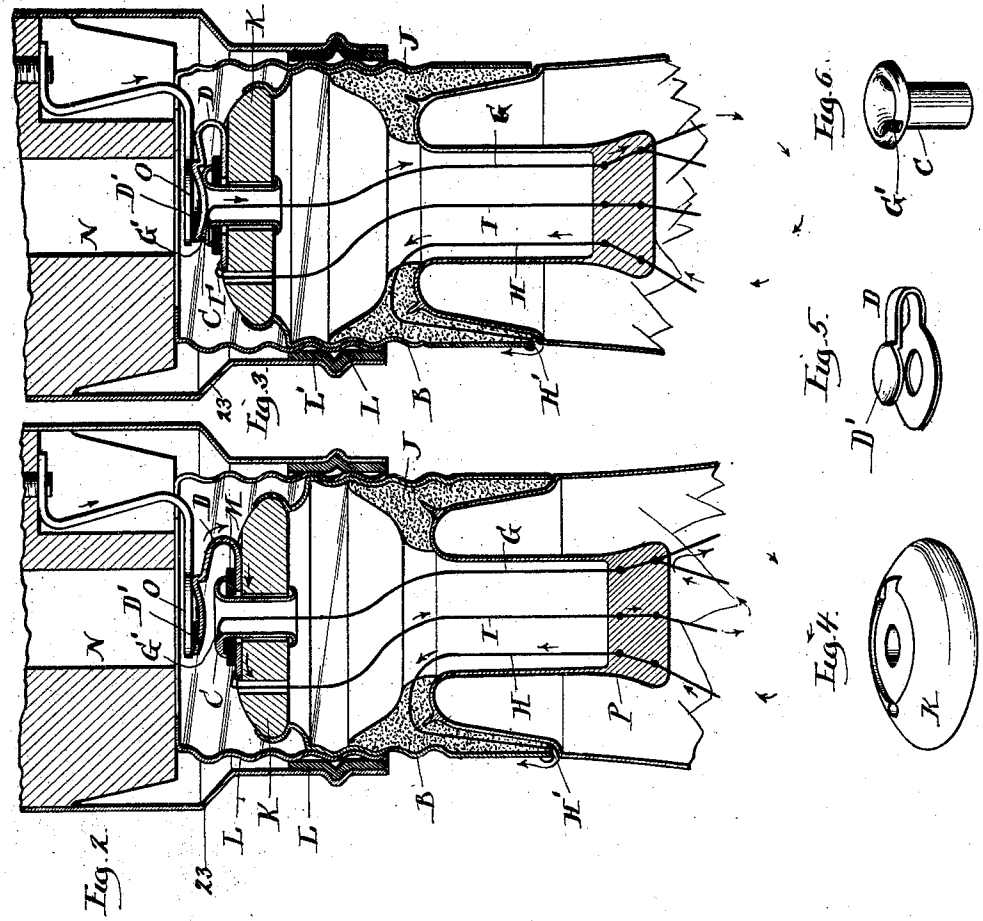
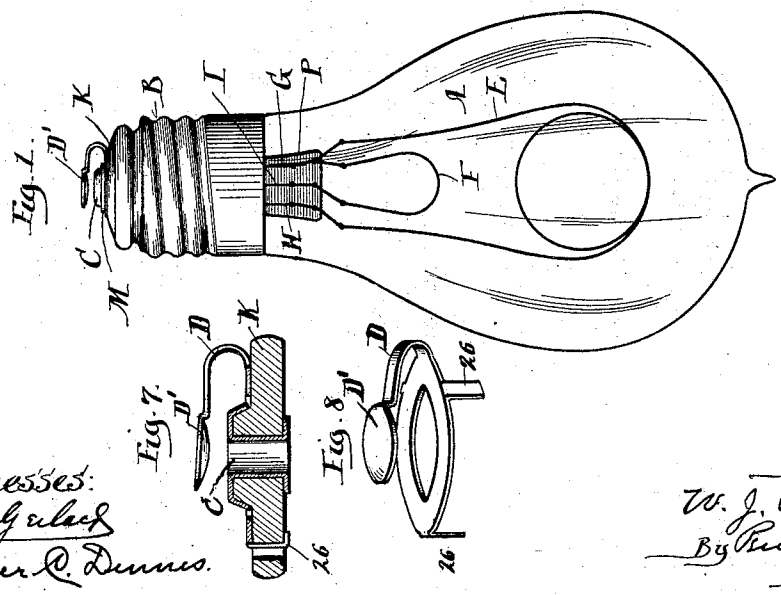
(No Model.) 3 Sheets—Sheet 1.

