No. 659,710. Patented Oct. 16, 1900.

G. E. STEVENS.

ELECTRIC ARC LAMP.

(Application filed Nov. 14, 1898.)

(No Model.) 2 Sheets—Sheet 1.

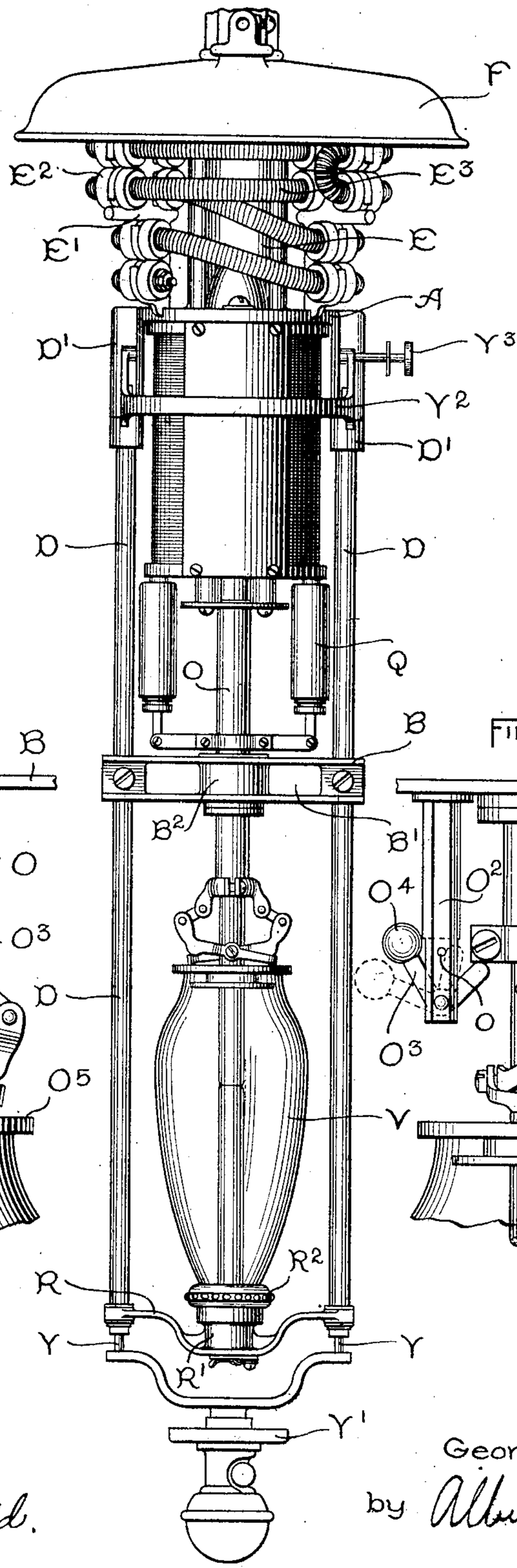

FIG. 1.

FIG. 8.

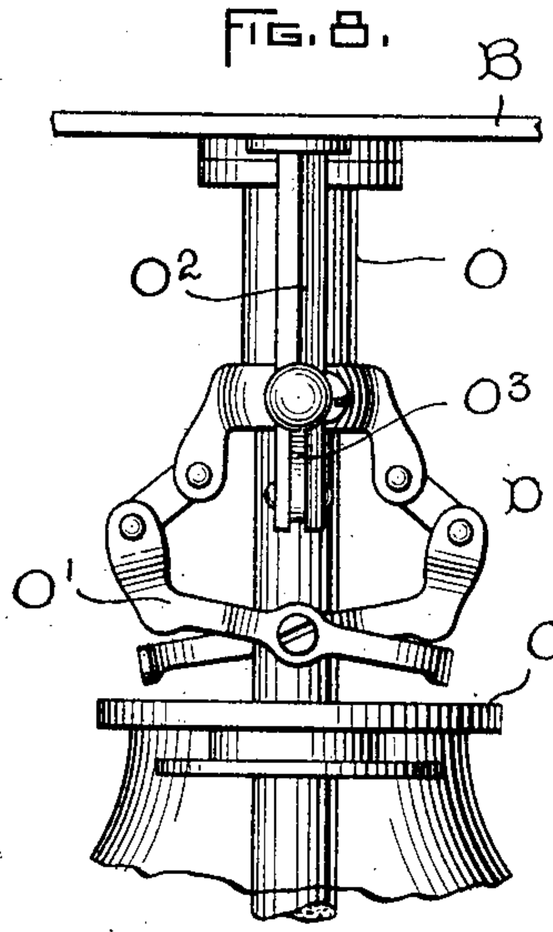

FIG. 9.

