(No Model.) 2 Sheets—Sheet 1.

M. N. LYNN.

ELECTRIC LAMP FOR LOCOMOTIVES.

No. 313,009. Patented Feb. 24, 1885.

Fig. 1.

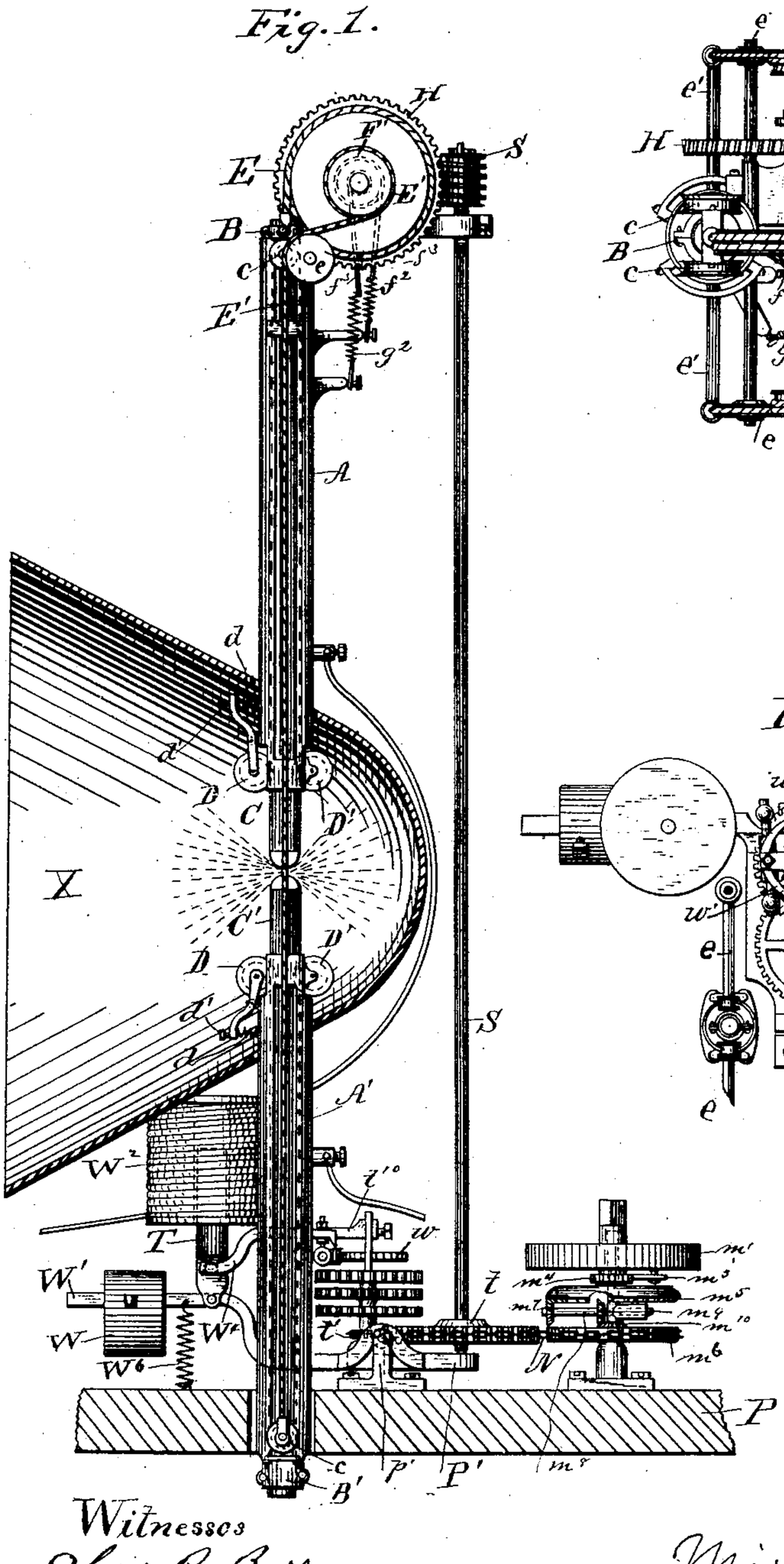

Fig. 2.

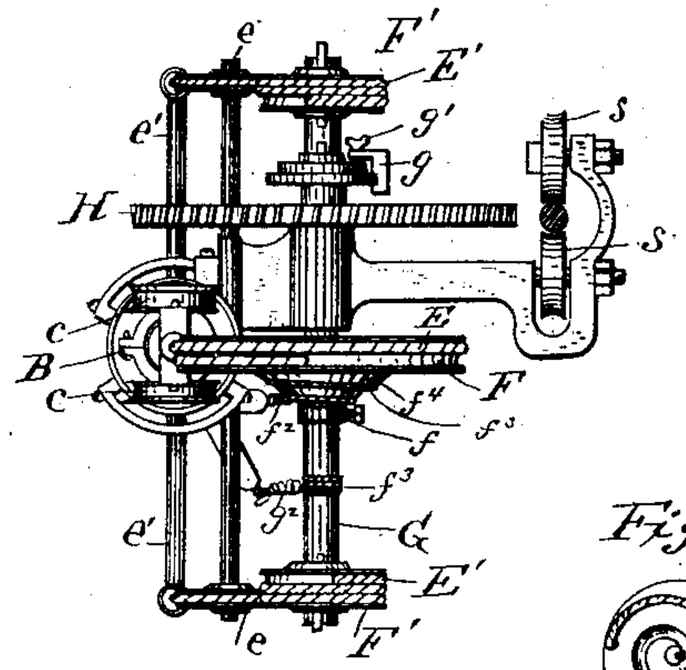

Fig. 5.

