C. OLIVER.

ELECTRIC ARC LAMP.

APPLICATION FILED JULY 7, 1905.

914,868. Patented Mar. 9, 1909.

4 SHEETS—SHEET 1.

Fig. 2.

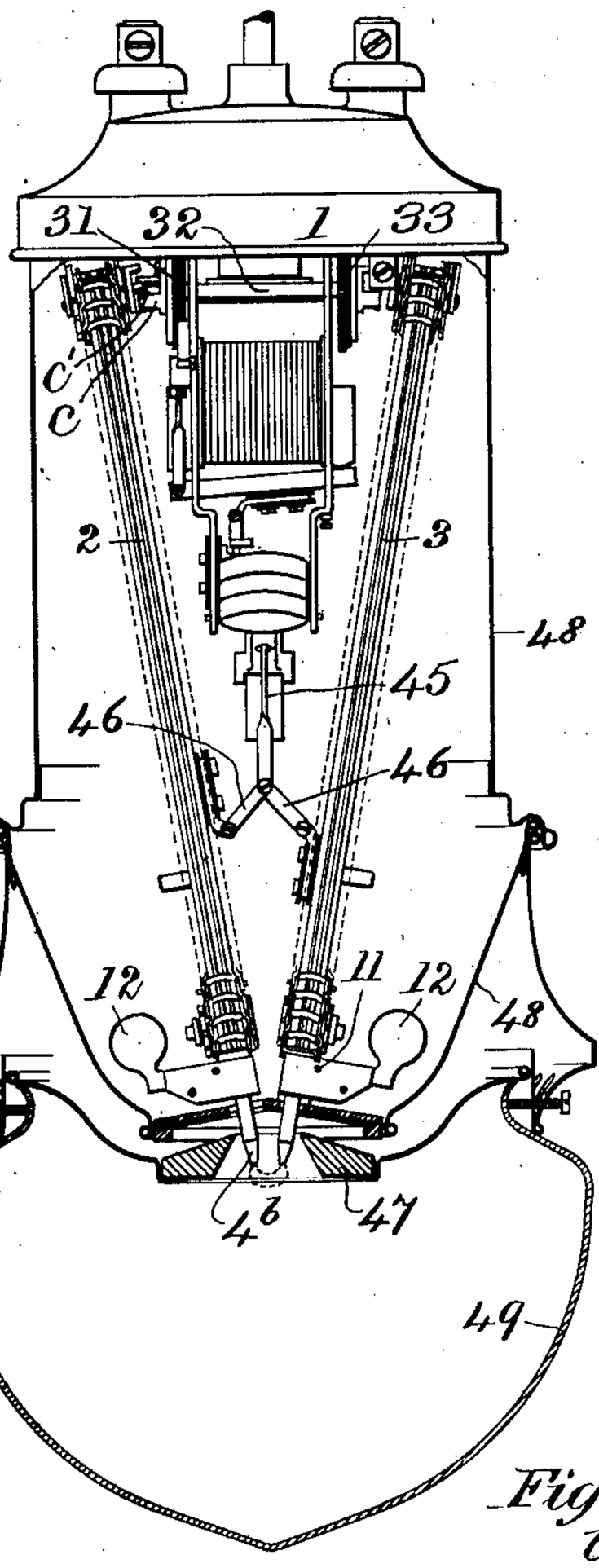


Fig. 1.

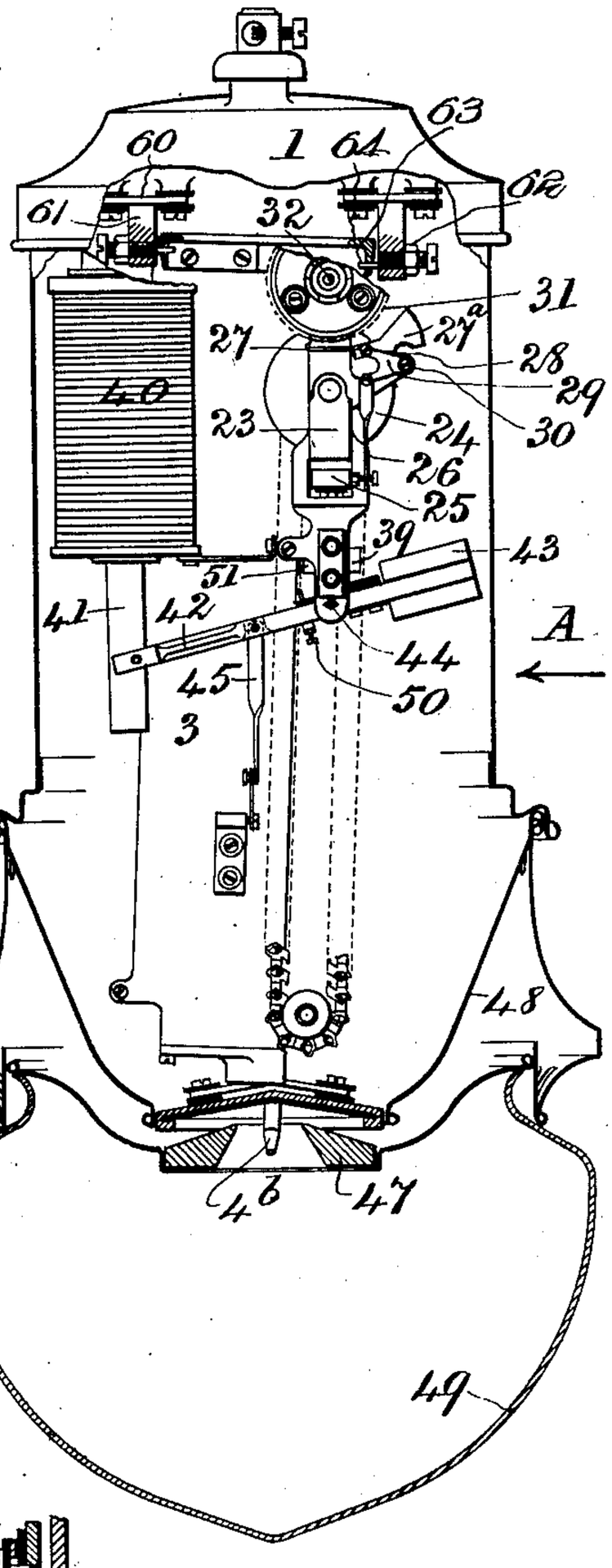
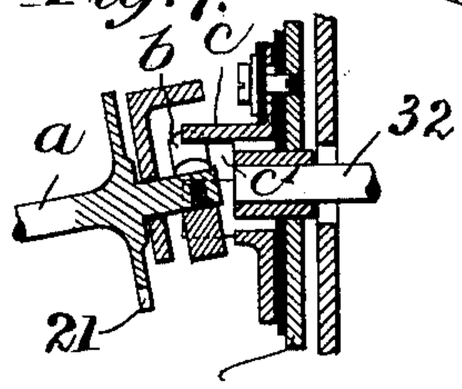


Fig. 7.



