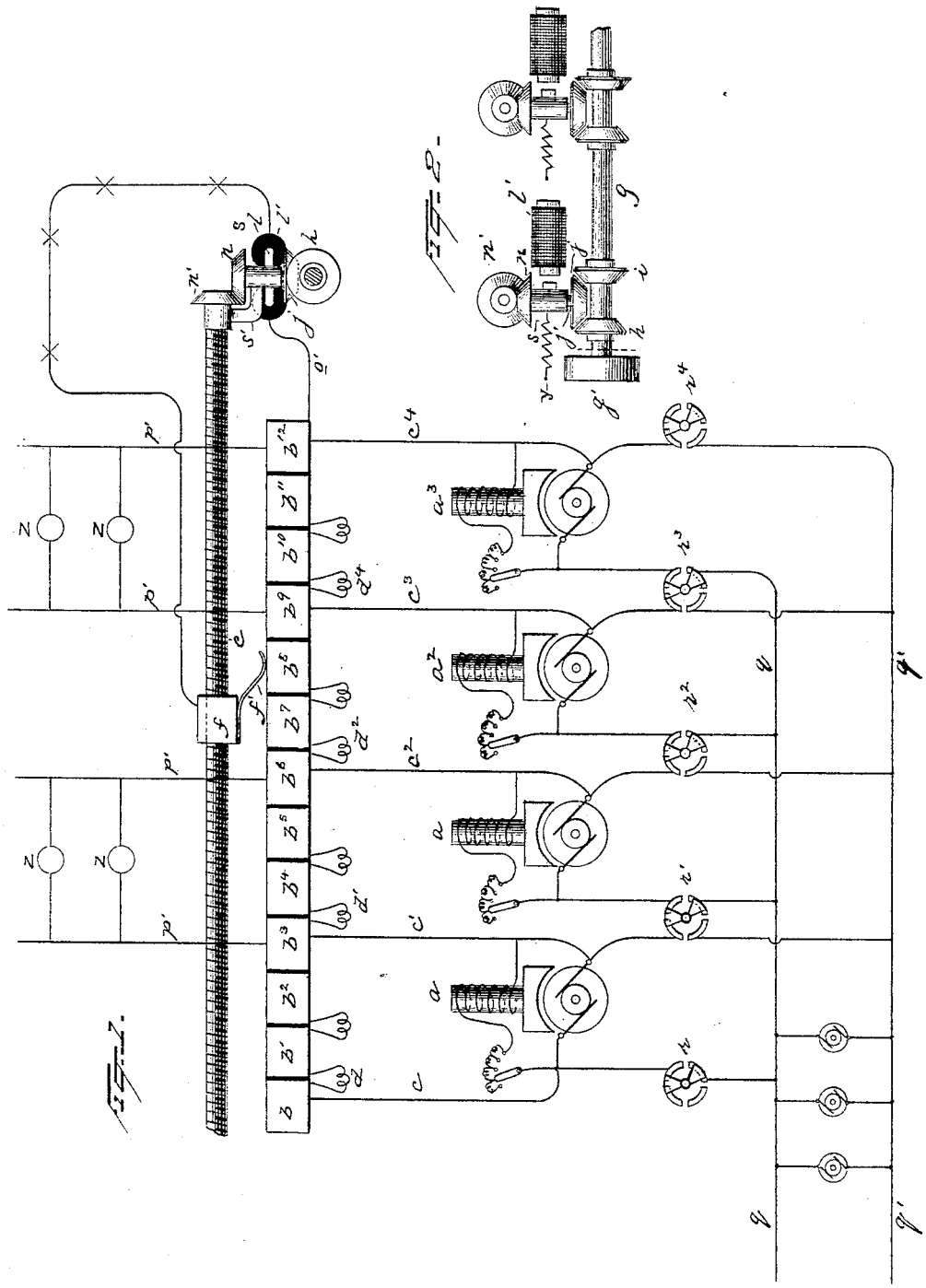
(No Model.) 2 Sheets—Sheet 1.

