(No Model.)

S. E. NUTTING.

ELECTRO MECHANICAL MOVEMENT.

No. 420,955. Patented Feb. 11, 1890.

Fig. 1.

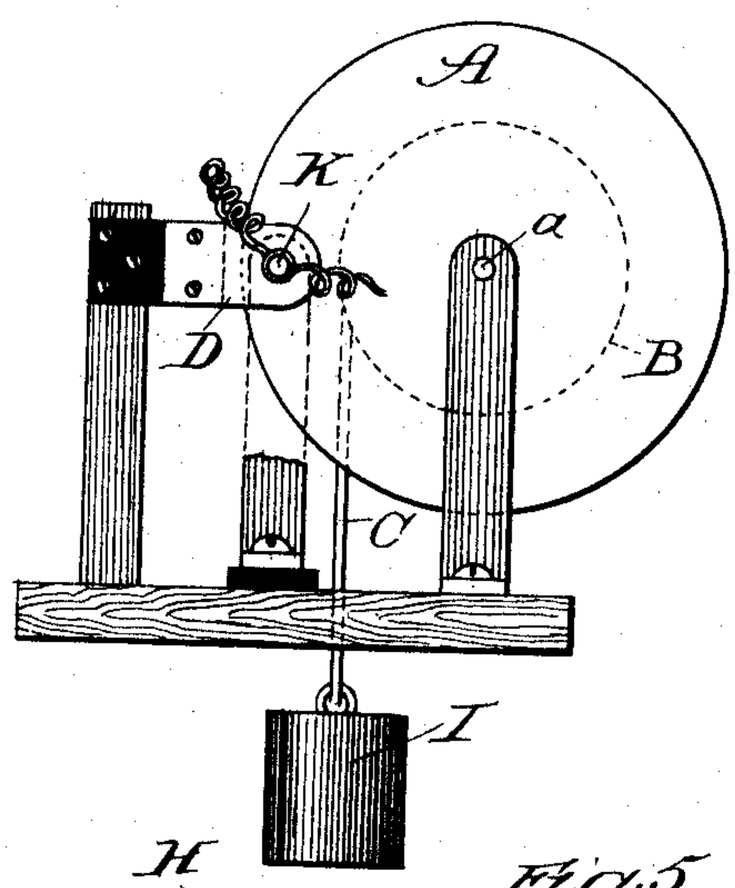

Fig. 2.

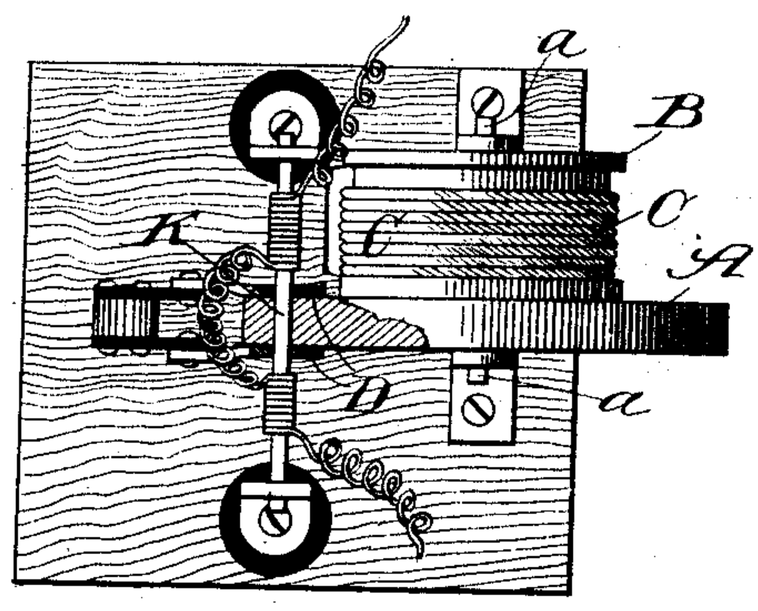

Fig. 3.

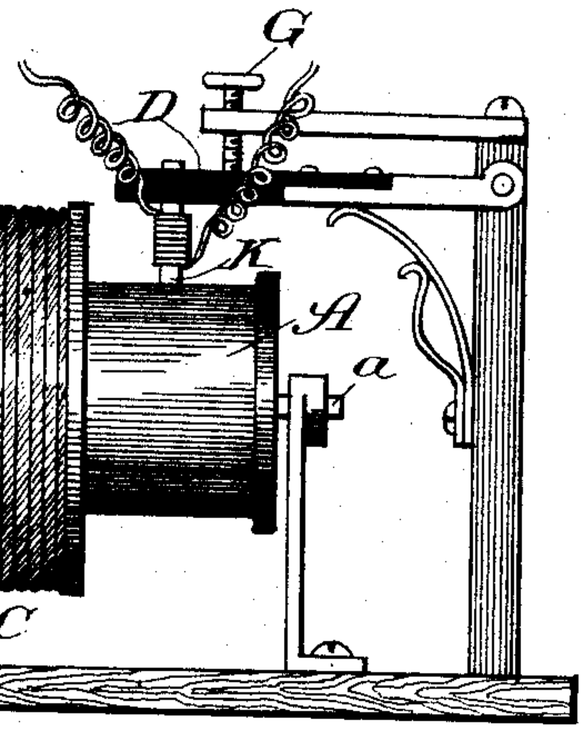

Fig. 4.

