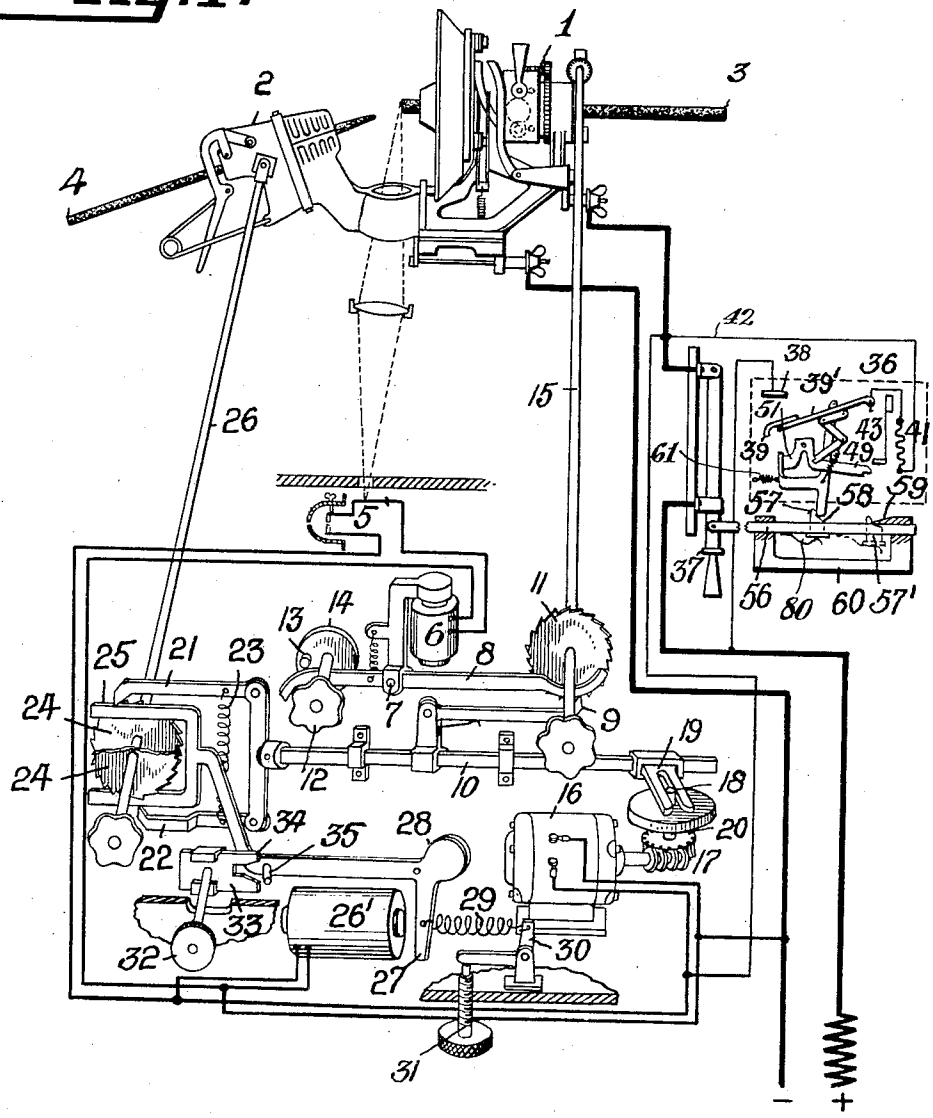
March 7, 1939. H. WALTER 2,150,014

FEEDING AND ARC STRIKING MECHANISM FOR SEARCHLIGHTS

Filed Nov. 21, 1934 2 Sheets-Sheet 1

Fig. 1.




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Filed Nov. 21, 1934 2 Sheets-Sheet 2

Fig. 4.

