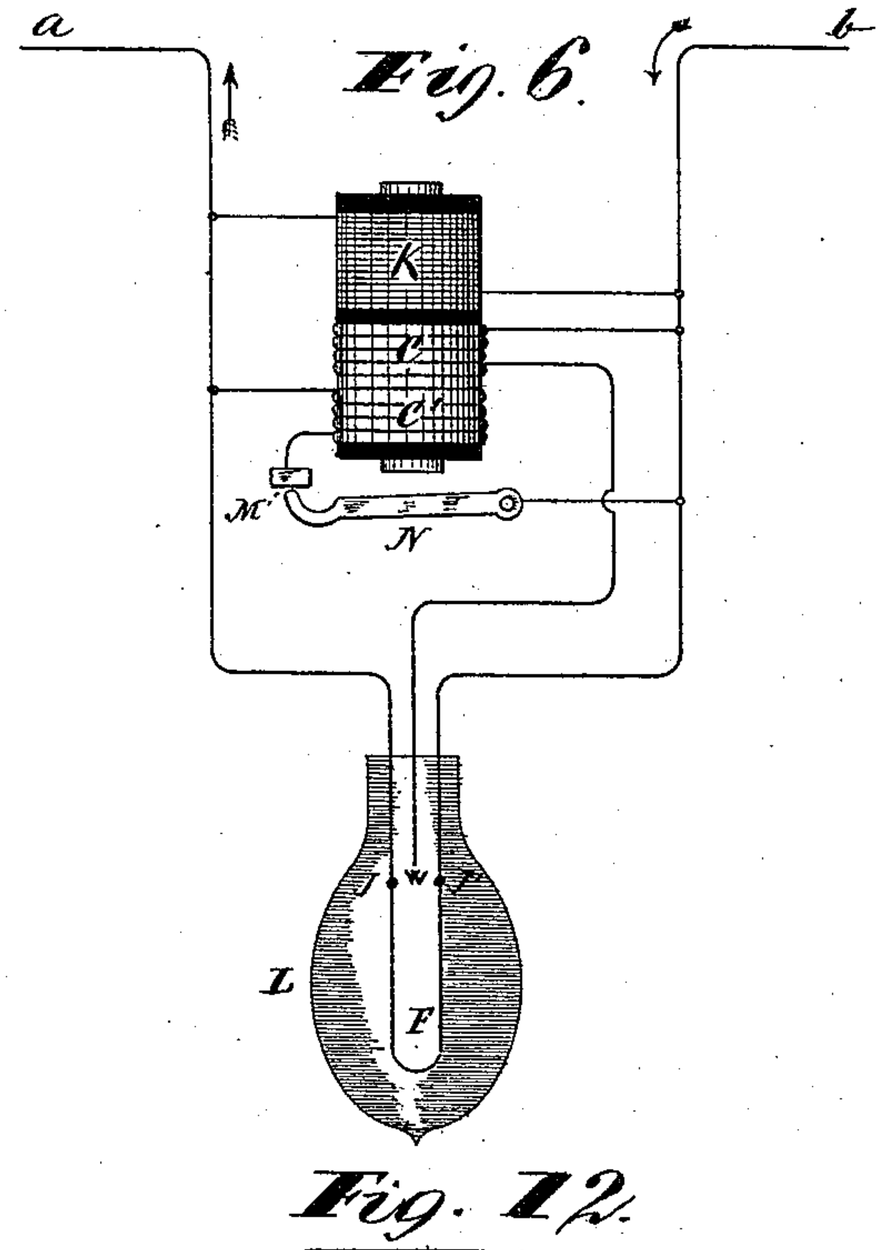



Fig. 12.

