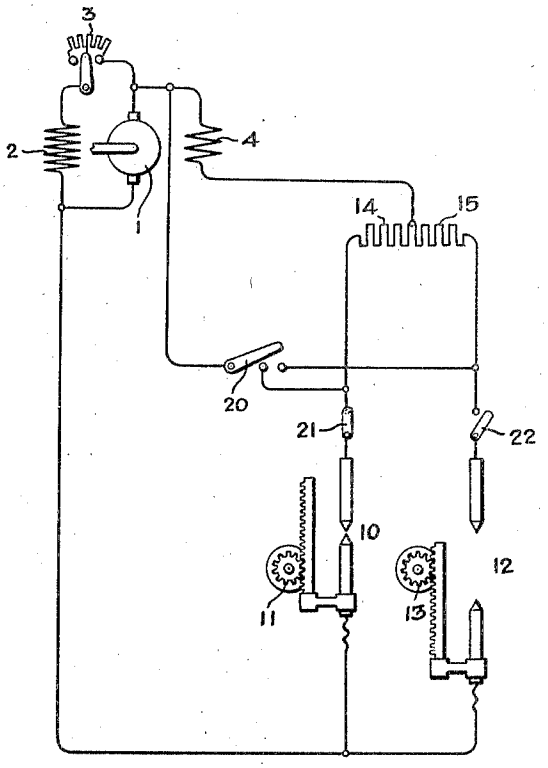
A. L. HADLEY.

OPERATION OF ARC LAMPS.

APPLICATION FILED AUG. 14, 1915.

1,334,854. Patented Mar. 23, 1920.



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UNITED STATES PATENT OFFICE.

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OPERATION OF ARC-LAMPS.

1,334,854. Specification of Letters Patent. Patented Mar. 23, 1920.

Application filed August 14, 1915. Serial No. 45,545.

To all whom it may concern:

Be it known that I, ARTHUR L. HADLEY, a citizen of the United States, residing at Fort Wayne, county of Allen, State of Indiana, have invented certain new and useful Improvements in the Operation of Arc-Lamps, of which the following is a specification.

My invention relates to the operation of arc lamps for motion picture machines and especially the alternate operation of two or more lamps supplied from a single generator.

The direct current arc lamp has been found to be more desirable for use with motion picture machines because of the quality of light and better economy obtained. It is often the case, however, that only an alternating current supply is available. In such cases it is necessary to interpose some form of rectifying apparatus, either a mercury arc rectifier, a synchronous converter or a motor generator set. Further, it is well-known that the carbon arc is characteristically subject to sudden and extreme variations of current when operated directly from a constant potential circuit. If a sufficient resistance is connected in series with the arc, a satisfactory stability may be obtained, because any change in the current required produces a corresponding change in the total voltage across the arc and the resistance, but with a practically constant potential supply circuit, the direct current arc requires sufficient steadying resistance to give a voltage drop of at least 15 to 20 volts and, since the voltage required for a single arc is approximately 55 volts, this makes the required supply voltage about 70 or 75 volts. The continuous use of such a steadying resistance is evidently very uneconomical and even where a direct current supply circuit is available, its voltage is usually 110 volts or higher and it will accordingly be seen that an excessive resistance is required which is very wasteful of power and generates an amount of heat in the grids which makes the operating room very uncomfortable in warm weather.

Another difficulty arises from the fact that many motion picture houses now find it desirable to provide two projection machines and to so arrange their electrical apparatus that the second machine may be started up immediately at the close of the operation of the first or even that the two may be operated simultaneously for a short period of time in order to "dissolve" one view into another, thereby eliminating all delay. This, however, necessitates the use of ballast resistances during the time that the two arcs are operating in multiple and in order that the light delivered by the first machine may not be affected, it is also necessary that the voltage delivered to the arcs should be increased when the ballast resistances are inserted and the second arc is struck.