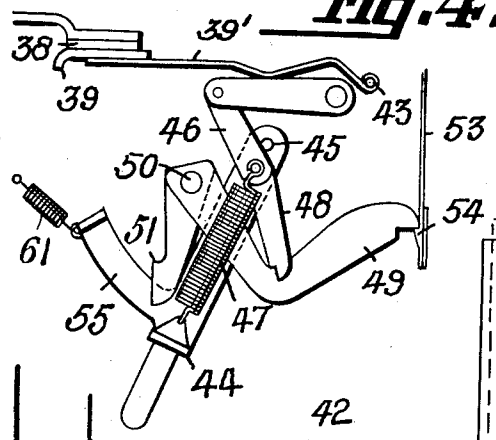
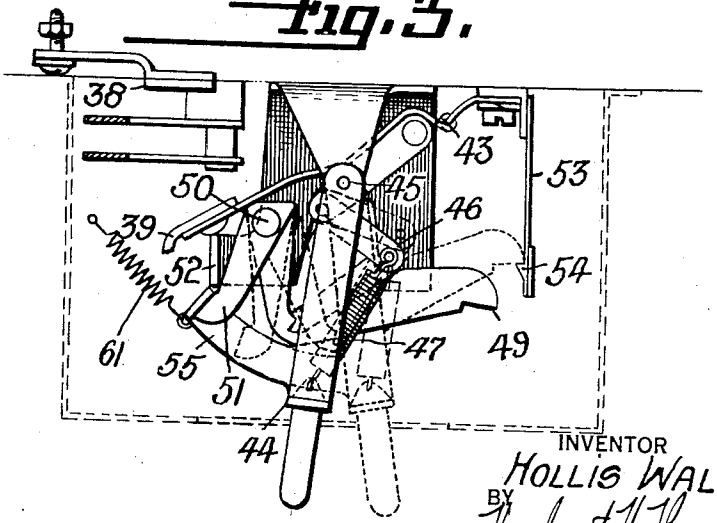



Fig. 2.




Fig. 3.




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## FEEDING AND ARC STRIKING MECHANISM FOR SEARCHLIGHTS

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6 Claims. (Cl. 176—73)

This invention relates to arc striking mechanisms especially adapted for high intensity searchlights. The purpose of the invention is to enable the arc to be struck automatically and promptly upon closing of the main switch. In the present type of high intensity searchlight, when the main switch is opened or the arc is extinguished for any cause, the carbons remain spaced in the position that they were at the time. When the main switch is closed again, therefore, the arc is not struck until the automatic feeding mechanism slowly feeds the negative up to touch the positive and then withdraws the same. Some time is consumed in this operation, which has certain disadvantages in military work. Various auxiliary arc striking devices have been tried, such as an auxiliary movable electrode for temporarily bridging the gap, tilting the negative head, or sliding the negative head, or accelerated negative feeds, but such devices possess the disadvantage that they are likely to damage the delicate positive crater and thin negative tip and are also complicated and not very effective on cold arcs in some cases. By my invention I eliminate such defects and also the complications of prior arrangements. My invention permits a gentle forward feed of the negative carbon by the standard negative feeding mechanism before the switch is thrown to turn the arc on, and insures a positive contacting of the negative with the positive carbon without injury to the delicate positive crater edge. To accomplish this purpose, I provide auxiliary means for causing the negative feeding mechanism to continue to operate after extinguishing of the arc and until the negative electrode touches the positive carbon. The arc is therefore ready for instant striking the moment the main switch is closed, the closing of the main switch preferably resetting the aforesaid auxiliary mechanism. Preferably, also, a time delay device is interposed at the time the arc is extinguished, so that the negative feed is not discontinued due to ionization in the vicinity of the arc until the electrodes actually touch.

Another object of the invention is to improve the positive electrode feed.

Referring to the drawings illustrating one form my invention may assume,

Fig. 1 is a diagrammatic view of a typical high intensity arc mechanism with my invention applied thereto.

Fig. 2 is a diagram, on a larger scale, of the auxiliary arc striking switch, showing a slight modification in the method of actuating the same from the main switch.

Fig. 3 is a side elevation of the auxiliary switch mechanism.

Fig. 4 is a detail of said switch, showing the same in the closed position.

