F. P. COBHAM.

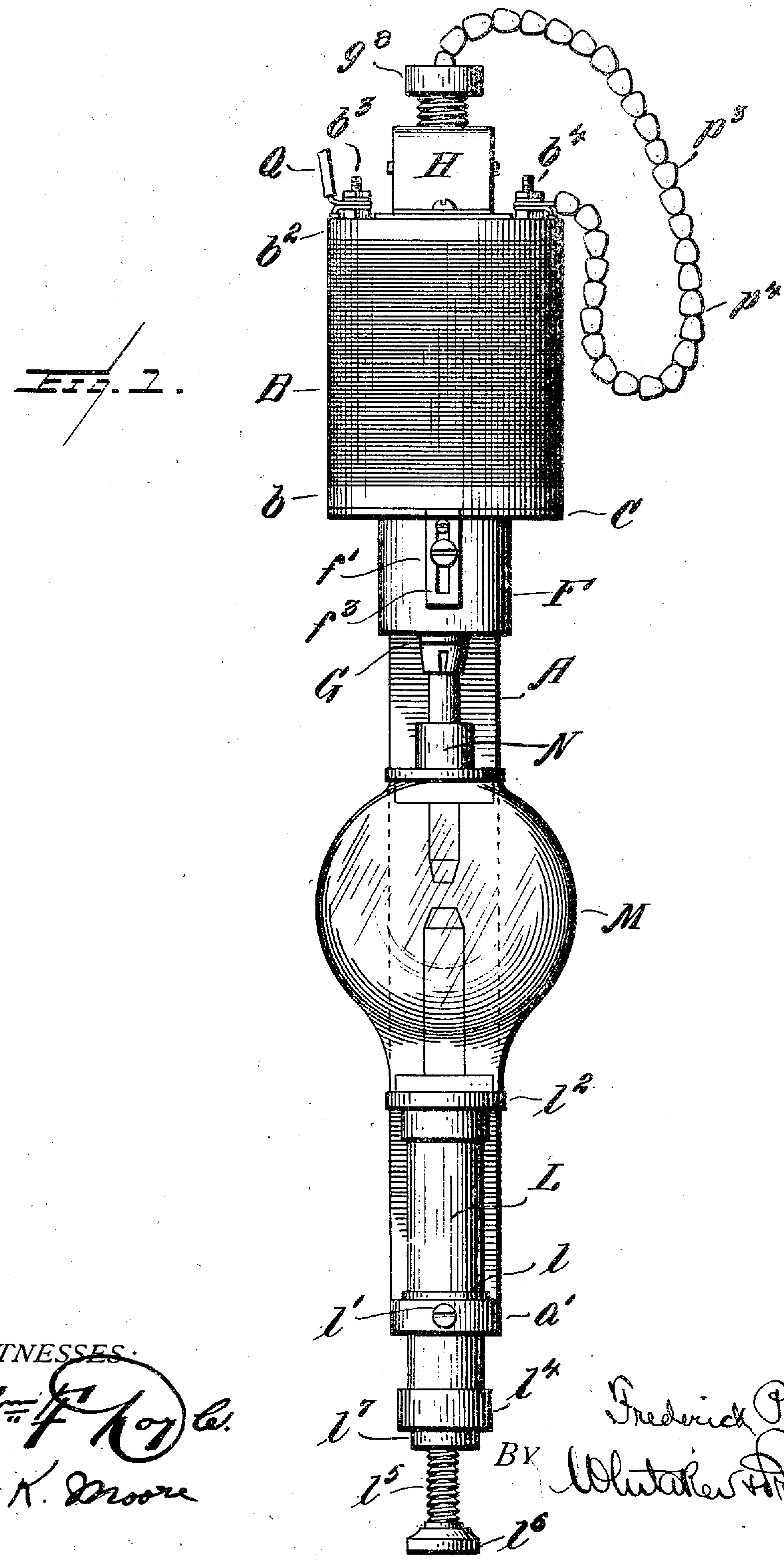
ELECTRIC ARC LIGHT.

APPLICATION FILED JAN. 10, 1908.

936,305.

Patented Oct. 12, 1909.