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(No Model.) 2 Sheets—Sheet 2.

FIG. 2.

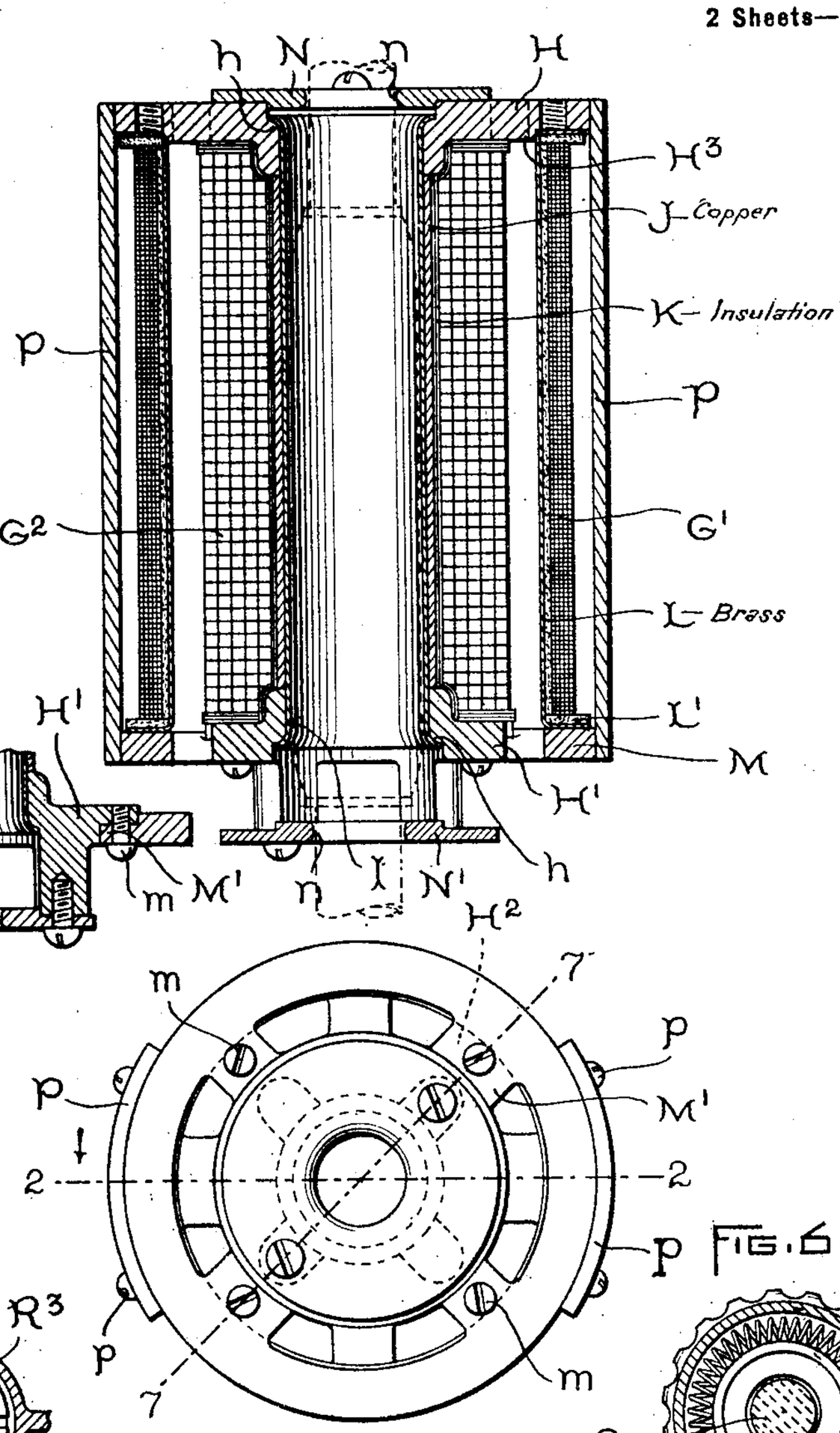

FIG. 7.

