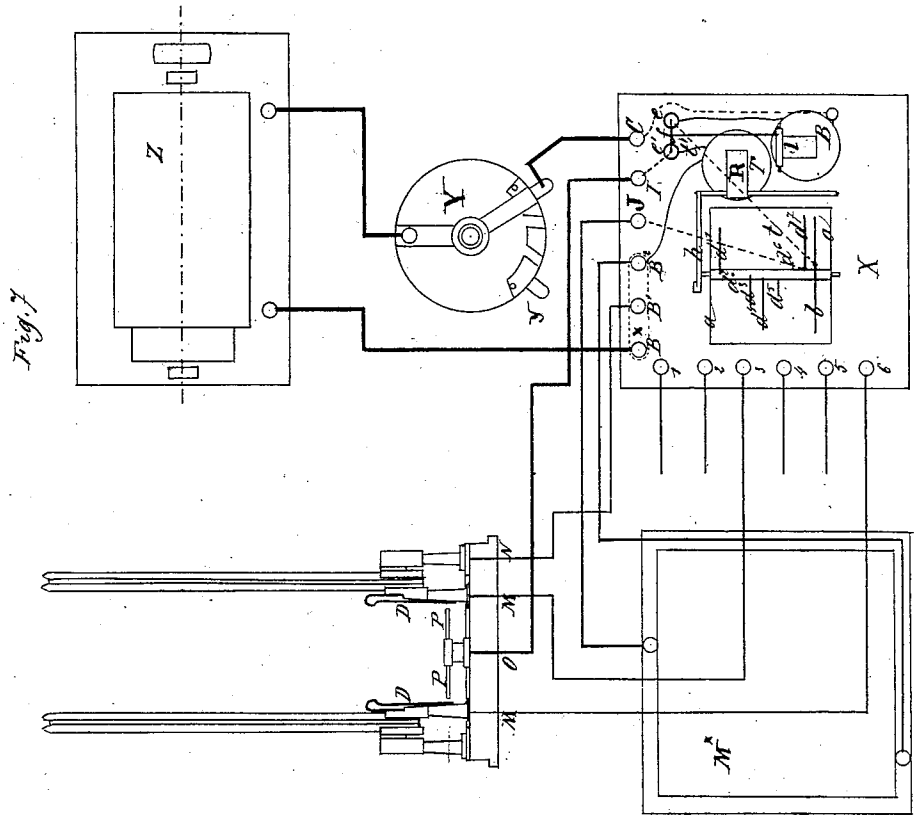
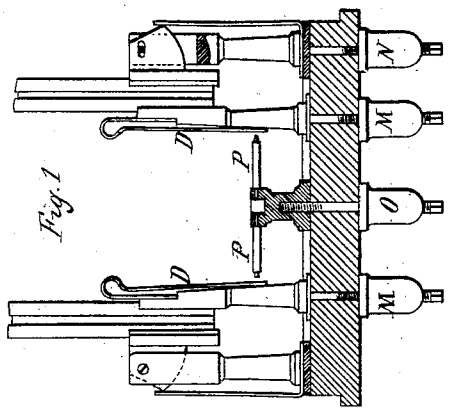
(No Model.) 2 Sheets—Sheet 1.

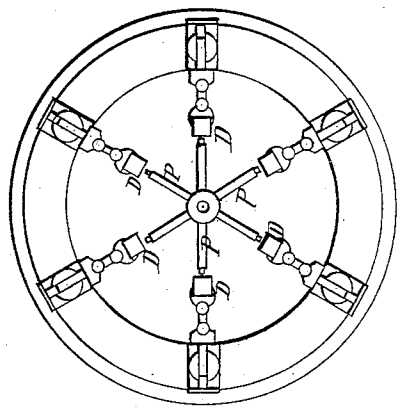
G. LECOQ.

Distributing Currents to Electric Lamps.

No. 231,725. **Patented Aug. 31, 1880.**







C. J. Hedrick
Philip Pellaury

Gustave Lecoq
by A. Pollok
his attorney.

(No Model.) 2 Sheets—Sheet 2.

G. LECOQ.

Distributing Currents to Electric Lamps.