4 SHEETS—SHEET 1.



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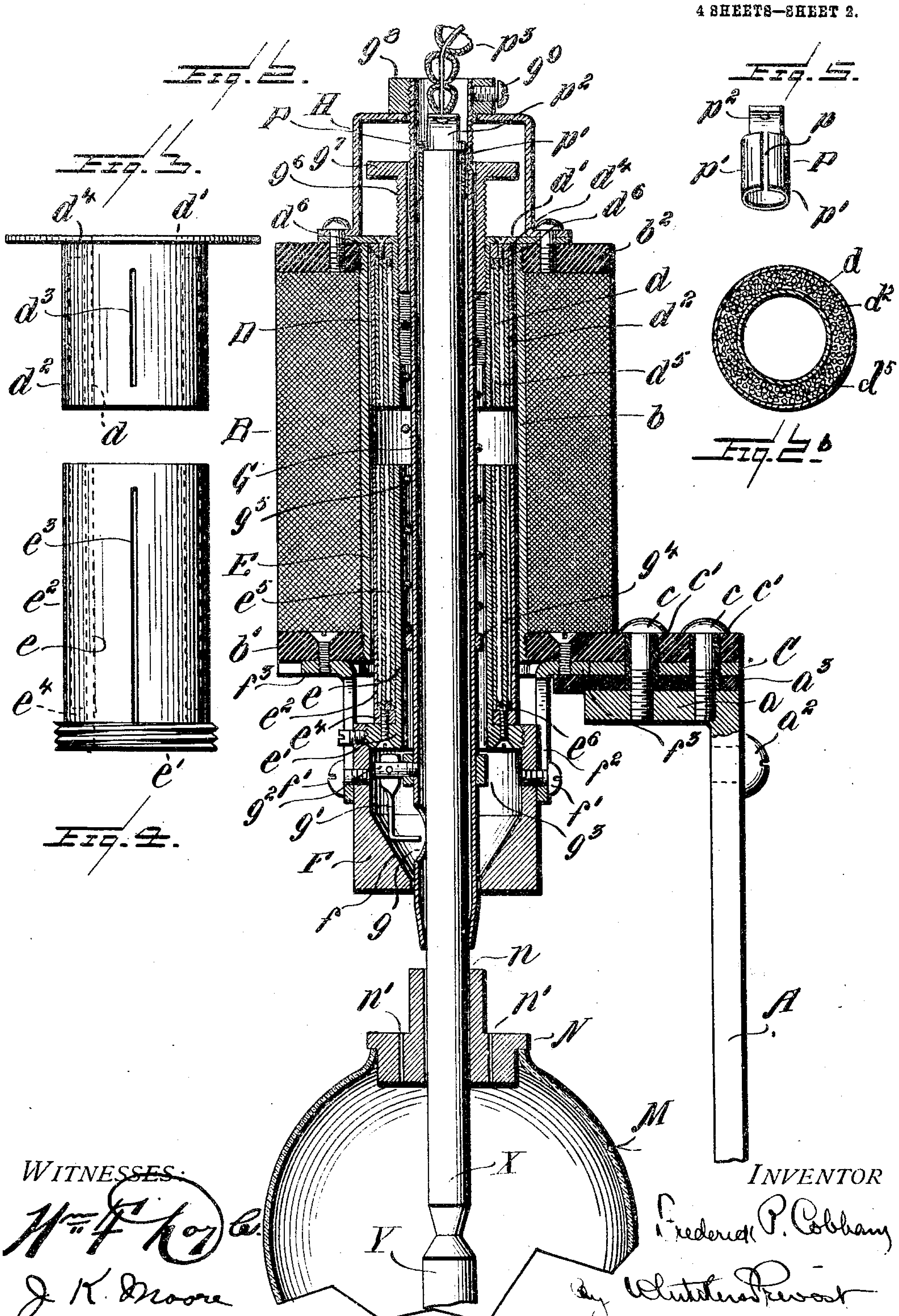