FIG. 3.

FIG. 5.

FIG. 6.

FIG. 4.

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UNITED STATES PATENT OFFICE.

GEORGE E. STEVENS, OF LYNN, MASSACHUSETTS, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 659,710, dated October 16, 1900.

Application filed November 14, 1898. Serial No. 696,338. (No model.)

To all whom it may concern:

Be it known that I, GEORGE E. STEVENS, a citizen of the United States, residing at Lynn, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Electric-Arc Lamps, (Case No. 757,) of which the following is a specification.

My invention relates to electric-arc lamps, and has for its object the improvement of their construction; and to that end it consists in the parts and combination of parts, as hereinafter described and claimed.

In the accompanying drawings, which show an embodiment of my invention, Figure 1 is a side elevation of an arc-lamp with the casing and outer globe removed. Fig. 2 is a section through the magnet-coil on the line 2 2 of Fig. 3. Fig. 3 is an inverted plan view of the magnet-coil. Fig. 4 is a detail view in section of the globe and lower-carbon-securing device. Fig. 5 is a section taken on the line 5 5 of Fig. 4 looking upward. Fig. 6 is a sectional view taken on the line 6 6 of Fig. 4. Fig. 7 is a sectional view taken on the line 7 7 of Fig. 3; and Figs. 8 and 9 are front and side elevations, respectively, of an auxiliary support for the clutch.

The lamp-frame consists of an upper head A and a lower head B, the head B comprising two flat disks separated from each other by an air-space B′ and connected by a hub B^2. Situated on each side of the frame and extending downwardly are side tubes D, and the lower head B is secured to the tubes by screws or other suitable means. Extending downwardly from the upper frame-head A are sockets D′, adapted to receive the upper ends of the side tubes D. Secured to the upper head and extending upward is a resistance-dome E, to which is secured the resistance-carrying frame E′. The resistance-frame consists of a number of vertically-extending pieces containing notches for the reception of the insulating-bushings E^2, and mounted in the bushings is a coiled resistance E^3, which is included in circuit with the lamp to cut down the potential. Situated above the resistance-dome and secured thereto is a cap F for protecting the interior of the lamp.

In arc-lamps as ordinarily constructed there is more or less heating, due to the passage of current through the coils and also to the upward passage of heat from the arc. As the coils become heated their resistance, and particularly that of the shunt-coil, increases, and consequently the current flowing therein decreases. When this occurs, the balance previously existing between the shunt and the series coils is destroyed and the arc becomes abnormally long before sufficient current is forced through the shunt-winding to cause it to move the armature and trip the clutch. To overcome this objection, I separate the two windings by an air-space, which communicates with openings in the spool-flanges, so that air admitted near the base of the lamp is permitted to pass upward between the coils or parts of a single coil and through the openings in the top flange and out. In certain instances it is desirable to divide the winding forming a single coil into two or more parts and to separate the parts by an air-space, and I aim to embrace such a construction in the claims.

Referring to Fig. 2, the construction and arrangement of the coils will be more clearly seen. The spool is provided with two flanges, H and H′, of iron or other magnetic material, and these flanges are secured together by a tube I, the ends of which are spun down over the shoulders *h*, formed thereon. This tube is made of non-magnetic material, so that the armature, which is connected to the carbon-tube O of the lamp, will not stick as it moves up and down. Surrounding this tube and acting as a spacer to separate the flanges of the magnet-spool is a copper tube J. In addition to separating the heads of the magnet this copper tube acts to damp the sudden movements of the armature of the magnet due to changes in the strength of the current passing through the shunt-winding G′ and the series winding G^2. Surrounding the copper tube and the inner faces of the spool-flanges is a body of insulation K, which serves to protect the winding from the metal parts of the spool.

In constructing the magnet the spool is assembled and the insulation K placed thereon. The spool is then placed in a lathe and the required number of turns of wire wound thereon. As soon as this is done a second

spool L, made of sheet-brass or other non-magnetic material and having end flanges L′, is slipped endwise over the first spool and winding and is retained in place by an iron ring M, located at the lower end of the spool and forming a part of the magnetic circuit. This ring is provided with four radially-extending projections M′, as shown in Figs. 3 and 7, which overlap four corresponding radially-extending projections H^2 on the lower flange H′ and are secured thereto by the screws *m*. The openings formed between the lugs communicate with the space between the windings and permit a current of air to circulate from the bottom to the top of the magnet. Formed on the upper flange are lugs H^3, which serve to center the spool and hold it in place. I prefer to wind and insulate the fine-wire coil G′ on the spool L prior to mounting it on the first-mentioned spool, since the wire is so fine that it is likely to be broken in the lathe. By providing a suitable winding-machine for the shunt-coil all danger of breaking the wire is entirely obviated. If desired, however, the spool L may be wound after it is placed in position on the series spool.