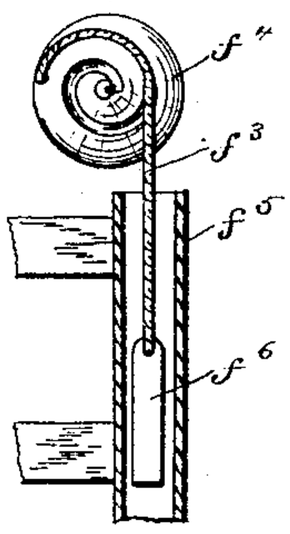

Fig. 3.

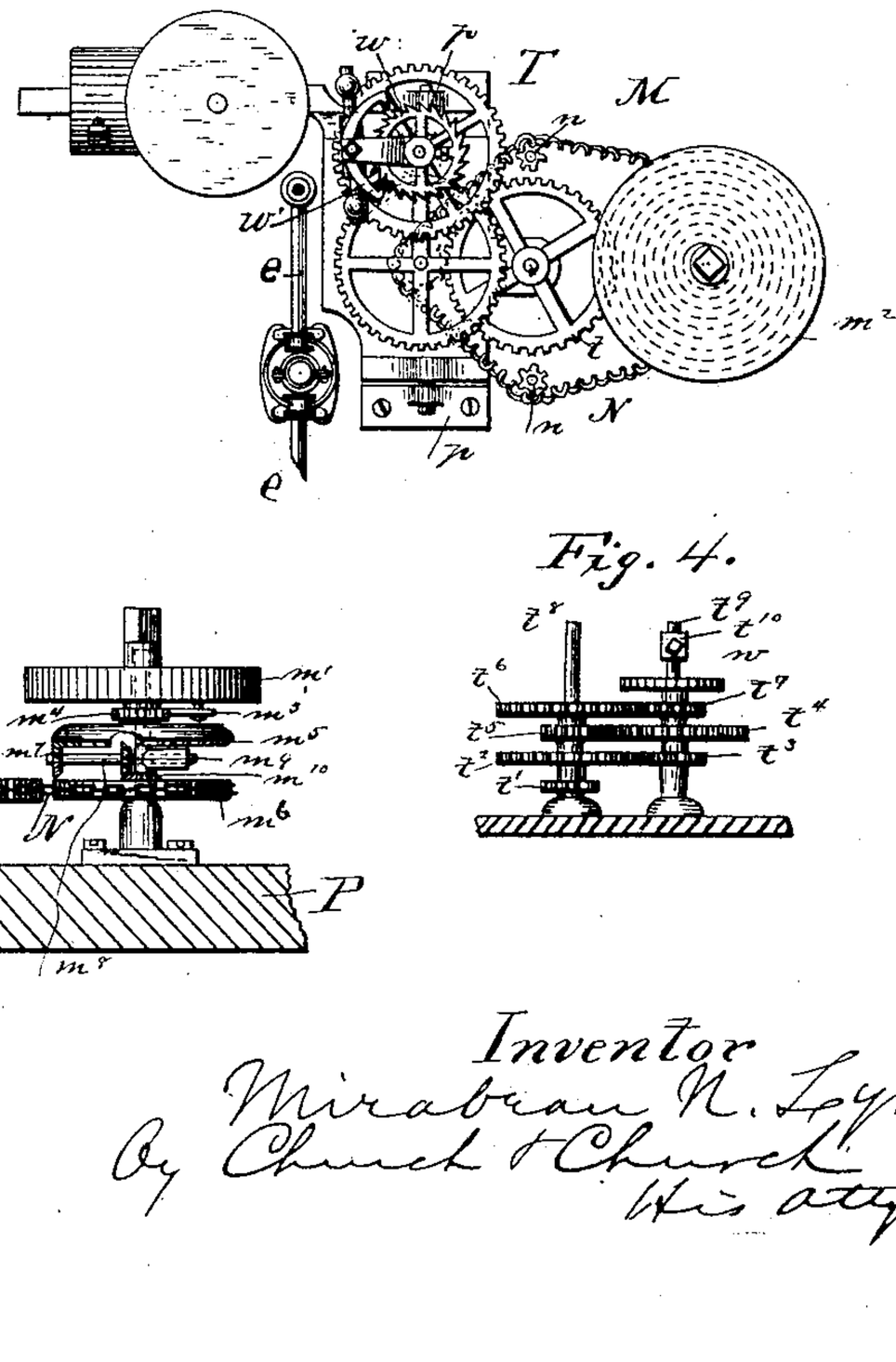

Fig. 4.