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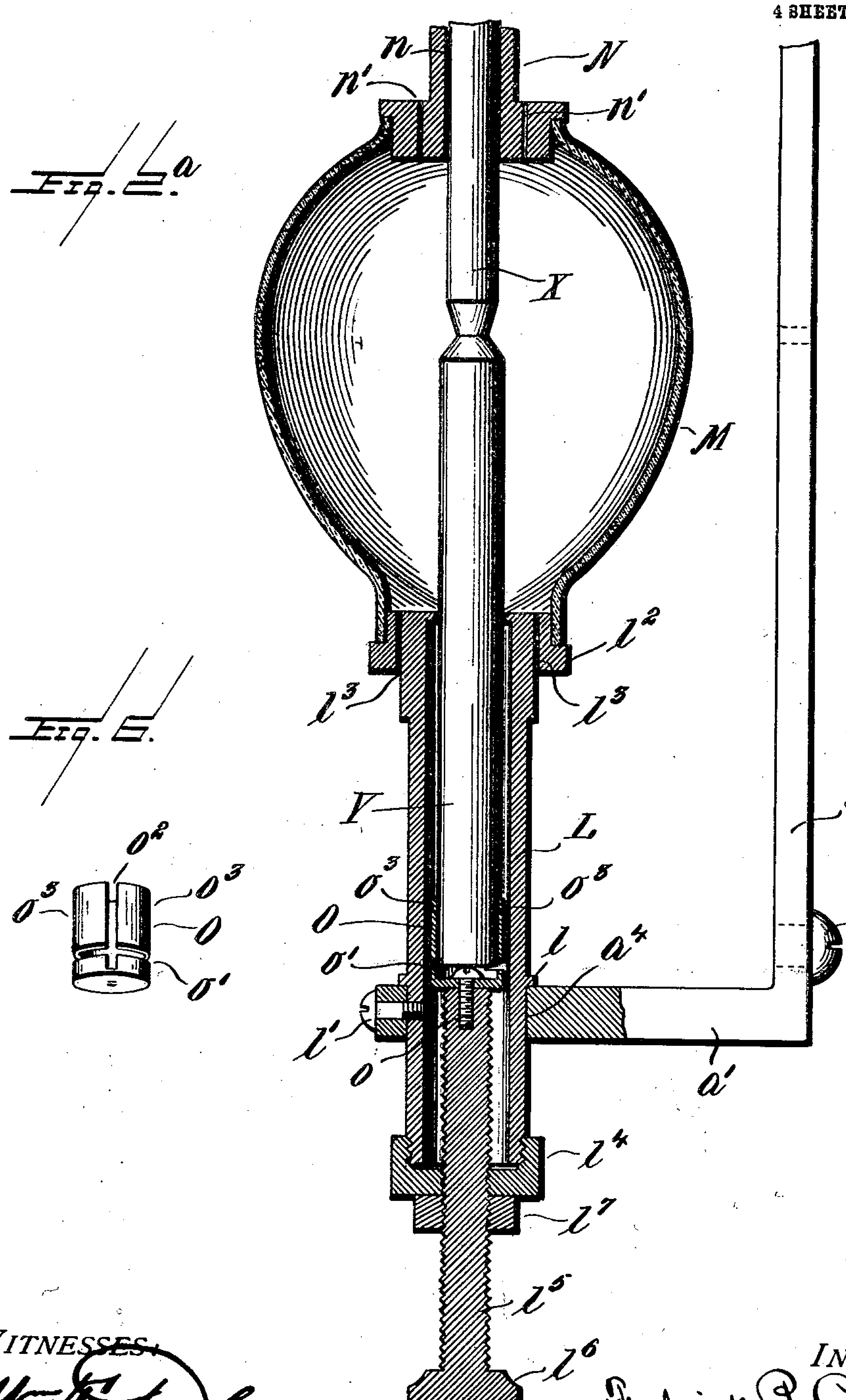

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4 SHEETS—SHEET 4.

Fig. 8.

