(No Model.) 2 Sheets—Sheet 1.

F. VON HEFNER-ALTENECK.

ELECTRIC CLOCK FOR USE IN ELECTRIC LIGHTING AND OTHER SYSTEMS.

No. 455,041. Patented June 30, 1891.

Fig. 1.

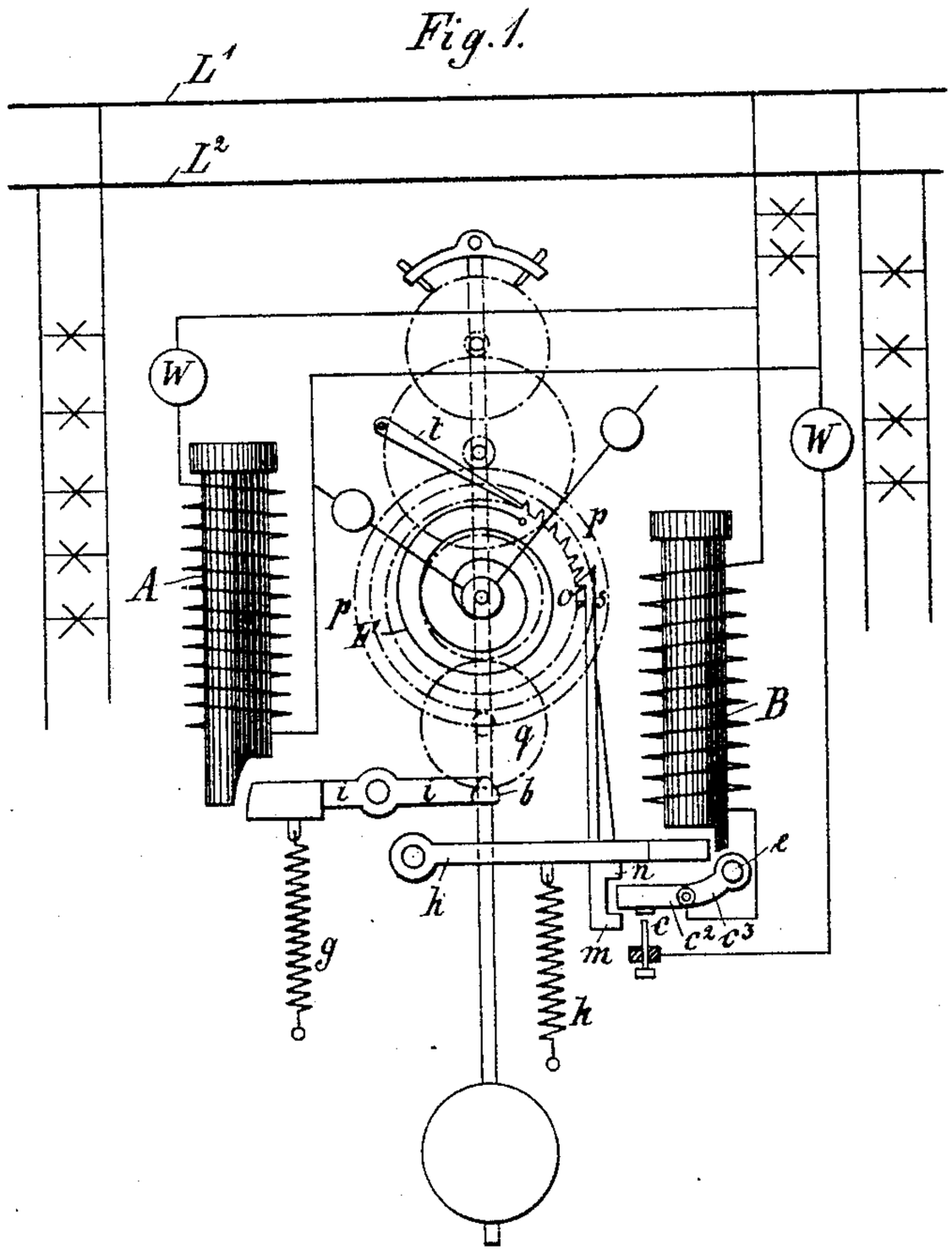
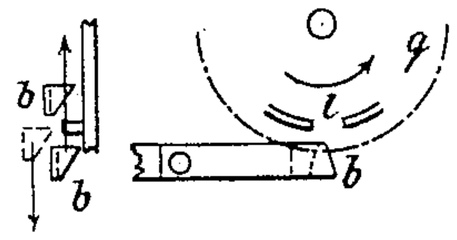


Fig. 2.