No. 231,725. **Patented Aug. 31, 1880.**

Fig. 5

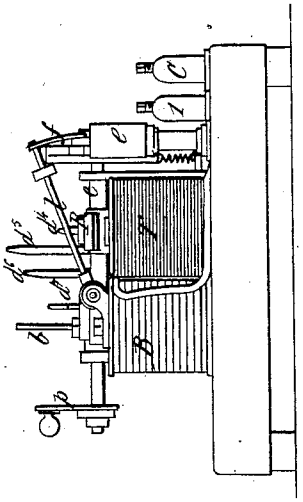


Fig. 6

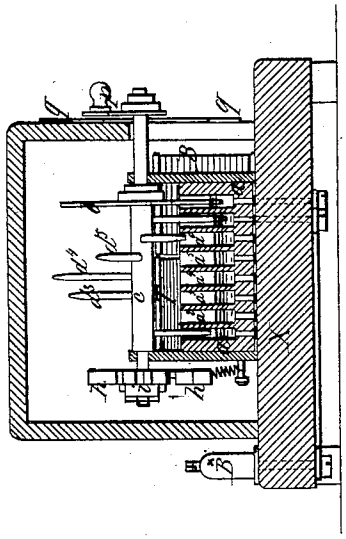


Fig. 3

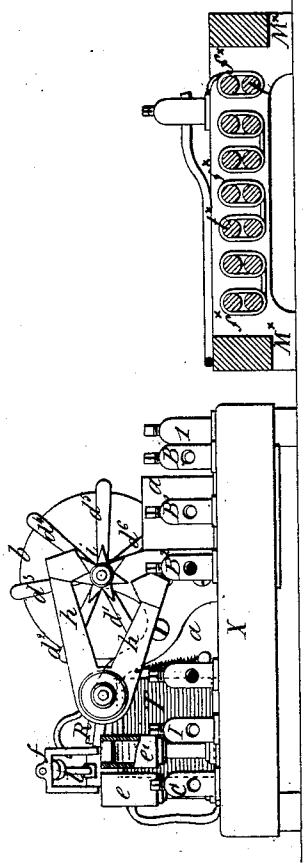
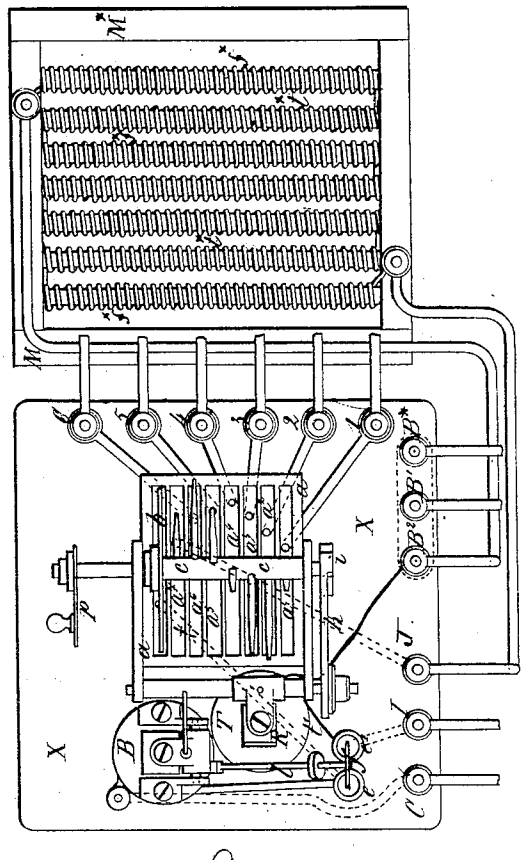


Fig. 4



C. J. Hedrick
Phil. Pellaner

Gustave Lecoq
by A. Pollok
his attorney.

UNITED STATES PATENT OFFICE.

GUSTAVE LECOQ, OF PARIS, FRANCE.

DISTRIBUTING CURRENTS TO ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 231,725, dated August 31, 1880.

Application filed May 26, 1880. (No model.) Patented in France January 26, 1880.

To all whom it may concern:

Be it known that I, GUSTAVE LECOQ, of Paris, France, have invented a new and useful Improvement in Distributing Currents to Electric Lamps or Candles, of which the following is a specification.

This invention relates to the system of lighting in which a number of Jablochkoff candles or other electric lights or lamps held in a chandelier are to be burned or lighted in succession, thus preserving the continuity of the light; and its object is to effect the necessary changes in the distribution of the current, so that it is directed to a new candle when the one through which the current has been passing is burned out, or when, by some unforeseen circumstance, it is extinguished, although unconsumed, or, finally, when the candle to which the current is directed is broken or for any cause rendered unfit to burn, or so that it is directed through an artificial resistance when there are no more candles to burn. In the present invention these changes are effected automatically by means of the chandelier itself and a commutator, both of which are, to this end, of special construction.

In order that the invention and the manner of carrying the same into effect may be the better understood, the automatic chandelier and the commutator which operates in connection therewith will now be described, reference being had to the accompanying drawings, which form a part of this specification, and in which—

Figures 1 and 2 are, respectively, an elevation and plan of the chandelier; Fig. 3, an elevation, Fig. 4 a plan, Fig. 5 a bottom view, and Fig. 6 a vertical section, of the commutator; and Fig. 7, a diagram illustrating the operation of the system.