My invention is shown as applied to a fully automatic high intensity lamp having a positive head 1 and a negative head 2 supporting, respectively, a positive electrode 3 and negative electrode 4. In such lamps, which are especially adapted for searchlights or projector lamps, the positive electrode is usually both rotated and fed, the feed being controlled by a means for maintaining the positive crater in the focus of the projector. In this instance, such means is shown as comprising a thermostat 5 on which a portion of the light in the crater is focussed and which controls a solenoid 6 which, in turn, raises and lowers the pivot 7 of the bar 8. One end of said bar operates as a limiting shield for the pawl 9 which is mounted on and reciprocated with the rod 10. The arrangement is such that the ratchet wheel 11 is rotated by the pawl 9 at a normal rate less than the normal feed of the positive when the solenoid 6 is not excited, but when said solenoid is excited, the shield is moved farther upwardly to permit a longer effective engagement of the pawl with the ratchet on each stroke, thus increasing the rate of feed (and rotation) to greater than that normally required. The feed and rotation can also be controlled, if desired, by a hand wheel 12 which turns a pin 13 on a disc 14 to engage the opposite end of the lever 8. The rotation of the ratchet 11 rotates and feeds the positive electrode by rotating the long shaft 15 which rotates and feeds the positive by any of the well known mechanisms.

Similarly the negative electrode is fed in both directions from the same reciprocating bar 10. Said bar is continuously reciprocated from a motor 16 which revolves, through suitable gearing 17, an eccentric pin 18, revolving about the center of the shaft 20 of worm 17. Said rod 10 is shown as carrying at its left hand end a pair of oppositely facing pawls 21 and 22 yieldingly held and pressed towards each other by spring 23. The period of engagement of each pawl with its respective ratchet wheel 24 and 24' is controlled by a U-shaped shield 25. In its central position said shield prevents either pawl from engaging the teeth on each ratchet, and if moved upwardly, the lower pawl will drive the common shaft 26 of the ratchet wheels in one direction, and if lowered slightly, the upper pawl will drive the

said shaft in the opposite direction so that the negative is fed forwardly or backwardly, dependent preferably on the voltage drop across the arc.

The position of the U-shaped member 25 is controlled from electromagnet 26' connected across the arc, which attracts a downwardly extending arm 27 of bell crank lever 28 against the action of a tension spring 29. When the arc is operating at a correct length, the armature is in a balanced position between the pull of the magnet 26' and that of spring 29, in which position the U-shaped member 25 holds both pawls off. When, however, the voltage drop across the arc rises due to too great arc length, for instance, the pull of magnet 26' increases and causes a forward feed of the negative. On the other hand, if the arc becomes too short, the pull of the magnet decreases, causing a backward feed, the rate of feed in each case being controlled to a certain extent by the extent of departure of the position of the negative from its normal position, thus varying the amount of engagement of the pawls with their respective ratchets, and hence the rotation of the shaft 26. The spring 29 is shown as connected at its opposite ends to a bell crank lever 30 adjusted by a set screw 31 so as to adjust the arc length.

The feed may also be manually controlled from a thumb piece 32, the shaft of which is secured to a block 33 having a forked end 34. By pushing said thumb piece and block to the right in Fig. 1, the fork will engage a pin 35 on lever 28, and by rotating it in that position it will be obvious that member 25 may be moved up or down to control the feed. For further details of this type of feed, see the patent of Frank R. House, #2,023,475, dated December 10, 1935, for Automatic feed for high intensity arc lamps.

While the mechanism so far described will operate the arc satisfactorily, it is, as stated above, slow in striking the arc. I propose, therefore, to add an additional device for quick striking purposes. One form such device may assume comprises an auxiliary switching mechanism 36 which is preferably operated from the main arc switch 37. During normal operation of the arc with the switch 37 closed, the auxiliary or branch circuit contacts 38, 39 stand open, as shown in Figs. 1 and 3, but when said switch 37 is opened, the contacts 38 and 39 are consequentially closed (Fig. 4), thereby closing a branch circuit through wire 40, switch 38, 39, resistance 41 (hereinafter described) and wire 42 through the arc feeding mechanism to maintain the same in operation. Therefore the negative electrode will be fed forward to contact with the positive electrode, since substantially full line voltage is impressed on the coil 26'.