Witnesses:
Robert Stearns.
C. F. Beer.

Inventor.
Friedrich von Hefner-Alteneck
by Herbert W. J. Jenner.
Attorney.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

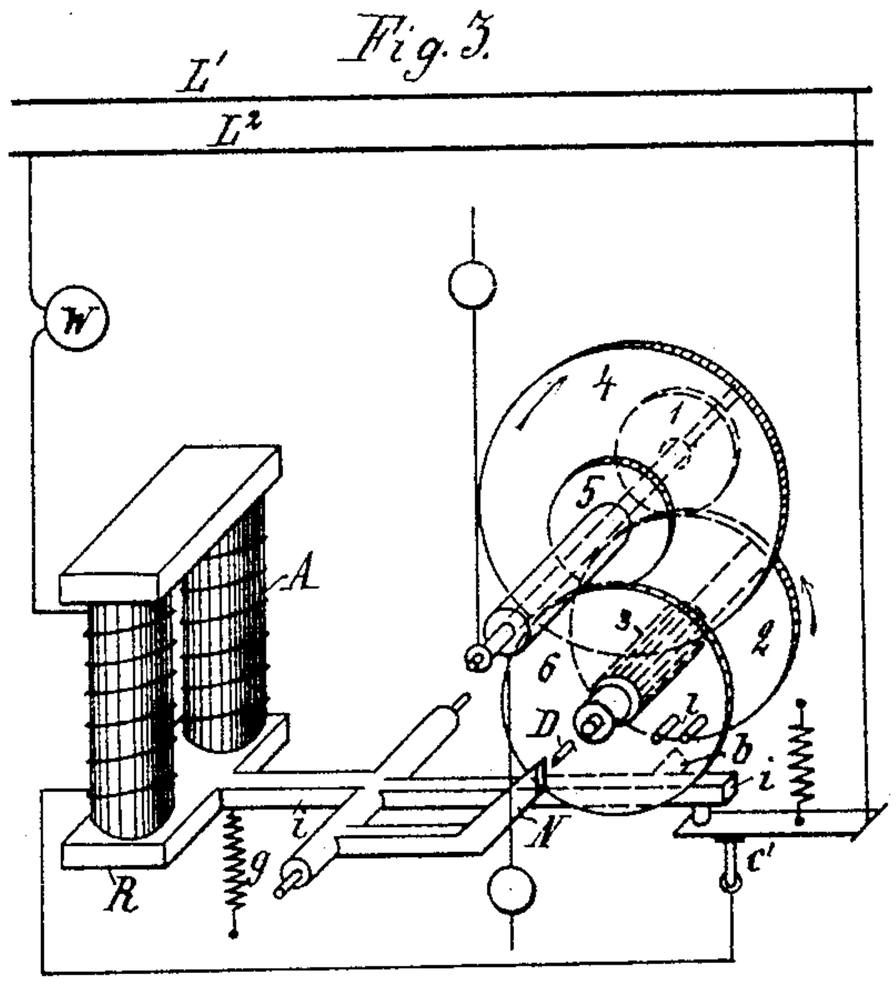
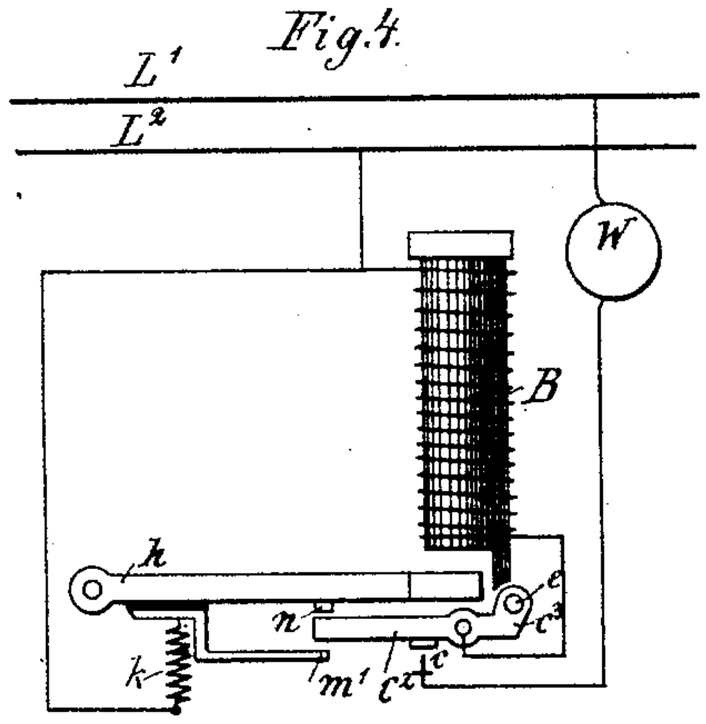


Fig. 4.



