(No Model.) 2 Sheets—Sheet 1.

T. A. EDISON.

SYSTEM OF ELECTRICAL DISTRIBUTION.

No. 382,415. Patented May 8, 1888.

Fig. 1.

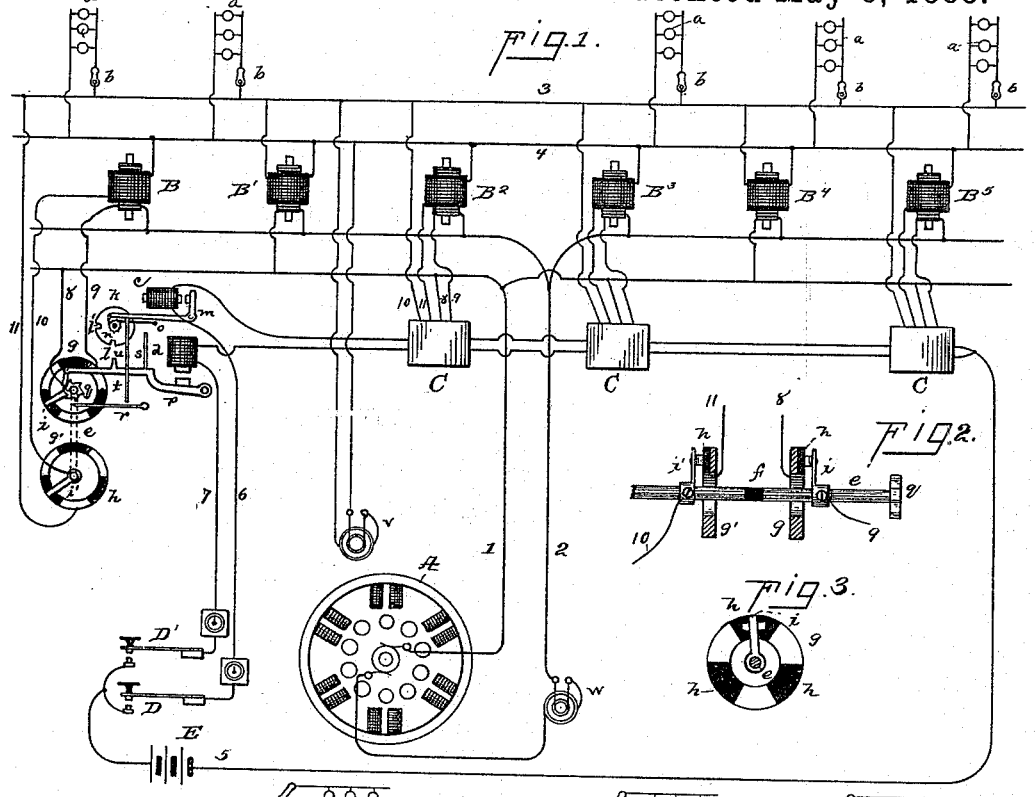
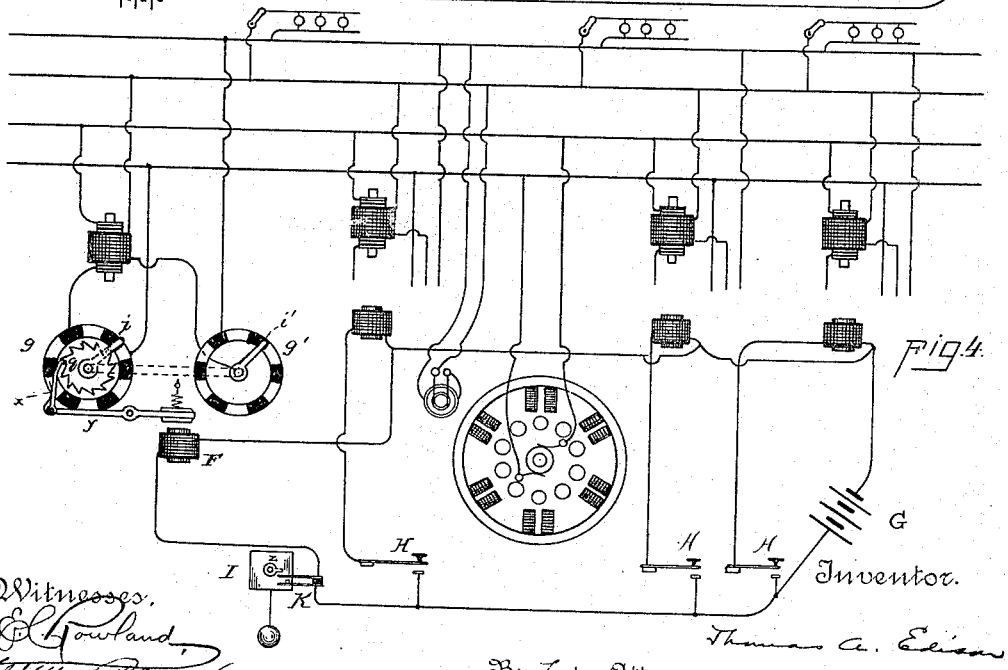


