No. 696,238. Patented Mar. 25, 1902.

M. HOEFT.

ELECTRIC CLOCK.

(Application filed July 18, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

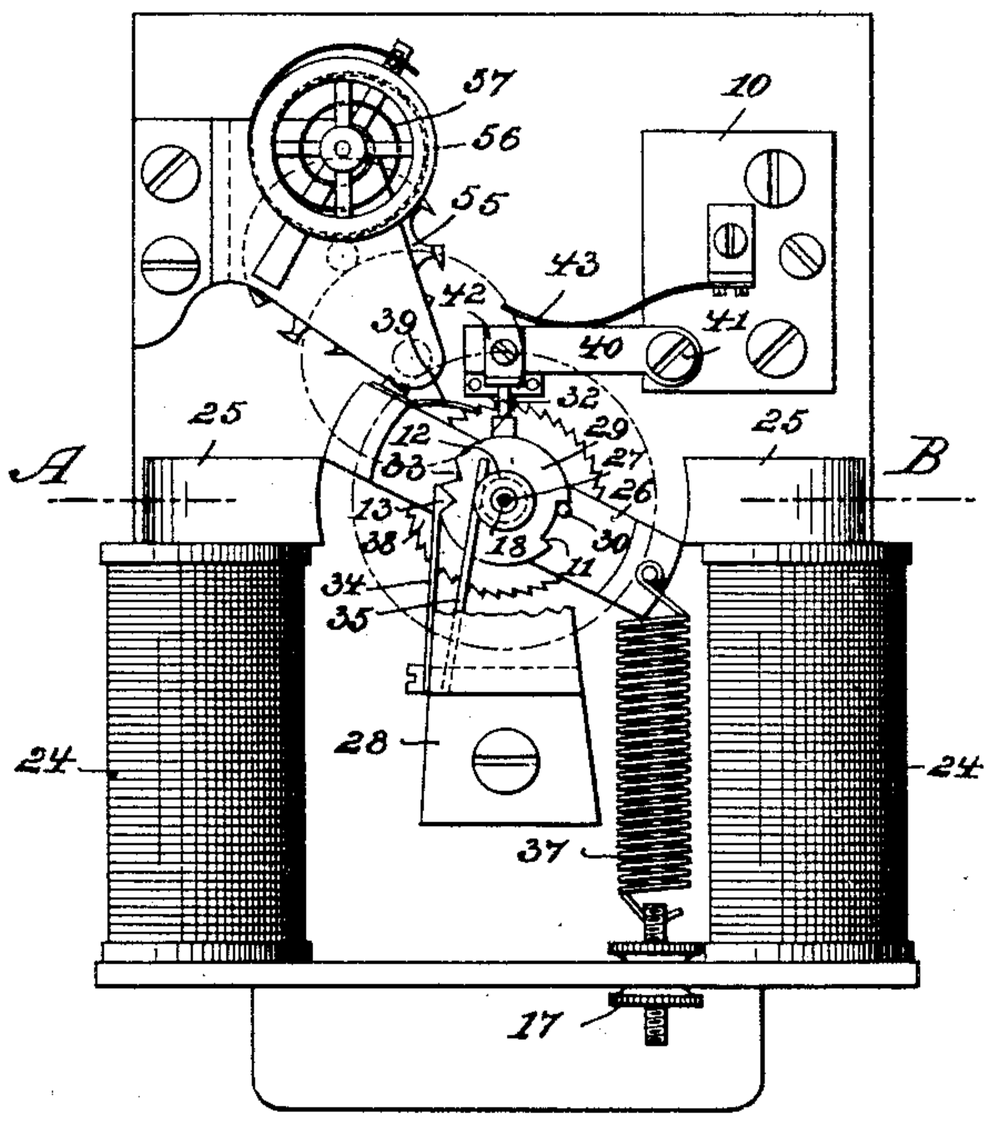


Fig. 2.

