No. 667,107. Patented Jan. 29, 1901.

E. THOMSON & C. E. HARTHAN.

ELECTRIC ARC LAMP.

(Application filed Nov. 4, 1897.)

(No Model.) 2 Sheets—Sheet 1.

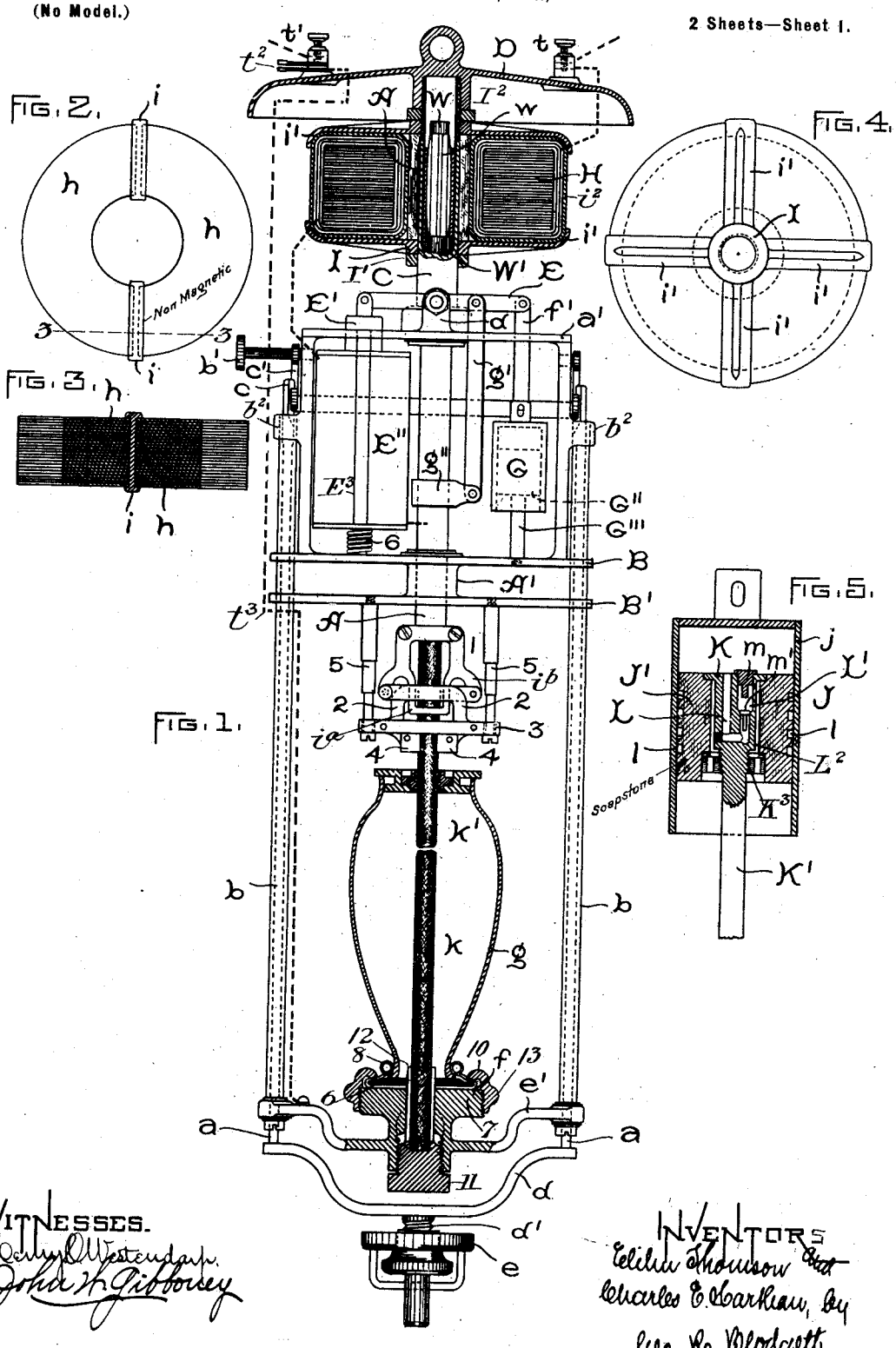

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FIG. 6.