Fig. 2.

Fig. 3.

Fig. 4.



Witnesses.
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Wm. Pelzer.

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By his Attorneys.
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(No Model.) 2 Sheets—Sheet 2.

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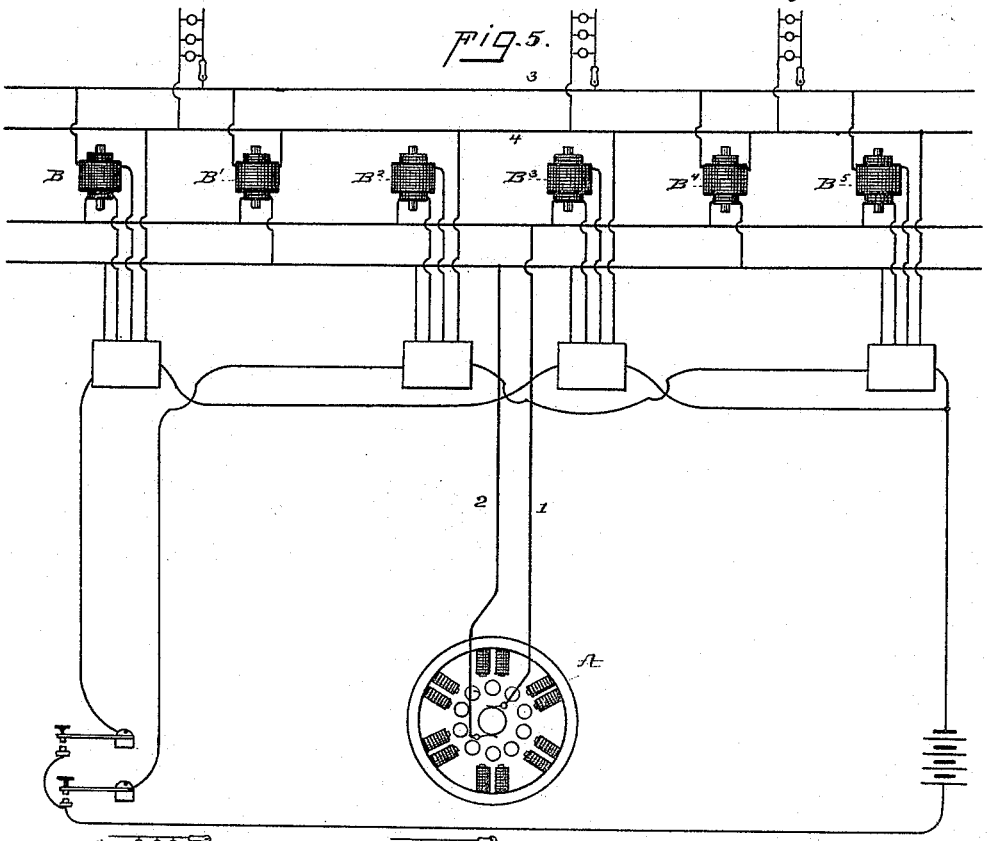
Fig. 5.