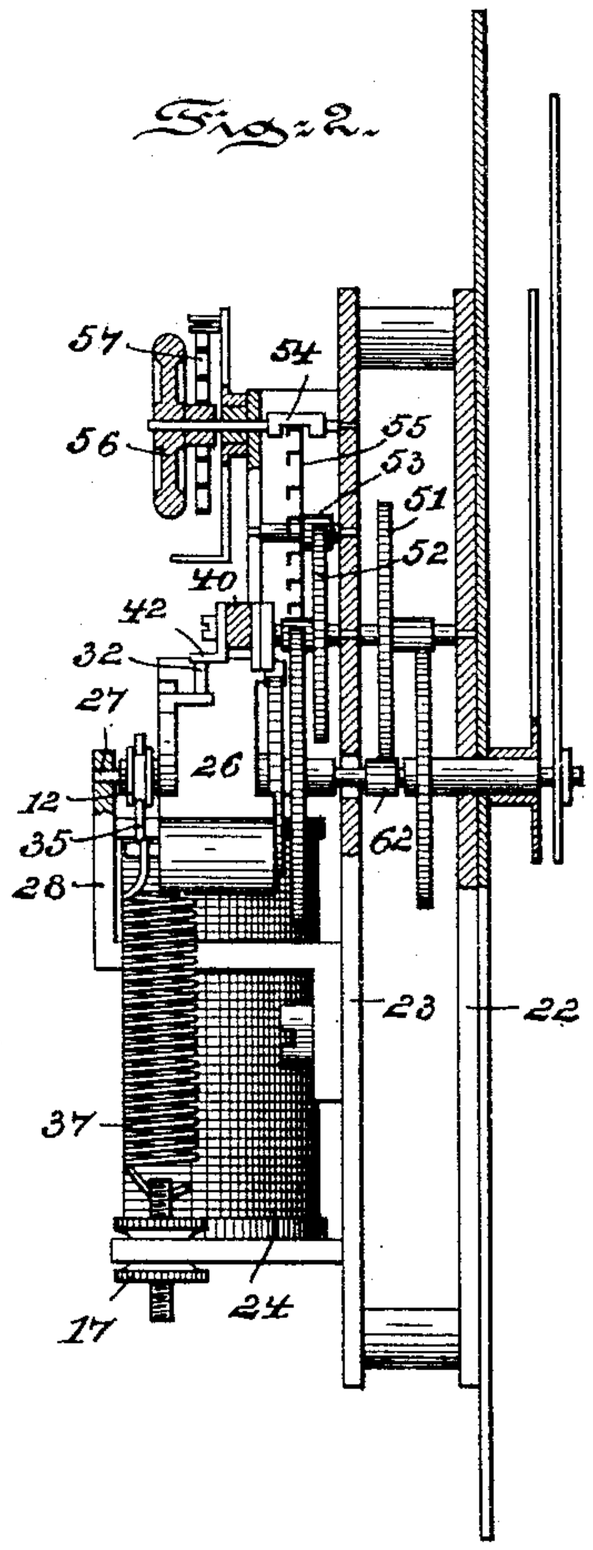
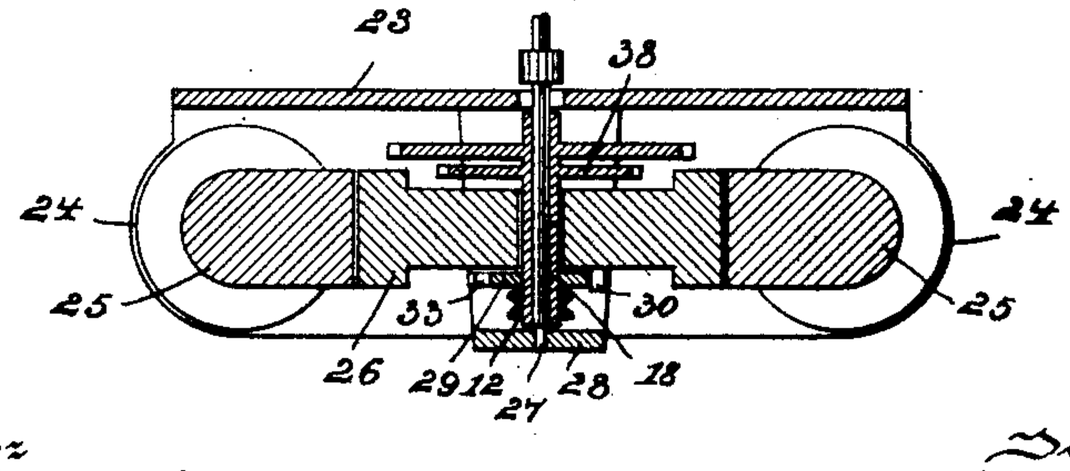


Fig. 3.