Witnesses
Chas. R. Burr
Fred F. Schenck

Inventor
Mirabeau N. Lynn
By Church & Church
His attys.

(No Model.)

2 Sheets—Sheet 2.

M. N. LYNN.

ELECTRIC LAMP FOR LOCOMOTIVES.

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Fig. 6.

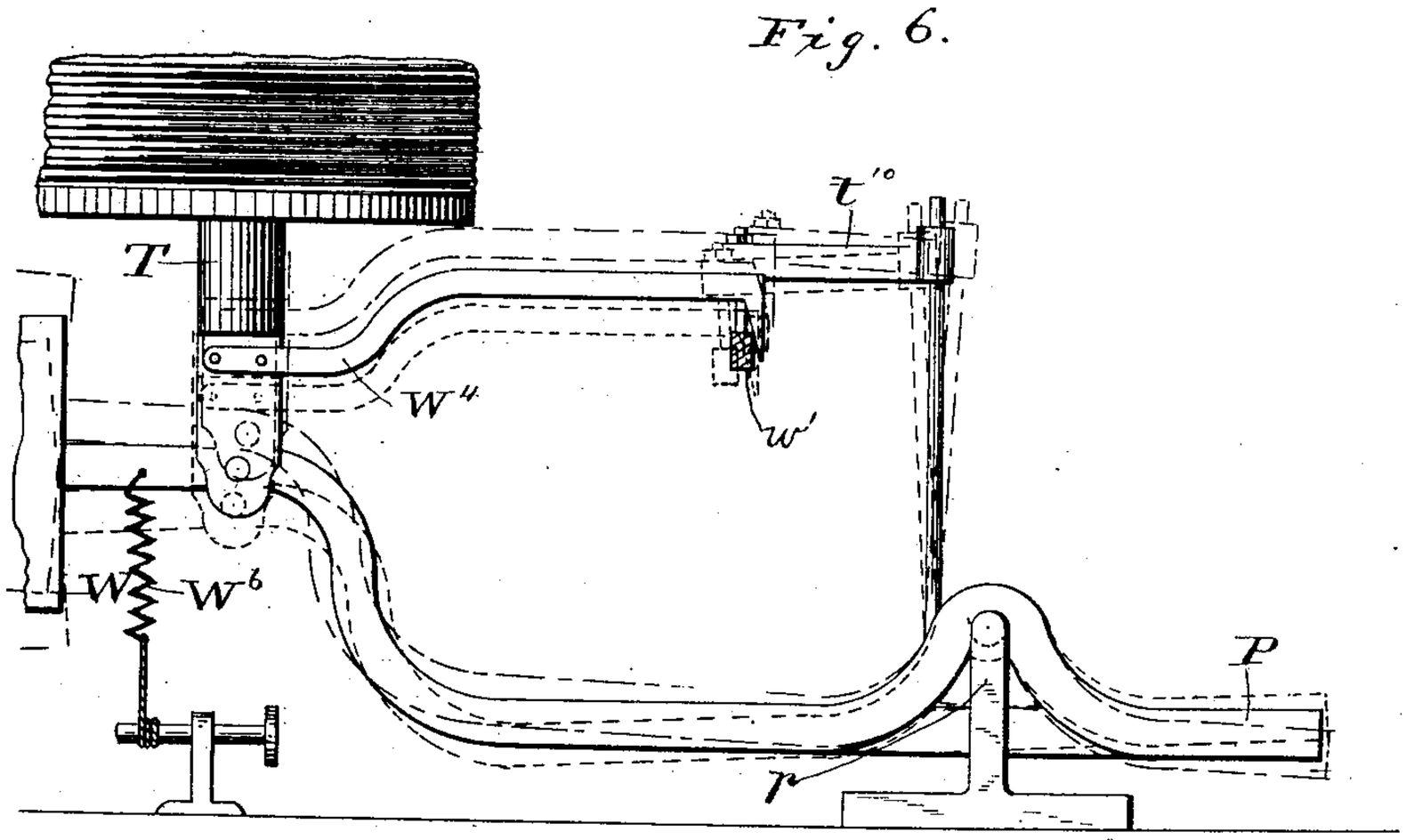


Fig. 7.