Automatic chandelier.—The improvement in the chandelier has for its principal object the sending of the current, when a candle is consumed, through the electro-magnet of a mercurial commutator, hereinafter described, and the causing the operation of the apparatus, so as to light the following candle. This result is obtained by means of the expansion-piece D, placed on the side of each candle-holder, and consisting of a spring formed of two superposed strips of metal with different coefficients of expansion.

As shown, the chandelier supports on a base of insulating material six candle-holders, each composed of two standards, between which the candle is held by spring-pressure. The inner standards are insulated from each other. The outer ones are connected at the bottom by a ring of metal.

M represents the binding-posts, one for each candle, by which the current enters the candles; and N, a binding-post connected with the outer standard of all the holders, by which the current returns to the generator.

O is a binding-post in permanent electrical connection with the arms P, and connected by a wire with the commutator, as hereinafter described.

There is no electrical connection between M and O so long as the expansion-piece D is cold; but when the candle is consumed the arc then heats the expansion-piece, and it makes contact with the corresponding arm P, so that N and O are connected. The current, finding less resistance by this new way, leaves the candle and passes by the post O to the electro-magnet of the commutator.

Automatic commutator.—This apparatus is intended, by operating in connection with the chandelier above described, to make the required changes in the direction of the current according to the circumstances before stated.

It consists of a vessel, *a*, of hard rubber or other suitable insulating material, divided into as many compartments or troughs a' a^2 a^3 as there are candles to burn plus two. As shown, there are eight such compartments. Each of these compartments or troughs contains mercury. Into the first, a', dips a metal disk, *b*, mounted on an arbor, *c*, journaled in suitable bearings. This arbor carries as many rods d' d^2, &c., as there are candles to burn plus one, each rod being arranged radially on the arbor to make, with the preceding one, a constant angle, and lengthwise of the arbor in a position corresponding with one of the divisions or troughs of the vessel *a*. The level of mercury in these divisions or troughs is so regulated that when one of the rods is on the point of leaving the mercury the following one is

beginning to enter it. At the end of the arbor *c* is fixed a star-shaped escapement-wheel, *i*, which is revolved by the engagement with the teeth thereof of the pallets at the ends of the arms *h h* of lever R.

The angular movement at each vibration of the arms *h h* is equal to $\frac{360°}{n+1}$, *n* being the number of candles. The vibration of the arms *h h* is effected by the electro-magnet T.

The current of the magneto-electric machine normally passes through the coil of magnet B, which acts upon the end of the lever *l*. At the other end this lever carries a fork, *f*, of which the prongs are arranged so as to enter the mercury-cups *e e'* when depressed. When the current passes through the coils of magnet B the lever *l* is attracted, and fork *f* is lifted out of cups *e e'*, and there is no longer any connection between them. If the current cease, the lever *l* is no longer attracted and the fork drops into the two mercury-cups and connects them with each other; but at the same time, the current repassing through the magnet B, the lever *l* is attracted anew and breaks the connection.

M* is an artificial resistance formed of a suitable frame in which are arranged the bars *t**, wound with coils, *f**, of iron wire. Its object will hereinafter be explained.

The electrical connections are as follows, (see Figs. 4 and 7:) The poles of the magneto-electric machine Z are connected with posts B* and C. The post C is connected through coils of magnet B with mercury-cup *e*, and this latter, by the wire *t*, with the mercury trough or compartment of vessel *a*, in which the plate *b* dips. The trough a^7, corresponding to rod d^7, is connected through post J, and the troughs *a'* to a^6 are connected by means of the posts 1 to 6 of the commutator, the posts M of the chandelier, and intermediate conductors, with the inner standards of the several candle-holders. The connections with two only of the posts M are shown. The post N is connected with the post B'. The posts B*, B', and B^2 are all connected with each other. From the mercury-cup *e'* there is a connection through the coils of magnet T with post B^2. The binding-posts of the resistance M* are connected with the posts J and B^2.

The different cases which may arise will now be considered, and the operation of the apparatus described.

1. *Circuit of the current when a candle is burning.*—The machine Z sends the current through the commutator X to a chandelier or group of chandeliers of many candles each. In case there are other chandeliers or groups of chandeliers to be supplied by the same machine, the current then passes to other commutators and chandeliers or groups of chandeliers in succession, and finally returns to the machine. As shown, the current returns to the machine from the first chandelier. The current arrives by the post C and pasess through magnet B, which attracts the lever *l* and lifts the fork *f* out of the mercury-cups *e e'*.