Witnesses.

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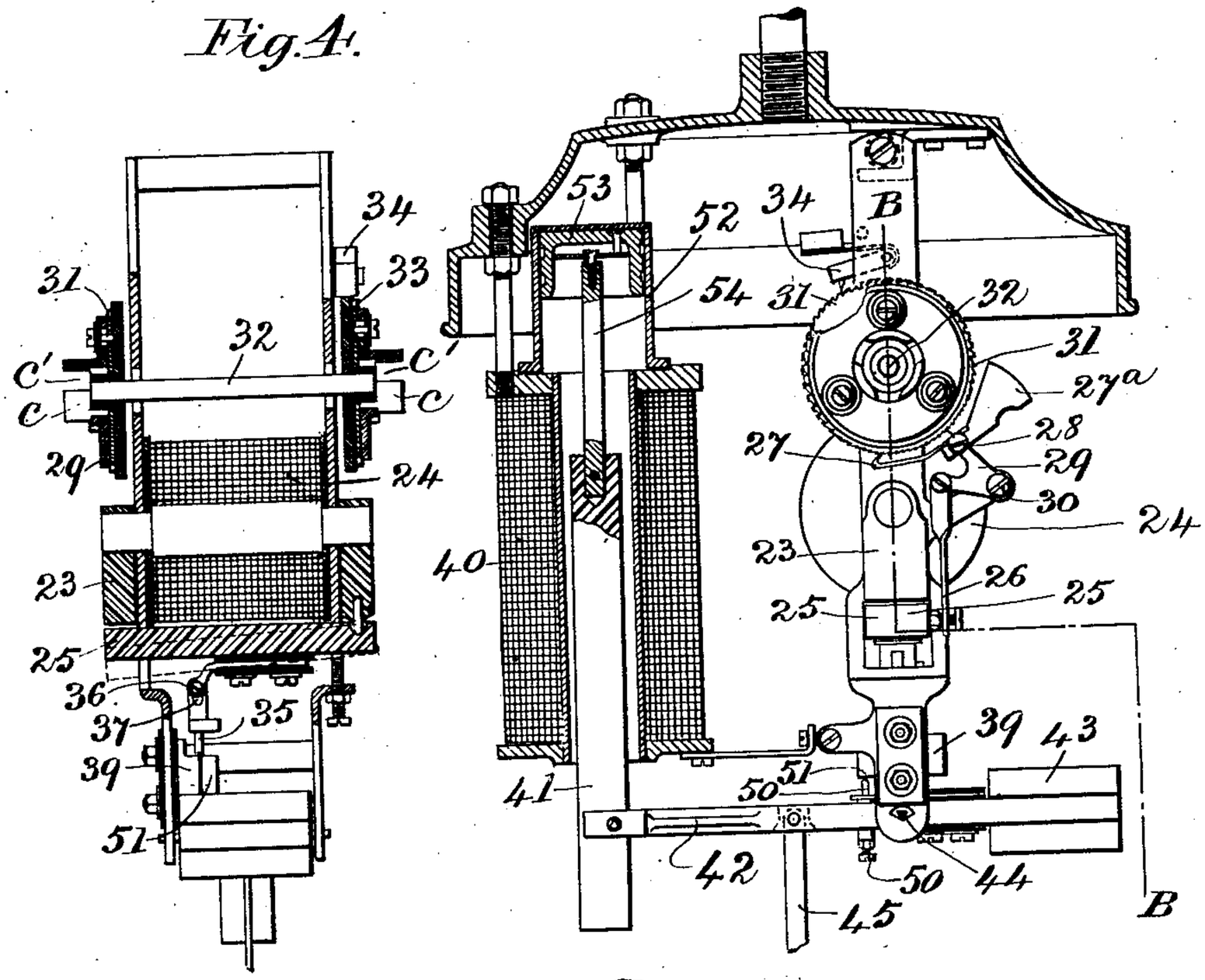
4 SHEETS—SHEET 2.

Fig. 3.

Fig. 4.



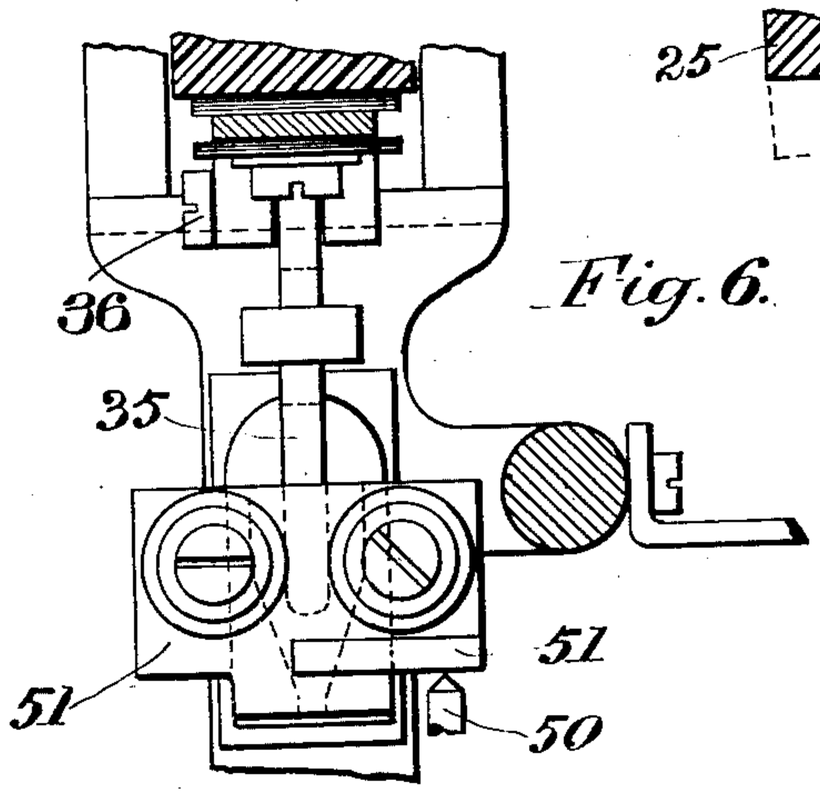


Fig. 6.