S. W. RUSHMORE.

ELECTRIC LIGHTING SYSTEM.

No. 493,842. Patented Mar. 21, 1893.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

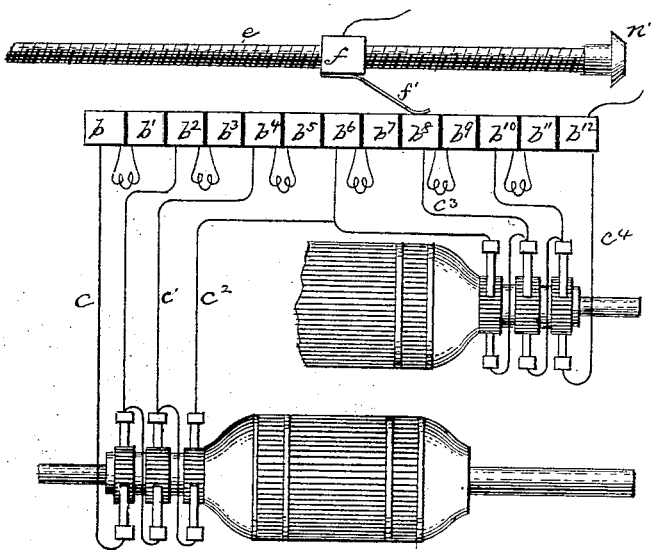
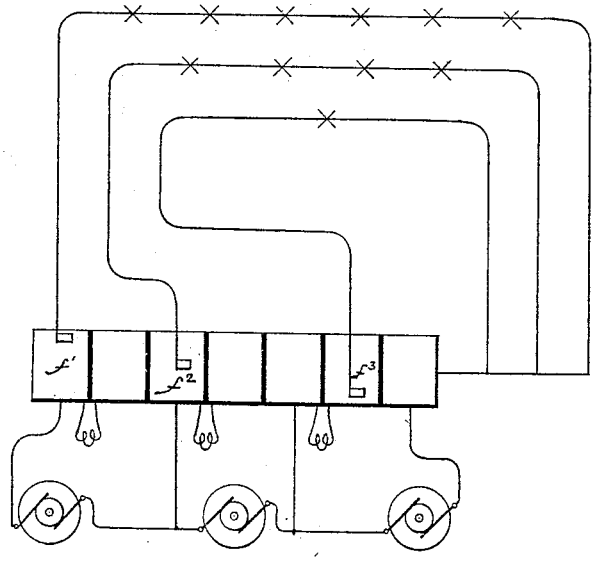


Fig. 4.



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UNITED STATES PATENT OFFICE.

SAMUEL W. RUSHMORE, OF BROOKLYN, NEW YORK.

ELECTRIC-LIGHTING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 493,842, dated March 21, 1893.

Application filed February 7, 1891. Serial No. 380,692. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL W. RUSHMORE, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented a certain new and useful Improvement in Systems of Electrical Distribution, of which the following is a specification.

The main object of my invention is to enable constant current circuits in which translating devices are employed in series, such as arc lighting circuits, to be supplied in an effective and convenient manner by constant potential generators such as are ordinarily used for incandescent electric lighting and for electric motor work; thus by my invention I am enabled to supply from the same generators and the same central station both arc lights and incandescent lights, as well as electric motors, whereby an increase of economy and profit is obtained.