Witnesses:
Robert Stearns.
C. J. Belt

Inventor.
Friedrich von Hefner-Alteneck.
by Herbert W. J. Jenner.
Attorney

UNITED STATES PATENT OFFICE.

FRIEDRICH VON HEFNER-ALTENECK, OF BERLIN, GERMANY.

ELECTRIC CLOCK FOR USE IN ELECTRIC-LIGHTING AND OTHER SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 455,041, dated June 30, 1891.

Application filed February 25, 1891. Serial No. 382,786. (No model.) Patented in Germany April 16, 1890, No. 55,239; in England May 1, 1890, No. 6,726; in Belgium May 8, 1890, No. 90,485, and in France May 8, 1890, No. 205,546.

To all whom it may concern:

Be it known that I, FRIEDRICH VON HEFNER-ALTENECK, engineer, a subject of the King of Bavaria, residing at Berlin, in the Kingdom of Prussia and German Empire, have invented certain new and useful Improvements in an Elecrical Time-Piece Combined with Installations for the Distribution of Electrical Energy for Lighting and other Purposes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Patents for this invention have been obtained in the following countries: Germany, No. 55,239, dated April 16, 1890; Great Britain, No. 6,726, dated May 1, 1890; Belgium, No. 90,485, dated May 8, 1890, and France, No. 205,546, dated May 8, 1890.

This invention relates to the regulation of time-pieces; and it consists in the novel construction and combination of the parts hereinafter fully described and claimed.

In the drawings, Figure 1 is a diagram of an electrically-regulated time-piece combined with an electric-lighting plant. Fig. 2 is a side and a front view of the end of the regulating-lever and the stops on the clock with which it engages. Fig. 3 is a perspective view of a portion of the time-piece, showing a modification. Fig. 4 is a side view of a portion of the time-piece and shows another modification.

In Fig. 1 of the drawings the electrically-regulated time-piece is provided with two electro-magnets A and B, the two coils of which are connected to the lighting-mains $L' L^2$ parallel to the lamps. The electro-magnet A effects the regulation in the hereinafter-described manner, and is called the "adjusting electro-magnet." Its armature-lever *i i* has a considerable amount of play, and the poles of the electro-magnet are so formed and the withdrawing-spring *g* is so proportioned that the armature-lever is held either in a balanced condition or with slight pressure against the end of the magnet A when the normal potential exists in the mains, but is caused to make an oscillation when the potential momentarily decreases in the lighting-mains. This oscillation is caused by means of an arrangement, which is generally of known construction, to effect the adjustment (to correct time) of the hands of the time-piece, which at the moment are nearly in correct position. This may be effected, for example, by causing a wedge-shaped beak *b* on the lever *i i* to enter a gap *l* in the wheel *q* of the clock-work, or to enter between two pins on the same, as at Fig. 3, thereby adjusting the hands slightly forward or backward, as the case may be. If it be desired to arrange the duration of the decrease of potential so that it shall be of any extent and without effect on the movement of the time-piece, the beak *b* and the gap in the wheel *q* may be so arranged that the former shall pass right through the latter and the beak be made to yield laterally with spring action, when the lever performs the return motion, which is not limited to any exact time. This arrangement is indicated in front and side view at Fig. 2. The decrease of potential, which is made so slight and at such times as not to clash or interfere with the action of the lamps or other apparatus, is effected at the central station for the light, &c., either by the engineer or automatically by means of a normal time-piece.

If the supply of current to the lamps is to be interrupted, this must, in order not to disturb the action of time-pieces, be effected at such a time when either the movement of the lever *i i*, produced thereby, effects the correct setting of the hands in the same manner as above described with reference to a smaller variation of current, or when the gap in the wheel *q* and the beak *b*, or other devices employed in lieu thereof, are not within reach of each other. It is obvious that a momentary increase of potential in the lighting-mains might be used for the above-described adjustment of the time-pieces; but this is not advisable on account of the danger to the glow-lamps which may be caused thereby.