W. J. PHELPS.

ELECTRIC INCANDESCENT LAMP.

No. 603,705. Patented May 10, 1898.





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Fig. 13.

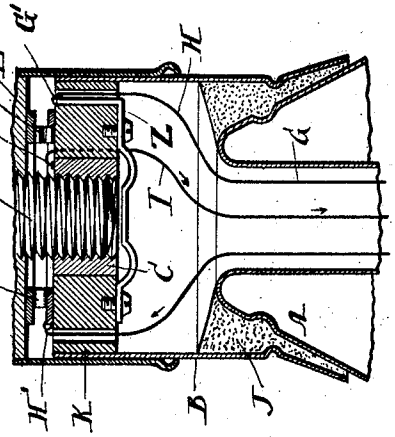


Fig. 14.

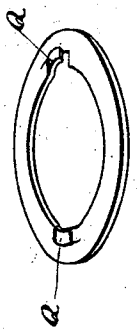


Fig. 10.

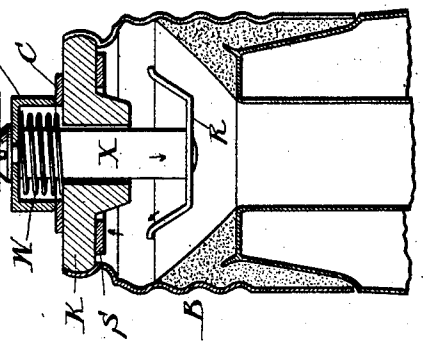


Fig. 12.

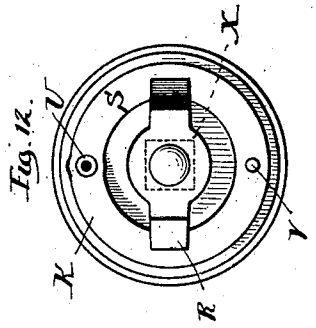


Fig. 9.

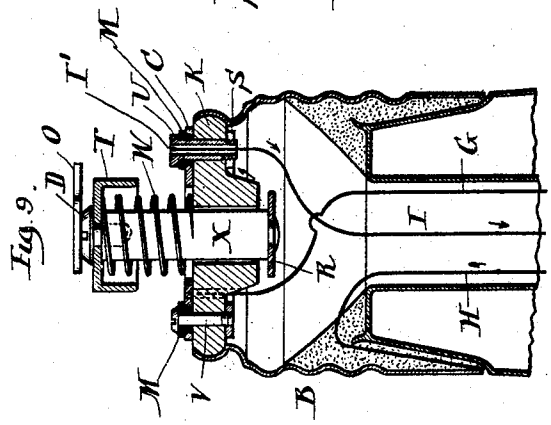
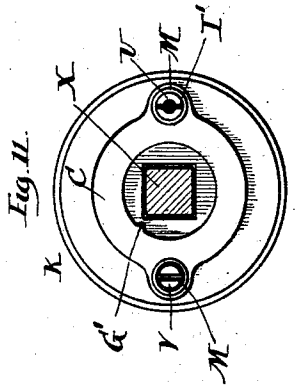


Fig. 11.



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Fig. 18.

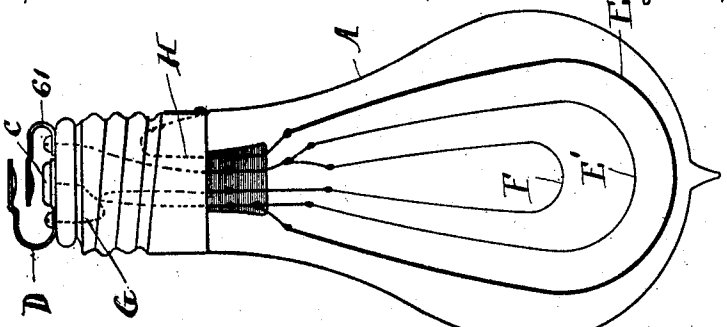


Fig. 17.