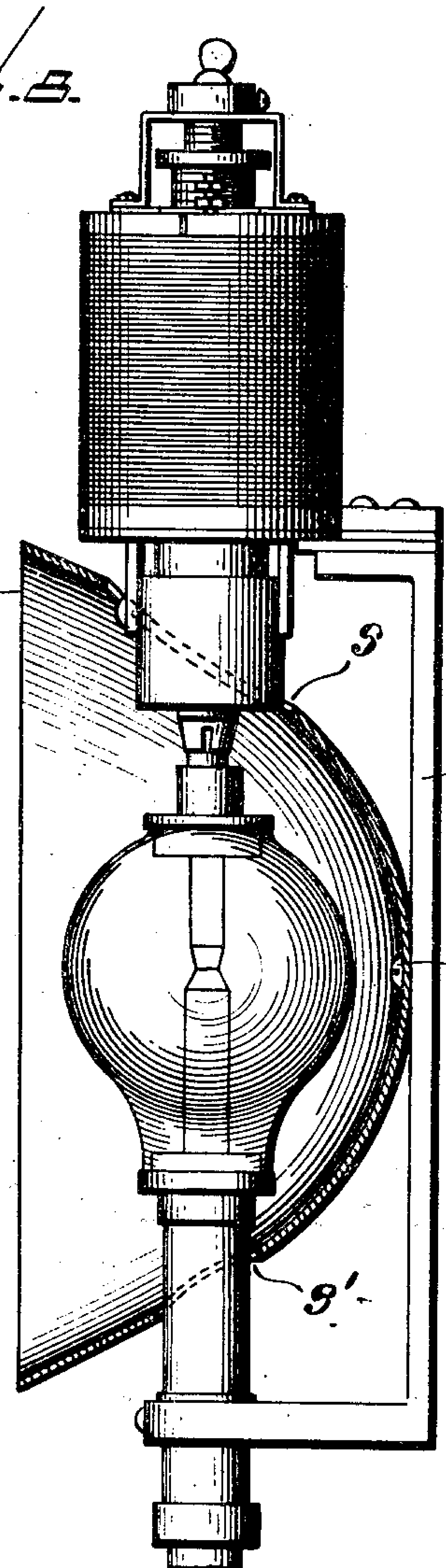
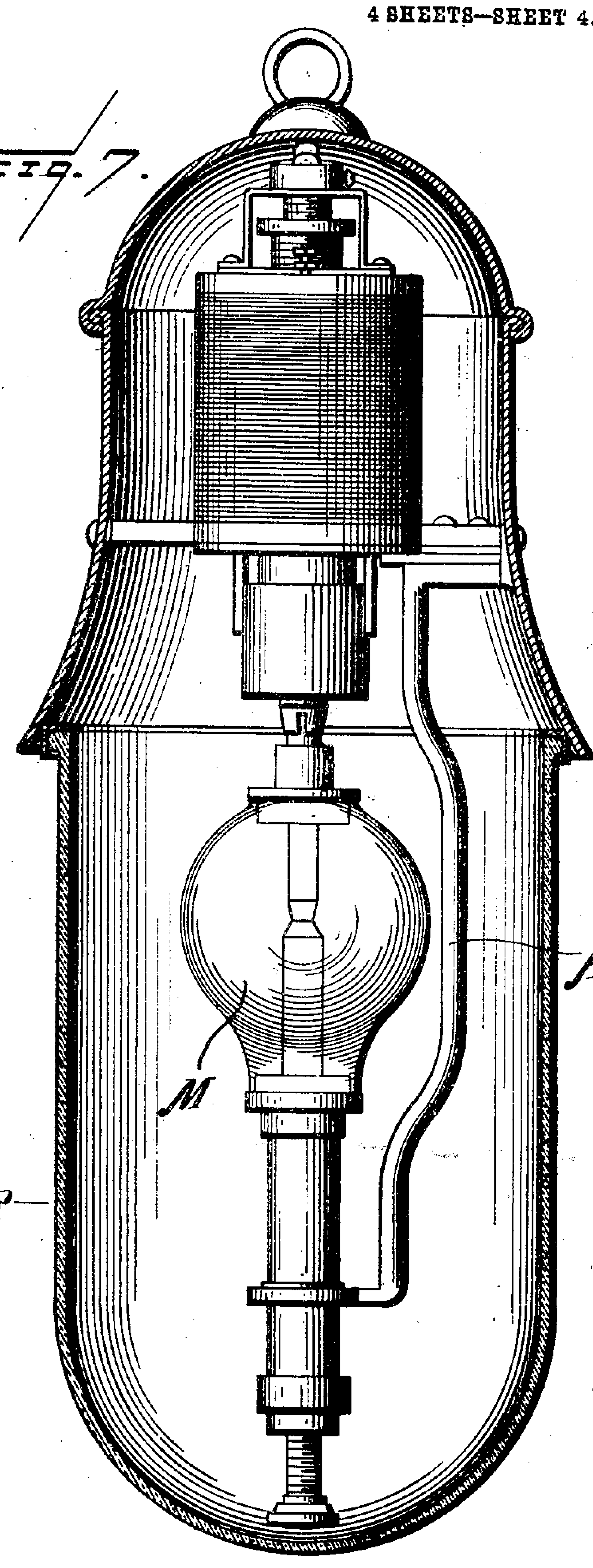


Fig. 7.



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UNITED STATES PATENT OFFICE.

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ELECTRIC-ARC LIGHT.

936,305. Specification of Letters Patent. **Patented Oct. 12, 1909.**

Application filed January 10, 1908. Serial No. 410,237.