Situated on the top of the magnet-flange H and retained in place by screws is a guide-plate N for centering and guiding the movements of the carbon-tube O. Situated below the lower flange and supported on lugs formed integral therewith is a second guide-plate N′, which assists the upper guide-plate N to guide the movements of the carbon-tube. These plates are each provided with shoulders to center them and a rounded surface *n* for engaging with the tube. The arrangement of parts is such that these plates can readily be replaced when worn. After the spool containing the shunt-winding has been mounted in place the pieces of iron or other magnetic material P are mounted in place and secured to the upper flange H and to the ring M by screws *p*. These curved pieces serve to complete the magnetic circuit of the spool, the armature shown in dotted lines forming the balance of the magnetic circuit.

Situated on each side of the carbon-tube O and connected thereto in any suitable manner is a dash-pot Q, which dash-pots are arranged to damp the movements of the carbon-tube. Extending downward from the lower head B are the side rods D. These rods support the yoke R, which carries the lower-carbon holder and the holding device for the inner-globe cylinder V. Mounted within the tubes D are rods Y, which carry the outer-globe holder Y′. These rods Y are arranged to move vertically within the tube D and are held in their raised position by means of the bail Y^2, which is controlled by the milled head or handle Y^3. To lower the outer globe, the bail Y^2 is raised by means of the handle, which permits the rods to slip downward through the side tubes D.

In arc-lamps of the inclosed type it is desirable under certain conditions to be able to remove the lower carbon without removing the inclosing globe from the lamp and also to provide a single means for holding or clamping both the lower carbon and the cylinder.

Referring to Fig. 4, R represents the yoke connecting the side tubes D, and formed in the center of the yoke and extending upward is a cylindrical extension R′, which is screw-threaded on its upper end to receive the nut R^2. Mounted within the extension is a clutch consisting of three tapered members R^3, each member having a groove on the bottom end to receive the flat spring *r*, which tends at all times to press them outward and release the lower carbon S. Situated above the clutch members is a ring or collar T, having a conical bore adapted to receive the tapered pieces forming the clutch R^3. Mounted on the top of this ring is a sheet of asbestos or other heat-resisting material U, which renders the lower end of the globe practically air-tight when it is clamped in place. Between the inner globe or cylinder V and the nut R^2 is a coiled spiral spring W, although any other device may be employed which will adjust itself to slight irregularities of the globe or cylinder V. The yoke R is bored out on its under side to permit the insertion of the carbon S, and under this opening is a spring-pressed plate X, arranged to close the opening and make it practically air-tight and also to prevent the dropping of carbon-dust. When it is desired to recarbon the lamp, the plate X is swung to one side and the nut R^2 released, which causes the ring T to relieve the pressure on the members of the clutch R^3, so as to allow the lower carbon to drop downward through the yoke. The upper carbon may be removed from the upper holder and permitted to follow the lower carbon, after which a new carbon may be inserted in the upper holder and forced upward through the carbon-tube and followed by the lower carbon. As soon as the lower carbon has been raised to its proper height the nut R^2 is set, which causes the clutch R^3 to grip the lower carbon and the spring W to grip the cylinder V. This arrangement permits the retrimming of a lamp in a building where the dust and dirt from the carbon would be destructive, and it also enables me to provide a lamp in which the danger of breaking the globes is eliminated to a large degree, since they do not have to be removed from the lamp.

More or less difficulty is experienced in recarboning lamps having a gravity-feed owing to the fact that when no current is flowing through the magnet coil or coils the feed mechanism will permit the upper carbon to fall. This is objectionable at times and particularly when the trimmer is engaged in fixing the lower carbon and cleaning or adjusting the arc-inclosing cylinder. To overcome this objection, I propose to employ a mechanical support which is the equivalent in its

action of the feed magnet or magnets employed in regulating the lamp. In other words, an auxiliary support is provided, normally inactive, but which is manually thrown into operative position to support the feed mechanism when it is desired to recarbon the lamp.