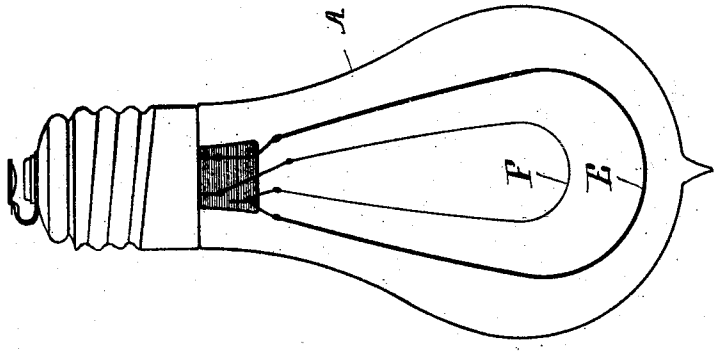


Fig. 16.

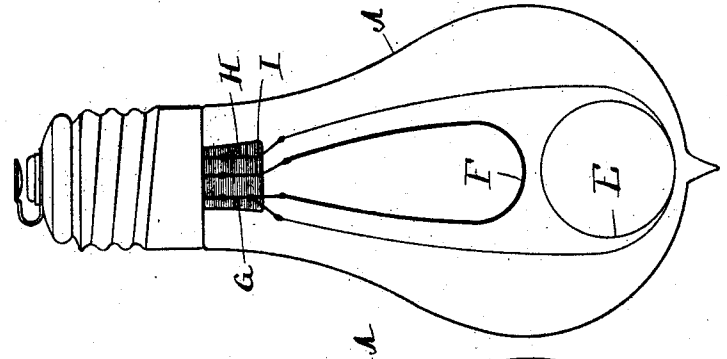
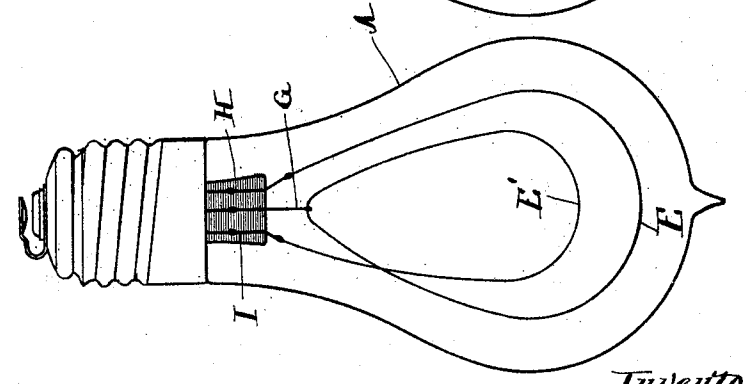


Fig. 15.



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UNITED STATES PATENT OFFICE.

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ELECTRIC INCANDESCENT LAMP.

SPECIFICATION forming part of Letters Patent No. 603,705, dated May 10, 1898.

Application filed September 7, 1897. Serial No. 650,870. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM J. PHELPS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Incandescent Lamps, of which the following is hereby declared to be a full, clear, and exact description, sufficient to enable those skilled in the art to make and use the same.

In the electric incandescent lamp of familiar construction no means is provided for varying the intensity of individual lamps from the maximum candle-power for which they have been designed. Various methods have been proposed from time to time for accomplishing such regulation and have been made the subject of Letters Patent.