In carrying my invention into effect I prefer to employ a series of constant potential generators of any usual or effective type used for supplying multiple arc or incandescent electric light circuits, the number of generators which may be placed in series being proportioned to the number of arc lamps or other translating devices to be supplied in series, and I so connect these generators that the full potential of the entire series may be directed upon one or more series circuits of translating devices; although this potential may be varied when necessary, partly by the individual regulation of the generators and partly by placing a greater or less number of such generators in series. At the same time I make such connections from the series of generators to the multiple arc or constant potential circuits to be supplied that each of such circuits is provided with such a fraction of the whole potential as is necessary to operate its translating devices. I also provide switches so arranged that the generators may be altogether removed from their series relation and all applied in multiple arc to incandescent or power circuits. Thus the station may be employed in the day-time or constant potential circuits, and at night may be used to supply both arc lamps and incandescent lamps. The regulation of the generators in accordance with the variation in the number of translating devices in series I accomplish by automatically-operating devices controlled by the current in the circuit, and it will be evident that this feature of regulating one or more series circuits by automatically increasing or decreasing the number of generators in series therein or by this method combined with the regulation of individual generators, is applicable to any series systems and is not confined to systems in which constant current and constant potential circuits are both supplied from the same generators.

My invention is illustrated in the accompanying drawings.

Figure 1 is a diagram of a system embodying my invention; Fig. 2, a side view of an automatic regulating device for the series circuit; Fig. 3, a diagram of a modified arrangement in which each generator has several independent armature coils connected externally in series; and Fig. 4, a diagram showing the supplying of two or more series circuits from the same generators.

Referring first to Figs. 1 and 2, a, a', a^2 and a^3 represent suitable generators of the constant potential type. These generators are all shown as connected in series through the switches r, r', r^2, r^3 and r^4.

b to b^{12} is a series of contact blocks insulated from each other. One terminal of the series of generators is connected by wire c with contact block b, the other terminal by wire c^4 with contact block b^{12}. Intermediate connections c', c^2 and c^3 are made from between the generators to blocks b^3, b^6 and b^9 respectively, and those blocks to which connections are made are connected with the adjacent blocks on one side through resistance coils d, d', d^2 and d^3. From the wire c^4, which is at one terminal of the series of generators, a conductor o' extends, which, after including the coils of the magnet l', whose function will be presently explained, passes to the series circuit containing arc lamps or other translating devices x, the other end of this circuit being connected with the traveling nut f threaded on the shaft e and carrying the contact spring f' which moves over the series of contact blocks b to b^{12}. It will be seen that when the spring f' rests on the end block b, the series circuit o' will receive the full potential of the series of generators, but

if the said spring is moved to the right, the potential will be diminished first by the including of resistance coils d in circuit, then by the removal of the generator a when the spring reaches the block b^3, then by the further including of resistance, and following this the removal of the generator a', and so on until at the position indicated in Fig. 1 the series circuit is supplied by the generators a^2 and a^3 through the resistance coils connected between blocks b^6 and b^8. On movement in the other direction it is evident that the potential of the series circuit will be gradually increased in the same manner. In addition to their regulating function, the resistance coils d, d act to prevent short circuiting when the spring f' bridges two contact blocks. This movement of the contact spring f' I prefer to produce automatically in the following way: a shaft g is kept in continual rotation by suitable power as indicated by the belt g'. On this shaft are two beveled friction wheels h and i. Between these beveled wheels is a beveled wheel j turning on a spindle j', which has at its other end a beveled friction wheel n engaging a friction wheel n' on the end of the threaded shaft e. The spindle j' passes through a sleeve s carried by an arm s' pivotally hung on the threaded shaft e, whereby the beveled wheel j may be rocked into engagement with either wheel h or i. The sleeve s has upon it an armature l, in proximity to which is placed the magnet l', which is in the series circuit o', and a spring y is attached to the opposite side of the sleeve s. Normally, therefore, the friction wheel j is kept midway between the friction wheels on the shaft g, but when the current in the series circuit is increased by the removal of lamps, the magnet l' draws said wheel against the wheel i which turns said wheel in such direction as to communicate a movement to the threaded shaft e, which moves the nut f and spring f' in the direction to first insert resistance coils d into the circuit, and, if the movement is continued, to remove one or more of the generators from the series. A decrease of current in the series circuit by causing the spring to draw the wheel j in the opposite direction, produces a contrary effect.