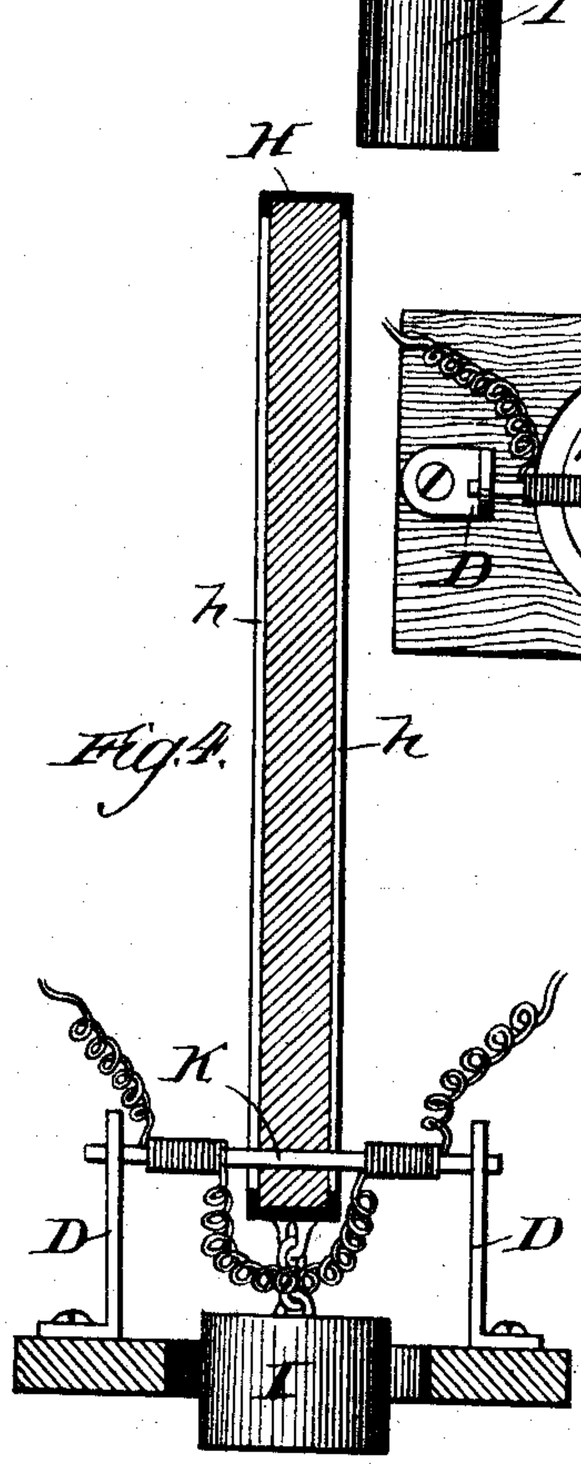

Fig. 5.

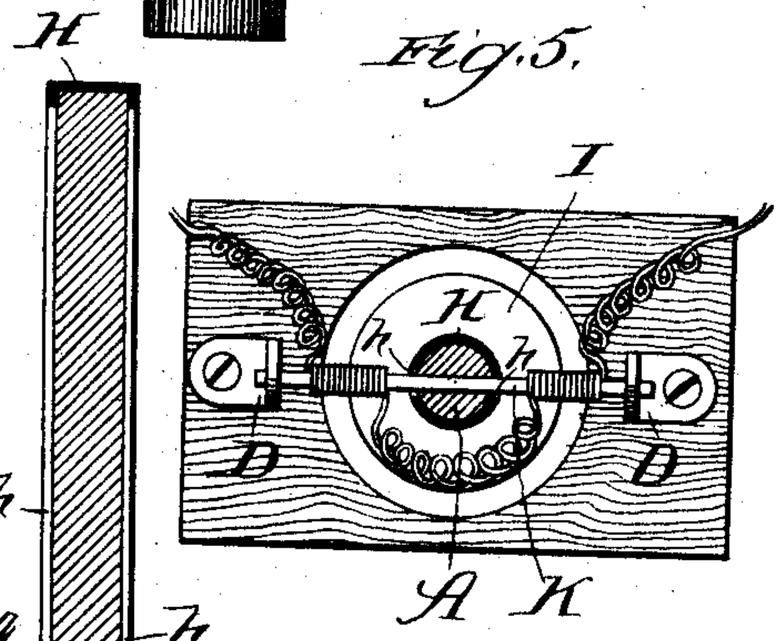

Fig. 6.