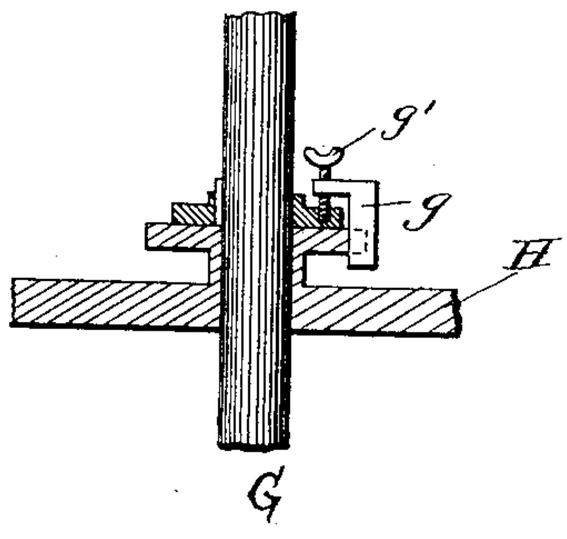
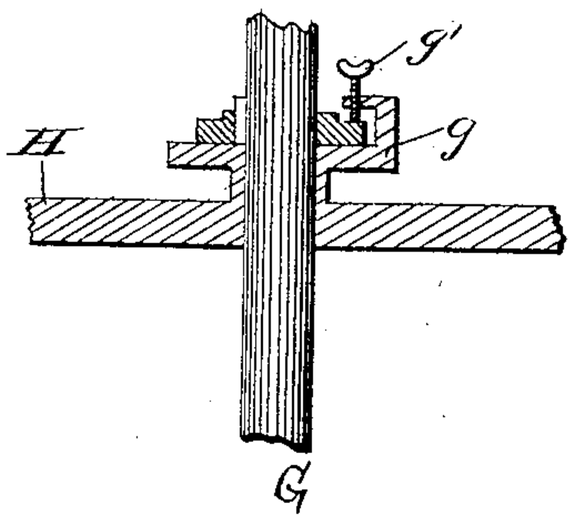


Fig. 8.



Witnesses.
Chas. R. Burr
Fred J. Church

Inventor
Mirabeau N. Lynn
by Church & Church
Attys

UNITED STATES PATENT OFFICE.

MIRABEAU N. LYNN, OF RISING SUN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE AMERICAN ELECTRIC HEADLIGHT COMPANY, OF INDIANAPOLIS, INDIANA.

ELECTRIC LAMP FOR LOCOMOTIVES.

SPECIFICATION forming part of Letters Patent No. 313,009, dated February 24, 1885.

Application filed January 12, 1884. Renewed December 3, 1884. (No model.)

To all whom it may concern:

Be it known that I, MIRABEAU N. LYNN, of Rising Sun, in the county of Ohio and State of Indiana, have invented certain new and useful Improvements in Electric Lights for Locomotives; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures and letters of reference marked thereon.

The advantages to be secured by the use of electricity as the illuminating agent for locomotive head-lights are many and important, and its desirability is illustrated by the numerous and frequent though unsuccessful attempts which have heretofore been made to adapt otherwise successful lamps to the use suggested. Experience has shown that lamps may be in all respects successful and operative when used under certain conditions, and inoperative and worthless when submitted to other abnormal influences. It has been amply demonstrated that a lamp whose feeding mechanism is so nicely adjusted and controlled as to produce, when the lamp is maintained in a fixed position, a practically uniform and steady light, is totally incompetent to perform these functions when subjected to the vibrations and shocks resulting from the motions of a locomotive. Unless the arc can be maintained with practical uniformity under all the varied conditions necessarily incident to the running of a locomotive, the electric light cannot with safety ever supersede or supplant the lights now employed, notwithstanding its superior brilliancy. There is still another and equally important condition imposed, which is that the light shall be maintained at the proper focal point in the reflector, the necessity for which is only second in importance to uniformity.

The present invention is designed to accomplish both of the objects and under the conditions named.

The construction and arrangement of the feeding and controlling mechanism are such that while the consumption of the carbons is compensated for the uniformity of the light is in no wise interfered with by the motions of the engine, and at the same time the arc is maintained at substantially the same focal point in the reflector.

The manner of accomplishing these novel and important results will first be described, the inventions for which a patent is desired being pointed out specifically in the appended claims.

In the accompanying drawings, Figure 1 is a side elevation of the improved lamp, the supporting-frame being removed. Figs. 2, 3, 4, and 5 are details of the feeding mechanism. Fig. 6 is an enlarged view of the detent, pallet, and pivoted platform, the gear-train being removed and the relative movements of the parts shown in dotted lines. Fig. 7 illustrates the manner of attaching the worm-wheel to its shaft. Fig. 8 illustrates a modification of the arrangement shown in Fig. 7.

Similar letters of reference indicate like parts in all the figures.

A A′ represent the hollow guides for the reception of the carbon-holders B B′ and their attached carbons C C′. These guides are slotted longitudinally for the reception of the grooved anti-friction rollers *c c*, carried by the holders B B′, and are provided near the inner ends with rollers D D′, between which the carbons are guided. One of the rollers D of each set is mounted upon a lever journaled in bearings on the hollow guides, and a spring, *d*, bears against the free end of the lever to press and hold the roller against the carbon with a force regulated by adjusting screw *d′*. The carbons thus guided and supported are connected to the adjusting mechanism by cords or chains E E′ E′, fastened at one end to the holders B B′, and at the other to the pulleys or drums F F′ F′ upon the shaft G. The cords E′ E′ pass over guide-rollers *e e*, and are connected to the laterally-projecting arms *e′ e′* of the holder B′, carrying the lower carbon. The cord E passes directly from the drum F to the upper holder, B, to which it is removably secured by a hook or otherwise. It will be noticed that by this arrangement the connecting-cords or operating mechanism for the two

carbon-carriers are maintained in the same vertical plane with the guides A A′ and carbons C C′.