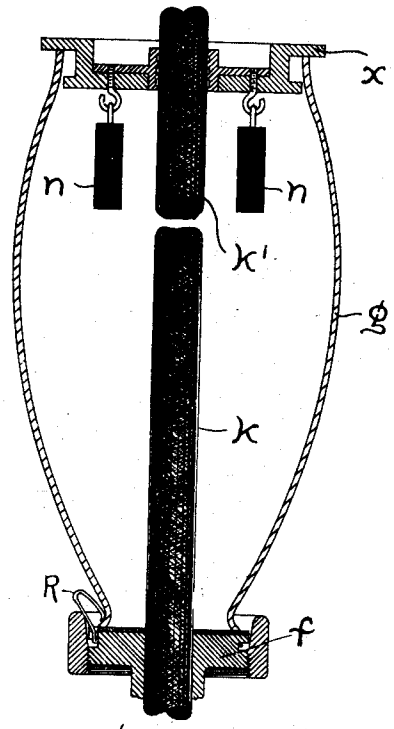
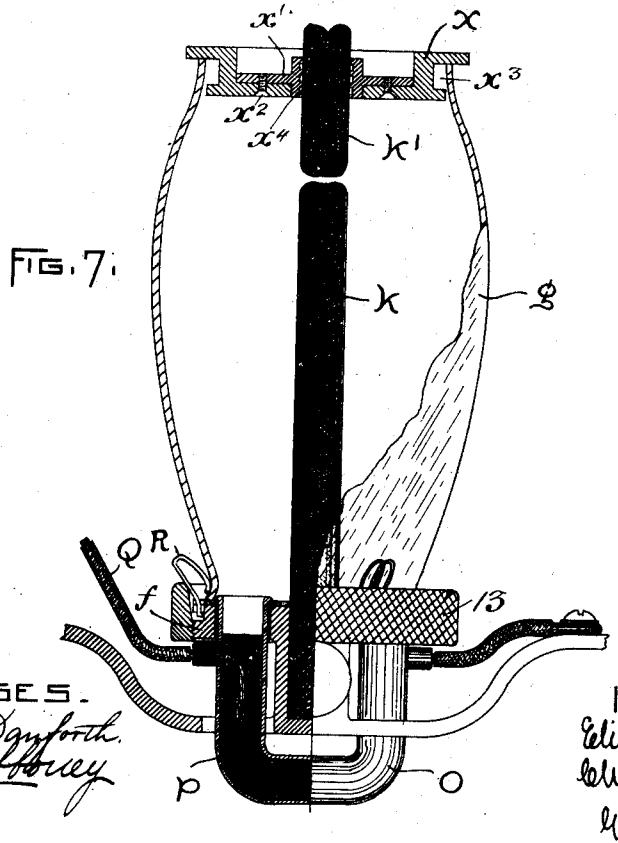


FIG. 7.



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UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF SWAMPSCOTT, AND CHARLES E. HARTHAN, OF LYNN, MASSACHUSETTS, ASSIGNORS TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 667,107, dated January 29, 1901.

Application filed November 4, 1897. Serial No. 657,419. (No model.)

To all whom it may concern:

Be it known that we, ELIHU THOMSON, residing at Swampscott, and CHARLES E. HARTHAN, residing at Lynn, in the county of Essex, State of Massachusetts, citizens of the United States, have invented certain new and useful Improvements in Electric-Arc Lamps, (Case No. 641,) of which the following is a specification.

The present invention relates to arc-lamps, and more particularly to those designed for alternating-current circuits of constant potential; but certain features of novelty are applicable to other types of lamps, and we aim to embrace such a use in the claims.

Referring to the accompanying drawings, Figure 1 is a front elevation of a lamp with the casing removed and certain of the parts in section. Fig. 2 is a plan view of the core for the reactance-coil. Fig. 3 is a section of the same, taken on line 3 3 of Fig. 2. Fig. 4 is a plan view of a spider for supporting the reactance-coil. Fig. 5 is a sectional view of the dash-pot and piston employed for steadying the action of the lamp. Fig. 6 is a longitudinal section of an arc-inclosing globe having oxygen-absorbing means; and Fig. 7 is a partial longitudinal section of an arc-inclosing globe, with a slight modification of the means employed for absorbing oxygen in the globe.