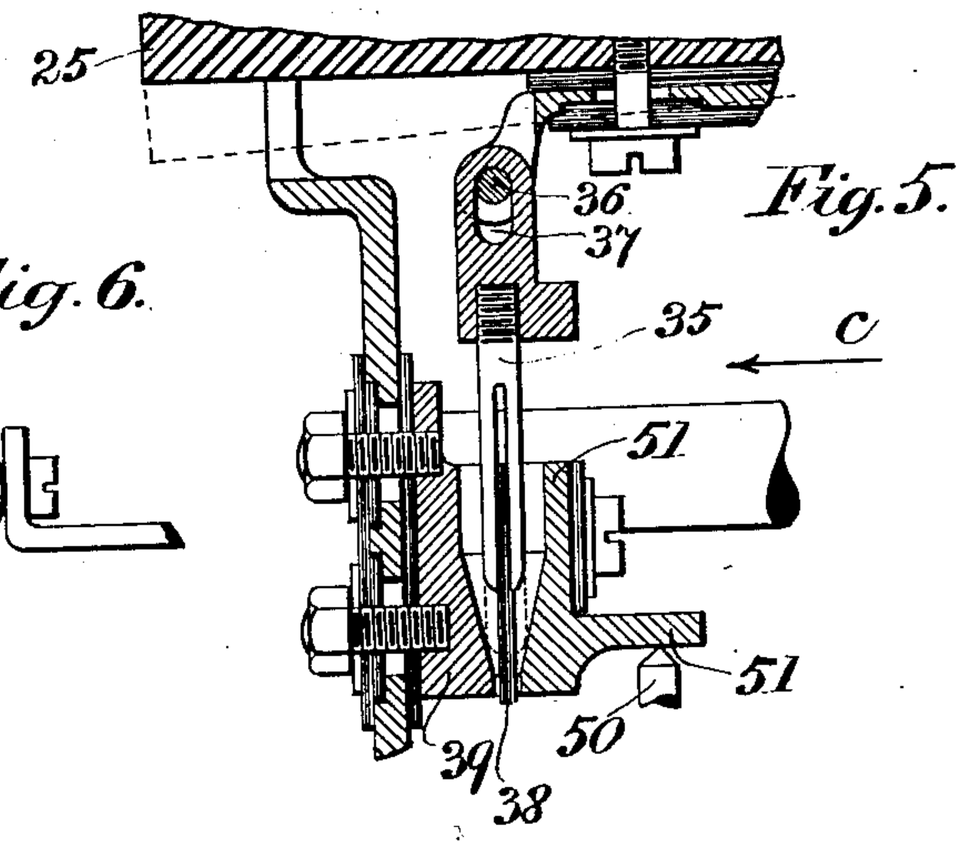


Fig. 5.

Witnesses
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4 SHEETS—SHEET 3.

Fig. 7.

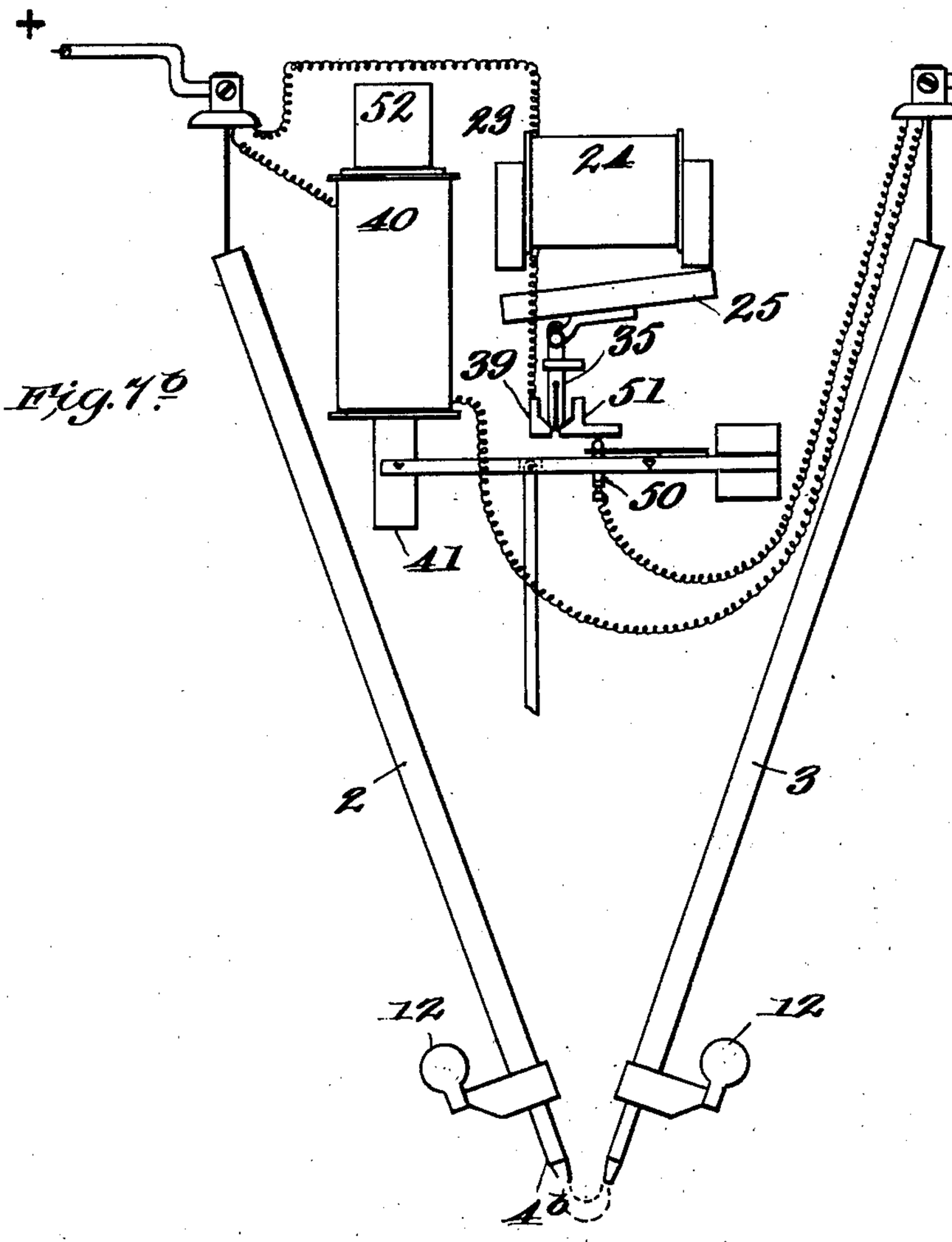
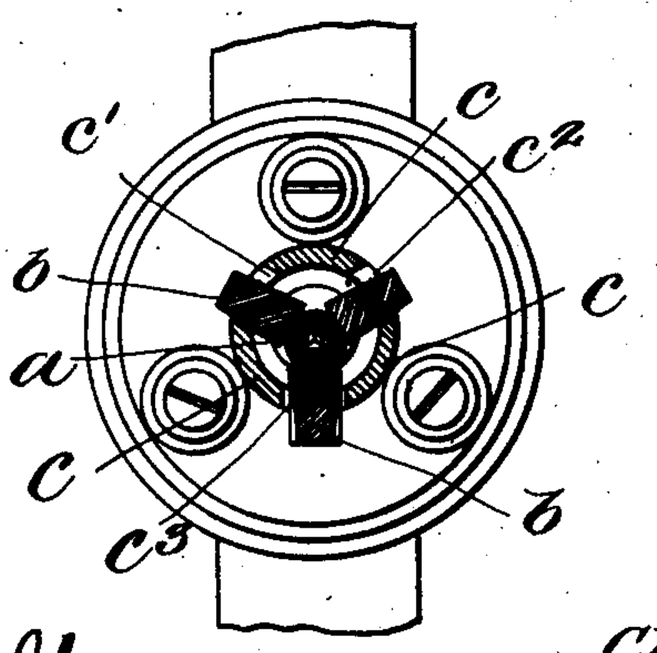