It is a well-known fact that in arc lights the carbons are burned away or destroyed in about the proportion of 1 to 2, depending upon the direction of the current. In the present instance the connections are so made that the upper carbon shall be the more rapidly consumed, and to compensate for this unequal loss the drum F is made twice the size of the drums F′ F′, so that as the shaft G is rotated to feed the carbons together, the upper carbon shall move twice as far as the lower in a given time, and thus maintain substantially the same focal position in the reflector X. The drum F is fastened to a sleeve, *f*, and is adjustably secured to the shaft G by a thumb-screw or equivalent device, whereby the position of the carbons within the reflector can be adjusted to compensate for any difference in length of the two carbons and to secure the proper focal positions. The shaft G, carrying the drums F′ F′, is in like manner secured to the operating-gear H by a clamp, *g*, fastened to a collar on the shaft and projecting into a notched collar on the gear H, as shown in Fig. 7, thus providing for the adjustment of the lower carbon.

Instead of the bolt projecting into the notched collar, as shown in Fig. 7, a friction-clamp may be employed, such as illustrated in Fig. 8, wherein the piece *g* is secured to the collar on the gear H, and the screw *g′* bears against the side of the collar on the shaft.

It is found absolutely essential to the operation of lamps of this kind that the two carbons and their holders shall at all times accurately balance each other, in order that their relative feed and position shall not be influenced or disturbed by the rocking or pounding motion of the engine. This object is attained by first establishing an equilibrium between the two carbon-holders. As the upper-carbon holder is connected to a drum of twice the diameter of that carrying the lower-carbon holder, the latter holder must be weighted, or made twice as heavy as the former, due allowance being made for the weight of the cords. Having thus accurately balanced the carbon-holders, so that when set at any height they will remain in position and not be disturbed by the shocks experienced by the locomotive when in motion, it becomes necessary to provide a means for balancing carbons of different lengths and weights, and to compensate for their unequal consumption. This is accomplished by attaching the compensating-springs f^2 g^2 to the shaft and sleeve, respectively, of the drums F F′. One end of the spring f^2 is adjustably attached to a post on the guide A or other part of the frame, the other end being connected to a cord or chain, f^3, passing around and fastened to the sleeve *f* on drum F. The spring g^2 is fastened in like manner to the frame and to a cord or chain, f^3, on the shaft G. These cords are wound in opposite directions, and, together with the springs, are so adjusted, proportioned, and arranged as to exert a force equal but in opposition to the weight of the carbons. Thus each carbon is sustained by a power at all times equal or nearly equal to its weight, said power decreasing in proportion to the consumption of the carbons and their consequent diminution in weight.

The carbons to be employed are prepared of substantially uniform weight in proportion to their length, and when applied to the holders, the upper carbon is balanced by the spring f^2 and the lower carbon by the spring g^2. As the carbons are fed toward each other by the rotation of the shaft G, the loss in weight of the lower carbon is compensated for by the unwinding of the cord and consequent decrease in the tension of the spring g^2; but an opposite effect would be produced upon the spring f^2 were not some special provision made for decreasing the power exerted by said spring as its cord is wound up, for, as will be preceived, the motion of the shaft, which effects the feed of the upper carbon by unwinding the cord E, would at the same time wind up the cord attached to the spring f^2, thus increasing instead of diminishing its tension. To provide for this contingency and maintain a running balance for the upper carbon which shall at all times while the lamp is in action balance or nearly balance said carbon as it is consumed, the cord attached to spring f^2 is wound upon a grooved conical pulley or fusee, f^4, attached to the sleeve *f*. The pitch of the groove in the pulley f^2 is so adjusted that as the cord is wound up and the tension of the spring slightly increased, its leverage upon the shaft, and hence the counterbalancing force, shall decrease in proportion to the feed of the carbon and the resulting decrease in its weight. If found desirable, in balancing the lower carbon the cord attached to the spring g^2 may in like manner be wound upon a fusee or conical pulley. It will thus be seen that at all times the weight of the upper carbon and its holder plus the power of the spring g^2, equals the weight of the lower carbon and its holder plus the power of the spring f^2. Hence, at all times and in all situations, the operating parts are so balanced that the relative position of the carbons will not be varied by the shocks and oscillations of the engine.

In the place of the spring f^2 for the upper carbon it will be found advantageous to employ a counter-weight, f^6, Fig. 5, suspended from the cone-pulley, and working in suitable guides, f^5, to prevent excessive lateral vibration.