The auxiliary mechanism is also provided with means to throw out the feeding mechanism as soon as the electrode tips contact to prevent them from being separated again. This may be accomplished by a special switch construction which may be referred to as a trigger type thermostatically released branch circuit switch. As shown, see especially Figs. 3 and 4, the contact 39 is mounted on an arm 39' pivoted at 43. An operating lever 44 for the same is pivoted at 45 and is connected to the switch arm by a toggle lever 46 and by tension springs 47. Also pivoted on said toggle lever 46 is a second toggle lever 48 which has a fork at its lower end engaging a bell crank lever 49 pivoted at 50. On the pivot shaft 50 of said bell crank lever is a stop arm 51, the outer end portion of which engages a fixed stop 52 in the position shown in full lines in Fig. 3. The outer end of the arm 51 also bears against an extension 55 secured to operating lever 44, so that when the operating lever is moved to the right in Fig. 3, the lever 49 connected with arm 51 is carried with it. The outer end of the bell crank lever 49, when the same is revolved counter-clockwise in Figs. 2 and 3, catches under a spring arm 53 made of a thermostatic strip or strips, so that when the operating lever 44 is moved from the full line position in Fig. 3 counter-clockwise to the dotted line position, the outer lip of lever 49 catches under a tooth 54 on the strip 53 and is held there, thereby cocking the switch, so that when the operating lever 44 is released, as hereinafter described, it will be moved clockwise by spring 61 to the position in Fig. 4, the toggle formed by links 46 and 48 will be straightened out and the switch 38, 39 closed. Also it should be noted that if the thermostatic strip 53 becomes heated, as by resistance 41 adjacent thereto, it will withdraw the tooth 54 from under the lever and release the same, so that the lever 49, switch 39 and lever 44 will re-assume the full line position in Fig. 3.

The arm 44 is preferably operated primarily from the movements of the main switch 37. One method of operating the same is by a slide rod 56 having a spring pressed pin 57 secured to move longitudinally therewith. When, therefore, the switch 37 is opened, the lever 44 will be moved to the right in Fig. 1, causing lever 49 to catch under the tooth 54 (see the dotted position in Fig. 3). The pin 57 then occupies the position shown in dotted lines at 57', where it is preferably caused to drop below the full line position in Fig. 1, as shown, so as to clear the end of the lever 44. This is effected by engagement of the inclined upper surface 58 on said pin with the lip 59 on a bracket 60 supporting the rod 56, thus forcing the pin downwardly against spring 80. A tension spring 61 will, as soon as pin 57 is drawn downwardly, snap the arm 44 to the left again, thus closing the switch 38, 39 (Fig. 4) and therefore closing the branch circuit to maintain the feeding mechanism in operation. As soon, however, as the negative electrode touches the positive, a short-circuit is completed, causing heavy current to pass through resistance 41, withdrawing the tooth 54 from the lip 49, which immediately causes the opening of the switch 39, 40 by breaking the toggle 46, 48 (full line position, Figs. 2 and 3).

As stated, it is desirable that the forward feed of the negative after the arc is extinguished be not too rapid, since there is danger that an arc might strike through the branch circuit before the electrodes touched, due to the incandescent electrodes ionizing the air between the same. In this event the branch circuit might be opened before the carbons touched. To prevent this, I preferably provide some means for delaying slightly the forward feed of the negative. This may be accomplished by inserting said resistance 41 in the wire 42 to lessen the rate of forward feed; or the closing of the switch 38, 39 may be delayed after the opening of the main switch 37 by some delayed action means, as, for instance, illustrated in Fig. 2.

According to this form of the invention, the slide rod 56 and pin 57 of Fig. 1 are replaced by a dash-pot arrangement comprising a cylinder 66 slidably mounted in framework 67 and connected to the lever 44' by a pin and slot connection 68.

Within said cylinder is mounted a piston 69 and a compression spring 70 between the piston and the left hand end of the cylinder. The piston rod 71 is shown as suitably connected to the main switch 37. Said spring normally holds the cylinder against stop 73 but is of insufficient strength to open the switch 37. The cylinder is preferably filled with oil or other liquid and a bleeder hole 72, or holes, are provided through the piston. When the switch 37 is opened, therefore, the piston 69 and cylinder 66 will be moved to the right together, the cylinder then assuming the dotted line position and therefore moving the lever 44' to the right to cause the lever 49 to assume the dotted line position. The spring 70 will then exert a pressure to force the cylinder 66 to the left, but this action will be retarded by the slow transfer of the liquid from the right hand to the left hand side of the piston. Therefore the closing of the switch will be delayed until the lever is returned to nearly the full line position.