Referring to Figs. 8 and 9, O represents the carbon-tube, on the lower end of which is mounted a clutch O′ of any desired type, the one shown consisting of a pair of pivoted jaws which are arranged to grip the upper carbon between them. Situated at one side of the carbon and secured to the head B is a post O^2, and mounted in the post is a bell-crank lever O^3, having a weighted outer end O^4, normally tending to withdraw it from engagement with the clutch O′. A pin *o* limits the anticlockwise movement of the lever, and the ball on the opposite end of the lever limits the clockwise movement. I have termed this an "auxiliary support" for the carbon, since it is entirely inoperative during the normal operation of the lamp. When it is desired to recarbon, the new upper carbon is mounted in the holder in the ordinary manner. The carbon-tube O and clutch are then moved upward by hand and the lever O^3 moved into engagement with the clutch. This causes the clutch to grip and hold the carbon in just the same way as if the magnets were energized, and a new lower carbon may be inserted without trouble. It is of course evident that the upper carbon need not occupy its normal position, but be raised to a point above it to facilitate trimming. With an arrangement of this kind there is always the possibility of the trimmer leaving the clutch in its suspended position, which will prevent the lamp from burning. To prevent this, the release of the clutch is rendered automatic as well as manual, so that no matter what position the upper carbon and clutch occupy after retrimming they will automatically return to their operative position as soon as current is turned on the lamp. This is accomplished in the present instance by the weight O^4 on one end of the bell-crank lever, which automatically returns to the position shown in dotted lines, where it is out of the way of the normal movement of the clutch, as soon as the magnet draws up its armature, the tube O, and the attached clutch. If the upper carbon is not properly adjusted when the clutch first drops, the latter will strike the cap O^5, which acts as a tripping-floor, and the carbon will be permitted to feed.

It is evident that the construction of the auxiliary support may be widely varied without departing from the spirit of my invention.

While I have shown and described my improvement in the construction of electromagnets in connection with electric-arc lamps, it is evident that it is not limited to this use, but can be employed in connection with various other electrical devices.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a magnet, the combination of a spool upon which a portion of the wire is wound, a flange for the spool having a ventilating-opening, a second spool arranged to be slipped over the first and receive a portion of the winding, and a detachable ring having a ventilating-opening which surrounds one of the flanges of the first-named spool and serves to center and retain the second spool in place, the ventilating-openings in the flange and ring communicating with each other so that a current of air can pass between the windings.

2. In an electromagnet, the combination of a spool upon which a portion of the wire is wound, a second spool arranged to receive a portion of the winding and to be slipped over the first-mentioned spool, and separated by an air-space therefrom, and a ring having an opening which communicates with the air-space, the said ring forming a part of the magnetic circuit for securing the spools in such a manner that they may be separated without disturbing the winding on either spool.

3. In an electro magnet, the combination of a pair of magnetic spool-flanges, each flange having a ventilating-opening, a tube connecting the flanges, a closed band of good conducting material which acts to damp the magnetic changes and also to separate the flanges, a coil wound on and insulated from the tube, a second coil wound on a spool which is slipped over the first, but separated from the first coil by an air-space, and magnetic material connecting the flanges of the spool and forming a part of the magnetic circuit.

4. In an electromagnet, the combination of a pair of magnetic spool-flanges, a non-magnetic tube arranged to hold the flanges together by being spun over shoulders formed on the flanges, a closed band of good conducting material for damping the effect of changes in strength of the magnet, a winding mounted on a spool and arranged to be slipped endwise over the tube and one of the flanges, a ring for retaining the spool in place, which forms a part of the magnetic circuit, and pieces of magnetic material which join one of the spool-flanges with the ring.

5. In a magnet structure, the combination of a pair of spool-flanges connected by a tube, each flange having a ventilating-opening, a spool arranged to be slipped over the first and to be separated therefrom by an air-space, and a magnetic ring for separating and centering the two spools with respect to each other.

6. In a magnet structure, the combination of a pair of spool-flanges made of magnetic material and connected by a tube of non-magnetic material, a second spool arranged to be slipped over the first and separated therefrom by an air-space, shoulders formed

on the upper flange for centering the second spool, a ring for securing the second spool in place and forming a part of the magnetic circuit, lugs on the ring which engage corresponding lugs on the lower flange of the first-named spool, and strips of iron which connect one of the spool-flanges with the ring.