Fig. 7a.



Witnesses.

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APPLICATION FILED JULY 7, 1905.

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4 SHEETS—SHEET 4.

914,868.

Fig. 9.

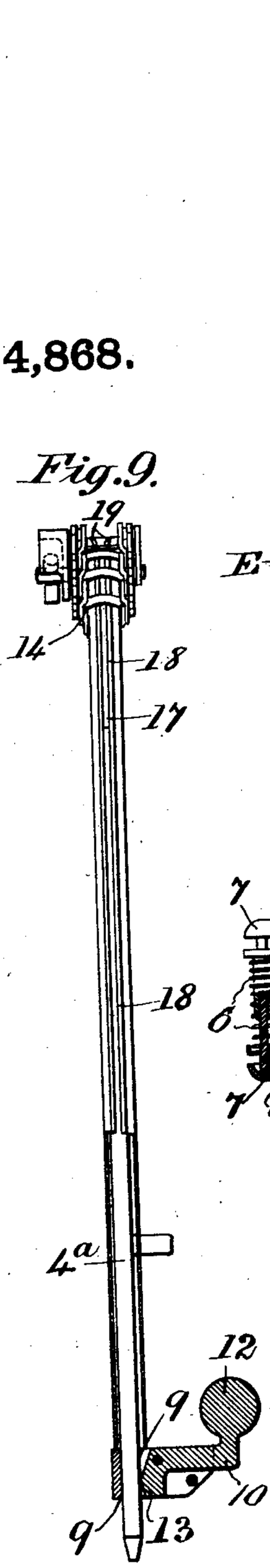


Fig. 8.

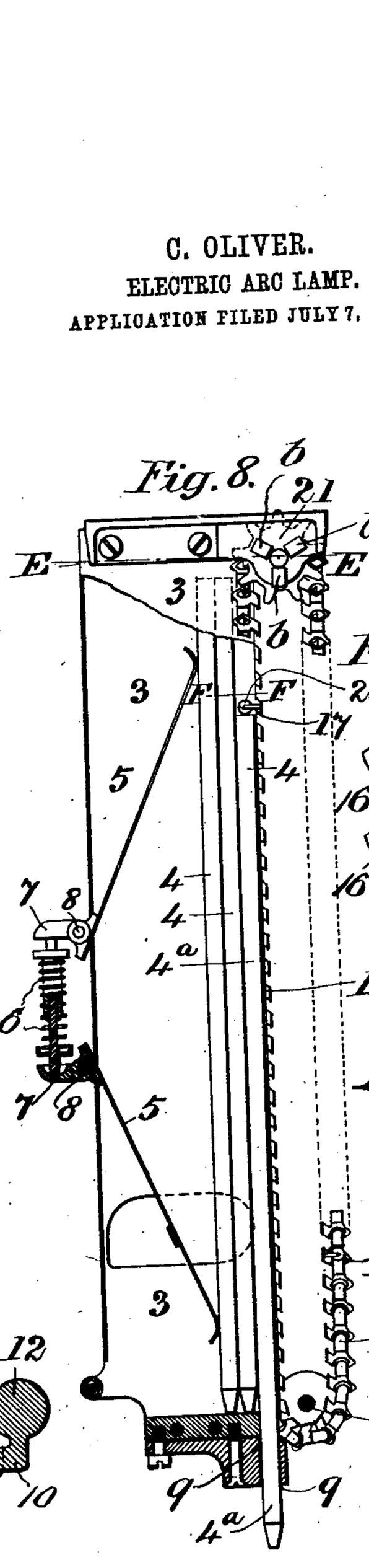


Fig. 14.

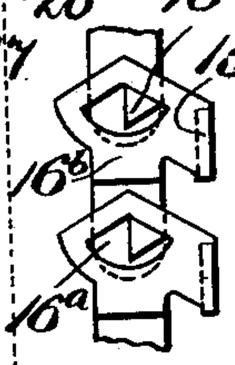


Fig. 13.