Referring first to Fig. 1, the frame of the lamp is composed of two circular heads B and B′, which are united by the hub A′. Extending upwardly from the heads are side pieces which support the flat plate a'. Between the heads B B′ is an air-space which when the cylindrical casing is mounted on the lamp communicates with the external air and prevents the heat from the arc from passing upward and affecting the regulating mechanism. Extending downward from the heads B B′ are side tubes b b, which are secured to bosses b^2 b^2 of the frame, and connecting the side tubes, but insulated therefrom, is a yoke e', which supports the lower-carbon holder, and also the arc-inclosing globe g. This yoke has a screw-threaded portion and also a straight cylindrical bore. The latter part is designed to receive the lower-carbon holder. The holder for the lower carbon k consists of a screw-threaded plug 11, which is provided on its upper end with straight-sided spring-clips 12, arranged to grasp the lower carbon. In recarboning the lamp the plug 11 is removed, and with it the lower carbon. This also permits the removal of the upper carbon.

Mounted for vertical movement within the side tubes b b are rods a a, and connecting these rods at the lower ends is a yoke d, which supports the outer globe. The support for the outer globe consists of a screw-threaded stem d', which is rigidly secured to the yoke d, and an adjustable cup-shaped holder e, in which the flange on the lower part of the outer globe is adapted to rest. The upper ends of the rods a a are provided with hooks c, which engage with corresponding hooks on the bail c'. This bail is pivoted to the lamp-frame and is actuated by a handle b', which extends outward through the frame-casing. No claim is made to this feature of the outer-globe support in this application, as it is the invention of Charles E. Harthan, and is claimed in another pending application, Serial No. 686,978, filed July 27, 1898.

Secured to the frame a' is a tube C, which supports the reactance H and the cover D. The reactance comprises a number of thin punchings or laminæ h of semicircular outline, which are held together in any one of the well-known ways—as, for example, by wooden pins or screws—and one or more layers of shellacked paper. The parts of the core are assembled in the manner best shown in Figs. 2 and 3, with a piece of non-magnetic material i located between the adjacent ends of the punchings. In the present instance we have shown the core of the reactance made in two parts, with non-magnetic material located between the parts; but, if desired, we can make the core in a single piece and have a slot at one side which may or may not be filled by a piece of non-magnetic material. Mounted on the core is a suitable winding comprising a number of turns of wire, and surrounding this wire is a layer of insulating material i^2. (Shown in section in Fig. 1.) The reactance limits the amount of current which flows through the lamp and also assists to.

regulate the action of the feed mechanism. Mounted on the tube C is a spider I, having a number of radial arms i', and situated below the spider is a nut I' for adjusting the relation of the spider with respect to the lamp. After the parts of the core have been wound and insulated they are slipped into place on the lower spider, and a second spider of the same general construction as the first is placed on top of the core and retained in place by the check-nut I^2. The arrangement of the reactive coils II and the spiders is particularly desirable, since the core can be separately wound and insulated and placed in the lamp without disturbing the balance of the mechanism other than removing the cover, and by placing the reactance inside of the lamp it is not liable to be injured. By placing the reactive coil in such a manner that it surrounds the fixed tube C and the carbon-tube A the lamp is materially shortened by utilizing that portion of the lamp which otherwise would not be used.

The upper end of the tube C is screw-threaded, and mounted thereon is a cover or cap D, which extends outward over the casing and serves to protect the mechanism of the lamp from injury. This cap is provided with a ring from which the lamp may be suspended. Mounted in the cap and insulated therefrom are two binding-posts $t\ t'$. The connections of these binding-posts and the magnet will be described hereinafter. The binding-post t' is provided with two switch-contacts t^2, which are adapted to be engaged by a switch-blade, (not shown,) for the purpose of cutting the lamp into and out of the circuit.

Mounted for vertical movement within the stationary tube C is a carbon-tube A. This tube surrounds the carbon and at its lower end carries the carbon-feeding clutch. Mounted in the lamp-frame is one or more spring-supported magnets E''. In the present instance only a single magnet is shown, which is supported by two parallel rods E^3, only one of which is shown, and around each rod is a coil-spring 6, located under the lower head. This permits the coil to move up and down slightly, the rods acting as guides. Situated on the opposite side of the carbon-tube from the magnet is a dash-pot having a stationary piston G''', which is supported by the rod G''', and a moving cylinder G. The cylinder is supported by a link f, which in turn is connected to the lever E, and between the link and cylinder is a loose connection, so that the lamp mechanism is permitted to have a certain amount of movement before the dash-pot begins to operate. Extending upwardly from the frame-plate a' is a lug d, and pivoted therein is a lever E. One end of the lever is connected to the core E' of the magnet and the other end to the dash-pot by the link f'. Surrounding the carbon-tube at a point midway between the upper and lower heads of the lamp-frame is a collar g'', and between this collar and the lever E is a link g' by which motion is transmitted from the magnet-core to the carbon-tube.