As compared with the spring, the weight has this advantage, that when submitted to violent concussion the effects of inertia will be manifested equally on each side of the balance, whereas in case a spring is used, the in-

ertia of the carbon might, by varying the pull upon the shaft, cause the carbon to rise and fall, and thus in a measure disturb the equilibrium.

The mechanism for forming the arc and feeding the carbons of a lamp thus balanced must itself possess the same counterbalancing principle—that is to say, its parts must be so arranged and combined that while retaining the requisite degree of sensitiveness to the slight fluctuations of power governing its movements they shall at all times remain practically balanced.

One form of carbon-feeding and arc-forming mechanism designed and adapted to accomplish these results is shown in the drawings. It consists, essentially, of a motor mounted upon the bed-plate or frame and pivoted platform upon which are mounted the gear-train, the vertical worm-shaft gearing with the worm-wheel, the core piece or armature, and the counterbalancing-weight.

The spring-motor M is mounted upon a stud-post, m, fastened to the bed-plate P. It consists of a drum, m', fitting the end of the post m, and inclosing a spring, m^2, one end of which is attached to the post and the other to the drum. A spring-pawl, m^3, on the under side of the drum, engages the teeth of ratchet-wheel m^4, fastened to the bevel-gear m^5, from which gear the motion of the drum is communicated to the pulley or sprocket-wheel m^6 through the pinion m^7, shaft m^8, and pinions m^9 m^{10}, the pinions m^7 and m^9 being fast upon the shaft m^8 and the pinion m^{10} upon the wheel m^6. The platform P′, pivoted at $p\ p$ to the standards $p'\ p'$, supports the gear-train T near the center and in line with the pivots and the vertical shaft S on one side and the core T′ and counter-weight W on the opposite side of the pivots. The shaft S, working in roller-bearings $s\ s$, is provided near its upper extremity with a worm, S′, gearing with the worm-wheel H, and near the bottom with a gear-wheel, t, meshing with the pinion t' of the gear-train. This last-named pinion receives motion from the wheel m^6 of the motor through the chain or cord N, which is passed over guide-rollers $n\ n$ to clear the gear t. The scape-wheel w is connected to the pinion t' through the gear-wheels t^2, pinion t^3, gear t^4, pinion t^5, gear t^6, and pinion t^7. These gear-wheels are all mounted to turn upon two stud-axles, $t^8\ t^9$, fastened in the platform, the pinions and gears $t'\ t^2$, $t^3\ t^4$, and $t^5\ t^6$ being fastened together in pairs, and the pinion t^7 to the scape-wheel w. On the upper extremity of the stud-axle t^9 is fastened an overhanging arm, t^{10}, in which is pivoted the balanced pallet w', engaging the teeth of the scape-wheel w, whereby the movement of the gear-train is governed and regulated.

To an arm, W′, projecting from the side of the platform opposite to the vertical shaft S, is adjustably secured the counter-weight W.

The electro-magnet W^2 is located above, and its core T, carrying the detent W^4, is pivoted to the arm W′.

By adjusting the weight W upon its arm the platform and mechanism supported thereby are accurately balanced, so that any shocks experienced by the engine while in motion will be equally distributed throughout the lamp, and the irregular action which would otherwise result were there a preponderance of weight on either side of the pivots is entirely avoided. When the platform is thus balanced, the detent is in contact, or nearly so, with the pallet, as shown in full lines in Fig. 6, and prevents the rotation of the gear-train; but if the arm W′ falls below the horizontal, the detent is carried beyond the pallet, as shown in dotted lines, Fig. 6, and the gear-train rotated. The movement of the arm above the horizontal will not, however, effect the release of the pallet, but will lock it all the more firmly.

These motions of the platform above and below the horizontal or neutral line necessary to the feeding of the carbons and the maintenance of the arc are effected through the agency of the current traversing the coil of the electro-magnet and the opposed retracting-spring W^6, adjustably fastened at one end to the frame or bed-plate.

The operation of the lamp is as follows: The holders having been balanced, the compensating-springs adjusted with respect to the length and weight of the carbons, and the proper focal position secured, the pulleys and worm-gear are clamped tightly to the shaft G. The gear-train and feeding mechanism are likewise separately balanced by adjusting the weight W on its supporting-arm, and the tension of the retracting-spring is adjusted with reference to the power of the electro-magnet, which latter is in circuit with the carbons. As soon as the current is established, the electro-magnet raises the front of the platform, thus locking the gear-train, and at the same time causing the descent of the vertical shaft, and the worm thereon acting as a rack causes the backward revolution of the worm-wheel and shaft. By this movement of the shaft G the carbons are caused to separate until the desired arc is formed. As the carbons burn away, and the arc elongates, the resistance increases, the power of the electro-magnet diminishes, and the worm-shaft is carried upward, causing a rotation of the worm-wheel in the direction of the feed. As soon, however, as the platform in its movement under the varying influence of the electro-magnet and the retracting-spring reaches or falls below the neutral line, the detent releases the gear-train, and the carbons are, by the rotation of the worm-shaft, caused to approach each other until the electro-magnet again raises the platform and locks the gear-train.