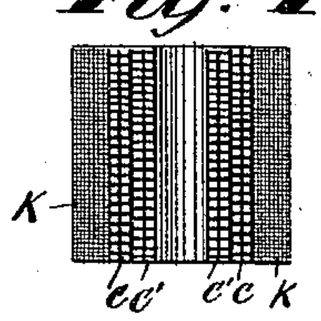
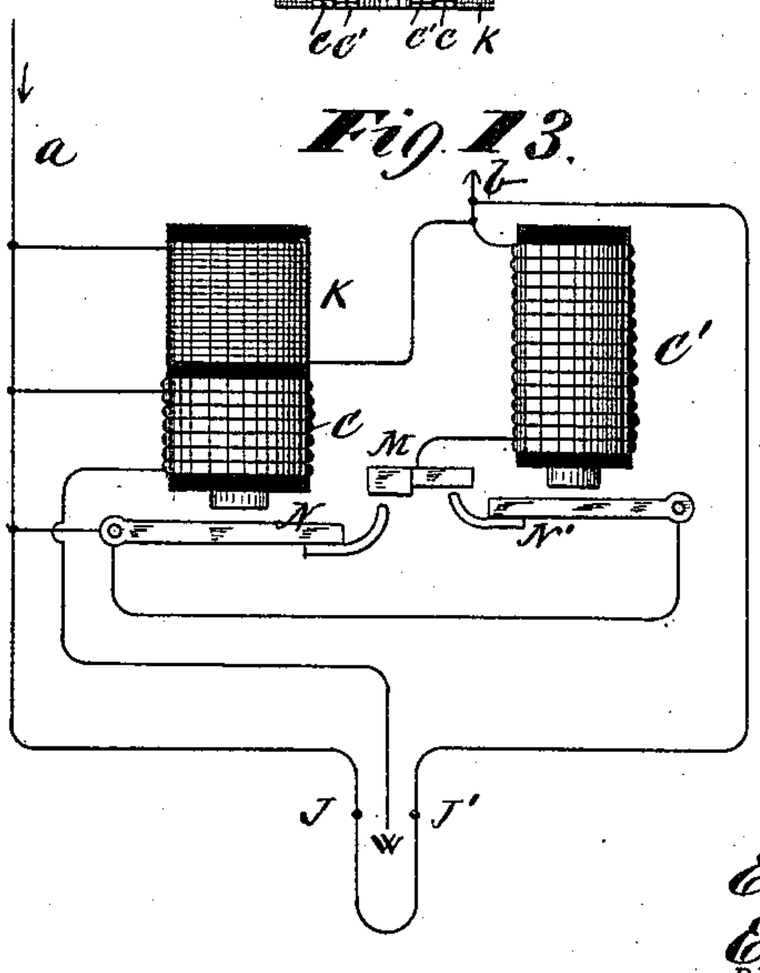



Fig. 13.




WITNESSES:

Edmond J. W. Galsley

Wm. H. Capel

INVENTORS

Elihu Thomson

E. Wilbur Rice Jr.

BY

Townsend & Townsend

ATTORNEY

# UNITED STATES PATENT OFFICE.

ELIHU THOMSON AND EDWIN WILBUR RICE, JR., OF LYNN, MASSACHUSETTS.

## ELECTRO-MAGNETIC CUT-OUT FOR ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 430,326, dated June 17, 1890.

Application filed September 6, 1886. Serial No. 212,770. (No model.)

*To all whom it may concern:*

Be it known that we, ELIHU THOMSON and EDWIN WILBUR RICE, Jr., citizens of the United States, and residents of Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Electric Cut-Off Apparatus for Electric Lamps, of which the following is a specification.

Our invention relates to devices for shunting incandescent lamps when run in series upon a line of constant or nearly constant current, so as to preserve the continuity of the line in case of rupture of the carbon conductor of the lamp or in case of other accidents, such as partial diversion of current around the filament by arcing over the vacuous space. Two conditions arise in practice which demand that a lamp be cut out—*i. e.*, abnormally high resistance or abnormally low resistance occurring in the lamp from any cause.

Our invention is particularly designed to facilitate the running of incandescent lamps of large candle-power on arc-light circuits of, say, four, six, to ten ampères, as may be needed, the incandescent lamp being constructed to take the whole current of the circuit.

To this end our invention consists, primarily, in constructing the lamps with a third wire, or a wire in addition to the wires holding the filament, and we use this third wire to operate a cut-off coil for closing a shunting contact around the lamp; but this cut-off coil is arranged to be combined in its action with that of a high-resistance derived-circuit coil around the lamp.