To all whom it may concern:

Be it known that I, Frederick P. Cobham, citizen of the United States, residing at Jamestown, in the county of Chautauqua and State of New York, have invented certain new and useful Improvements in Electric-Arc Lights; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention consists in the novel features hereinafter described reference being had to the accompanying drawings which illustrate the best form in which I have contemplated embodying my invention and said invention is fully disclosed in the following description and claims.

The object of my invention is to produce an arc lamp which can be used effectively, particularly with alternating currents of low frequency, such as 25 cycle alternating currents, and obviating the vibration of the carbons and consequent "flickering" or non-uniformity of the arc which is liable to occur where such currents are employed, for arc lighting purposes.

Lamps constructed according to my invention are very well adapted for use in the headlights of electric railway cars, but they are also adapted for street and house lighting and for all purposes where an arc lamp is desired.

Referring to the accompanying drawings, Figure 1 represents a front elevation of an arc lamp embodying my invention. Fig. 2 is a vertical sectional view of the upper part of the lamp shown in Fig. 1 drawn to an enlarged scale. Fig. 2^a is a similar view of the lower part of the lamp. Fig. 2^b is a horizontal sectional view of the upper core piece. Fig. 3 is an elevation of the upper magnet core detached. Fig. 4 is a similar view of the lower magnet core. Fig. 5 is a detail view of the upper carbon clip. Fig. 6 is a similar view of the lower carbon clip. Fig. 7 is a vertical sectional view of a lamp embodying my invention and adapted for street or house lighting, and drawn to a smaller scale than Fig. 1. Fig. 8 is a similar view of a lamp provided with a parabolic reflector, for use as a headlight or for other purposes.

In Figs. 1, 2, 2^a, 3 and 4 I have shown a form of lamp arranged to be inserted within a suitable casing (not shown) such as the casing of a headlight or lantern, and provided with a vertically disposed frame A, having at its upper and lower ends the horizontally disposed arms or brackets a and a' respectively for supporting the parts of the lamp, said frame A being adapted to be secured to a part of the casing, or to some other suitable support, in any desired manner, as by means of screws a^2 a^2. The upper arm or bracket a supports the clutch mechanism for the upper carbon, and the lower bracket a' supports the lower carbon holder and the globe surrounding the arc, as hereinafter described.

Upon the upper bracket a is located a fiber or other insulating plate a^3, above which is a horizontal metal plate C, preferably of brass, and above said plate is an insulating plate b' of fiber or other insulating material forming the bottom or lower end of the spool of magnet B. Screws c c provided with insulating tubes c' c' (preferably of hard rubber) pass through apertures in the plates b', C and a^3 and securely support the magnet spool, at the same time insulating the brass plate C from the magnet and also from the bracket a.

The spool of the magnet B comprises a tube b preferably of brass which is threaded at its ends, the lower end being screwed into an aperture in the fiber plate b' and its upper end similarly screwed into a disk b^2 of insulating material, such as fiber. The magnet spool is provided with a suitable number of ampere turns, the wire being preferably provided with insulating material which will resist heat, and I prefer to employ what is termed "flame proof" insulated wire having an asbestos covering, the coils of which constitute say 500 to 600 ampere turns of 15 or 18 gage copper wire, terminating in binding posts b^3, b^4 (see Fig. 1).

Within the upper part of the magnet B is secured the upper core piece which is permanently held in position. This core piece is indicated as a whole by the reference letter D, and consists of the following parts. d represents an interior sleeve or casing formed of soft iron and provided at its upper end with a flange d' extending outwardly and resting on the fiber disk b^2, to which it is secured by suitable screws. d^2 is an external casing of larger diameter than and surrounding the interior casing, and said external casing is formed of a non-magnetic metal such as brass or copper, and is provided with a vertically disposed slot d^3 as shown in Fig. 3. The upper end of the external casing is secured to the flange d' of the internal casing by means of screws which engage an inwardly extending flange d^4 of the external casing. The space between the inner and outer casing is completely filled with vertically disposed soft iron wires or strips d^5 of small diameter, which are secured to the flange d^4 of the outer casing preferably by hard solder, as indicated at d^6, and have their lower ends flush with the ends of the inner and outer casings as shown.

Within the lower part of the magnet spool is arranged a vertically movable lower core piece, which is indicated as a whole by the letter E and is constructed exactly in the same manner as the fixed core piece except that it is inverted. Thus e represents the inner soft iron casing, e' the flange portion thereof which is externally threaded as shown, e^2 is the external casing of non-magnetic metal, provided with slot e^3 (see Fig. 4) and flange e^4 which is secured to the flange of the inner casing by screws as shown. e^5 are the soft iron wires or strips located between the inner and outer casings and secured to the flange e^4 by hard solder as indicated at e^6.