As before explained, the counterbalancing of all the dependent or pivoted portions of the lamp is absolutely necessary, in order to avoid the disturbing influences of the shocks, &c., to which locomotives are constantly subjected, and this counterbalancing is effected

by the employment of the least possible number of extra parts, while the focusing of the arc is amply provided for.

The arrangement of the feeding mechanism longitudinally of the bed-plate, and the supporting of it upon pivots transverse to the direction of the engine, are likewise attended with important advantages, in that the lateral vibrations of the support will be borne wholly by the pivots without in any manner effecting the equipoise of the platform and its operating mechanism.

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

1. In an electric lamp, and in combination with the mechanism for feeding the carbons, the balanced carbon-holders, substantially as described.

2. In an arc lamp containing mechanism for feeding the carbons, and in combination with the carbon-carriers, the compensating-balances for the carbons, substantially as described.

3. In an arc lamp containing mechanism for feeding the carbons, and in combination with the latter, the balanced carbon-holders and the compensating-balances, substantially as described.

4. In an arc lamp, and in combination with the movable carbon-holder, the rotating shaft and intermediate connecting-cord, the compensating-balance acting in opposition to the weight of the carbon with a force decreasing in proportion to the consumption of the carbon, as set forth.

5. In an arc lamp containing mechanism for effecting the movement of the carbons, and in combination with the latter, the balanced carbon-holders and independent counter-balances for each carbon, whereby the carbons and their holders are at all times balanced and their movements derived from an independent source, substantially as described.

6. In an arc lamp for locomotives, and in combination with the mechanism for feeding and separating the carbons, the rotating and reciprocating worm, and mechanism for operating the same, substantially as described.

7. In an electric lamp, the combination of two carbon-holders arranged to balance each other, mechanism for causing their simultaneous approach and recession to feed and form the arc, and a compensating-balance for the carbon applied to each holder, substantially as described.

8. The balanced carbons and mechanism for causing their approach and recession, in combination with the reciprocating worm-shaft, and mechanism for effecting the rotation thereof, mounted upon a balanced platform, substantially as described.

9. In combination with the balanced holders, movable carbons and compensating devices applied to the carbon-holders, the carbon-feeding and arc-forming mechanism supported upon a balanced platform, substantially as described.

10. In combination with the balanced holders, movable carbons, and compensating devices therefor, the carbon-feeding and arc-forming mechanism consisting of a gear-train and worm-shaft supported and balanced upon a pivoted platform, and mechanism for tilting said platform to form the arc and release the gear-train, substantially as described.

11. In an arc lamp for locomotives, and in combination with the movable focusing carbons, the balancing holders and compensating mechanism, and the balanced feeding mechanism controlled by the electro-magnet, substantially as described.

12. In combination with the shaft carrying the pulleys, and mechanism for rotating the same to feed the carbons, the fixed guides, movable carbon-holders, guide-pulleys, and the connecting-cords, the latter being located in the same plane as the carbons, substantially as described.

13. The combination, in an arc lamp, of the rotating shaft, the differential pulleys, the connecting-cords, and the dependent carbon-holders differing in weight in proportion to the diameters of their respective pulleys to maintain a running balance, substantially as described.

14. In combination with the lower carbon and its holder, the connecting-cords and pulleys, the reversely-wound cord, and attached tension-spring, substantially as described.

15. In combination with the upper carbon and its holder, the connecting-cord and pulley, the conical pulley, the reversely-wound cord and tension-spring adapted and arranged to compensate for the shortening of the carbon and its diminution in weight, substantially as described.

16. In a focusing arc lamp for locomotives, the combination of the movable carbons, balanced holders, connecting-cords, and differential pulleys mounted upon the same shaft, the compensating mechanism consisting of the conical and plain pulleys, reversely-wound cords, and attached adjustable springs, substantially as described.

17. In combination with the worm-wheel, the rotating shaft to which it is attached, the movable carbons, and intermediate mechanism for causing the approach and recession of the carbons by the movements of the worm-wheel, and the rotating and reciprocating worm, and mechanism for operating the same, substantially as described.

18. The movable carbons, worm-wheel, and intermediate mechanism, substantially such as described, the vertical worm-shaft and worm, the balanced platform supporting said shaft and the gear-train, in combination with the fixed electro-magnet and its pivoted core carrying the detent, substantially as described.

19. In combination with the movable carbons and intermediate mechanism, the piv-

oted and counterbalanced platform carrying the gear-train and worm-shaft, and the spring-motor connected to the vibrating gear-train by a chain or belt, substantially as described.

20. In combination with the carbons of an electric lamp and the intermediate mechanism for effecting the movements of the carbons, the pivoted platform carrying the gear-train and scape-wheel, and the reciprocating core carrying the detent and pivoted to the platform, substantially as described.

21. In combination with the worm-wheel and mechanism, substantially as described, connected thereto for controlling the movements of the carbons, the worm-shaft supported in roller-bearings and mounted upon a vibrating support, substantially as described.

