J. H. ALLEN.

SYSTEM OF ELECTRIC LIGHTING.

APPLICATION FILED APR. 12, 1921.

1,434,727. Patented Nov. 7, 1922.

Fig. 1.

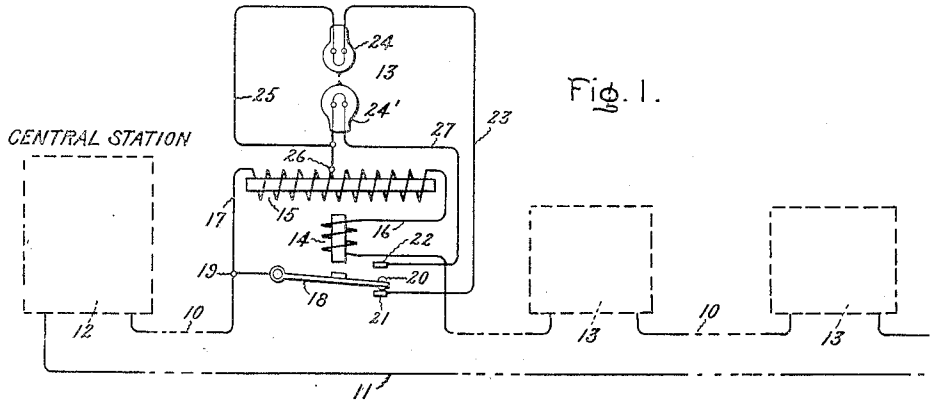
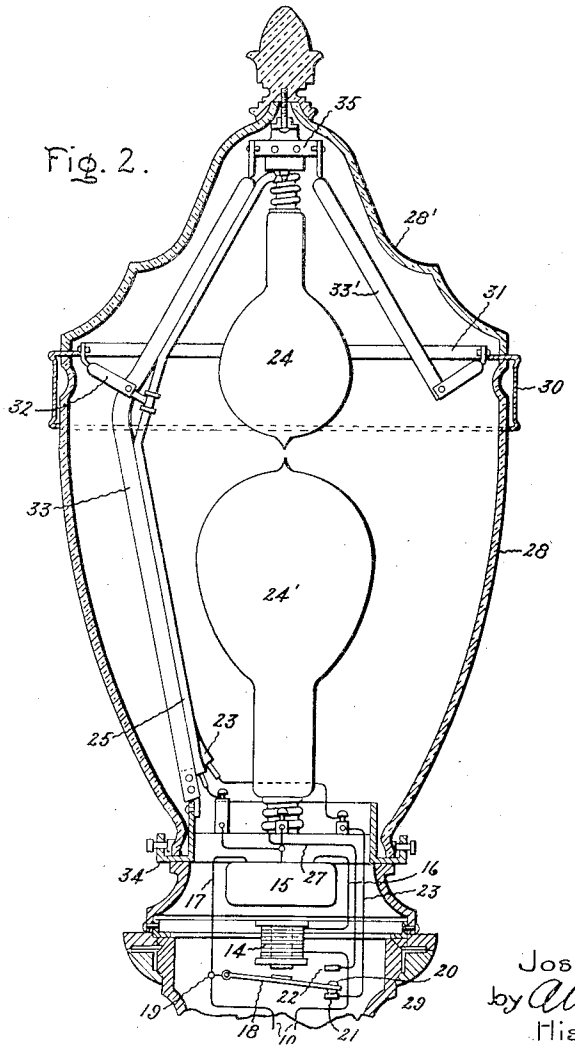


Fig. 2.



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UNITED STATES PATENT OFFICE.

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SYSTEM OF ELECTRIC LIGHTING.

Application filed April 12, 1921. Serial No. 460,828.

To all whom it may concern:

Be it known that I, JOSEPH H. ALLEN, a citizen of the United States, residing at Chicago, in the county of Cook, State of Illinois, have invented certain new and useful Improvements in Systems of Electric Lighting, of which the following is a specification.

My invention has reference to a system of alternating current series lighting which includes a lighting unit especially adapted to the system and which in its turn makes the system commercially useful.

Ornamental electric lighting units for the business sections of cities are furnished each with a lamp of high candlepower to illuminate the street, both roadway and sidewalk, sufficient for the purposes of dense traffic during business hours. When late in the evening the stores and shops are closed and the traffic subsides, such high illumination is not required, and in order to save expense the lighting units which are strung along the street are served by two independent circuits, each circuit serving alternate units and one of these circuits is interrupted by the central station at a certain hour when the traffic has subsided, leaving one set of lamps burning. But these burning lamps are now widely spaced and the uniformity of illumination of the street is disturbed, showing some highly illuminated spots in the immediate vicinity of the units and dark stretches between the same.