Considerable groups of lamps, as in theaters, are modulated by varying the effective voltage of the electric supply through adjustable resistance inserted in the circuit, and it has been proposed to apply the same method to the individual lamp, a small rheostat being formed as a part of the lamp-socket. Other inventors have proposed to employ several circuits differing in electromotive force and either to arrange a lamp to be burned on any of the circuits or to provide a multiplicity of lamps on the several circuits, so that a light of the desired intensity may at any time be selected. Again, it has been suggested that several filaments of different candle-power be mounted in one vacuum-bulb in connection with means for turning on the current to any one filament or to several at once. Finally, it has also been proposed to mount two filaments in one vacuum-bulb under the control of a commutating-switch arranged to burn either filament alone, both in parallel, or both in series, thereby securing three different intensities of illumination. The qualities of the incandescent filament are such that white light coincident with reasonable durability is only secured through an exceedingly small range of electromotive force, which is the critical voltage for which the filament is designed. More voltage causes the lamp to blacken and, if continued, to burn out, while less than the critical voltage causes the filament to emit a yellow and then a red light, growing more dim down to the point of no light. Modulation of one incandescent filament by varying the effective voltage is therefore attended with the disadvantage that the lamp is burned at anything less than maximum intensity, with poor color and low efficiency. On the other hand, a multiplicity of lamps or of filaments in parallel in one bulb is relatively expensive and has the disadvantage that the least intensity practical at the usual voltages is as great as eight or ten candle power.

My invention is intended to secure an economical incandescent lamp in which widely-differing intensities may be obtained without materially changing the quality or color of the light emitted. It is a further object to provide a modulating incandescent lamp of such form that it may be used without a socket of special construction, but which may be used interchangeably with ordinary lamps.

The nature of the improvements will appear in detail from the description following, and will be more particularly pointed out by claims at the conclusion thereof.

In the accompanying drawings like parts of structure are denoted by like marks of designation throughout.

Figure 1 is an elevation of my improved lamp with Edison-type base. Figs. 2 and 3 are enlarged vertical sections of the lamp-base and a portion of an Edison socket, respectively, showing the lamp in the two positions of least and greatest intensities. Figs. 4, 5, and 6 are enlarged perspective views showing parts of the lamp-base. Fig. 7 shows in enlarged vertical section an alternative construction for the parts illustrated in Figs. 4, 5, and 6. Fig. 8 is an enlarged perspective view of the shunting-spring which forms part of Fig. 7. Figs. 9 and 10 show two enlarged vertical sections of a lamp-base so constructed that the current is turned off during the change from the position of greatest to that of least intensity, and vice versa. Fig. 11 is a plan view, partly in section, looking at the top of Fig. 9. Fig. 12 is a plan view looking at the bottom of the lamp-base shown in Fig. 10. Fig. 13 is an enlarged vertical section of a Thomson-Houston lamp-base and part of a Thomson-Houston socket, showing my improvement as applied to this type

of lamp-base. Fig. 14 is a perspective view of the contact-ring which forms part of Fig. 13. Figs. 15, 16, 17, and 18 show diagrammatically various embodiments of my invention, illustrating features which form the subjects of the claims.

Referring now to Fig. 1, A is the glass bulb of an incandescent lamp; B, the metal screw-base of familiar Edison type; E, the incandescing filament, and H and G the leading-in wires, sealed into the glass neck P.

F is an auxiliary filament connected to G and to the extra leading-in wire I.

K is a disk of insulating material, (preferably porcelain,) to which the shunting-spring is secured by a tubular rivet C. Rivet C is insulated from the shunting-spring D by the washer M and is preferably clenched on the under side of K. The free end of the shunting-spring D carries a round disk D′, which is slightly concavo-convex, as shown, in order to more readily engage the various styles of central contact used by the several makers of Edison-type sockets.

In Figs. 2 and 3 the bulb A and filaments E and F are broken away and the remaining parts, as hereinbefore described and designated, are shown in vertical section, the scale being enlarged to secure greater clearness. Part of the porcelain core of an Edison socket is shown at N, to which are attached the central contact O, the screw-shell L, and the outer shell 23, which is insulated from L by the bushing L′, of fiber or other suitable insulating material. The leading-in wires are electrically connected as shown at H′, I′, and G′—H to screw B, I (through a hole in K) to shunting-spring D, and G to the head of tubular rivet C, being passed through the rivet and secured in a small groove, (shown at G′, Fig. 6.) The glass bulb is secured to the base B by means of the customary plaster-of-paris filling, (shown at J.)

Figs. 4, 5, and 6, respectively, show enlarged perspective views of the porcelain disk K, the shunting-spring D, and the tubular rivet C.