To the threaded flange e' of the lower core is screwed a cylindrical clutch case F having the interior tapering or inclined portion f the downward movement of the clutch case being limited by means of screws or studs f' f' engaging vertical slots f^2 f^2 in brackets f^3 f^3 secured to the under side of the bottom plate b' of the magnet spool, the brass plate C being preferably cut away as shown to accommodate said brackets.

Through the center of the upper and lower core pieces D and E extends a vertical tube G which receives the upper carbon X. This tube is slightly larger in diameter than the carbon, and is tapered at its lower end to form a guiding aperture for the same. A short distance above the lower end the tube G is provided with an aperture g, above which is pivoted a clutch member g'. In this instance the clutch member, which is L-shaped, is pivoted at its upper end in a slot in a screw g^2, extending through a collar g^3, and said tube and securing the collar on the tube. The horizontal portion of the clutch member extends through the aperture g and when the clutch case F is raised, said clutch member is pushed by the inclined surface f into contact with the carbon, thereby gripping it and lifting it with the clutch member and tube G.

Above the clutch member g' the tube G is provided exteriorly with an annular shoulder, formed in this instance by a collar g^4, which engages one end of a spiral spring g^5 surrounding tube G and the upper end of the said spring engages the end of a threaded adjusting sleeve g^6, which is screwed into the threaded interior of inner casing d of the upper core piece, and is provided with a milled flange g^7 or other means for turning said sleeve to adjust the tension of the spring. The object of this spring is to assist in overcoming the surging and tendency to vibrate on the part of the upper carbon, (which is particularly liable to occur where an alternating current of low frequency is used), and generally to prevent such vertical vibration and also to exert a proper tension or downward pressure on the tube G, when the carbon and tube are raised and keep the clutch member g' in firm engagement with the inclined portion f of the clutch case, and with the carbon X. In practice I prefer at times to adjust the sleeve g^6 so that the spring exerts no pressure downward on the tube G, when no current is passing through the lamp or when the upper carbon tube G is in its lowest position, as for instance, when the lamp feeds, the tension of the spring being only exerted when the tube G is raised by the clutch.

On the top of the magnet B is a yoke H secured thereto in this instance by the same screws which secure the flange of the inner casing of the upper core piece, said yoke having an aperture for the passage of the upper end of the upper carbon holding tube G. The upper end of tube G is threaded and provided with an adjusting nut or collar g^8 adapted to rest on the yoke H when the tube is in its lowest position and having a set screw g^9 to secure it rigidly in its adjusted position. This set screw determines the amount of lift of the upper carbon, by adjusting the relative positions of the clutch member g' and the clutch case F. As the clutch case can only lift until the upper edge of the same engages the bottom plate of the magnet spool it must follow that the higher the tube G is raised, the shorter must be the remaining distance that the carbon can be lifted after the clutch case engages the clutch member g' and forces it into engagement with the carbon. By turning the adjusting nut g^8 therefore in one direction or another, the amount of separation of the upper and lower carbons and the length of the arc can be readily adjusted to produce the best arc with the current employed.

The lower bracket a' is provided with a circular orifice a^4 in which is fitted the lower carbon tube L having a shoulder or flange l above said bracket and being secured in position by the screw l'.

The upper end of the tube L is provided with a globe receiving socket l^2, which is furnished with a plurality of vertically disposed air inlet passages l^3.

M is the glass globe, the lower end of which engages the socket l^3, and the upper end is fitted with a gas cap N, preferably of lava or other refractory material, having a portion fitting the upper end of the globe, a central aperture n to permit the passage of the upper carbon and a plurality of vertically disposed ventilating apertures n' n' to permit the escape of gas and products of combustion from within the globe and to prevent excess of gas pressure upon the arc flame.

The lower end of the lower carbon tube is threaded to receive a cap l^4 having a threaded central aperture through which extends the carbon adjusting screw l^5 having a milled head l^6 or other means for turning the screw and provided with a lock nut l^7.