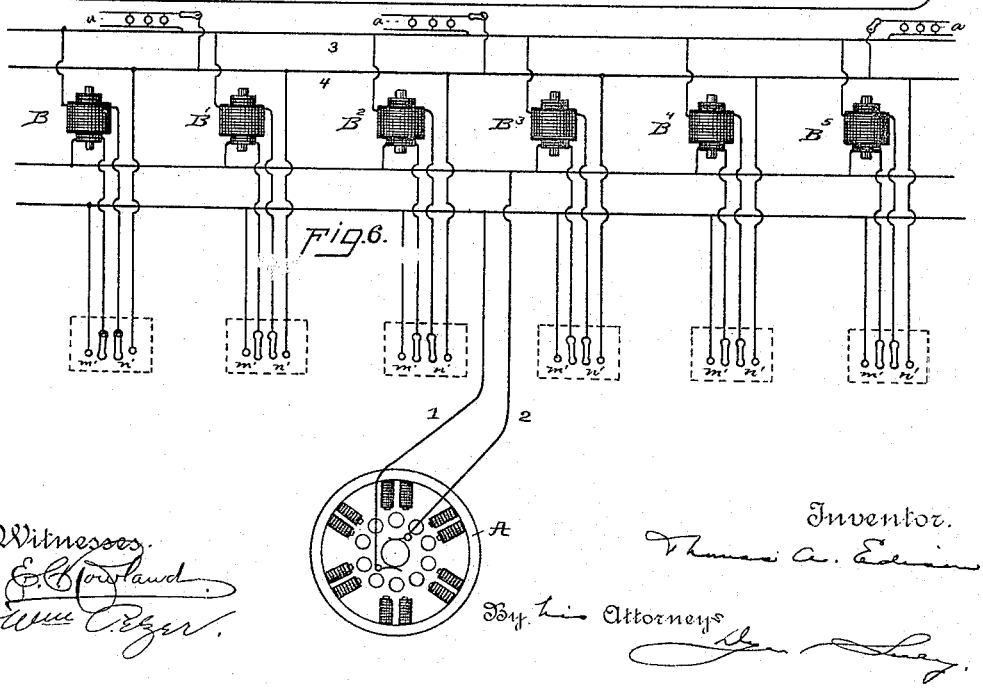


Fig. 6.

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By his Attorneys
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UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

SYSTEM OF ELECTRICAL DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 382,415, dated May 8, 1888.

Application filed December 27, 1887. Serial No. 259,141. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Systems of Electrical Distribution, (Case No. 746,) of which the following is a specification.

My invention relates to systems for the distribution of electricity of that character in which a source of current of high tension is employed, and such current is conveyed by conductors of small size to or near to the place where the current is to be used, where the current is transformed by means of tension-reducing converters into a current of low tension suitable for lighting by electrical incandescence, or for other domestic or business purposes. In such systems the source of current is usually a dynamo electric machine generating an alternating current, and the converters are induction-coils receiving the high-tension current in their primary circuits of fine wire, and discharging the low-tension current from their secondary circuits of coarser wire.

In systems wherein a number of converters are used, all receiving current from a common source and all discharging into a common lighting circuit or system of circuits, the difficulty arises that, although the whole or the greater number of the lamps supplied are in circuit and using current only during about four hours out of the twenty-four, the converters themselves are using current during the whole day. There is a loss of from seven to twelve per cent., according to the construction in each converter, and this loss goes on all the time, whether all the lamps are in circuit or only a very few of them, so that the removal of lamps does not cause a corresponding reduction in the amount of current required in the system. It will be seen that this detracts enormously from the economy of the system, since though only a few lamps may be in use it is necessary to always keep the generation of current at a sufficient amount to supply the loss in all the converters. In some cases the current used in the converters—which of course is a dead loss to those operating the plant—will be equal in amount to that sold to the consumers. Evidently this results in a great diminution of the profits of the business.

The object of my invention is to remedy this by so arranging the system that only so many converters will be in circuit at any time as are required to supply the lamps or translating devices actually in use. I do this by providing the converters, or certain of them, with switches whereby their primary and secondary circuits may be opened or closed, as desired, and thus any desired number of the converters may be removed from or maintained in connection with the system, according to the amount of current required to be used at any time. I may provide simple hand-switches for this purpose; but I prefer to employ switches controlled from the central station. For the latter purpose I may employ electro-magnetic switches—such as are set forth in my application, Serial No. 257,369, filed December 9, 1887—whereby any particular switch may be operated without affecting the others, though they are all controlled by the same circuit; or I may have a separate controlling-circuit extending from the station to a controlling-magnet for each switch; or I may place the switching-magnets for two or more converters in one controlling-circuit, so as to throw them on or off at once; or I may control the circuits by time mechanism, which at a certain hour—according to the requirements of the particular system—will cause the converter to be disconnected; or various other modifications may evidently be made.