It is accordingly the object of my invention to provide an efficient and compact apparatus whereby these difficulties may be easily and effectively overcome and to provide a novel method for alternately operating arc lamps connected in multiple to a source of supply.

In accordance with my invention I employ, as a source of current for the arc lamps, a generator capable of operating, when desired, with a drooping voltage-current characteristic and of operating, when desired, with such a voltage-current characteristic that, for the same value of current, a higher voltage obtains than when operating with said drooping voltage-current characteristic. This generator is provided with shunt and series field windings and is adapted to operate, with its circuits connected according to one arrangement, with a drooping voltage-current characteristic and to operate, with its circuits connected according to another arrangement, with such a voltage-current characteristic that, for the same value of current, a higher voltage obtains than with its circuits connected according to the first mentioned arrangement. This I accomplish as is more fully described hereinafter, by designing the generator to have high armature reaction and causing the series field winding to be ineffective when the generator circuits are connected according to the first arrangement and causing the series field winding to be effective to assist the shunt field winding when the generator circuits are connected according to the second mentioned arrangement. This, however, is only one of the several ways in which the generator may be designed to operate with the desired voltage current characteristics. The current for operating the arc lamps is then supplied from

the generator either with its circuits connected according to the first mentioned arrangement or with its circuits connected according to the second mentioned arrangement.

My invention will be more readily understood from the following specification when taken in connection with the accompanying drawing, in which the single figure is a diagrammatic view illustrating the apparatus employed.

At 1 is indicated the armature of a direct current dynamo electric machine which may be driven in any convenient manner, as, for example, by an alternating current motor (not shown) connected to commercial supply mains. This machine is provided with a shunt field winding 2 which may be regulated by means of the usual field rheostat 3. I have also provided a series field winding 4 capable of being employed whenever desirable. An arc lamp 10 is shown diagrammatically as provided with operating mechanism 11 whereby the electrodes may be separated or brought together. Similarly the arc lamp 12 is provided with operating mechanism 13 and is shown with its electrodes separated so that the lamp is inactive. In series with field winding 4 and the arc lamp 10 I provide a ballast resistance 14 while in series between the field winding 4 and the arc lamp 12 I have provided a similar resistance 15. For a purpose to be later described, I have also provided a switch 20 by means of which the series field winding 4 and the resistances 14 and 15 may be short-circuited and have provided switches 21 and 22 to control the lamps 10 and 12.

Let us now suppose that the arc 10 is in operation and that the switches 20 and 21 have been closed. Owing to the design of the generator, 1, the elimination of the ballast resistance is possible and economic operation may be secured. If it is now desired to put the lamp 12 in operation the switch 20 will be opened, thereby introducing the series field winding 4 and the resistance 14. The current required by the arc lamp 10 by its passage through the field winding 4 will increase the voltage delivered to such a degree that it will compensate the drop through the resistance 14 and consequently the voltage received by the arc 10 will remain practically constant. This is very desirable since in the particular use in which this arrangement is employed any change in the light produced is readily noticeable. Because of the effect of the resistance 15 in series with the electrodes of the lamp 12, the switch 22 may be closed and its electrodes may be brought together without fear of interference with the operation of the lamp 10. All danger of short-circuit is avoided since a drop through the resistance 15 will maintain a sufficient voltage across the lamp 10 to keep the same in operation. In the ordinary operation, the electrodes of the lamp 12 will be immediately separated for a short distance and an arc struck, making it possible thereby to heat up the carbons of this second lamp so that the same will be in condition for immediate use at the time required. No light will be thrown on the screen by the second lamp 12 because of a special shutter or "dowser" which is provided on the motion picture machine. When it is desired to "dissolve" the view being shown into the one to follow, the "dowser" on lamp 12 is removed so that the views from the two machines overlap. The switch 21 is then opened, whereupon the electrodes of the arc 10 may be separated if desired. During this operation the ballast resistances 14 and 15 will insure the steadiness of the arcs while the series field winding 4 will automatically maintain the voltage delivered at the value desired. Because of the special design of the machine employed, the switch 20 may now be again closed, since only one lamp is in operation, and the field winding 4 and ballast resistances 14 and 15 cut out of circuit, thereby improving the economy of operation. It will be evident that, in the particular operation which I have outlined above the resistance 14 is not absolutely necessary. In order, however, that the operation may be reversed, I find it convenient to provide two such resistances, one of which is in series with each lamp.