Witnesses:
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(No Model.) 2 Sheets—Sheet 2.

Fig. 4.

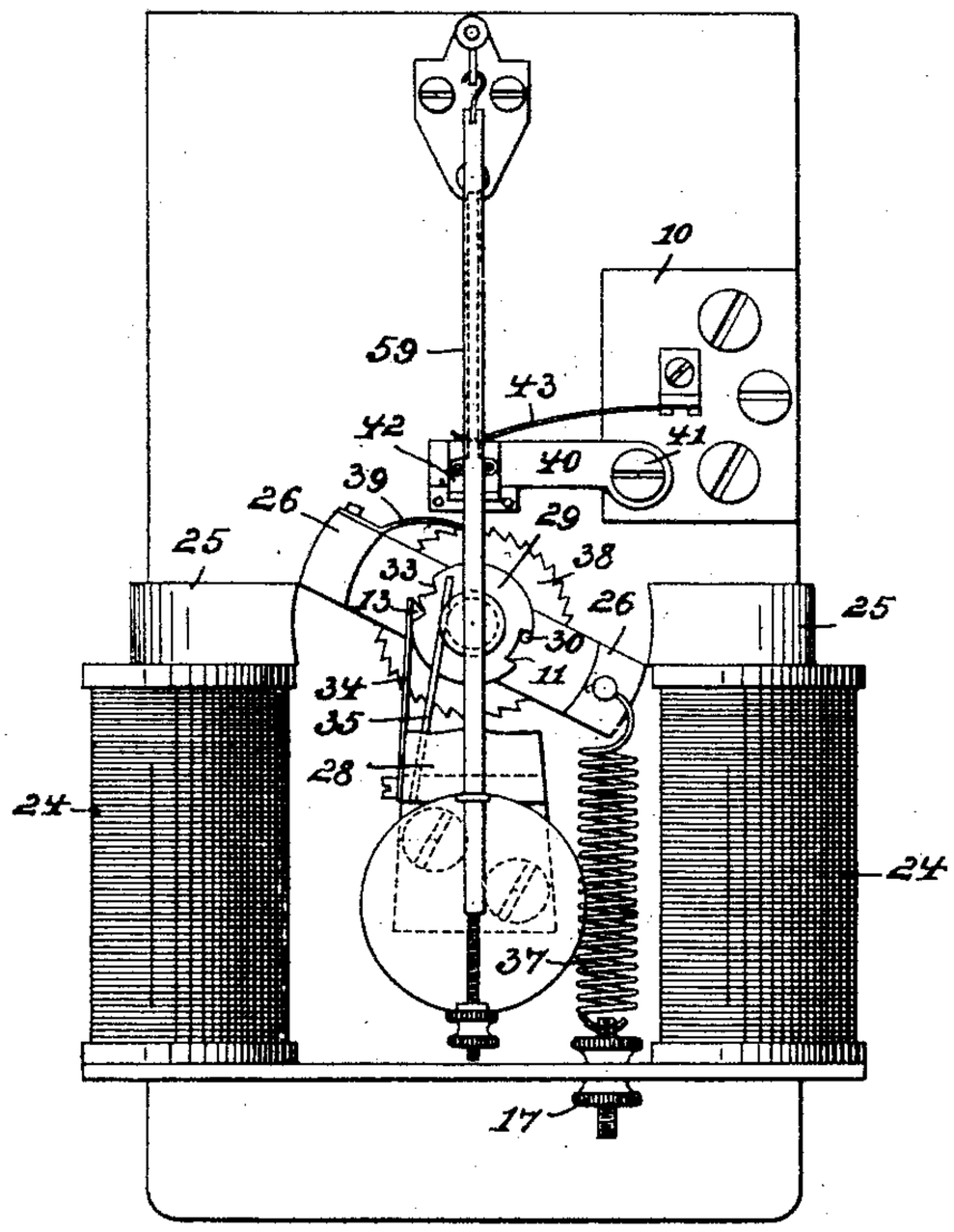


Fig. 5.