Witnesses:
Chas. E. Gaylord,
Clifford N. White.

Inventor:
Samuel E. Nutting,
By Banning & Banning & Parker,
Att'ys

UNITED STATES PATENT OFFICE.

SAMUEL E. NUTTING, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE NUTTING ELECTRIC MANUFACTURING COMPANY, OF SAME PLACE.

ELECTRO-MECHANICAL MOVEMENT.

SPECIFICATION forming part of Letters Patent No. 420,955, dated February 11, 1890.

Application filed April 29, 1889. Serial No. 308,922. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL E. NUTTING, a citizen of the United States, residing at Chicago, Illinois, have invented certain new and useful Improvements in Electro-Mechanical Movements, of which the following is a specification.

The object of my invention is to make an electro-mechanical movement that will be proportioned at all times and under all circumstances to the quantity of the electric current, varying with every variation in the quantity of such current; and my invention consists in the features and details of construction hereinafter described and claimed.

In the drawings, Figure 1 is a side elevation of one form of mechanism embodying my invention. Fig. 2 is a plan view of the same. Fig. 3 is a side elevation of another form of mechanism embodying my invention. Fig. 4 is a vertical section of still another form of mechanism. Fig. 5 is a plan view of the same, and Fig. 6 is a side elevation of a modification of one of the parts.

In embodying my invention I take a substance which softens or liquefies at a low temperature, such as beeswax, tallow, stearine, paraffine, and similar substances. As shown in the first three figures of the drawings, I make a cylinder or disk A out of such substance and mount it on a shaft *a*, supported in suitable bearings. I mount a pulley or sheave B on this same shaft, adapted to receive a cord C, which is wound around the same and provided with a weight. This arrangement of sheave, cord, and weight will constantly tend to rotate the cylinder or disk A in the direction of the unwinding of the cord. Other means for rotating the disk or cylinder may be employed, however, if preferred. In proper relation to this disk or cylinder I arrange a bracket D, which is either preferably formed of non-conducting material or insulated from its support, as shown in the first three figures of the drawings. I lead a wire adapted to carry a current of electricity from any source or generator to a heat-conductor K, which passes into or through the disk or cylinder A, composed, as above said, of a substance that will soften or liquefy at a low temperature.

As shown in the drawings, the wire conveying the current of electricity is coiled or wrapped around the heat-conductor, leaving that portion which extends into or through or comes in contact with the softenable substance intended to be softened or liquefied by the heat imparted to it from the current of electricity bare or uncovered.

It will be understood that the wire forming the electric circuit is insulated from the heat-conductor, so that the current of electricity merely imparts its heat to the conductor without passing through the portion in contact with the softenable substance.

As shown in Fig. 3, the heat-conductor has its end slightly sunk into the surface of the cylinder, and means are provided, as a set-screw G, for adjusting its depth in or out of the cylinder.

That portion of the wire which conveys the heat to the heat-conductor should be formed of material furnishing greater resistance to the passage of the current than the rest of the circuit. As it thus possesses greater resisting-power, it will cause a portion of the current of electricity passing through it to be converted into heat and impart it to the heat-conductor in contact with the liquefiable material, and thus soften or melt the material in contact with it. The portion of the heat-conductor passing through or into the disk or cylinder will melt or soften a way for itself therein, so that any force tending to rotate the disk or cylinder will cause it to revolve constantly in proportion to the rapidity with which the material of which it is composed softens, melts, or liquefies. If, therefore, the quantity of the electric current converted into heat and imparted to the conductor be great, the softening or melting will be rapid, and if it be small it will be slow, so that at all times the movement of the disk or cylinder will be dependent upon the quantity of the electric current.

In Figs. 4 and 5 I have applied the same principle in a somewhat modified way. Instead of using a disk or cylinder composed of material capable of softening, melting, or liquefying, I have placed such material in a tube H, provided with slots *h* on its opposite sides, forming a channel or way from near

one end of the tube to the other. This tube is intended to be made of non-conducting material, and the brackets D are intended to be arranged at the sides, with the conductor K passing through the slots in the tube, as shown in Figs. 4 and 5. If this tube now be filled with a substance that will soften, melt, or liquefy at a low temperature, and a weight I, preferably but not necessarily, be suspended from its bottom, the current of electricity imparting its heat to the heat-conductor, a way will be melted through the material and the tube caused to gradually descend in proportion to the rapidity at which the melting or softening occurs. This will at all times be in proportion to the quantity of the electric current imparting a greater or less amount of heat to the heat-conductor.