It then passes to the base of the cup *e*, and follows the wire *t* to the mercury-trough in which the disk *b* turns. Thence the current passes by the disk *b*, supporting-arbor *c*, one of the rods, *d'* to d^6, which dips in the mercury in vessel *a*, and the corresponding one of the posts 1 to 6, to the post M of the holder of the candle which is burning. It passes through the candle to the post N, thence to post B to B', and to the next commutator, if used, or back to the machine Z.

2. *Circuit when the candle is extinguished while burning, or when there is an imperfect candle.*— In this case the circuit of the current is broken, the electro-magnet B ceases to attract lever *l*, which turns on its fulcrum, so that the fork *f* dips in the cups *e e'*. The current then passes from C through B to *e* to *e'*, through coils of magnet T to post B^2, and thence to B, to return to the machine Z. The passage of the current through magnet T causes it to attract the lever R and moves the arms *h h*. The arbor *c* is revolved one step, and the current then passes to the next good candle and follows the circuit already explained.

The passage of the current through the magnet B of course moves the circuit-closing lever *l*, and breaks the connection between the cups *e e'* and cuts out the magnet T. If there are two or more bad candles, the current will be interrupted and the electro-magnetic escapement will operate twice, thrice, or oftener until it enters a perfect candle.

3. *Circuit when, the candle being consumed, the expansion-piece operates.*—By the operation of the expansion-piece D electrical communication is established between M and O, through said piece and one of the arms P, to the post O. To the post M the current follows the same circuit as while the candle is burning; but finding less resistance by the piece D, it passes through it, arm P, post O, and conductor to post I. It then passes through the electro-magnet T, and escapes by way of the post B^2, which is in communication with the return line from post B'. By the passage of the current through the electro-magnet T the lever R is attracted and the arms *h* raised, so as to revolve the arbor *c* and cause the next in its order of the rods *d* to dip in its mercury-trough. The current then ceases to pass by the former candle-holder, the lever R drops, and the second or succeeding candle burns.

4. *Case where there are no more candles, or when it is wished to put out the light.*—If the last candle is burned out and the arbor *c* is moved one step, then the last rod (d^7 on drawings) dips into the mercury in its trough. The current then passes from the post J through the resistance M*, which is equal to the resistance of one candle, to the post B^2, (or B' if desired,) and then through B and the return-wire to the machine.

The arbor which carries the rods *d* is provided at one end with a pointer, *p*, which moves

over a dial, q, marked into $n+1$ divisions, and placed so that when the apparatus is inclosed, as shown in Fig. 6, its condition can be readily ascertained.

A commutator, Y, may be placed in the conductor between the machine Z and post C, so as to send the current directly into the resistance M* through the post B or B′, when it is wished to put out the light. The connection would be between one of said posts B B′ and the post y of the commutator.

It will be understood that in place of a chandelier for candles, electric lamps or burners of any other systems, arranged on the same circuit or receiving the current from the same magneto-machine, or other source of electricity, could be substituted. My system of distribution by commutator applies also to these different cases. It is sufficient to modify the disposition of the expansion-piece so as to adapt it to each type of burner.

Having thus fully described my invention, and the manner in which the same is or may be carried into effect, what I claim, and desire to secure by Letters Patent, is—

1. The combination, with a chandelier or group of holders for electric candles, burners, or lamps, and electrical conductors, of a distributer of electric currents and an electro-magnetic escapement for operating said distributer automatically by interruptions of the current through said chandelier or group of holders, substantially as described.

2. The combination, with a series of lines or conductors, of a distributer of electric currents controlled by an electro-magnetic escapement, said distributer acting, on the interruption of the current through one of said lines or conductors, to direct it to another throughout the series, substantially as described.

3. The combination, with a holder or support for an electric candle or carbon pencil, of a circuit-closing expansion-piece arranged as indicated, so that it is heated by the consumption of the last part of the candle or carbon pencil, substantially as described.

4. The combination, with a chandelier or group of holders for electric candles, burners, or lamps, expansion-pieces for said holders, and electrical connections, of an automatic commutator comprising a distributer of electric currents and an electro-magnet for operating the same, substantially as described.

5. The combination of a distributer for electric currents, an electro-magnetic escapement for operating said distributer, an electro-magnetic circuit-closer, and electrical connections, said circuit-closer acting to momentarily close a circuit through the magnet of said escapement, and its own magnet being included in said circuit, substantially as described.

6. The combination of a source of electricity, a chandelier of electric lights or group of chandeliers, an automatic commutator for each chandelier, an artificial resistance or resistances, and electrical connections, substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

G. LECOQ.

Witnesses:
ROBT. M. HOOPER,
C. MUNIER.