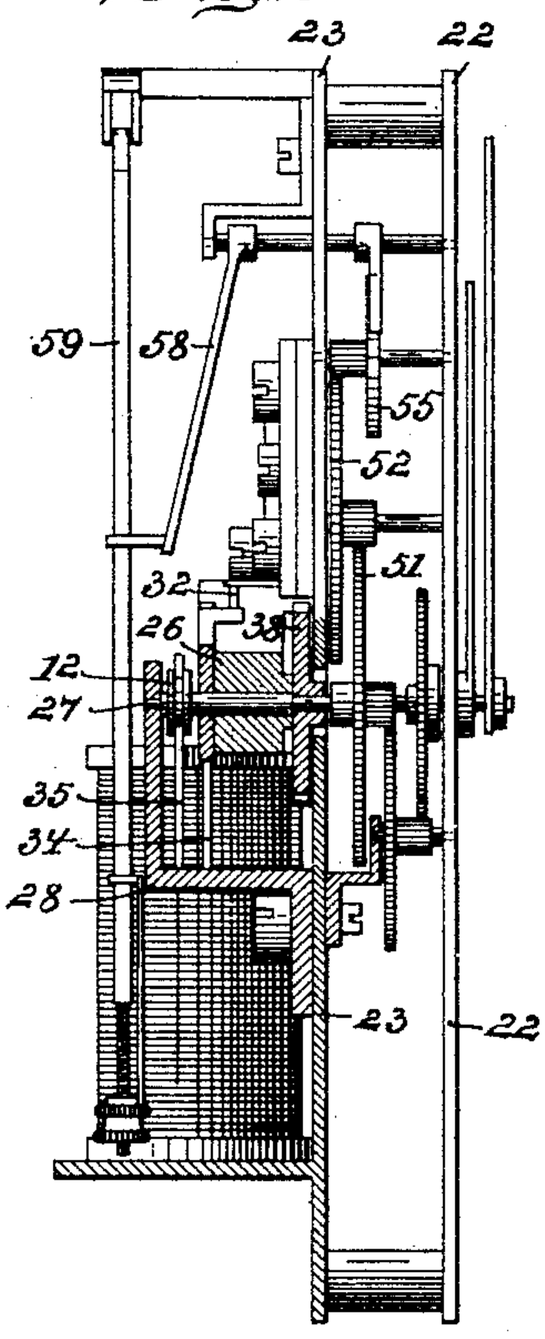


Fig. 6.

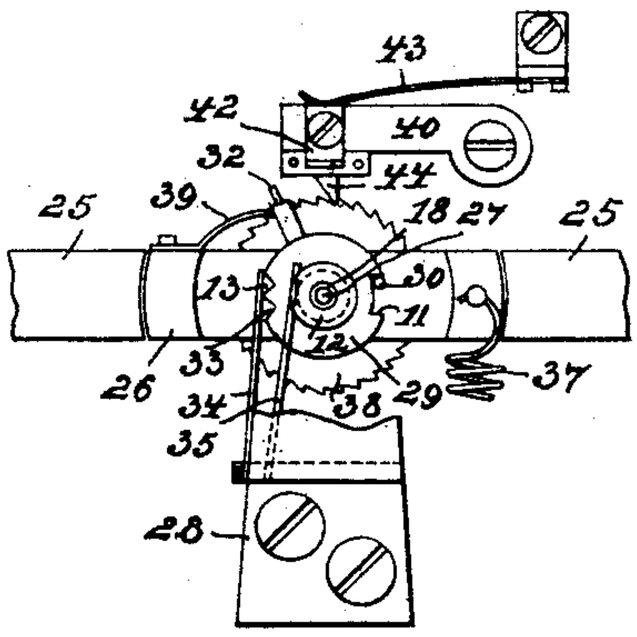


Fig. 7.

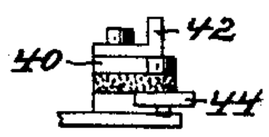


Fig. 8.