In order to insure proper electrical connections with the carbons, I prefer to provide spring connecting clips for engaging the same. The clip for the lower carbon is shown best in Figs. 2^a and 6. The clip consists of a cylindrical shaped piece O of conducting metal, preferably spring brass, which is provided with a solid bottom, having an aperture through which passes a screw o which secures it to the end of the adjusting screw l^5. The cylindrical body is slotted nearly all the way around horizontally as at o' and the portion above the slot o' is slotted vertically as at o^2, thus forming two curved spring arms o^3 o^3 which grip the lower carbon Y as shown in Fig. 2^a, insuring a good electrical connection therewith.

P (Figs. 2 and 5) represents the upper carbon clip which consists of a split tube, preferably spring brass, having a vertical slot p, and spring arms p' p' which grip the upper end of upper carbon X. An integral part p^2 of the clip extends above the slotted portion, is bent over and perforated to receive the connecting wire p^3, which is preferably formed of fine woven copper wire, and the end of which is passed through the aperture in the part p^2 and secured by hard solder. The connecting wire p^3 extends to the binding post b^4 (Fig. 1) and to protect it from the heat of the lamp it is inclosed in a refractory substance. In this instance I have shown it properly insulated by incasing in a number of sea beans p^4 known as "Job's tears" which are bored and strung on the connecting wire.

In order to supply current to the lamp, current is led in through the wire Q (Fig. 1) to binding post b^3 and thence passes through the coils of magnet B, thence by wire p^3 to the upper carbon, thence to the lower carbon (forming the arc), thence through the screw l^5 to the frame A, from which the return wire may lead in any desired manner.

When the current is turned into the lamp and the coils of magnet B are energized the lower core will be lifted and will operate the clutch member g' thus engaging and lifting the upper carbon X and producing the arc. The construction of the cores in the manner described I have found by practical experiment will produce most satisfactory results with alternating currents of less than 60 cycles.

In reference to the perforated gas cap N, I have also found by experiment that when using alternating current of low frequency such as a 25 cycle current, if no ventilation is afforded, the fumes and gases generated within the globe M, appear to obscure the rays of light from the arc, and also to cause it to change its shape, from a full spark to a broken and disrupted discharge. When, however, the globe is ventilated properly as by the holes in the gas cap and the air inlet holes in the globe socket, as herein shown and described, there is a steady full spark and the fumes are greatly diminished resulting in the production of a steady white light. The construction of the lamp also tends to prevent breaking and dimming of the arc upon wide ranges of line voltage drop.

When it is desired to use the lamp for street and house lighting, I employ a modified form of frame A' shown in Fig. 7, so constructed that the mechanism in its entirety can be inclosed in an exterior globe R much larger than the globe M, which partially incloses the carbon, the mechanism being inclosed in a suitable case or covering similar to that shown in Fig. 7. In this case the lamp may be suspended from the top in any desired practical manner.

In some cases I prefer to employ with the lamp a reflector of parabolic form. In such case the reflector S is used, with the frame A such as shown in Figs. 1, 2 and 2^a, the reflector having apertures s s' for the passage of the carbon supporting devices and being secured to the frame A by a small screw s^2 which passes through a hole in the reflector exactly in the center or axis of its parabolic curve. This screw will serve also as a guide to the eye in adjusting the lower carbon so that the arc will be focused exactly in line with the screw head and the axis of the parabolic curve and thus reflect the rays of light directly forward in the most accurate manner.

While I have described my improved arc lamp as being especially adapted for use with alternating currents of low frequency such as 25 cycle alternating currents, I wish it to be understood that it can also be employed with high and low alternating currents of from 15 to 125 cycles, and with direct currents with a line voltage from 90 to 100, as has been successfully demonstrated by use on commercial circuits.

What I claim and desire to secure by Letters Patent is:—

1. In an electric arc light, the combination with stationary and movable carbon holders, said movable carbon holder comprising among its members, a vertically disposed tube, having an aperture in its side, of a pendent clutch member pivotally connected with said tube at one side of the same and having a thin horizontally disposed part projecting through the said aperture in the tube, a magnet coil, a movable core piece located therein, and a clutch member connected with said core piece, and adapted to operatively engage said pivoted clutch member, substantially as described.

2. In an electric arc light, the combination with the stationary and movable carbon supports and clutch members for said movable carbon, of a magnet coil, a core piece within the same comprising an inner casing of magnetic metal, an outer casing of non-magnetic metal, and finely divided magnetic metal filling the space between the inner and outer casings, and operative connections between the said core piece and one of said clutch members, substantially as described.