My invention is illustrated in the accompanying drawings.

Figure 1 is a diagram of a system in which switches are employed, controlled from the station by the same circuit; Fig. 2, a side view and partial section of one of these switches; Fig. 3, a front view of the switch; Fig. 4, a diagram of a system in which the converters are controlled by separate circuits. Fig. 5 illustrates one in which two or more converters are controlled by each circuit, and Fig. 6 illustrates the use of hand switches for the converters.

In each of the figures, A represents a dynamo-electric machine, generating an alternating current of high tension, and 1 2 is the circuit extending therefrom to the locality to be supplied.

B B', &c., are tension-reducing induction

coils or converters, having their primary coils all connected in multiple arc across the high-tension circuit, 1 2, and their secondary coils all feeding in multiple arc into the low-tension or secondary circuit, 3 4, with which electric lamps or other translating devices *a a* are joined in multiple arc, each lamp or group of lamps having a switch, *b*, for connecting and disconnecting it. Certain of these converters are provided with switches for connecting and disconnecting them from the circuit. It is not usually necessary to provide all the converters with such switches, since there will probably always be use for some of them; but they may all be so provided, if desired. Converters B′ and B⁴ are shown as unprovided with switches.

The switching mechanism for each converter is preferably placed in a suitable box, C, which may be attached to a pole or placed in any other convenient situation. One of the switches is shown at the left of the drawings, and the switches are all alike. Two circuits, 5 6 and 5 7, extend from the central station through all the boxes, the circuit 5 6 including all the magnets *c* of the switches, and circuit 5 7 all the magnets *d* in series. Both these circuits are supplied by a battery, E, and each has a key, D or D′, at the station.

The switching mechanism, it will be seen, is substantially such as is shown and described in my application above referred to. The switch itself is different, however. It consists of a shaft, *e*, Figs. 2 and 3, which has at its middle part an insulating-section, *f*. Loose on the shaft are two metal disks, *g* and *g′*, the faces of which have insulating-segments *h*, and upon the face of each disk bears an arm, *i* or *i′*, carried by the shaft. The primary circuit 8 9 of the converter is connected to the arm *i* and metal disk *g*, and the secondary circuit 10 11 is connected to arm *i′* and disk *g′*. Therefore, when the shaft is turned so that the arms rest on the insulating-segments, both circuits of the converters are broken; but when the arms are on the metal spaces both circuits are closed.

The switching mechanism consists of a stop-disk, *k*, having two notches, *l* and *l′*, the notches *l* being all in different positions on the disks in the different switches, and the notches *l′* all situated alike; a magnet, *c*, in the circuit 5 6, for revolving the disk by means of its vibrating armature *m*, engaging with the ratchet *n*; a unison stop-arm, *o*, for stopping the disks when they are all at unison; a magnet, *d*, in circuit 5 7, turning the switch-shaft *e* and arms *i i′* by its armature-lever *p* engaging the ratchet *q* on said shaft; a unison stop-arm, *r*, for stopping all the switches at unison; an arm, *s*, extending from lever *p*, for releasing the stop-disk *k* when the disks are at unison, and an arm, *t*, extending from armature-lever *m*, for releasing the switches when they are at unison.

The stop-disks are first all brought to unison by working the key D in circuit 5 6 until all the disks are held from revolution by the unison-arms *o*. Then all the notches *l′* come opposite the fingers *u* on levers *m*, and all the notches *l* are at different places on the disks. Then a movement of key D′ in circuit 5 7 throws the unison-arm up and releases the disks. Next the switches are all brought to unison by key D′, and they are finally all stopped by unison-arms *r*. Then a movement of key D throws this arm out of engagement and releases the switches. The parts are now ready for operation.

The operator at the station by observing the volt-indicator *v* in the indicating-circuit extending back from the secondary system, or the ampère-indicator *w* in the high-tension circuit, can see when the number of lamps in circuit is so reduced as to make it desirable to remove a converter from circuit. It will be understood, of course, that with the converters all in circuit the arms *i* and *i′* of all the switches are bearing on the metal parts thereof. To remove a converter the key D is worked until the stop-disk of the switch to be operated is turned so as to bring its notch *l* opposite the finger *u* of that switch. Then by means of key D′ the arms *i i′* of that switch are turned so as to bear upon insulating sections and both the circuits of the converter will be broken. No other converter will be affected, because the other switches will be held from motion by the fingers *u* encountering the peripheries of the disks. The operator is provided with electrically-operated dials *b′* in the circuits 5 6 and 5 7, by observing which he knows how far he has moved the stop disks and switches.