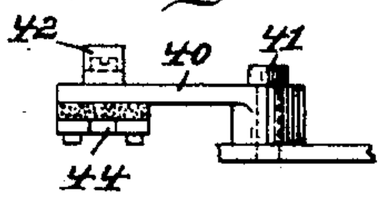
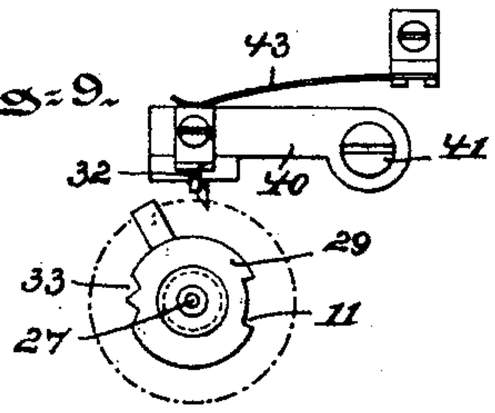


Fig. 9.



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UNITED STATES PATENT OFFICE.

MAX HOEFT, OF BERLIN, GERMANY.

ELECTRIC CLOCK.

SPECIFICATION forming part of Letters Patent No. 696,238, dated March 25, 1902.

Application filed July 18, 1899. Serial No. 724,248. (No model.)

To all whom it may concern:

Be it known that I, MAX HOEFT, a subject of the Emperor of Germany, residing at Berlin, Germany, have invented certain new and useful Improvements in Electric Clocks or Timepieces, of which the following is a specification.

My invention relates to a clock or timepiece adapted to measure periods of time by means of electricity.

The principal object of my invention is to produce an electrical timepiece whose mechanism can be finely adjusted to keep accurate time and which will operate independently of any slight variations of the electric current.

Another object of my invention is to provide in such a clock or timepiece an automatic electrical contact device (by which I mean a device for making and breaking the electric circuit) comprising an electromagnet having two pole-pieces between which the armature of the magnet is adapted to oscillate, the energizing of the magnet causing the armature to swing in one direction and break the circuit and a spring causing the armature to swing in the other direction and again complete the circuit. The movement of the armature of the contact device furnishes the power for driving the clockwork.

The nature and scope of my invention will be more fully understood from the following description, taken in connection with the accompanying drawings, forming part hereof, in which—

Figure 1 is a rear view of a balance-wheel timepiece embodying the main features of my invention. Fig. 2 is a side elevational view, partly sectionated, of Fig. 1. Fig. 3 is a horizontal sectional view on the line A B of Fig. 1. Fig. 4 is a rear elevational view of a pendulum-timepiece embodying my invention. Fig. 5 is a side elevational view, partly sectioned, of Fig. 4; and Figs. 6 to 9 are detail views illustrating the electric contact device.

Referring to the drawings, 24 24 represent an electromagnet provided with pole-pieces 25 25, between which is arranged an armature 26, supported by and adapted to oscillate on a shaft 27 independently of any movement of said shaft 27. The shaft 27 has its journals in the framework 22 23 of the clock. The armature 26 is retracted by the spring 37 out of the position to which it is attracted by the pole-pieces 25 25, which position is in a plane passing through the line A B of Fig. 1, as illustrated in Fig. 6. The oscillation of the armature 26 is thus effected, on the one hand, by the magnetization and demagnetization of the magnet 24 and, on the other hand, by the tension of the spring 37, which latter may be delicately adjusted by means of a suitable check-nut 17.