In the accompanying drawings, forming part of this specification, Figure 1 is a side elevation of a lamp embodying our invention. Fig. 2 is a diagrammatic representation of the windings and connections of the lamp shown in Fig. 1. Figs. 3, 4, and 5 show modified arrangements of the magnet-coils. Fig. 6 shows another modification. Figs. 7, 8, 9, and 10 are detail views of a lamp-socket embodying our invention. Fig. 11 shows a system of lamps embodying our invention. Fig. 12 shows a modified way of winding the magnet-coils. Fig. 13 shows a modification of the arrangement shown in Fig. 6.

In Fig. 1, B is a box or case surrounding and inclosing the mechanism. K is a shunt or derived circuit fine-wire coil on the magnet shown, and C is a coarse-wire coil. N is the armature of the magnet which, when attracted, closes a contact at M. S is the socket, and T the neck, of the incandescent lamp L, fitting the socket and making connections. J J′ are the wires to filament F, and W is the middle wire carried into vacuous space of lamp between wires J J′, preferably. U is a screw-union for supporting the box B, as by a pipe from the ceiling. *a b* are the wires leading from the line of constant current or the like. Normally when lamp L is lighted and is of normal resistance the current passes from *a* to *b* directly through the lamp, a small portion being carried through the fine-wire coil K, but not sufficient to attract the armature N so as to close contact at M. When lamp L is too high in resistance, however, coil K is energized, so as to attract the armature N, thereby closing contact M, at which time the current passes from *a* to *b* through the coarse coil C in same direction as in K, serving to hold the contact closed and shunt the lamp L. To this end one wire from C is carried to *b*, the other to the upper contact at M, while the lower contact, carried by the armature, is attached to a wire from *a* through the frame or pivot of said armature. When the contacts are closed at M, it is obvious that circuit from *a* to *b* will be formed through the coil C, but that so far as the contacts are concerned the coil C will be out of circuit when the armature N is retracted. A connection for coil C independent of the contacts, whereby the coil C may act in conjunction with K in drawing up the cut-out lever, is afforded by the wire leading down, as shown, to the middle wire W of the lamp. This connection may be readily made by simply attaching a wire to the upper contact M, to which one end of the coil C is joined. Now, should an arc form from J to J′ in the lamp-chamber, (which might occur upon a rupture of the filament,) the wire W will be included in the circuit or arc whether the arc so formed have a higher or lower resistance than the filament, and the current will pass in part through the coarse coil C, lift the armature N, and close the contact M, after which the lamp will

remain shunted, as before described. It is preferable in the construction to connect *a b* to the lamp-circuit, so that the current enters at *b* from positive pole and leaves at *a* to negative pole, as this disposition is found to favor diversion of current to C to close the contact under the circumstances just mentioned. The connections are more clearly shown in Fig. 2, which has the same reference-letters as in Fig. 1. It is not essential that both coils K and C be wound on the same core or in the same axial positions. Thus in Fig. 3 the coils K and C are independent, though acting on a common armature. In Fig. 4 the coil C is wound on a core which is itself the armature for the magnet K. In Fig. 5 the magnet-coils K C act on separate armatures to close the contact at M. In any such disposition the principle is the same as in the foregoing devices.

Fig. 6 shows a modification in which the coil C of Figs. 1 and 2 is replaced by two coils C and C′, one end of a coil C being connected with *b* and the other end to W, the middle wire of the lamp. The coil C′ has one end attached to upper contact at M and the other to line *a*, as shown, so that it is thrown into circuit as a shunt upon the closure of the contact M, the lower contact, carried by N, being in connection with line *b*. The windings are in such direction as to assist one another. The action is the same as in Fig. 1, excepting in so far as the coils C and C′ act successively. When an arc is formed from J to J′, the third wire W is in its path, and current is thereby diverted through the coil C, the circuit being from line *b* to conductor J′ and over to J, and from line *b* through coil C to wire W and over to conductor J. The armature N is thereupon attracted and closes contact M, at which moment current passes from line *b* to armature N and lower contact, to upper contact, and through coil C′ to line *a*.