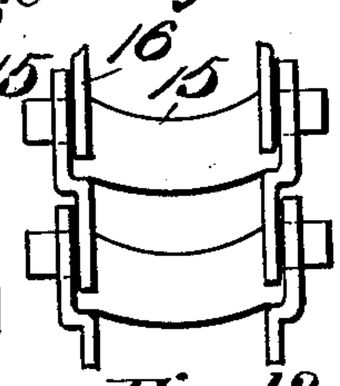
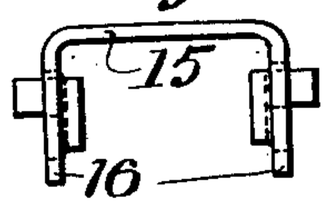
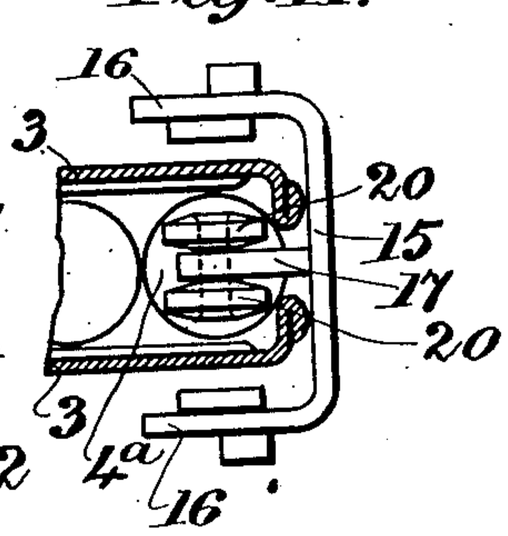


Fig. 12.



D

Fig. 11.



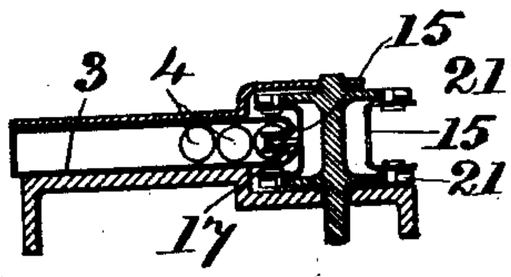


Fig. 10.

Witnesses.

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UNITED STATES PATENT OFFICE.

CHARLES OLIVER, OF WOOLWICH, ENGLAND.

ELECTRIC-ARC LAMP.

No. 914,868. Specification of Letters Patent. Patented March 9, 1909.

Application filed July 7, 1905. Serial No. 268,646.

To all whom it may concern:

Be it known that I, CHARLES OLIVER, engineer, a subject of the King of Great Britain, residing at Cambridge Place, Burrage Road, Woolwich, in the county of Kent, England, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

Heretofore in electric arc lamps employing carbons—it has been proposed to employ carbon holding magazines, but such magazine arc lamps so far as I am aware have not been found practicable, nor have they come into extensive commercial use.

According to this invention an electric arc lamp is provided having two magazines or storage chambers each adapted to hold a plurality of carbons and the carbons in which are adapted to act in succession as the electrode in the magazine containing it. I also locate both magazines above the point where the arc is to be formed and provide each with mechanism adapted to positively feed the carbon electrodes downward together so that the arc is formed between the lower ends of said downwardly projecting electrodes. Furthermore in carrying my invention into practice I arrange one or both of the magazines, or storage chambers, in such wise as to be adapted to be swung or otherwise moved toward or away from the other, to thereby strike the arc; and I provide electrically operated means to move one or both of said magazines for the purpose, not only of striking the arc, but, also, for the purpose of automatically regulating the arc—or governing its length after striking it.

Magazine arc lamps according to this invention also comprise means to automatically eject the butt ends of the carbons when used up, and to automatically and positively replace each used up electrode in turn with a new carbon from the magazine or storage chamber. This operation is accomplished without interruption of the burning of the lamp, except for a very few seconds during the automatic changing of the electrodes, at the end of say every six hours of the burning of the lamp, or until the supply in the magazines is exhausted.

Referring to the accompanying drawings:—Figure 1 is a view of a magazine arc lamp according to my present invention partly in vertical section and partly in elevation. Fig. 2 is a similar view to Fig. 1 and taken at right angles thereto looking in the direction of the arrow A. Fig. 3 is an enlarged detail view partly in vertical section, of the upper part of the lamp showing the mechanism for swinging one or both of the magazines, and thereby striking and regulating the arc and also showing the motor for feeding the carbon electrodes. Fig. 4 is a detail view partly in section along the line B—B Fig. 3. Fig. 5 is an enlarged detail view of the lower part of Fig. 4 showing the switching arrangement. Fig. 6 is an edge view of Fig. 5 looking in the direction of the arrow C Fig. 5. Fig. 7 is a local sectional view on an enlarged scale of the universal joint arrangement between the electrical motor or other means for actuating the feeding mechanism and the shaft of the sprocket wheels by which such feed is obtained. Fig. 7[a] is a transverse sectional detail view of the universal joint shown in Fig. 7. Fig. 7[b] a diagrammatic view showing the magazines, the solenoid, and regulating mechanism detached from the lamp casing. Fig. 8 is an interior view in elevation partly in section on an enlarged scale of one of the magazines showing how the carbons are stored therein and also showing the means for feeding down the carbon 4[a] which is illustrated as serving as the electrode in said magazine. Fig. 9 is a view partly in vertical section taken at right angles to Fig. 8 looking in the direction of the arrow D Fig. 8. Fig. 10 is a horizontal cross-sectional view on line E—E Fig. 8, showing the open upper end of the magazines. Fig. 11 is a horizontal detail sectional view, on a greatly enlarged scale on the line F—F Fig. 8, and Figs. 12, 13 and 14 are detail views of the links, forming the sprocket chain 14 hereinafter described for operating or feeding down the carbon serving as the electrode in each magazine.

Referring to the above drawings in which like characters refer to like parts in all the views, 1 represents a suitable frame, or support, for the lamp, and 2 and 3 suitable storage chambers or magazines for the carbons 4. Inside each chamber 2 and 3 are one or more spring arms 5, as illustrated in Fig. 8, which normally extend across such chamber from one side to the other, so as to keep the carbons 4, in said chamber, all pressed sidewise toward one of the inner sides of the magazine, which side I will call the "discharging side". These spring arms 5 are so arranged that they readily permit the insertion of the carbons 4 through the open bottom of the

magazine, and are pushed back or otherwise put under tension on the insertion of the carbons when charging each magazine 2 and 3.