Mounted for vertical movement within the carbon-tube A is a carbon-holder W, having a spring-clip W' at its lower end for grasping the upper carbon, and a number of flat springs a, which engage with the inside of the tube for conveying current from the tube to the carbon. In the present instance we have shown no particular means for conveying current from the fixed part of the lamp to the carbon-tube; but it is to be understood that any of the well-known means may be employed.

Referring to Fig. 5, the construction of the dash-pot will be described. K' represents the support for the piston and is provided at its upper end with an outwardly-flaring flange K and at a point below the body of the piston with a nut K^3, and between the nut and the flange is located the piston J'. This piston is preferably constructed of soapstone or some similar material having antifriction properties and is grooved on the outside at l in the usual manner. Extending vertically in the metal support for the piston is a passage L, which communicates with the interior of the cylinder J. A second passage L' is also provided, which communicates with the first, and mounted in the top thereof is a plug which closes the upper end of the passage and also acts to limit the upward movement of the check-valve m'. The auxiliary opening L' communicates with the cylindrical chamber located between the piston-support and the piston. This chamber communicates with the external air through holes in the nut K^3. As shown, the cylinder is made of thin sheet metal j and is provided with a suitable top having means for connecting it with the link f'. The valve arrangement in the dash-pot is such that free downward movement of the cylinder is permitted by reason of the air passing through the passage L' in a direction to open the valve m', while movement of the cylinder in the opposite direction is opposed by reason of the closing of the said valve. This construction of the dash-pot and piston has been found to be especially desirable, as all friction and sticking of the parts is reduced to a minimum, the natural lubricating quality of the piston being sufficient to insure the free and easy working of the parts.

Extending downward from the lower head B' are two posts 5 5, forming a support for the cross-piece 3. This cross-piece is mounted on the posts in such manner that it has a certain freedom of movement in a vertical and horizontal direction.

Mounted on the lower end of the carbon-tube is a clutch for the carbon comprising a frame 1, having a downwardly-projecting portion 1^a, which encircles the carbon pencil k' and forms a guide therefor, and ears 1^b, to which the levers 2 are pivoted, one lever be-

ing pivoted to one ear and the other lever to the other. These levers consist of flat metal punchings and are loosely connected to the ears in a manner to form a lost-motion connection therewith. These levers have a right-angle bend therein, and pivotally mounted on the lower end of each lever is a shoe 4, which is arranged to grip the upper carbon k'. The arrangement of the clutch-lever is such that when the carbon-tube descends to a certain point the shoes will automatically release the upper carbon and permit it to feed.

The above-described arrangement of parts makes a clutch which will positively grip the carbon and yet be very sensitive, so that the potential around the arc will not materially increase at the time of feeding, which is so common in lamps having a clutch which does not trip freely.

A further advantage of the construction shown lies in the fact that the trimmer can grip the upper-carbon holder with his fingers while recarboning the lamp, and thereby save time in the operation and prevent injury to the holder common in lamps of this class and caused by the trimmer forcing the carbon and holder upward against the cover D to seat the carbon in the holder. This would not be so objectionable if the holder made an easy fit with the carbon; but on account of increasing conductivity the holder is made so that it is necessary to spring the sides outwardly slightly in order to insert the carbon.

The arc-inclosing globe g is mounted on the support f, and between the base of the cylinder and the support is located a body of material 6, preferably asbestos or some similar material, which will prevent the entrance of air into the inclosing cylinder. For retaining the globe in position we employ novel means, consisting of a plurality of flat metal springs 7, having inwardly-extending portions 8, which are arranged to grip the lower flange of the globe. The periphery of the support f is screw-threaded, and mounted thereon is a nut 13, having an inwardly-extending flange 10, arranged to engage with the spring extensions 8 and force them against the flange of the globe. Air in excess is prevented from entering the upper portion of cylinder by means of a suitable gas-cap. This gas-cap is best shown in Fig. 7 and consists of a metal ring X, which is preferably of cast iron or some other cheap metal, and mounted in the center is a removable bushing X', which is retained in place by screws X^2. This removable bushing is preferably made of brass or some composition material which is easily worked, is capable of taking a smooth finish, and does not corrode to any great extent. This detachable bushing is a desirable feature, since it permits the substitution of a new bushing when the old one is worn instead of substituting an entire cap, and, furthermore, there is less liability of the hole for the carbon changing its diameter, as would be the case if it were made of iron and were exposed to dampness, which would cause it to rust. Furthermore, the single-piece cap is more liable to have a soft spot near the carbon-opening, so that the latter would become eccentric. The outside of the cap is provided with a circumferential groove X^3, which prevents the free entrance of air into the cylinder and the exit of gas. The removable bushing is provided with one or more grooves X^4, which act to prevent the free entrance of air and the exit of gas around the upper carbon.