In Fig. 12 it is shown that the windings may be superposed layers around a core, and it is evident that other simple modifications in the mode of winding may be resorted to.

In order to effect an easy and rapid connection of the lamp to the cut-off devices, a special socket S, Fig. 1, is attached to the case B, and the lamp L has a neck-piece T, constructed to match. The socket S has, as shown in Figs. 7 and 8, two metal rings or pieces R R″, which surround the central screw R‴, but are insulated, respectively, by being mounted on an insulating-block. One of the rings R R″ should be springy or yielding, so as to allow the use of the neck-piece constructed similarly with a threaded hole to fit screw R‴ of the socket. The neck-piece is shown in Figs. 9 and 10, and the connecting-pieces are marked *r′ r″ r‴*. Wires are carried to each of the pieces R R″ R‴, as in Fig. 1, and to each of pieces *r′ r″ r‴*, as in Fig. 1, so as to make, when the parts are screwed together by R‴ *r‴*, the attachments described as made in Figs. 1 and 2.

In the circuit from *a* to *b*, Fig. 11, is indicated the employment of arc lamps A with incandescent lamps L, used with our cut-off device, as described.

In Fig. 13 one of a number of similar modifications is shown. Thus, instead of causing a direct shunting of the lamp by the derived-circuit coil connected with the middle wire, as in Fig. 6, such coils may act simply to call into action a separate shunting-magnet and armature, as C′ N′, Fig. 13. Either of the coils K or C being sufficiently energized causes the attraction of the armature N, the connections being quite like those in Fig. 6; but when N closes a contact at M current then flows from *a* to lower contact carried by N, to upper contact M, through coil C′, to line *b*, thus causing the attraction of armature N′ and closure of contact to M from N′, in which case current passes from line *a* to lower contact carried by N′ to M and through C′ to *b*, thus holding the shunting-path through C′ closed.

What we claim as our invention is—

1. In a cut-out for an electric lamp, the combination of a cut-out lever, shunting-contacts controlled thereby, but normally open, two primary actuating-coils for said cut-out lever, one a derived-circuit coil in circuit around the lamp and the other in a circuit, the connections for which are independent of the contacts, which are closed by the operation of the lever, whereby said second coil may act in conjunction with the derived-circuit coil in establishing the cut-out circuit, as and for the purpose described.

2. The combination, with an incandescent lamp, of a third wire extending into the vacuous space, a low-resistance coil attached thereto at one end and to a leading-in terminal at the other, a high-resistance derived-circuit coil, and mechanism whereby a cut-out shunt is closed and retained closed when either coil is unduly energized, as and for the purpose described.

3. The combination, with an incandescent lamp, of a third wire extending into the vacuous space, a low-resistance coil attached thereto at one end and to a leading-in terminal at the other, a high-resistance derived-circuit coil, an armature or equivalent device common to said coils, and mechanism whereby such armature or equivalent device will close a shunt-circuit through the low-resistance coil by the action of the high-resistance coil and be retained closed thereafter by the action of the low-resistance coil, as and for the purpose set forth.

4. A socket for an incandescent lamp, having a center screw to fit a counterpart in the lamp-neck, and two insulated metallic rings or sections corresponding to metallic rings or sections in said neck, one of the three connections so provided being attached to a middle or third wire conductor of the lamp when in use, as and for the purpose described.

5. In an incandescent lamp, the combina-

tion of a lamp-neck provided with three insulated metallic contacts and a socket adapted to receive such neck and provided with three corresponding metallic contacts, said contacts making connection with the terminals of the lamp and a third wire conductor when the lamp is in use, as and for the purpose described.

6. An incandescent lamp provided with the usual terminals and with the third wire entering the lamp and also provided with a neck adapted to fit into a corresponding socket, the neck and socket being provided with three matching insulated conducting rings or sections on their meeting faces, whereby connections may be had to said terminals and to said third wire, as and for the purpose specified.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 31st day of August, A. D. 1886.

ELIHU THOMSON.
E. WILBUR RICE, JR.

Witnesses:
J. W. GIBBONEY,
GEO. W. DAVENPORT.