My improved system, while still saving the expense of superfluous illumination after business hours maintains a uniformity of illumination and in addition thereto requires only one circuit embracing all the units in series.

For this purpose each lighting unit is equipped with two lamps, one of high candlepower designed to operate with a high current, say 20 amperes, and one of smaller candlepower designed to work with a smaller current, say 6.6 amperes, so located with reference to each other that when one of them is burning the other will not cast a shadow upon the enclosing globe of the unit. In the system several units are connected in series and each lamp is supplied with current from an individual circuit having a section in common with the series circuit. Associated with each unit is an auto-transformer individual to the unit, all of which transformers are in series in the series circuit. The lamps in each unit are brought into operative engagement with the transformer circuit one at a time by means of an electromagnet or relay, of which there is one for each unit and all of which relays are controlled over the series circuit to throw either the high current lamp or the low current lamp, as desired, across the transformer terminals. In the embodiment of the invention here shown the circuit connections within the lighting unit are such that when the line current is turned on in the evening with full normal strength (about 6.6 amperes), the high candlepower lamp is put in circuit. When the time for reducing the general illumination arrives, the line current is considerably reduced by the central station (to about 2.2 amperes), and by this action the high candlepower lamp is cut out and the low candlepower lamp is included in the circuit and continues to burn during the remainder of the night. Toward morning the main circuit is lastingly interrupted, whereby the switching apparatus is again put in condition to connect the high candlepower lamp in the circuit when the full current strength is thrown upon the line in the evening.

It will be seen that by this system a considerable amount of current is saved and uniformly distributed illumination all throughout the night is preserved. But in order to make this system commercially effective, it is necessary that the two lamps in each unit be so arranged that neither of them casts a shadow upon the globe of the unit while the other lamp is burning.

All of this is more fully set forth in the following detail description with reference to the accompanying drawing, in which Fig. 1 is a diagram of the system of distribution in accordance with my invention, showing the switching apparatus connected with the lamps and with the main circuit, and Fig. 2 is an axial section of one of the lighting units, showing certain parts in elevation.

Referring now particularly to Fig. 1, the alternating constant current mains 10, 11, extend from the central station 12 along the line of distribution, with lighting units 13 connected therein in series; the electrical equipment of one of these units is indicated upon an enlarged scale near the left hand

end of Fig. 1. To the main 10 is connected the magnet 14 and in series therewith the auto-transformer 15, by conductors 16, 17. The pivoted armature 18 of the electro-magnet is connected with the conductor 17 at a point 19, and it carries at its free end a contact 20. The armature is here shown as a gravity armature, but it may as well be spring controlled. When the magnet is not sufficiently energized (which is the condition indicated in the drawing) the contact 20 bears upon a contact 21, and when the magnet is sufficiently energized contact 20 bears upon contact 22. A conductor 23 connects contact 21 with one terminal of an incandescent lamp 24, the other terminal of which is connected by conductor 25 to a selected intermediate point 26 of the auto-transformer. The same intermediate point 26 is also connected with one terminal of an incandescent lamp 24′ the other terminal of which is connected with contact 22, by conductor 27. In the arrangement here shown the lamp 24′ is the high candle power lamp and the lamp 24 is the lower candle power lamp.

In alternating constant current systems of distribution the central station is provided with means for setting the line current strength within certain limits, at the will of the attendant at the station, and is also provided with means for automatically maintaining the current sensibly constant at that strength. These are well known equipments and are, therefore, not shown in the drawing. A switch for closing and opening the line circuit is, of course, also provided at the central station. In normal practice the line current in such systems can be maintained at uniform strength, either at 6.6 amperes or at 2.2 amperes, and the transformer at each consuming station raises the line current to the required amperage in the local circuit. In the auto-transformer here shown the intermediate point 26 of the winding is so selected that a line current of 6.6 amperes furnishes to the local circuit, including the left hand section of the transformer a current of approximately 20 amperes, while a line current of 2.2 amperes gives to the local circuit approximately 6.6 amperes, the former being sufficient to run the high candle power lamp 24′ and the latter sufficient to run the low candle power lamp 24.