It is evident that any desired number of converters may thus be removed from action, and they may also be readily replaced, the stop-disk of the proper switch being turned to release the arms of that switch, and such arms being then turned so as to bear on the metal portions of the switch-disks. It will be seen that by this means any converter may be readily removed from or placed in circuit, and thus the number of converters in use is always kept proportional to the amount of the load as the load varies, so that there is no greater loss in the converters than is absolutely necessary at any time.

Fig. 4 shows another way of accomplishing the same result. Here each converter is provided with a switch consisting of two stationary disks, *g* and *g′*, having alternate metal and insulating spaces, and arms *i i′*, carried by the shaft and working on said disks, respectively, the shaft being turned by a pawl, *x*, engaging with ratchet *q* and carried by armature-lever *y* of magnet F. Such a switch is provided with each converter which it is desired to ever remove from circuit, though I have shown only the operating-magnets except in one instance. These magnets are all placed in separate circuits, having a common return through battery G, and each of these circuits is provided with a circuit-breaker, which may be a simple key, H, by the movement of any one of which keys the magnet in that circuit is made to turn

the arms *i i'* of that switch, so as to disconnect or connect the circuits of the converter desired to be affected. Instead of this I may use a clock-work or time mechanism, as shown at I, which at a certain point in its operation closes the switch K by means of a cam, *z*, or otherwise, and so causes the converter to be connected or disconnected. It can be readily determined in practice at what time of the day it will be desirable to throw off or throw on a converter, and the time-movement will then be set to act at that time. Any number of the converters may thus be provided with separate time-operated switches, each of which will be set to operate at the desired moment.

Fig. 5 shows an arrangement in which switches like those of Fig. 4 are used; but two or more such switches are placed in the same circuit, so that both or all of them may be connected or disconnected at once. Thus the converters B and B^3 in different parts of the district are both affected by the same circuit. Converters B^2 and B^5 are both affected by another circuit, while converters B' and B^4 are arranged to always remain in circuit.

Fig. 6 shows an arrangement of hand-switches for the converters. Such switches—*m'* for the primary circuits, and *n'* for the secondaries—are placed, preferably, in suitable boxes near the converters. In this case it will be necessary for the operator to go from one converter to another to connect or disconnect them at certain hours, or as the load varies.

What I claim is—

1. The combination of a source of current of high tension, a circuit extending therefrom, two or more tension-reducing converters having their primary circuits connected with said high-tension circuit, a translation-circuit supplying a variable number of translating devices, to which the secondary circuits of all said converters are connected, and switches for making and breaking the primary and secondary connections of individual converters, substantially as set forth.

2. The combination of a source of current of high tension, a circuit extending therefrom, two or more tension-reducing converters having their primary circuits connected in multiple arc with said high-tension circuit, a translation-circuit supplying a variable number of translating devices, with which the secondary circuits of all said converters are connected in multiple arc, and switches for making and breaking the primary and secondary circuits of individual converters, substantially as set forth.

3. The combination of a source of current of high tension, a circuit extending therefrom, two or more tension-reducing converters having their primary circuits connected with said high-tension circuit, a translation-circuit supplying a variable number of translating devices, to which the secondary circuits of all said converters are connected, and switches controlled from the central station or source of supply for making and breaking the primary and secondary connections of individual converters, substantially as set forth.

4. The combination of a source of current of high tension, a circuit extending therefrom, two or more tension-reducing converters having their primary circuits connected with said high-tension circuit, a translation-circuit supplying a variable number of translating devices, to which the secondary circuits of all said converters are connected, one or more separate circuits extending from the central station, electro-magnets energized thereby, and switches controlled by said electro-magnets for making and breaking the primary and secondary circuits of individual converters, substantially as set forth.

This specification signed and witnessed this 4th day of December, 1887.

THOS. A. EDISON.

Witnesses:
WM. PELZER,
E. C. ROWLAND.