To those of the contact blocks b to b^{12} to which connections from the generators are made, I connect the multiple arc circuits p', containing incandescent electric lamps z or other translating devices which require a constant potential. Each of these multiple arc circuits is connected across the terminals of a single generator, as shown, so that each is supplied with the potential of one machine. The movement of the contact spring f', it will be seen, does not affect the supply of current to the multiple arc circuits, but the generators a' and a^3 continue to supply the multiple arc circuits without regard to whether they are also joined in the series circuit or not, each multiple arc circuit receiving the required fraction of the total potential.

The series of generators may supply any desired number of series circuits, these being in multiple arc relation to each other, and each circuit having its own automatic regulator, all such regulators being operated by the same shaft g as illustrated in Fig. 2. The arrangement of two or more multiple series circuits is indicated in diagram in Fig. 4. The generators are connected as already described to the series of contact blocks, and the several series circuits all have one terminal connected to an end block, and each has its other terminal movable upon the range of contact blocks by means of a traveling contact f', f^2 or f^3 which may be operated by a threaded shaft e (see Fig. 2) as already explained. It will be seen that each circuit will therefore be regulated in accordance with the number of translating devices which it contains at any time and in accordance with variations of its own current caused by changes in the resistance of the other circuits. As shown, the traveling contacts will assume different positions on the range of contact blocks in accordance with the current required for each circuit, and when the number of translating devices in circuits is varying, each traveling contact will travel back and forth upon the contact blocks in accordance with the requirements of its particular circuit.

I have shown in Fig. 1 an additional constant potential circuit q, q' connected with the switches r to r^4. This may be a power circuit containing electric motors and supplied from the same generators. It will be seen that by turning the switches all the generators may be connected in multiple arc with the circuit q, q' at the same time that they are connected with the circuits p', so that at this time all these circuits form a single multiple arc system supplied by all the generators in multiple arc. It is designed that the system may be operated in this way in the day-time when arc lights are not in use, and that at night the power circuit will be disconnected at the switches r to r^4 and the series of generators thrown upon the arc light circuit, while at the same time individual generators supply the constant potential circuits p'.

In Fig. 3 I have shown generators, each of whose armatures is wound with several independent coils connected outside the machine with separate commutators. These commutators being joined in series are connected with the contact blocks b to b^{12} in the same manner as the individual machines of Fig. 1, and by the movement of the contact spring f', the sections of coils are inserted in or removed from the circuit so as to vary the potential and maintain a constant current as already explained.

What I claim is—

1. In a system of electrical distribution the combination of two or more electrical generators, means for connecting them in series, a circuit containing translating devices arranged in series supplied by said generators, and devices controlled by the current in the said series circuit for connecting more or less of the said generators in the series whereby a constant current is maintained in the circuit under changes in the number of translating devices in circuit, substantially as set forth.

2. In a system of electrical distribution, the combination of two or more dynamo-electric machines, means for connecting them in series, a circuit of translating devices supplied thereby, and means controlled by the current for progressively reducing the potential of individual machines and successively removing such machines from the series circuit and, vice versa, successively replacing machines in the circuit and increasing their potential, substantially as set forth.

3. In a system of electrical distribution, the combination of two or more dynamo electric machines, means controlled by the current for connecting them successively in series, and a series circuit of translating devices one terminal of which is connected with a terminal of the series of dynamos while the other terminal is adapted to be connected either with the opposite terminal of the series of dynamos or with the terminals of intermediate dynamos of the series, and means controlled by the current to automatically change the connection of the latter terminal, whereby the number of dynamos in series may be varied to maintain a constant current in the circuit, substantially as set forth.

4. In a system of electrical distribution, the combination of two or more electrical generators, means for connecting them in series, a range of separated contacts, connections from the terminals of the series to the end contacts, intermediate connections from between the generators with intermediate contacts, and a circuit of translating devices, one terminal of which is connected with an end contact and the other terminal movable from one to another of the range of contacts, substantially as set forth.