22. In combination with the movable carbons and intermediate mechanism, the platform and its supporting-pivots, the gear-train located nearly in line with and between said pivots, the vertical shaft at one end and the counter-balance and core at the other, substantially as described.

23. In an electric lamp, and in combination with the movable carbons, worm-wheel, and intermediate mechanism, the pivoted platform, gear-train, counter-weight, core, vertical worm-shaft, electro-magnet, and opposing spring, substantially as described.

24. In an electric lamp, and in combination with the rotating shaft to which the carbons are connected, the pivoted platform carrying the gear-train, counter-weight, core, and worm-shaft, the electro-magnet, and opposing spring acting upon the said pivoted platform, and the motor mounted upon a fixed support, substantially as described.

25. In an electric lamp, as a means for controlling the feed of the carbons, and in combination with carbon-carrying devices substantially such as indicated, the improved gear-train for driving the main shaft, which consists of the several pinions and gears mounted upon the two fixed stud-axles, the arm supporting the scape-wheel and the movable detent, substantially as described.

26. In an electric lamp, the gear-train for moving the carbon-holders mounted upon a pivoted platform and vibrating in the arc of a circle, in combination with the detent mounted upon a reciprocating support pivoted to the platform, whereby as the platform and gear-train vibrate the detent will be brought in contact or removed from the path of the scape-wheel, substantially as described.

27. The combination, in an arc lamp, and with the movable carbon-holders and connecting-cords, of the pulleys adjustably mounted upon the driving-shaft, substantially as described.

28. In an arc lamp, and in combination with the movable carbon-holders and the connecting-cords, the driving-shaft carrying the fixed pulleys, adjustable pulley, and adjustable driving-wheel, substantially as and for the purpose set forth.

29. In an arc lamp wherein the carbons are moved by mechanism acting directly upon the carbon-holder, and in combination with the latter, a compensating-balance acting in opposition to the weight of the carbon with a force decreasing in proportion to the weight of said carbon, substantially as described.

30. In combination with the carbon of an arc light, and with the mechanism for effecting the movements of the same to feed and form the arc, a compensating-balance acting in opposition to the weight of the carbon with a force decreasing in proportion to the consumption of the carbon, substantially as described.

31. The upper-carbon holder suspended directly from the large pulley by a cord, in combination with the lower-carbon holder provided with lateral arms, the vertical cords attached to said arms passing over guide-pulleys, and connected to the smaller pulleys, substantially as described.

32. The movable carbons, operating-pulleys, and connecting mechanism, substantially as described, in combination with the compensating-springs, and pulleys mounted upon the same shaft with the operating-pulleys, the worm-wheel fastened to said shaft, and the reciprocating and rotating worm, substantially as and for the purpose set forth.

33. The balanced holders, movable carbons, and compensating-balances, all connected to and applied upon a single shaft, in combination with a separate feeding mechanism controlled by the current and operating through suitable connecting mechanism, such as described, to rotate said shaft to form the arc or feed the carbons.

34. In an arc lamp for locomotives, and in combination with the carbon-carrying mechanism thereof, the balanced feeding devices mounted upon pivots transverse to the length of the bed-plate.

35. In an arc lamp for locomotives, and in combination with the feeding mechanism thereof, the platform carrying the gear-train, counterbalanced and mounted upon pivots transverse to the direction of the engine, substantially as described.

36. In an arc lamp for locomotives, the mechanism for supporting and carrying the carbons mounted in a frame above the carbons, in combination with the balanced feeding mechanism pivoted to the base-plate, the two mechanisms being put in operative connection by means of the vertical rotating and reciprocating worm-shaft, substantially as described.

37. In an arc lamp, and in combination with the movable carbons thereof, suspended from differential pulleys, means, substantially as described, whereby either or both pulleys may be adjusted upon their shaft with respect to each other and the operating worm-gear, substantially as described.

38. In an arc lamp for locomotives, the combination of counterbalanced holders, movable

carbons, compensating-balances for the carbons, supporting-cords, differential pulleys, worm-gear, reciprocating rotary worm, counterbalanced platform carrying the gear-train and worm-shaft, and stationary electro magnet and motor, substantially as described.

39. In an arc lamp, and in combination with the pivoted and counterbalanced platform carrying the feeding mechanism, the spring-motor located near one end of the platform and mounted on a fixed bearing, a chain connecting the motor with the gear-train, an electro-magnet fixed to the frame at the opposite end of the platform, and a core pivoted to the platform, substantially as described.

40. In an electric lamp, and in combination with mechanism for effecting the movements of the carbon-holders proportionately to the movements of a shaft with which they are connected by suitable intermediate devices, the driving and controlling mechanism consisting of the spring-motor, the counterbalanced platform, the gear-train mounted upon said platform, and the electro-magnet and its core, the latter pivoted to the platform and carrying the detent for engagement with the scape-wheel of the gear-train, substantially as described.

MIRABEAU N. LYNN.

Witnesses:

C. A. NEALE,

MELLVILLE CHURCH.