In the above-described arrangement the adjusting electro-magnet A is continuously acted upon by the electric current from the lighting-mains. Although this is very much weakened by suitable resistances, yet this arrangement occasionally causes a considerable waste of electric energy. In order to obviate

this I connect the adjusting electro-magnet to the lighting-main by means of a contact which is closed and opened by the clock-work itself, so that it is only coupled up for a comparatively short time, but with the requisite excess of duration when it is to effect the adjustment.

Assuming, for instance, that the clocks shall be adjusted daily at six o'clock a. m., and an adjustment be allowed within the limit of three minutes on either side of the correct time, then the contact is closed at each clock by means of a suitable wheel in the train thereof during the interval of time in which the hands move from, say, eight minutes to six to eight minutes past six. The correct time will consequently be certain to fall within this interval, and the variation of current produced at that precise moment will consequently find at all the clocks the said contact closed, and the adjustment will be effected just the same as if the current had passed continuously through the adjusting electro-magnet. A reciprocating movement of the armature-lever will of course be also effected at the closing and opening of the contact; but these movements will be without influence upon the position of the hands, because at these times the devices that act upon the hands are not within reach of each other, and consequently do not come in contact at the times of such movement of the armature-lever. These parts are, in addition, so arranged that in each of the two said end positions of the armature-lever they pass by each other, and they only effect the adjustment of the hands on the movement of the armature-lever inside the before-mentioned shorter interval of time.

In order to enable the difference in the strength of the current by which the hands are to be adjusted, as also the current in the adjusting electro-magnet itself, to be as low as possible, I adopt the arrangement that the return movement of the armature is not effected by the adjusting electro-magnet itself on the increase of the current's strength again, but by the clock-work of each clock at the given time, so that the weakening of the current which has to effect the adjustment of the hands need only be sufficient to cause the adjusting electro-magnet to drop its armature, and not sufficient to cause the current, again increasing, to attract the armature from its distant position. This arrangement can be combined with the before-described clock-contact. A construction for this purpose is shown in diagram at Fig. 3, the distance apart of the devices being exaggerated in order to show the arrangement more clearly. The wheels 1, 2, 3, and 4 constitute the clock-train or dial-work, as with any ordinary clock.

On the arbor of the hour-hand wheel 4 is fixed the wheel 5, with which gears a wheel 6, which is loose upon the same axis as the wheels 2 and 3, and which revolves once in twenty-four hours. This wheel 6 carries a tappet D, which during the time when the wheel 2 makes its last revolution before the moment of adjustment of the hands acts on the arm N of the armature-lever *i i*, and in thereby turning this in the direction to the right causes the armature R to be applied to the pole of the adjusting electro-magnet A. Toward the end of this motion the contact *c'*, Fig. 3, is closed, which couples up the adjusting electro-magnet with the lighting-main L' L^2. Shortly afterward the tappet D leaves the arm N; but the lever *i i* now remains in the position into which it has been moved, as the armature R will now be held in the attracted position by the excited magnet. This action is completed before the passage of the gap *l* over the nose *b* on the lever *i i* takes place. During this passage the before-described weakening of the main current takes place, whereby the hands are to be adjusted. In consequence thereof the adjusting-magnet releases the armature R, and by its weight, either alone or aided by a spring *g*, the armature-lever turns to the left and the nose *b* passes through the space *l* and adjusts the hands. The contact *c'* is thereby again broken, and the nose *b* passes above the pins of the gap and allows these to pass free underneath.

It will be obvious that every mechanical device by means of which a variation in the current of an electric-light installation can be made to effect the adjustmant of the hands of a clock is applicable for the purposes of this invention. Thus, for example, the clocks can be so arranged that they are always slightly fast, and that the hands, as the time approaches when they are to be correctly adjusted, are made to come in contact with a projection on the lever *i i*, (or any equivalent thereof,) and thus to have their motion impeded until the fluctuation in the electric-light current takes place, when the said projection leaves the hands free again, thus causing the slight advance of the hands to be corrected at intervals, so that it cannot increase to a detrimental extent.

The ordinary movement of the time-pieces may be effected in any known manner. Thus it may also be effected by the electric-lighting current, in which case the following arrangement may be employed.