The alternative construction shown in Figs. 7 and 8 is intended to enable the advantages of my invention to be realized with the smallest possible change in the design of the common Edison-type base. The parts K, C, and C′ are substantially the insulating-disk and central contact used by several manufacturers. The shunting-spring D in this case is secured to disk K, concentric with C′, (but separated from it,) by means of the prongs 26, which are passed through holes in K and clenched. Thus the addition of the part shown in Fig. 8 to the ordinary Edison-type lamp-base will fit it to be used in connection with my bifilament lamp. If the parts are in the position shown in Fig. 2 and the contact O be connected to one pole of an electric circuit, current will flow to shunting-spring D and thence by leading-in wire I to the auxiliary filament F, thence through the main filament E, the leading-in wire H, and the screw B to the shell L, which is connected to the opposite pole of the circuit. The auxiliary filament will now glow with a small white light, and the main filament will be black or only dull red. If now the globe A be turned toward the right so as to drive the screw B into the socket-shell L, the shunting-spring D will be pressed down against the rivet C and the parts will then assume the relation shown in Fig. 3. In this position current flows from central contact O to disk D′ and thence by the path of least resistance to rivet C, leading-in wire G, and main filament E, returning by leading-in wire H, screw B, and shell L, which is connected to the opposite pole of the circuit. The main filament now being subjected to the maximum electromotive force burns with full incandescence, passing the normal current for which it has been designed.

Owing to the fact that the resistance of the filament increases with the decrease of current it may be desirable, in order to avoid straining the auxiliary filament, to turn out the main filament and allow it to cool before connecting the two in series. This is accomplished by the means shown in Figs. 9 and 10. B is the screw-base of Edison type. K is an insulating-disk (preferably porcelain) fixed in one end of same. C and S are two flat rings secured on either side of K by means of the screws U and V, which are separated from the ring C by the insulating-bushings M M. The screw U is drilled to permit the passage of leading-in wire G. X is a square rod of metal passing through disk K and having on one end the light spring R and on the other end the cap T, secured by screw D. The stiff spiral spring W forces the parts into the position shown in Fig. 9. In this position the screw D being against the central contact of an Edison socket O, current passes through X to R, and thence through ring S, tubular screw U, and leading-in wire I to both filaments burning in series. On screwing the lamp farther into its socket spring R leaves the ring S, thereby breaking the circuit; but a further movement establishes the circuit again, as shown in Fig. 10. Current now passes from screw D to cap T and ring C, thence by leading-in wire G (through a hole in disk K) to the main filament burning alone. The current returns in either case by leading-in wire H to screw-base B. If now the lamp be partly unscrewed from the socket, it is evident from the construction that the cap T will leave the ring C before the spring R can touch the ring S. Thus the main filament will be turned out (and will quickly cool, thereby reaching the condition of greatest resistance) before being connected to the circuit in series with the auxiliary filament. The sections shown in Figs. 9 and 10 are at right angles to each other and approximately double size. Fig. 11 is a plan view looking at the top of the lamp, with the cap T and

spring W removed. The screws U and V and the ring C are shown together with a section of rod X. Leading-in wire G is soldered to ring C at the point G', and leading-in wire I is soldered to the screw U (in electrical connection with ring S) at the point I'. Fig. 12 is a plan view looking at the bottom of Fig. 10, with the glass bulb and plaster-of-paris filling entirely removed. Spring R, ring S, and screws U and V are shown, and rod X is indicated by the dotted lines.

Referring to Fig. 13, B is a metal shell, in one end of which is secured the disk K, of insulating material, (preferably indurated fiber or other similar composition.) The disk K surrounds the nut C, to which the leading-in wire I is soldered at the point I' and carries the flat springs Q, to which the leading-in wire H is soldered at the point H'. A portion of the vacuum-bulb is shown at A, secured to B by the plaster-of-paris filling J. The flat spring Z is secured to the under side of disk K in such a position as to make contact with the central post O of a Thomson-Houston socket when screwed into nut C. Spring Z carries a prong at one end which projects through disk K and connects with leading-in wire G at the point G'. The springs Q are arranged in a circle concentric with, but insulated from, the nut C. N, L, and 23 are portions of a Thomson-Houston socket, together with the post O. If now this base be screwed into a Thomson-Houston socket until springs Q touch the annular contact-plate L, which forms one pole of the socket, the current will pass from springs Q and leading-in wire H through both filaments in series to the leading-in wire I and nut C. The auxiliary filament will then be alight. On screwing the lamp still farther into its socket the springs Q will be bent down and the contact-post O of the socket will touch the spring Z. The auxiliary filament will then be shunted by the superior path offered by leading-in wire G and spring Z, and the main filament will then burn with full candle-power.