In Figs. 6 and 7 somewhat different means are shown for retaining the arc-inclosing cylinder in place, consisting of small spring-clips R, which are secured at one end to the support f and are free at their other end to engage with the cylinder g when forced inward by the nut 13.

In Figs. 6 and 7 we have shown an oxygen-absorbing material placed within the inner globe g for the purpose of rapidly absorbing the oxygen contained therein after the lamp has started into action. In Fig. 6 the oxygen-absorbing material n is hung in masses from the cap X. This material may be pieces of more combustible carbon than the carbon pencils between which the arc is located or a piece or pieces of spongy metal which when hot would take in oxygen—such as zinc, magnesium, spongy iron, or even copper, providing it is hot enough. A variety of carbon, such as is produced by carbonization of light woods, at low temperatures and used either in powered form or in loosely-molded sticks, or a combination of both, will work satisfactorily.

Referring to Fig. 7, we have shown a slight modification in which the oxygen-absorbing material is located in a receptacle in the base of the lamp. Secured to the support f is a U-shaped tubular extension O, which is partially filled with granulated carbon P of a highly-combustible nature, or other oxygen-absorbing substance made absorptive by a moderate degree of heating, whereby when the current is passed through the said material by the connection shown at Q its temperature is sufficiently raised on account of its resistance to make it oxygen-absorbing. The tubular extension O opens into the globe at both ends and the current from the lower carbon K passes through the whole or a portion of the carbon-powder P as it returns to the circuit.

Referring to Fig. 1, the circuit connections are as follows: The current enters at binding-post t and passes through the winding on the reactive coil H, thence through the magnet E'' to the carbon-tube g'', through the contact-springs w on the upper-carbon holder W, through the upper carbon k' and lower carbon k to the yoke e', and by wire t^3 to the binding-post t'. By this arrangement there is connected in circuit with the arc a coil of

definite reactance which is very effective in preventing sudden changes in current and corresponding changes in light.

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

1. In an electric-arc lamp, the combination of a movable clutch-carrier, with a clutch mounted thereon comprising a collar having two downwardly-extending arms which are united at the lower end to form a guide for the carbon, which guide moves with the clutch-carrier, levers loosely pivoted to the arms, shoes pivotally secured to the levers, and a support to which the levers are pivoted, the said support being loosely mounted so that it is capable of a certain amount of movement with the clutch.

2. In an electric-arc lamp, the combination of a movable guide for the upper carbon, which is located between the clutch-shoes and the clutch-carrier, and forms a part of the clutch structure, a follower for said carbon, a movable clutch-support which also carries the guide, and an opening between the guide and its support to permit the follower to be grasped when recarboning.

3. In an electric-arc lamp, the combination with a movable guide for the upper carbon, a follower for said carbon, a movable clutch-support which also carries the guide, an opening between the guide and its support, and a guide secured to and moving with the clutch-support for centering the carbon.

4. In a dash-pot, the combination of a metal cylinder, a piston therefor made of some lubricating material, a metal holder for the piston, a flange and a nut on the holder for clamping the piston, a chamber between the holder and the piston, and a valve for regulating the passage of air from the cylinder.

5. In a dash-pot, the combination of a cylinder, a piston made of soapstone, a metal support therefor, a cylindrical chamber which surrounds the metal support, a passage in the metal support, and a valve for regulating the passage of air between the inside of the cylinder and the cylindrical chamber.

6. In an electric-arc lamp, the combination of a lamp-frame, a tube extending upwardly therefrom by means of which the lamp is suspended, a spider secured to the tube, a reactance-core having an air-gap in circuit mounted on the support and separated from the tube by a space at all points, and a carbon-tube which is movable within the fixed frame-tube.

7. An induction-coil for electric-arc lamps, consisting of built-up bundles of semicircular laminæ placed together to form a ring, said bundles being separated by non-magnetic material and wound, and a spider having radial arms for securing the parts together.

8. An induction-coil for electric-arc lamps, comprising a ring-shaped magnet-circuit, formed of built-up bundles of semicircular laminæ brought together to form a ring, said bundles being separated by non-magnetic material, and the whole being wound with coils of wire and spiders or clips having a central hub extending through the ring, the spiders holding the parts together.