3. In an electric arc light, the combination with the stationary and movable carbon supports and clutch members for said movable carbon, of a magnet coil, a core piece within the same comprising an inner casing of magnetic metal, an outer casing of non-magnetic metal provided with a longitudinal slot, extending to but not through its end portions, leaving the end portions integral, and a plurality of finely divided pieces of magnetic metal, located between said casings and in contact with said outer casing and operative connections between said core piece and one of the clutch members, substantially as described.

4. In an electric arc light, the combination with a stationary carbon holder and a movable carbon holder, and clutch mechanism for the movable carbon, of a magnet coil, a stationary core piece located within a portion of said coil and comprising an inner casing of magnetic metal, an outer casing of non-magnetic metal and finely divided pieces of magnetic metal filling the space between said casings, a movable core piece within a portion of said coil, and connections between the movable core piece and said clutch mechanism, substantially as described.

5. In an electric arc light, the combination with a stationary carbon holder and a movable carbon holder, and clutch mechanism for the movable carbon, of a magnet coil, a stationary core piece located within a portion of said coil and comprising an inner casing of magnetic metal, an outer casing of non-magnetic metal provided with a longitudinal slot extending to but not through the end portions thereof and finely divided pieces of magnetic metal located in the space between said casings, a movable core piece within a portion of said coil, and connections between said movable core piece and said clutch mechanism, substantially as described.

6. In an electric arc light, the combination with a stationary carbon holder and a movable carbon holder, and clutch mechanism for the movable carbon, of a magnet coil, a stationary core piece located within a portion of said coil and comprising an inner casing of magnetic metal, an outer casing of non-magnetic metal provided with a longitudinal slot extending to but not through the end portions thereof and a plurality of finely divided pieces of magnetic metal located between said casings, a movable core piece located within said coil, and comprising an inner casing of magnetic metal, an outer casing of non-magnetic metal provided with a longitudinal slot extending to but not through its ends and a plurality of finely divided pieces of magnetic metal between said casings and connections between said movable core piece and said clutch mechanism, substantially as described.

7. In an electric arc light, the combination with a stationary carbon holder and a movable carbon holder consisting of a vertically disposed tube, a clutch member having a part adapted to extend through said tube to engage the movable carbon and a clutch case for engaging said clutch member, of a magnet coil having a stationary and a movable core piece within the same, each comprising an inner casing of magnetic metal, an outer casing of non-magnetic metal, slotted longitudinally between its end portions and a plurality of pieces of magnetic metal located between said casings, said movable core piece being operatively connected to said clutch case and a spring constructed to exert a downward pressure on said tube when the latter is raised by the movable core, substantially as described.

8. In an electric arc light, the combination with the stationary and movable carbon supports and clutch mechanism for the movable carbon, of a magnet coil surrounding the movable carbon support, a hollow movable core piece within said coil and surrounding the movable carbon holder, said core piece comprising inner and outer casings of non-magnetic metal and finely divided magnetic metal between said casings the outer casing being provided with a vertical slot extending to near the upper and lower ends of said casings, and operative connections between said movable core piece and said clutch mechanism.

9. In an electric arc light, the combination with the stationary and movable carbon supports, the latter comprising a vertically movable tube, a magnet coil surrounding the same, a hollow fixed core piece located within said coil and surrounding said tube, a hollow movable core piece within said tube and surrounding the said tube, each of said core pieces comprising concentric tubular casings of non-magnetic metal and laminated magnetic metal between said casings, the outer casing being provided with a longitudinal slot extending to near the upper and lower ends of the casing and clutch mechanism for the upper carbon, connected with said movable core piece.

10. In an electric arc light, the combination with a stationary carbon holder, of a magnet coil, a tubular stationary core piece within said coil, a tubular movable core piece having portions within said coil, adjacent to said stationary core piece, said core pieces each comprising inner and outer casings of non-magnetic material and a plurality of finely divided pieces of magnetic metal between said casings, the outer of said casings being provided with a longitudinal slot extending to near the opposite ends of said casing, a vertically movable tube for the movable carbon, extending vertically through the tubular core pieces, and provided with an aperture near its lower end, a carbon clutch member having a part projecting through said aperture, a clutch member secured to the movable core piece, and adapted to engage the first mentioned clutch member, a coiled spring surrounding the movable carbon tube, within said tubular core pieces, a projection on said tube for engaging the lower end of said spring and an adjusting sleeve extending into the stationary core piece, and engaging the upper end of said spring.

In testimony whereof I affix my signature, in the presence of two witnesses.

FREDERICK P. COBHAM.

Witnesses:
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L. W. Brainard.