The electric contact device consists of a pin 32, Figs. 6 and 9, which is attached to and travels with a disk 29. This disk 29 is secured to a sleeve 18, surrounding the shaft 27, on which sleeve the armature 26 freely oscillates. The disk 29, however, has but a slight movement independently of the armature 26, for the reason that a pin 30, projecting from the armature 26, enters a slot 11, cut in the periphery of the disk 29, and the length of the slot 11 forms the limit of the independent movement of the disk. The disk 29 and pin 32 are brought into circuit by causing the current to pass first to the support 28 and thence by a weak contact-spring 35 to a grooved collar 12, secured to the sleeve 18, which carries the disk 29. The rim of the disk 29 is provided with two notches or indentations 33, into each of which successively a pawl 13 is adapted to enter. This pawl 13 projects from or is carried at the free end of a flat spring 34, which is secured at its other end to the support 28. Upon a base-plate 10, suitably insulated from the framework 22 23 of the clock, is pivoted, as at 41, an arm 40. The arm 40 is depressed by a spring 43, so as to present an angle-piece 42, having a platinum contact-surface, in the path of the contact-pin 32 of the disk 29. On the under side of the arm 40 and suitably insulated therefrom is arranged a spring-actuated ratchet-pawl 44, adapted to engage the teeth of a ratchet-wheel 38, suitably fastened to and adapted to govern the shaft 27. A small flat spring 39, fastened to the armature 26, engages the teeth of the ratchet-wheel 38 and is adapted to advance the wheel 38 when the armature 26 swings in obedience to the tension of the spring 37.

From the foregoing description it appears

that the action of the contact device is intermittent. The armature 26 is attracted by the excitation of the magnet 24, and thereupon the pawl 13 of the spring 34 slides from the first to the second indentation in the disk 29, the disk following the oscillation of the armature to that extent, because the pin 30 of the armature, working in the slot 11 of the disk, will serve to turn the disk sufficiently to cause the pawl 13 to slide into the second indentation of the disk 29, as illustrated in Fig. 6. During this oscillation of the armature 26 in obedience to the magnet 24 the spring 39, carried by said armature, slides backward over the ratchet 38, and no movement of said ratchet or of the shaft 27, rigidly connected thereto, will result. When now the armature has responded to the magnet, the contact-pin 32 has been moved out of contact with the contact-piece 42, and there is thus caused a break in the circuit, which causes a demagnetization of the electromagnet 24. The armature 26 is now free to yield and does respond to the tension of the spring 37. The reverse movement of the armature 26 thus occasioned will cause the spring 39 to engage the ratchet 38 and to move said ratchet and the shaft 27 a certain defined distance. As the armature 26 moves the disk 29 is obliged by reason of the pin 30 and slot 11 to follow this movement, and the pawl 13 is returned to the first indentation 33. During the movement of the armature the pawl 44 slides over the teeth of the ratchet 38 until the contact-pin 32 arrives opposite the contact-piece 42, when it enters a tooth, and the circuit is closed. The circuit being made, the armature responds to the attraction of the magnet and returns into the position shown in Fig. 6, when the circuit is again broken, Fig. 6. This operation of alternately breaking and making the circuit is continuously repeated in the manner described.

To the shaft 27 is secured a pinion 62, Fig. 2, which engages one of the wheels or pinions 51 of the clockwork. As before explained, the shaft 27 is only turned upon the movement of the armature in response to the spring 37. Inasmuch as the tension of this spring is adjustable and uniform when adjusted, small variations in the strength of the current used in exciting the magnet 24 have no influence upon the accuracy of the movement of the clockwork. To retard or control the movement of the armature under the influence of its spring 37, and consequently to diminish the number of times the circuit is closed by the pin 32 in a given period of time, and thereby economize the expenditure of the electric energy upon which the operation of the timepiece depends, there should be provided an escapement to control the movement of the shaft 27. Thus in Figs. 1 and 2 the pinion 62 is placed in train with the wheels 51, 52, and 53 of a well-known form of escapement, consisting of the cylinder 54, controlling an escapement-wheel 55 and connected in the usual manner with a balance-wheel 56 and spiral spring 57. In Figs. 4 and 5 the cylinder 54 is replaced by a lever-arm 58 and the spring 57 by a pendulum 59 in order to adapt the device to a pendulum-timepiece.

It is obvious that the disk 29 may carry the contact-piece 42 and the arm 40 carry the contact-closing pin 32 without departing from the spirit of my invention.

Having thus described the nature and object of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an electrical timepiece, the combination of an oscillating lever-armature, with a spiral spring, finely adjustable by a check-nut, and a contact device for making and breaking the electric circuit comprising, in combination, with said lever-armature, a disk freely rotatable on the shaft of the lever-armature; a pin on the lever-armature engaging a slot of the said disk, limiting the movement of the same; two indentations in the said disk entered by a spring-actuated pawl; and an angle-shaped contact-piece integral with the above-mentioned disk and coacting with the pawl of the contact-lever; substantially as set forth.