The operation of the system is as follows: In the day time the main circuit is open at the central station and the switching apparatus at each lighting unit is in the condition shown in the drawing. When, in the evening, lighting is to be started, the line circuit is closed and a current of 6.6 amperes is sent over the line, including the electro-magnet and auto-transformer at each lighting unit. The electromagnet 14 is so constructed that this current powerfully energizes it and it instantly raises its armature whereby the contact 20 comes to bear upon contact 22. The circuit of lamp 24 is now open at 21 and the local circuit of lamp 24′ is closed upon the left hand section of the auto-transformer, giving to the lamp approximately 20 amperes. The 6.6 amperes are maintained on the line during the dense traffic hours of the night, say until 11 p. m. and the street is highly illuminated by the high candle power lamps.

When the street traffic has subsided (say at 11 p. m.) the central station operator reduces the line current to about 2.2 amperes. This current is not enough to sufficiently energize the magnet to hold its armature, the latter, therefore drops, breaking contact at 22 and establishing contact at 21. The circuit of lamp 24′ is thus broken and that of lamp 24 is closed, which now receives through the left hand section of the transformer a current of 6.6 amperes, which is sufficient and well adapted to maintain it at its rated candle power. When, toward morning, the line circuit is broken at the central station, the switching apparatus at each lighting unit remains undisturbed and is ready for the resumption of lighting in the evening.

It should be understood that the line and lamp current strengths specified in the foregoing description have only been assumed as possible and practical currents, but that these may be changed in accordance with the requirements of different localities.

It should likewise be understood that the switching apparatus connected with each lighting unit may be of any suitable kind or form. Such switching apparatus is preferably housed in the lighting unit, as shown in Fig. 2. In this figure of drawing only such details are shown as are required for an understanding of its operation.

The lamp equipment is surrounded by a transparent or translucent globe 28, and in the latter are mounted the two incandescent lamps 24, 24′ in vertical axial alignment the smaller lamp 24 pointing with the tip of its bulb downwardly and the larger lamp pointing with the tip of its bulb upwardly. By reason of this arrangement the light from either lamp has free exit through the enclosing globe 28, because if either lamp is lighted, the other will not cast a shadow upon the wall of this globe. The screw plugs of these lamps are the only opaque elements that may throw a sensible shadow, and it is clear that the shadow of lamp 24 will be projected upon the peak of the canopy 28′ and that of lamp 24′ will be projected into the cavity provided in the top of the column 29 upon which the lighting unit is mounted. This disposition of the two lamps, whereby the opaque elements of the lamps are located beyond the light flux through the globe and thereby the enclosing globe is rendered practically

shadowless is important in a system of illumination in which two lamps are housed in one enclosing globe in which only one of the lamps is burning at a time. I have found that any other relative positions of the two lamps result in unsightly and light obstructing shadows.

The switching apparatus described with reference to Fig. 1 is housed in the cavity at the top of the supporting column 29, the autotransformer 15 being shown in its casing. The electro-magnet, its armature, the contacts and circuit connections are the same as those shown in Fig. 1 and are marked with the same numerals of reference, and their operation in the system is the same. An ornamental ring 30 surrounds the upper part of the globe 28 and rests with a flange 31 on the edge of the globe. A bracket 32 secured to the flange 31 supports the conductors 23, 25, leading from the contact 21 and from the intermediate point 26 of the auto-transformer, respectively, to the lamp 24. A strut 33, rising from the globe support 34 sustains a plate 35 to which the socket for lamp 24 is secured, and this plate is further sustained by a strut 33′ secured to the flange 31. These details may be changed in any convenient manner; they form no part of my invention and are here only indicated for the sake of completeness of description. For the purposes of my invention it is of no consequence in what part of the lighting unit the switching apparatus is housed or how the conductors connecting the switching apparatus with the lamps are disposed, or how, the lamps themselves are supported, so long as these lamps are arranged in axial vertical alignment for the purpose and with the effect of rendering the enclosing globe practically shadowless.

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

1. A system of electric lighting comprising an alternating current line and lighting units in series in the same, each unit containing two lamps of high-and lower candle power respectively, and a transformer and switching apparatus controlled by the line current for lighting either lamp to the exclusion of the other.

2. A system of electric lighting comprising an alternating current line upon which currents of either of two strengths may be thrown and lighting units in series in the same, each unit including two lamps of high- and lower candle power respectively, and a transformer and switching apparatus controlled by the line current for lighting either lamp to the exclusion of the other.

3. In combination with a series light circuit, a series of light units each unit having; a transformer in the series circuit, a relay in the circuit, a pair of lamps, said relay operated over the series circuit to connect either lamp with the transformer whereby either lamp may be operated by a current flow different in volume from that in the series circuit.

In witness whereof I have hereunto set my hand this 8th day of April, 1921.

JOSEPH H. ALLEN.