One or both of the carbon-holding magazines are pivotally supported at the top as shown in Fig. 1. On the under side of the top of the frame 1 are secured plates 60 having downwardly extending arms or brackets 61. In perforations in these brackets are secured screws 62, each carrying a projecting pin, as 63, one of which is eccentric, which pins engage in perforations in the top 64 of the magazine.

6 represents a spring acting on the arms 7, 7, of the rockers 8, 8, to which the arms 5 are attached, and serves to keep said arms 5 under tension.

In alinement with the lower end of carbon 4^a when it is against the aforesaid discharging side of the chamber, an aperture 9 is provided through which the said carbon 4^a can pass endwise, see Figs. 8 and 9. The exit of the carbons from each of the magazines is controlled by the transverse pressure thereon of the spring arms 5 supplemented by bell-crank levers 10, pivoted as at 11 to the magazine frames, and weighted at their ends 12, so as to thereby normally keep the other ends 13 forced against the said carbons, while they are serving as electrodes. These bell-cranks not only prevent the electrodes from dropping out, but they maintain the same in any position to which they have been moved.

One pole of the circuit is connected to each of the magazines and thereby the current is conveyed by means of these bell-cranks or equivalent devices 10, to the electrodes, as close as possible to the burning points of the latter.

For the purpose of feeding down the electrodes in each magazine 2 and 3 when required during the burning of the lamp, I may employ, in conjunction with each magazine, a separate endless band or chain, advantageously a sprocket chain 14, the links 15, of which are formed somewhat U-shaped in cross section, see Figs. 11 and 12, so that the edges 16 of the links 15 of the sprocket chain 14 will embrace the outside of the magazine chamber.

Each link of the sprocket chain 14 consists of a cross-bar yoke 15 with the arm 16 at each end, said arm 16 being provided with a triangular aperture 16^a (see Fig. 14) and a downwardly projecting part 16^b on which latter is fixed the laterally extending triangular stud or pivot 16^c which passes through the triangular aperture 16^a of the link next the same; whereby the links all pivot together to form the sprocket chain 14. The inside of one or more of the links 15 of said chain 14 is provided, as shown in Figs. 8, 10 and 11, with a projecting finger or stud 17 at two separate points in the length of the chain and about equi-distant apart. Each of these fingers 17 in turn passes into the top end of the longitudinal slot 18 (Fig. 9) in the discharging side of the magazine, so as to thereby bear on, or engage the top or upper end of the electrode carbon 4^a lying against said discharging side of the magazine. This carbon 4^a thus lies on the path of travel of said finger or stud 17 on the sprocket chain 14, and there is provided means such as the converging sides 19 (Fig. 9) at the upper end of said slot 18, to guide or lead the fingers 17 into said slot 18. Therefore, as said sprocket chain 14 moves said finger 17 downward, or along the magazine, the carbon 4^a is forced along in front of said finger 17, see Figs. 1, 2, 8 and 9, against the resistance of the aforesaid device 10, which is overcome and the feed of the electrodes thus accomplished. The fingers 17 may if desired be provided with rollers 20 (see Figs. 8 and 11) to engage the top end of the carbon or electrode 4^a. Such sprocket chain 14 passes around sprocket wheels 21 conveniently arranged at the top and over a guide pulley 22 at the bottom end of said magazine chamber, and motion is imparted to each of said sprocket chains 14 through the medium of each upper sprocket wheel 21 which is rotated by a suitable motor fixed on the frame of the lamp as hereinafter explained. A universal or other suitable joint (see Fig. 7) is introduced between the upper sprocket wheel 21 and the motor so as to permit the swinging movement of one or both of the magazines. On the shaft a (Figs. 7 and 7^a) carrying the sprocket wheel 21 are carried three radially disposed studs b (see Figs. 7 and 8, as well as Fig. 7^a). On the shaft 32 on which is fixed the ratchet wheel 31 (as hereinafter described) there is fixed a part c which is slotted at c^1, c^2, c^3; these slots c^1, c^2, c^3 being rather wider than the aforesaid studs b and spaced apart equidistant and in corresponding position to the position at which the studs b are spaced apart. It will thus be seen that the radial arms or studs b and the slotted part c form between them a universal joint which permits swinging movement of the magazines relative to one another while insuring radial movement being transmitted from the shaft 32 to the shaft a.

The motor which I employ for operating the feed mechanism is adapted to rotate the sprocket wheel 21 and chain 14 of each magazine and thus feed the carbon electrode downward from each of said magazines; and by way of example I have illustrated suitable electro magnetic means which I have found satisfactory for effecting this carbon feeding operation as follows:—23 is the pole piece of a magnet and 24 the winding therefor which operates an armature 25, this armature 25 has pivoted thereto the connecting rod 26 which is pivoted to the

bell crank lever 29 which in turn is supported on the pivot 30. A pawl 27 is pivoted to the lever 29 at 28, and is weighted at 27ª so that the working end of this pawl 27 is kept in engagement with the teeth of the ratchet wheel 31, which latter is fixed on the shaft 32 which operates the sprocket wheels 21 through the medium of the universal joint, or flexible coupling shown in Fig. 7. On the other end of this shaft 32 (see Fig. 4) a second ratchet wheel 33 is fixed and a pawl 34 (see Figs. 3 and 4) engages in this latter so as to prevent the return motion of the shaft 32 and ratchet wheels 31 and 33 thereon. This shaft 32 see Figs. 3 and 4 (through the intervention of the universal joint or coupling shown in Fig. 7) at each end serves to rotate the respective sprocket wheels 21, see Fig. 2.

The pawl 27 is caused to rotate the ratchet wheel 31 step by step as follows:— When the armature 25 is drawn from its dotted position on the drawings, toward the magnet 23 and 24 (as shown in Figs. 3 and 5) the connecting plunger 35, which is connected to the underside of said armature by the pin 36 passing through the slot 37 in the plunger 35, is drawn upward opening the electrical circuit it completed between the two metal contact pieces 39 and 51, and thereby breaking the circuit through the magnet coil 24; whereupon the armature 25 drops and as it does so it moves the pawl 27 back along the ratchet teeth 31; and at the same time as the armature 25 drops it thereby forces the contact plunger 35 into position between the contact blocks 39, 51, and again closes the circuit through the magnet coil 24; whereupon the armature 25 is again pulled up, and thereby the pawl 27 forces round the ratchet wheel 31, the circuit through the magnet is again broken and the armature drops again, and so on. The insulation 38 insulates block 39 from block 51 so that said blocks are only put into electric connection through the switch member 35.