2. The combination with a timepiece of an electrical contact device, comprising in combination, a ratchet-wheel for actuating the clockwork mechanism; a lever-armature oscillating between the pole ends of an electromagnet; a spring-pawl secured on said oscillating armature and adapted to turn said ratchet-wheel in one direction; a lever pivoted proximate to said ratchet-wheel, and electrically connected to one electric terminal; a spring pressing said lever toward said ratchet-wheel, an electric contact-surface secured on said lever; a projecting tooth secured to, and insulated from, said lever, and adapted to engage in the teeth of said ratchet-wheel under the pressure of said spring; a disk having a slot in its face and two notches on its periphery; a pin secured to said lever-armature and adapted to engage in the slot in said disk, thus to oscillate, the same with intervals of rest; a pawl adapted to engage in the peripheral notches in said disk and thus hold the same; an electric contact-piece secured to said disk and adapted by the oscillation of said disk to alternately make and break contact with the contact-surface secured to the said lever pivoted proximate to said ratchet-wheel; a grooved collar in electrical connection with said disk; and a contact-spring bearing against said collar and electrically connected to the second electric terminal; substantially as set forth.

3. The combination in an electrical timepiece of a contact device, comprising, in combination, a ratchet-wheel for actuating the clockwork; a lever-armature oscillating between the pole ends of an electromagnet; a spring secured to said armature and adapted to turn said lever-armature contrary to the movement effected by the electromagnets; a

spring-pawl secured to said oscillating armature and adapted to turn said ratchet-wheel in one direction; a lever pivoted proximate to said ratchet-wheel and electrically connected to one electric terminal; a spring pressing said lever toward said ratchet-wheel; an electric contact-surface secured on said lever; a projecting tooth secured to, and insulated from, said lever, and adapted to engage in the teeth of said ratchet-wheel under the pressure of said spring; a disk having a slot in its face, and two notches on its periphery; a pin secured to said lever-armature and adapted to engage in the slot in said disk, and thus to oscillate the same with intervals of rest; a pawl adapted to engage in the peripheral notches in said disk, and thus hold the same; an electric contact-piece secured to said disk, and adapted by the oscillation of said disk to alternately make and break contact with the contact-surface secured to the said lever pivoted proximate to said ratchet-wheel; a grooved collar in electrical connection with said disk; and a contact-spring bearing against said collar and electrically connected to the second electric terminal; substantially as set forth.

4. An electrical contact device for electrical timepieces, comprising, in combination, a disk adapted to be oscillated in its periphery; a contact-piece secured to, and reciprocating with said disk; a lever pivoted to the framework and electrically connected with one terminal; a second contact-piece, secured to said lever, and arranged in the path of the said first and oscillating contact-piece; a grooved collar in electrical connection with said disk; and a contact-pin bearing against said collar and electrically connected to the second terminal; substantially as set forth.

5. An electrical contact device for electrical timepieces, comprising, in combination, a disk adapted to be oscillated and having notches in its periphery; a spring-pawl adapted to engage in the notches in said disk; a contact-piece secured to, and reciprocating with said disk; a lever pivoted to the framework and electrically connected with one terminal; a second contact-piece, secured to said lever, and arranged in the path of the said first and oscillating contact-piece; a grooved collar in electrical connection with said disk; and a contact bearing against said collar and electrically connected to the said second terminal, substantially as set forth.

6. An electrical contact device for timepieces and the like, comprising, in combination, an oscillating contact-piece; a ratchet-wheel adapted to turn in one direction with said contact-piece but not to return therewith; an insulated arm hinged with its free end proximate to said contact-piece; a second contact-piece attached to said arm and arranged to intercept the path of said first contact-piece; a pawl secured to said arm, and adapted by engagement with the teeth of said rotating ratchet-wheel to raise and lower said arm; all substantially as and for the purposes set forth.

In witness whereof I have hereunto signed my name, this 29th day of June, 1899, in the presence of two subscribing witnesses.

MAX HOEFT.

Witnesses:
HENRY HASPER,
WOLDEMAR HAUPT.