Fig. 14 is a perspective view of the annular spring-contact, (shown in section at Q Q, Fig. 13.)

In the form of my lamp shown in Fig. 1 the auxiliary filament has usually a smaller cross-section than the main filament, so that the amount of current which will bring the auxiliary filament up to white incandescence is insufficient to make the main filament luminous or at most more than red-hot. The design is such that the cold resistance of the main filament E (or its resistance when warmed much below the temperature of white incandescence) when added to the hot resistance of the auxiliary filament F is just sufficient to pass the normal current required by the auxiliary filament when both filaments in series are subjected to the electromotive force for which the lamp has been designed.

The design may be varied through a great many combinations according to the length and cross-section of the filaments. The auxiliary filament may be a very short length of the most attenuated carbon thread which it is practical to make, or it may be of the same cross-section as the main filament and only smaller in length, or it may be a thick filament of greater cross-section than the main filament, but too low resistance to be independently connected to the circuit.

In the embodiment of my invention I prefer that the sections of incandescing material shall be formed as separate filaments, since I believe that commercially this will be the most successful manner of producing the sections; but I do not wish the broad features of my invention to be understood as restricted to a lamp in which the sections of incandescing material are necessarily formed separate from each other or as two separate and distinct filaments. I should regard as the embodiment of my invention a lamp in which a single continuous length of incandescing material is separated into two sections by means of an extra electric connection located at some point between its two ends. I have shown such a lamp in Fig. 15, where the continuous length of incandescing material E E' is separated into two unequal sections by the extra connection G. The section E' is of too low resistance to be independently subjected to the full voltage of the circuit and is not burned alone, but when current is passed through both sections in series from the leading-in wire H to the leading-in wire I the added resistance of the section E' reduces the current below the amount sufficient to bring the section E to full incandescence. When current passes from leading-in wire H to leading-in wire G, section E' being shunted, the section E glows with full candle-power. In like manner Fig. 16 shows a main filament E, an auxiliary filament F, and three leading-in wires I H G. In this form of lamp the auxiliary filament is of greater cross-section than the main filament and when connected in series therewith serves as a dark and dead resistance to reduce the current below that amount which is required to bring filament E to full incandescence.

Fig. 17 shows a form of lamp in which the main and auxiliary filaments are permanently connected in series. The object in this form is to provide a lamp of small candle-power which may be used upon the standard commercial circuits of, say, fifty or one hundred and ten volts. The filament E acts as a dead resistance to modify the effective voltage for the filament F, which then glows with a small but relatively white light.

While I have shown and described as one embodiment of my invention a lamp with one auxiliary filament and one main filament, it is to be understood that I do not confine myself to the use of two filaments and the shunting-spring adapted thereto, because two or more auxiliary filaments and one main filament or one auxiliary filament and two or

more main filaments (each adapted to the full voltage) may be located within one vacuum-globe and fitted with connections to shunt the same in or out of circuit by the progressive longitudinal movement of the lamp in screwing the same in or out of its socket or support. I have shown a three-filament lamp in Fig. 18 in which the current passes first to the shunting-spring D, leading-in wire G, and the thin auxiliary filament F, from whence the current is led through the filament E′, the filament E, and the leading-in wire H. Filaments E and E′ now serve as relatively dark and dead resistance. If the lamp be further screwed into a socket, the spring D will be pressed into contact with spring 61, shunting out the filament F. The resistance of filament F being now removed, the flow of current through filaments E and E′ in series is sufficient to cause the latter to glow. If now the lamp be screwed into its socket to the utmost extent, spring D, and with it spring 61, will be pressed into contact with the central button C, and current will now pass directly to filament E and leading-in wire H, which is connected to the other pole of the circuit. The resistance of E is such that, the other filaments being withdrawn, sufficient current is passed to produce full incandescence.