9. In an electric-arc lamp, the combination of a tube which is attached to the frame, a reactance-core having an air-gap therein, which core is provided with a winding and surrounds the tube, and spiders or supports situated above and below the coil for holding it in place.

10. In a globe-holder for an arc-lamp, the combination of a support, a plurality of individually-adjustable spring-fingers for engaging with a flange on the globe, and means for forcing the spring-fingers against the globe-flange.

11. In a globe-holder for an arc-lamp, the combination of a support, spring-fingers rigidly secured to the support for engaging with a flange on the globe, and a screw-threaded nut for simultaneously forcing the several spring-fingers against a flange on the globe.

12. In an electric-arc lamp, the combination of a yoke, a screw-threaded support formed thereon, a plurality of spring-fingers secured to the support at one end and free at the other for engaging with the globe, a body of asbestos or similar material located so that it will be between the globe and the support, and a nut mounted on the support for forcing the spring-fingers into engagement with the globe.

13. In an electric-arc lamp, the combination of an arc-inclosing globe, a cover for the globe which engages therewith, a detachable bushing secured to the cover, having a carbon-opening for the reception of the carbon, and a plurality of chambers which surround the carbon-opening and communicating only with said opening for preventing the free entrance of air and the exit of gas.

14. As an article of manufacture, a gas-cap for an inclosed arc-lamp, comprising a body of metal adapted to engage with the top of the cylinder and a removable bushing therefor having an opening for the carbon and a groove around the opening and communicating only with said opening for limiting the exit of gas and entrance of air.

15. As an article of manufacture, a gas-cap for an inclosed arc-lamp, comprising a body of cast-iron with a circumferential groove, and a detachable brass or composition bushing having an opening for the carbon, and provided with a circumferential groove, which communicates only with the carbon-opening.

16. In an electric-arc lamp, the combination of arcing electrodes, an inclosure which surrounds the electrodes, means for limiting the entrance of air into the cylinder and exit of gas, and an oxygen-absorbing material which is located in such manner that it absorbs oxygen from the cylinder as soon as it is heated, and is included in circuit with the arc.

17. In an electric-arc lamp, the combination of arcing electrodes, an inclosure for the arc,

and oxygen-absorbing material placed in operative relation to the cylinder and included in the circuit of the lamp.

18. In an electric closed arc-lamp, the combination with the closed arc-inclosing glass chamber, of a receptacle opening into said chamber and containing oxygen-absorbing material located in the circuit of the lamp, as and for the purpose set forth.

19. In an electric-arc lamp, the combination of a disk, a flat metal frame-plate secured thereto by vertically-extending pieces, and a side tube which passes through the disk and is secured to a boss formed in one of the side pieces.

20. In an electric-arc lamp, the combination of a disk, a flat metal frame-plate, a pair of vertically-extending side pieces which are secured to the plate and the disk, bosses between the disk and the frame-plate formed on the side pieces, and a support for the outer globe which passes through the disk and is secured to the bosses.

21. In an electric-arc lamp of the carbon-feed type, the combination of a carbon-tube, a clutch carried thereby, and having an opening therein to permit the carbon-holder to be seized with the fingers or by a tool while trimming the lamp, a guide for the carbon formed integral with the clutch, a holder for the upper carbon, and a contact device on the holder for making contact with the tube.

22. In an electric-arc lamp designed for use on constant-potential alternating-current circuits, the combination of carbons movable with respect to each other, a magnet for separating and feeding the carbons as they are consumed, a base or frame to which the magnet is secured, a support extending upwardly from the base, a reactance comprising a laminated structure having an air-gap therein and wound with wire which is in series relation with the arc, and means for securing said reactance to the support.

23. In an electric-arc lamp, the combination of a pair of circular metal disks which are centrally connected through a hub formed integrally therewith, and side rods which extend through both disks and are secured against movement and form a globe-support.

24. In an electric-arc lamp, the combination of a carbon-tube, a follower, and a clutch secured to the tube comprising shoes, arms to which the shoes are pivotally secured, and a plate connecting the arms at the lower ends which is bored centrally to receive the carbon, the space between the arms, guide and tube being arranged to permit the carbon-follower to be grasped when recarboning.

In witness whereof we have hereunto set our hands this 2d day of November, 1897.

ELIHU THOMSON.
CHARLES E. HARTHAN.

Witnesses:
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