The connecting plunger 35 being attached to the armature 25 by the pin 36 through the slot 37 in the plunger, the electrical contact between the blocks 39, 51 is not broken on the upward motion of the armature until nearly at its extreme limit when the sudden impulse imparted to the plunger will make it break contact suddenly and the slot will allow it to travel upward a distance limited by the play in the slot. The circuit being now broken the armature falls as rapidly as the plunger and it is only at the limit of the movement of the armature downward that electrical contact is again established between the blocks 39 and 51; the contact plunger 35 supporting the weight of the armature 25 by the pin 36 resting upon the bottom of the slot 37. The object of this is that the magnet remains energized during nearly the whole of the upward stroke of the armature, and during the downward stroke it is not energized until the last moment. This gives a reliable full travel of the armature in each direction which is required to rotate the ratchet wheel 31 properly. This circuit through the magnet coils 24 is only completed, and the operation of the armature 25 can only take place, when the adjustable contact screw 50 (see Figs. 1 and 3) is touching the contact 51 so as to make electrical contact therewith as the circuit through the magnet coils 24 is only completed through said contacts 50 and 51. Thus when the regulating core 41 and weighted lever 42 drops into the position shown in Fig. 1, no current can pass to the magnet coils 24 but as the current through the solenoid 40 increases as described in another part of this specification thereby the core 41 is drawn up into the solenoid 40 and the adjustable contact screw 50 on said lever 42 moves up until it makes contact with the contact 51, and thereupon the electro magnet 23, 24 is energized and the armature acts and through the before described mechanism 26, 28, 29 and 30 the pawl 27 and ratchet wheel 31 feeds down the carbons as and when required by the regulating solenoid 40. This magnet or feeding coil circuit is connected as a shunt across the arc of the lamp.

The shunt excited solenoid or regulating coils 40 and core 41 act through a suitable lever or levers such as the lever 42 (weighted at 45) and pivoted at 44 to the frame and having a connecting rod 45 running to the toggle levers 46 or other suitable mechanism so that upon the solenoid being energized it will thereby serve to draw in the lower end of the movable magazine 2 toward the other and fixed magazine 3 until the carbon points 4ᵇ touch whereupon current will flow through the electrodes 4ª and thereupon there will be a drop in voltage across the solenoid 40 which latter will then move the lower end of the magazine 2 away from the fixed magazine 3 and thus move the burning points 4ᵇ of the electrodes apart and strike the arc and thereafter automatically regulate its lengths as will be readily understood—the solenoid being energized when the electrodes are apart and deënergized or substantially deenergized when the arc is first struck. As the points 4ᵇ of the electrodes are consumed by the current and become shorter; in order that a certain length and voltage of arc may be maintained, the core 41 gradually, as consumption increases, comes up to the position shown in Fig. 3 when electrical contact is made between 50 and 51 and the feeding of the carbons downward proceeds until the voltage of the arc is reduced, when the contact 50, 51 is broken by a movement of the

regulating lever 42; feeding does not further proceed until further consumption brings about the same operation. The burning points 4^b of the carbons are advantageously located within or just under a hood or reflector 47 which surrounds or partly surrounds said points 4^b; suitable apertures being provided in said hood not only to permit the electrodes to pass endwise therethrough but also to permit of the swinging movement which is imparted, as aforesaid, to one or both of said electrodes. The magazines and the whole of the working parts of the lamp above said "reflector" 47 may advantageously be inclosed in a suitable hood or other more or less closely fitting inclosing chamber 48 so as to exclude dust etc., from said parts of the lamp. An inclosing globe 49 of any suitable character may be carried on said casing 48 or otherwise mounted. Any suitable well known form of motor may be used instead of the one described.

A dash-pot is advantageously arranged in connection with the core 41 in the solenoid 40 to prevent too violent action of said core 41 a suitable dash-pot arrangement being shown in Fig. 3 consisting of the inverted cylinder 52 in which the plunger or piston 53 is adapted to slide; this latter being attached to the core 41 by the connecting rod 54, see Fig. 3.

Inasmuch as both the positive and negative carbons in this magazine lamp are each fed downward simultaneously, and inasmuch as it is well-known in a continuous current lamp that one carbon burns away more rapidly than the other;—therefore, to compensate for this I may form carbons for use as the electrode which is more rapidly used up of a larger cross-sectional area than the carbon for the other electrode which is not used up so rapidly; or I may use electrodes of different lengths, keeping an equal cross-sectional area for both positive and negative electrodes in which case I gear the driving chains on the magazines differently so that each longer positive electrode will feed entirely downward (and to a greater extent than the negative) in the same time as each shorter negative electrode.

The operation of this magazine arc lamp is as follows:—The desired number of carbons 4 having been placed in each of the magazines 2 and 3 respectively the spring arms 5 in each magazine keep the whole body of carbons pressed toward the discharging side as aforesaid. The projecting fingers or studs 17 on the sprocket chain are moved clear of each magazine during the charging thereof. When the lamp is ready for current to be switched on the motor is set going until a finger or stud 17 on each sprocket chain bears on the upper end of the carbon 4^a in each magazine, and thereby the other end of each of the two electrodes is projected out of the magazine, past the clips or devices 10, 12, 13; and when their downwardly projecting points meet the arc is struck; or if any carbon or carbons remain projecting from the magazine at the time the same is charged, then upon current being switched on the arc is immediately struck. As the carbon 4^a which is acting as the electrode (in each magazine) in the lamp is forced out of the magazine and consumed or used up, the next carbon thereto is by the action of the aforesaid spring arms 5 caused to take its place, and when the next finger or stud 17 on the sprocket chain 14 comes around and bears on the top or upper end of said next carbon the latter will thereby be forced against the butt end of the last electrode, which butt end will therefore be finally forced out of the passage 9, and drop into the bottom of the globe, while the new electrode thus automatically takes its place; and so on with each carbon in succession.

Each pair of electrodes in the lamp is consumed together, and the burned short ends or stumps preferably are thrown out of their respective magazines simultaneously so that a fresh pair of carbons is fed forward after the old pair have been consumed. This may be arranged by keeping the fingers 17, 20 in the same relative position in each magazine.