The second electro-magnet B operates with automatic interruption, and is thereby made to wind up the spring F by means of the movable pawl *s* and the check-pawl *t*. The one end of the spring is connected to the freely-rotatable ratchet-wheel *o* and the other end to the wheel *p* of the clock-work. The winding up is effected on the return motion of the armature by means of the drawing-off spring *k*. If the spring F is wound up to such an extent that the spring *k* cannot further act upon it, the action is stopped until the spring F has become unwound again to a certain extent. The interrupting-contact *c* is upon a peculiar double-ended contact-lever $c^2 c^3$, which

carries a small iron armature *e*, moving in proximity to the poles of the electro-magnet B. When the contact *c* is closed, the magnetic attraction of the small armature *e* by the poles of the electro-magnet will cause the contact *c* to remain securely closed; but if the contact *c* is forcibly broken the armature *e* is no longer attracted, and the contact-lever will remain in the position into which it has been moved. The opening and closing of the contact *c* is effected by the beaks *m* and *n*, carried by the armature-lever *h*. The distance between the beaks determines the motion of the armature-lever.

W W are resistances interposed in the leads connecting the time-piece with the lighting-mains.

In order to lessen the detrimental sparking at the contact *c* on breaking the circuit, I employ, besides known means, the arrangement shown in Fig. 4, in which the parts are lettered the same as the corresponding parts in the previous figures. The lower projection *m* of the lever *h*, Fig. 1, is replaced by a contact-piece *m'*, fixed in an insulated manner on the lever *h*, which contact-piece comes in contact with the lever c^2 c^3 shortly before the contact *c* is opened.

The windings of the electro-magnet B are connected on the one hand to the one lead of the circuit and to the movable contact-piece *m'* and on the other hand to the lever c^2 c^3 that closes the contact *c* on the other lead. Shortly before the contact at *c* is interrupted a short circuiting of the electro-magnet windings is effected by the contact of *m'* with c^2 c^3, by which the induction-current is confined to the short-circuited windings instead of passing as a spark at *c*. On the descent of the lever *h* this short circuiting is broken again.

The above-described invention can be employed with electric-light installations worked either with continuous or with alternating currents; but in the latter case the electro-magnets or their equivalents must be so arranged that they will operate properly with alternating currents—that is to say, they must, for instance, be made with cores consisting of separate wires or strips. It is also obvious that the adjusting electro-magnet of the clocks may, as in all other electrical transmissions, be worked from the main circuit by means of relays or transmitters instead of directly by the circuit, such as used frequently to be employed in electric telegraphy. Such relay would in that case be connected to the circuit in place of the electro-magnet of one or more clocks, and on the occurrence of the before-mentioned variation in the main current would effect the closing of a contact, by which the adjusting electro-magnets of one or more clocks situated in one or more separate circuits would be actuated. Such an arrangement would be of advantage when many clocks in one and the same house are required to be worked by the electric-light installation, because the arrangement of the adjusting electro-magnets, which are then only worked by closing and breaking the circuit, are simplified as regards their winding and regulation.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. The combination, with an electric circuit—such as the circuit of an electric-lighting plant—of an electro-magnet included in the circuit, a vibratory armature provided with a device for setting the clock, the said armature being adapted to be retained by the said magnet when placed in contact with it and while the potential of the current is normal, and an automatic operating device, such as a spring, adapted to actuate the clock-setting device when the said armature is released from the magnet by a variation in the potential of the current.

2. The combination, with an electric circuit—such as the circuit of an electric-lighting plant—of an electro-magnet included in the circuit, a vibratory armature provided with a device for setting the clock, the said armature being adapted to be retained by the said magnet when placed in contact with it and while the potential of the current is normal, a tappet operated by the clock and adapted to place the armature in contact with the magnet at periodic intervals, and an automatic operating device, such as a spring, adapted to actuate the clock-setting device when the said armature is released from the magnet by a variation in the potential of the electric current.

3. The combination, with an electric circuit—such as the circuit of an electric-lighting plant—of an electro-magnet, a vibratory armature provided with a clock-setting device, and a clock provided with a tappet adapted to periodically place the said armature in contact with the magnet and to include the said magnet in the circuit, whereby the said clock-setting device may be held in position to subsequently set the clock, substantially as set forth.

4. The combination, with an electric circuit, of the electro-magnet B, the armature *h*, provided with the pawl for winding the clock, and the contact-pieces *n* and *m'*, the spring *k*, the contact *c*, and the lever pivoted between the contact-pieces *n* and *m'* and provided with the armature *e*, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

FRIEDRICH VON HEFNER-ALTENECK.

Witnesses:
MARC M. ROTTEN,
SIEGFRIED HAMBURGER.