I am conscious that the use of two or more incandescent filaments connected in series or in parallel within the exhausted globe of one incandescent lamp is not new. Therefore I do not broadly claim such structures. My invention consists in a novel construction of the lamp-base whereby a multifilament-lamp may be used interchangeably with ordinary lamps in the sockets or supports commonly provided and in the advantageous use of one or more filaments as relatively dark resistance to modify the current for one or more other filaments within the same vacuum.

I do not wish to be limited by the details of structure shown in the drawings. Obviously these may be widely varied, according to the skill of the mechanic, without departing from the essential features of the invention.

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

1. An electric incandescent lamp comprising a vacuum-bulb, two sections of incandescing material, one of said sections serving as a resistance to modify the current for the other section when in series therewith, but being of too low resistance to be independently subjected to the full voltage of the electric supply, and connections whereby current may be passed to both sections in series or through the section of higher resistance alone, but not through the section of lower resistance alone.

2. A constant-potential electric lamp comprising a vacuum-bulb and two incandescing filaments, differing in resistance per unit of length, connected to receive current in series but not otherwise or separately, the resistance of said filaments being such that one glows while the other serves as a relatively dark and dead resistance to modify the current.

3. In constant-potential electric lighting the combination in one vacuum-bulb of two or more incandescent filaments or sections, the relative resistance of said filaments being such that when current is passed through two or more filaments in series one at least of said filaments glows while one at least of said filaments serves as a relatively dark and dead resistance to modify the current.

4. A constant-potential electric lamp comprising an exhausted globe, a main incandescing filament, an auxiliary filament of higher resistance per unit of length than the main filament, but having too low total resistance to be independently subjected to the full voltage for which the main filament has been designed, and connections whereby current may be passed to the main filament alone or to the auxiliary filament in series with the main filament but not otherwise.

5. An electric incandescent lamp comprising a vacuum-bulb, two sections of incandescing material, one of said sections serving as a resistance to modify the current for the other section when in series therewith, but being of too low resistance to be independently subjected to the full voltage of the electric supply, and a shunting device actuated by the longitudinal movement of the lamp in its socket, effected in screwing the same into place, whereby current may be passed to both sections in series or through the section of higher resistance alone but not through the section of lower resistance alone.

6. In constant-potential electric lighting, the combination with a vacuum-bulb, of two or more filaments or sections the relative resistance of which is such that when current is passed to two or more of the filaments in series, one at least of said filaments glows while one at least of said filaments serves as a relatively dark and dead resistance to modify the current, a base or part adapted to screw into a socket, or support and mechanism for shunting or disconnecting one or more of the filaments, actuated by the longitudinal movement of the lamp in its socket effected in screwing the same into place.

7. An incandescent lamp comprising a vacuum-bulb, two incandescing filaments therein, a base or part adapted to screw into a socket or support, a central stationary terminal constituting the point of electrical connection of one of the leading-in wires, and a movable contact adapted to engage said stationary terminal, said movable contact being rigidly attached at one part to the lamp-base.

8. An incandescent lamp, comprising a vacuum-bulb, a plurality of filaments therein, leading-in wires for said filaments, and a shunting device consisting of a movable

bridge-piece adapted to connect two of the terminals and supported from a relatively stationary base, said base constituting the point of electrical connection of one of the leading-in wires.

9. An electric incandescent lamp comprising an exhausted globe, a main incandescing filament adapted to withstand the full electromotive force of the electric circuit for which the lamp has been designed, an auxiliary filament having too little resistance to be directly connected to such circuit, three conducting-wires leading from the filaments (one end of each filament being electrically connected within the vacuum) a base containing the terminal of the conducting-wires normally insulated from each other and a rod or part situated on or within the base and actuated by the progressive longitudinal movement effected in screwing the base into a socket or support; in the normal position, the said rod or part carries the electric current to the main and auxiliary filaments in series when partly screwed into a socket; when screwed in somewhat farther the circuit is broken and when screwed into the socket to the utmost extent the current is turned through the main filament burning alone.

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