In order to protect shunt windings within the lamp and also to maintain the light of other lamps burning in the same series, during the period when the old electrode is burned out and a fresh pair of electrodes comes into operation, any suitable and well known cut-out (not shown) may be provided, which may be fixed either within or outside the lamp casing, and which will short circuit the terminals of the lamp through an equivalent resistance or choking coil during the changing operation. Such cut-out mechanism being a well-known and commonly used device with other and old forms of arc lamps it is therefore not necessary to further describe the same herein.

I claim—

1. In an arc lamp, the combination of a casing; two carbon holding magazines; means to move one of said magazines toward the other; means to move the carbons in succession into position to act as the electrode in each of the magazines containing them; electrically operated means to move said magazines apart; an endless traveling chain arranged on each magazine; a device on each of said chains adapted to engage the top end of each carbon after it has been moved into position to act as an electrode, and to force said electrodes downward in a positive manner, and an automatically acting electric motor adapted to operate the aforesaid chains, substantially as described.

2. In an arc lamp, the combination of a casing; two carbon holding magazines one

of which is capable of being moved and both of which are located above the burning point and adapted to hold a plurality of carbons; means to move said carbons in succession into position to act as electrodes; electrically operated means to move said electrodes apart; an endless traveling chain arranged on each magazine; a device on each of said chains adapted to engage the top end of the electrode in each magazine and to force said pair of electrodes downward in a positive manner; and an automatically acting electric motor adapted to operate the aforesaid chains, substantially as described.

3. In an arc lamp, the combination of a casing, two carbon holding magazines one of which is capable of being moved and both of which are located above the burning point and adapted to hold a plurality of carbons; means to move said carbons in succession into position to act as electrodes in the magazines containing them; electrically operated means to move said magazines apart; weighted frictional devices operating on the electrodes adapted to normally retain by friction the carbon electrodes in an operative position; an endless traveling chain arranged on each magazine; a device on each of said chains adapted to engage the top of the electrode in each magazine and to force said pair of electrodes downward in a positive manner through the said frictional devices; and an automatically acting electric motor adapted to operate the aforesaid chains, substantially as described.

4. In an arc lamp the combination of a casing; two carbon holding magazines one of which is capable of being moved and both of which are located above the burning point and adapted to hold a plurality of carbons; spring means to move said carbons in succession into position to act as the electrodes in each of the magazines containing them; electrically operated means to move said electrodes apart; weighted bell crank frictional devices operating on the electrodes, adapted to normally retain by friction the carbon electrodes in an operative position; an endless traveling chain arranged on each magazine; a device on each of said chains adapted to engage the top end of the electrodes in each magazine, so as to force said pair of electrodes downward in a positive manner through the said frictional devices; and an automatically acting electric motor adapted to operate the aforesaid chains, substantially as described.

5. In an arc lamp the combination of a casing; two carbon holding magazines one of which is capable of being moved and both of which are located above the burning point and adapted to hold a plurality of carbons; adjustable spring means to move said carbons in succession into position to act as electrodes; electrically operated means to move said magazines apart; an endless traveling chain arranged on each magazine; a device on each of said chains adapted to engage the top end of the electrode in each magazine and to force said pair of electrodes downward in a positive manner and an electrically operated pawl and ratchet device adapted to move the aforesaid chains, substantially as described.

6. In an arc lamp, the combination of a casing; two carbon holding magazines one of which is capable of being moved and both of which are located above the burning point and adapted to hold a plurality of carbons; means to move said carbons in succession into position to act as the electrode in the magazine containing it; electrically operated means to move said magazines apart; frictional devices comprising weighted bell crank levers operated on the electrodes and adapted to normally retain by friction the electrode therein; an endless traveling chain arranged on each magazine; a device on each of said chains adapted to engage the top end of the electrode in each magazine so as to force said pair of electrodes downward in a positive manner through the said frictional devices; and an electrically operated pawl and ratchet adapted to operate the aforesaid chains, substantially as described.

7. In an arc lamp, the combination of a casing; two carbon holding magazines one of which is capable of being moved and both of which are located above the burning point and adapted to hold a plurality of carbons and to move the latter in succession into position to act as the electrode in the magazine containing it; electrically operated means to move said magazines apart; an endless chain adjacent to each magazine and adapted to travel around in close proximity thereto; a device carried on each of said chains and projecting therefrom, adapted to extend toward the magazine and engage the top end of the electrodes in each magazine so as to force said pair of electrodes downward in a positive manner; and an automatically acting electric motor adapted to cause said endless chain to travel around, substantially as described.

8. In an electric arc lamp, the combination of two magazines both located above the burning point and each adapted to hold a plurality of carbons; means for automatically and successively moving said carbons into position to act as electrodes; the said two magazines being so inclined to one another as to cause the downwardly projecting points of the said electrodes to meet at the burning points; electrically operated means to move one electrode apart from the other and to thereby strike the arc; and an endless traveling chain arranged on each magazine, carrying devices adapted to en-

gage the upper end of each pair of electrodes in succession and force same downward in a positive manner, substantially as and for the purposes hereinbefore described.

9. In an electric arc lamp, the combination of two magazines both located above the burning point, and each adapted to hold a plurality of carbons, adjustable spring means for automatically and successively moving said carbons into position to act as electrodes; the said two magazines being so inclined to one another as to cause the downwardly projecting points of the electrodes to meet at the burning points; electrically operated means to move one electrode apart from the other to thereby strike the arc; an endless traveling chain arranged in each magazine respectively, provided with devices which positively engage the upper end of each pair of electrodes in succession and force the same downward in a positive manner; and pivoted frictional devices operating on the electrodes to normally retain the electrodes in their working position, substantially as and for the purposes described.

10. The combination in an electric arc lamp of two magazines both located above the burning point and each adapted to hold a plurality of carbons; spring means to move said carbons in succession into positions to act as electrodes; electrically operated means adapted to move one of said magazines and to thereby move one electrode apart from the other to strike the arc; an endless traveling chain 14 arranged on each magazine; a finger 17 on each of said chains adapted to positively engage the upper end of each electrode in succession after it has been moved into the proper position and positively force the same downward for the purpose of feeding the electrode; and pivoted, weighted frictional devices operating on the electrodes to normally retain the same in their working position, substantially as and for the purposes hereinbefore described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

CHARLES OLIVER.

Witnesses:
E. GANDER,
F. L. RAND.