5. The combination of two or more electrical generators, means controlled by the current for connecting the generators successively in series, a circuit of translating devices supplied in series thereby, and constant potential circuits supplied by individual generators of the series, substantially as set forth.

6. The combination, in a system of electrical distribution, of several generators connected or adapted to be connected in series to a series circuit of translating devices, switches having contacts, and switch arms or devices for connecting the generators in series in said circuit, said switches having additional contacts connected to a multiple arc circuit of translating devices, said switch arms or devices being constructed so that they can close the multiple arc circuit only after the series circuit is broken, substantially as described.

7. In a system of electrical distribution, the combination of two or more electrical generators, means for connecting them in series, a circuit containing translating devices arranged in series supplied by said generators, devices controlled by the current in the said series circuit for connecting more or less of the said generators in the series, and means for removing the dynamos from their series relation on the constant current circuit and for throwing the generators into multiple on a constant potential circuit, substantially as described.

8. The combination of a number of electrical generators, means for connecting them in series, a range of separated contacts, connections from the terminals of the series to the end contacts, intermediate connections from between the generators to intermediate contacts, constant potential circuits connected with the said intermediate contacts whereby they receive the potential of individual generators, and a circuit of translating devices in series, one of whose terminals is connected with an end contact and the other terminal of which is movable from one to another of the range of contacts, substantially as set forth.

9. The combination of a number of generators, means for connecting them in series, the range of contacts with which said generators are connected, the series circuit of translating devices having a terminal movable on said contacts, and the resistances connecting contacts with which generators are connected to adjacent contacts, substantially as set forth.

10. In a system of electrical distribution, the combination of a series of generators, a series circuit of translating devices connected across the terminals of the series of generators, automatic means for changing the current in the series circuit, by varying the number of generators in series intermediate conductors extending from between generators of the series, and translating devices connected in multiple arc between conductors of the series circuit and said intermediate conductors, and also between pairs of intermediate conductors, substantially as set forth.

11. In a system of electrical distribution, the combination of a series of generators, a series circuit of translating devices connected across the terminals of the series of generators, translating devices connected in multiple arc across the terminals of individual generators of the series, and means controlled by the current for varying the number of generators included in the series circuit, substantially as set forth.

12. In a system of electrical distribution, the combination of a series of generators, a series circuit of translating devices connected across the terminals of the series of genera-

tors, translating devices connected or adapted to be connected in multiple arc across the terminals of individual generators of the series, means for regulating the individual generators, and means controlled by the current for varying the number of generators included in the series circuit, and means for disconnecting the series circuit and connecting one or more of the generators in multiple to the multiple arc circuit, substantially as set forth.

13. In a system of electrical distribution, the combination of a series of generators, two or more series circuits of translating devices connected with said generators in multiple arc to each other, and means controlled by the current in the series circuits for varying the number of generators in series, in each circuit, substantially as set forth.

14. In a system of electrical distribution, the combination of a series of generators, two or more series circuits of translating devices connected with said generators in multiple arc relation to each other, and means controlled by the current in the circuits for varying the number of generators in series for varying the potential of individual generators, substantially as set forth.

15. In a system of electrical distribution, the combination of a series of generators, a range of contacts to whose extremities are connected the terminals of the series of generators, intermediate connections from between the generators to intermediate contacts, and two or more series circuits of translating devices each connected at one terminal with the end of the range of contacts and each having its other terminal movable from one to another of the range of contacts, substantially as set forth.

16. In a system of electrical distribution, the combination of a series of generators, a range of contacts to whose extremities are connected the terminals of the series of generators, intermediate connections from between the generators to intermediate contacts, two or more series circuits of translating devices all connected at one terminal with the end of the range of contacts and each having its other terminal movable from one to another of the range of contacts, and an electrically controlled device in each circuit controlling the position of the said movable terminals respectively upon the range of contacts, substantially as set forth.

This specification signed and witnessed this 24th day of January, 1891.

SAMUEL W. RUSHMORE.

Witnesses:

D. H. DRISCOLL,

EUGENE CONRAN.