In accordance with the provisions of the patent statutes, I have herein described the principle and operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combination and relations described, some of these may be altered and others omitted without interfering with the more general results outlined, and the invention extends to such use.

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. In an arc lamp adapted for burning two electrodes, a supply circuit therefor, a main switch in said supply circuit for turning the lamp on and off, automatically operated, electrically controlled means responsive to arc length for slowly feeding one electrode selectively in both directions to maintain the proper arc length during the normal operation of the lamp, means connected to said supply circuit for causing operation of said first named means to effect the feeding of said one electrode forwardly after said switch is opened and the arc is extinguished, and means actuated by contact of said electrodes for stopping said forward feed.

2. In an arc lamp having positive and negative electrodes, a supply circuit for said electrodes, a main switch in said supply circuit for turning the arc on and off, an automatically operated electrically controlled actuating means responsive to the length of arc between said electrodes for slowly feeding one of said electrodes to maintain the proper arc length during the normal burning of the arc, auxiliary switching means connected across said main switch for causing the operation of said actuating means to effect the feeding of said one electrode forwardly after the arc is extinguished by the opening of said main switch, and tripping means connected with said auxiliary switching means and actuated upon contact with said electrodes for opening the circuit of said feeding means to stop the feed of the electrode upon contacting of said electrodes.

3. In an arc lamp having positive and negative electrodes, a main supply circuit including a main switch for controlling the supply of operating current to the electrodes, automatically operable means for feeding at least one electrode selectively in both directions to maintain the proper arc length after said main switch is closed, and an auxiliary interconnected switch apparatus for causing the operation of said feeding means to feed said electrode forwardly, after the arc has been extinguished by opening said main switch, until said electrodes contact each other, the opening of said main switch serving to initiate the operation of said auxiliary switch apparatus, said apparatus having means for delaying such forward feed of said electrode for a period after the closing of said main switch to eliminate the possibility of premature stoppage of said feed prior to actual mutual contact of the electrodes.

4. A combined feeding and arc striking mechanism for searchlights and the like having positive and negative electrodes comprising a main supply circuit, a main switch for connecting said supply circuit to the electrodes, a branch circuit supplied from said main circuit upon the closing of said main switch, means connected in said branch circuit for feeding the negative electrode in either direction in response to variations in voltage drop across the arc established between the electrodes upon the closure of said main switch, means energized from said branch circuit and cooperating with said feeding means for positioning the positive electrode, an auxiliary switch apparatus connected to said main switch and operable after the opening of the latter to reestablish a supply for said branch circuit to continue the feed of said negative electrode, said switch apparatus having means operable in response to overload current resulting upon the mutual contacting of said electrodes to open said branch circuit together with means for retarding the feed of said negative electrode to eliminate premature actuation of said overload current responsive means.

5. An arc lamp adapted for burning two electrodes to produce an arc therebetween, a supply circuit having a main switch for turning the arc on and off, automatic electrical means energized from said circuit and responsive to arc length for slowly feeding at least one electrode in both directions to maintain the proper arc length during the normal burning of the arc, and means for causing said first means to feed said electrode forwardly after the arc is extinguished by the opening of said main switch, said last named means including an auxiliary interconnected switch rendered operative by the opening of said main switch.

6. A combined feeding and arc striking mechanism for searchlights and the like having positive and negative electrodes, a main arc circuit adapted to include said electrodes, electrically operated means for feeding the negative electrode in either direction responsive to the voltage drop across the arc, means cooperating with said feeding means for positioning the positive electrode, a main switch included in said arc supply circuit for throwing the electrodes into and out of said arc supply circuit, a branch circuit connected across said main switch for causing actuation of said first mentioned feeding means, a trigger type thermostatically released switch in said branch circuit, a connection between said trigger switch and said main switch to lock the former when the main switch is opened, means for consequentially closing said trigger switch, and thermostatic means responsive to an increase in current through said branch circuit for releasing the trigger and opening said switch.

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