7. In a magnet for an electric-arc lamp, the combination of a spool-flange made of magnetic material and forming a part of the magnetic circuit and provided with ventilating-openings, a guide-plate secured to the flange for guiding the carbon-tube, a second spool-flange also made of magnetic material and provided with projections, a winding or section of winding mounted on the spool, a second spool containing a winding, arranged to be slipped endwise over the first and separated therefrom by an air-space, and a ring of magnetic material for holding the spool in place, and provided with lugs which engage with the lugs on the lower spool-flange.

8. In a magnet for an electric-arc lamp, the combination of a spool-flange made of magnetic material and forming a part of the magnetic circuit and provided with ventilating-openings, a guide-plate secured to the flange for guiding the carbon-tube, a second spool-flange also made of magnetic material and provided with projections, a winding or section of winding mounted on the spool, a second spool containing a winding, arranged to be slipped endwise over the first, and separated therefrom by an air-space, a ring of magnetic material for holding the spool in place, and provided with lugs which engage with the lugs on the lower spool-flange, and strips of magnetic material for completing the magnetic circuit.

9. In an electric-arc lamp, the combination of a support having an opening to receive the carbon, a friction-clutch mounted on the support, a globe, a globe-holder, and means for holding the globe and forcing it downward against the clutch to cause it to grip the carbon.

10. In an electric-arc lamp, the combination of a support, a friction-clutch mounted on the support, a tapered collar or ring operating the clutch, a globe, a globe-holder, and means for forcing the globe downward against the collar or ring to actuate the clutch.

11. In an electric-arc lamp, the combination of side rods, a yoke connecting the side rods, a cylindrical extension formed on the yoke, a friction-clutch for gripping the carbon, composed of separate individually-adjustable members, a ring having a conical bore arranged to fit down over the clutch members, a globe or cylinder arranged to be seated on the ring, and devices acting both to clamp the globe in place and to force it downward against the ring to actuate the clutch.

12. In an electric-arc lamp, the combination of a pair of side rods, a yoke connecting the rods, a cylindrical extension having a straight bore carried thereby, a friction-clutch composed of a number of individually-adjustable members, the members having a straight bore and a tapered periphery, a globe, a flexible medium between the globe and the clamping-nut, a clamping-nut for compressing the medium, actuating the clutch and securing the globe in place.

13. In an arc-lamp, the combination of a cylindrical extension having an opening in the bottom, a carbon-clutch mounted in the extension and composed of separately-adjustable pieces, means for causing the pieces to grip the carbon, means for causing the pieces to release the carbon, and a plate for covering up the opening in the bottom of the cylindrical extension.

14. In an electric-arc lamp, the combination of a clutch for controlling the feed of a carbon, means for tripping the clutch at the proper time, and an auxiliary support for suspending the clutch during trimming in a manner to grip the carbon, which support forms no part of the feeding mechanism.

15. In an electric-arc lamp, the combination of a carbon, means for supporting and feeding the carbon, and an auxiliary support which performs no function in the normal operation of the lamp, but is arranged to hold the carbon during trimming.

16. In an electric-arc lamp, the combination of a carbon, an auxiliary support for sustaining said carbon which is normally idle except when the lamp is retrimmed, and means for automatically moving the auxiliary support out of engagement with the carbon when current is admitted to the lamp.

17. In an electric-arc lamp, the combination of a carbon, a clutch for feeding the carbon, and an auxiliary support, which is normally idle, for engaging with and supporting the clutch in operative position when no current is flowing in the lamp.

18. In an electric-arc lamp, the combination of a carbon, a clutch for feeding the carbon, an auxiliary support, which is normally idle, for engaging with and supporting the clutch in operative position when no current is flowing in the lamp, and means for automatically removing the support from engagement with the clutch when current is admitted to the lamp.

19. In an arc-lamp, the combination of a carbon, a clutch therefor, a tripping device for the clutch, an auxiliary support for holding the clutch in operative position during the time when current is cut off from the lamp, and means for automatically releasing the clutch when current is admitted to the lamp, and permitting it to strike the tripping-floor for the purpose of regulating the length of the arc.

In witness whereof I have hereunto set my hand this 9th day of November, 1898.

GEORGE E. STEVENS.

Witnesses:

DUGALD MCKILLOP,

JOHN MCMANUS.