While I have herein described the preferred embodiment of my invention in detail, I conceive that various modifications may be made therein and I, accordingly, do not desire to be limited to the exact arrangement shown but seek to cover in the appended claims all such modifications and variations as come within the scope of my invention.

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

1. The combination with a generator provided with shunt and series field windings and adapted to operate with a drooping voltage-current characteristic when its series field winding is ineffective, and to operate, when its series field winding is effective, with such a voltage-current characteristic that, for the same value of current, a higher voltage obtains than with series field winding ineffective, of a plurality of arc lamps, and means whereby the generator may be caused to supply current with its series field winding ineffective to one lamp, and to supply current with its series field winding effective to a plurality of lamps.

2. The combination with a generator provided with shunt and series field windings and adapted to operate with a drooping voltage-current characteristic when its series

field winding is ineffective, and to operate when its series field winding is effective, with such a voltage-current characteristic that, for the same value of current, a higher voltage obtains than with the series field winding ineffective, of a plurality of arc lamps, a resistance, and means whereby the generator may be caused to supply current with its series field winding effective to said lamp through said resistance or to supply current with its series field winding ineffective directly to said lamp.

3. The combination with a generator provided with shunt and series field windings and adapted to operate, with the series field winding ineffective, with a drooping voltage-current characteristic and to operate, with the series field winding effective, with such a voltage-current characteristic that, for the same value of current, a higher voltage obtains than with the series field winding ineffective, of a plurality of arc lamps, a plurality of resistances, and means whereby the generator may be caused to supply current, with the series field winding effective, to a plurality of parallel circuits, each comprising one of said lamps and one of said resistances arranged in series, or to supply current, with the series field winding ineffective, directly to one of said lamps.

4. The method of operating a system comprising a plurality of arc lamps, a plurality of resistances, and a generator provided with shunt and series field windings and adapted to operate with a drooping voltage-current characteristic when its series field winding is ineffective, and to operate, when its series field winding is effective, with such a voltage-current characteristic that, for the same value of current a higher voltage obtains than with its series field winding ineffective, which consists in supplying current from the generator, with its series field winding effective, to a plurality of parallel circuits, each comprising one of said lamps and one of said resistances arranged in series, and subsequently supplying current from the generator with its series field winding ineffective directly to one of said lamps.

5. The method of operating a system comprising a plurality of arc lamps, a plurality of resistances, and a generator provided with shunt and series field windings and adapted to operate with a drooping voltage-current characteristic when its series field winding is ineffective and to operate when its series field winding is effective with such a voltage-current characteristic that, for the same value of current, a higher voltage obtains than with its series field winding ineffective, which consists in supplying current from the generator, with its series field winding ineffective, directly to one of said lamps, subsequently supplying current from the generator, with its series field winding effective, to a plurality of parallel circuits, each comprising one of said lamps and one of said resistances arranged in series, and subsequently supplying current from the generator, with its series field winding ineffective, directly to another of said lamps.

6. The method of alternately operating a plurality of arc lamps connected in multiple to a source of supply in order to transfer from one lamp to another without a failure of light which consists in increasing the potential delivered by said source, inserting a resistance in series with one of said arc lamps which is inactive, putting said inactive lamp in operation, rendering said originally active lamp inactive, withdrawing said resistance and decreasing the potential of said source.

In witness whereof I have hereto set my hand this 11th day of August, 1915.

ARTHUR L. HADLEY.