In Fig. 6 I have shown the heat-conductor as bent in the form of a bow or loop, adapted to have its lower portion arranged in contact with the softenable substance, so as to soften or melt it, as in the other cases.

As the material composing the disk, cylinder, or rod is softened or melted for the passage of the heat-conductor, it will immediately return to its former place and cool and solidify behind the heat-conductor, thus restoring it to its original shape and condition, and fitting it for a repetition of the operation. In this way the condition of the substance is constantly maintained, so that the operation may be repeated indefinitely. This is particularly true where the arrangement is such as that shown in Fig. 3, although I have found it also to be true where the arrangement was that shown in the other figures.

Of course it will be understood in reference to the arrangement shown in Figs. 4 and 5 that when the heat-conductor has reached the top of the tube it must be slipped out and inserted through the material again at the bottom of the slot.

In all of these cases the same principle of operation is observed and applied. In all there is an electric circuit and a portion or section of the circuit arranged so as to impart heat to the heat-conductor, a non-conducting material composed of a softenable substance—that is, a substance that will soften, melt, or liquefy at a low temperature—arranged in contact with the heat-conductor, which becomes heated by the passage of the electricity, the heat-conductor and substance being held in fixed relative positions to each other until the conductor is heated, when it softens or melts a way for itself through the substance in contact with it, and means for automatically changing the relative positions of the heat-conductor and substance as the substance becomes softened by the heating of the conductor. In all of these cases the rapidity with which the way for the heat-conductor to pass through the softenable substance will be cut or made is in proportion to the quantity of the electric current passing through the circuit, by which greater or less heat will be developed and imparted to the heat-conductor in contact with the substance, and the weight or force employed to change the relative positions of the conductor and substance softened or melted by it.

I have thus been able to secure an electro-mechanical movement that is at all times regular, uniform, and invariably proportioned to the quantity of the electric current passing through the circuit and the force tending to change the relative positions of the heat-conductor and the softenable substance in contact with it. This movement may be applied to a variety of useful purposes, such as controlling and regulating the movement of the carbons in electric-arc lamps, or by connecting it with the proper parts forms an electrometer for measuring the quantity of electricity that passes through the circuit. I mention these merely as illustrations of the useful purposes to which my invention may be applied. In a word, I may say that it is applicable to all cases where a movement is required proportioned to the quantity of electricity employed in the circuit.

What I regard as new, and desire to secure by Letters Patent, is—

1. In an electro-mechanical movement, the combination of an electric circuit, a heat-conductor to which heat is imparted by said circuit, a softenable substance adapted to harden in an operative position in contact with the heat-conductor, such substance and conductor being held in fixed relative positions to each other until the conductor is heated, and means for changing their relative positions as the substance is softened by the heating of the conductor, substantially as described.

2. In an electro-mechanical movement, the combination of an electric circuit, a heat-conductor to which heat is imparted by said circuit, a softenable substance adapted to harden in an operative position in contact with the heat-conductor, such substance and conductor being held in fixed relative positions to each other until the conductor is heated, and means, set into operation only by the heating of the conductor, for changing their relative positions as the substance is softened by the heating of the conductor, substantially as described.

3. In an electro-mechanical movement, the combination of an electric circuit, a heat-conductor to which heat is imparted by said circuit, a disk or cylinder of softenable substance adapted to harden in an operative position in contact with the heat-conductor, such disk or cylinder and conductor being held in fixed relative positions to each other until the conductor is heated, and changing their relative positions as the substance of the disk or cylinder is softened by the heating of the conductor, substantially as described.

4. In an electro-mechanical movement, the combination of an electric circuit, a heat-conductor to which heat is imparted by said circuit, and a disk or cylinder of softenable sub-

stance, into or through which the heat-conductor projects or passes, such disk or cylinder and conductor being held in fixed relative positions to each other until the conductor is heated, and changing their relative positions as the substance of the disk or cylinder is softened by the heating of the conductor projecting into or passing through the same, substantially as described.

5. In an electro-mechanical movement, the combination of an electric circuit, a heat-conductor to which heat is imparted by said circuit, a disk or cylinder of softenable substance in contact with the heat-conductor, such disk or cylinder and conductor being held in fixed relative positions to each other until the conductor is heated, and means for rotating the disk or cylinder as the substance of the disk or cylinder is softened by the heating of the conductor, substantially as described.

SAMUEL E. NUTTING.

Witnesses:
THOMAS A. BANNING,
SAMUEL E. HIBBEN.