PATENT SPECIFICATION

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Complete Accepted: Oct. 11, 1923.

COMPLETE SPECIFICATION.

Improvements in Electrically Driven Periodically Moving Mechanisms.

I, CORNELIS DENIS JOSEPH JAMIN, JR., of Heemraadsingel 242, Rotterdam, Holland, a subject of the Queen of the Netherlands, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to electrically driven periodically moving mechanisms, such as principal clocks, auxiliary clocks, rocking devices for advertisement-apparatus, wash-troughs for photographers and chemists, *etc.* and has for its object to construct the electric driving means with the smallest possible number of members.

According to this invention the controlling member of the clock-work, which may consist of a pendulum, a balance wheel, or the like, or the spring, or the weight operating the periodically moving mechanism is periodically driven, or wound, or impelled by means of the deformation of a conducting member, which is with the periodicity of the said period-controlling member heated by an electric current.

When the invention is applied to a principal clock, the controlling member may be made to close two contacts alternately, one contact being closed while swinging in one direction, and the other while swinging in the opposite direction, said two contacts being arranged in the circuit of the previously mentioned conducting member and in a shunt respectively, the arrangement being such, that the two circuits are never open at the same time.

In one form of the invention the said conducting member may consist of a long, thin stretched metal wire, acting upon the pendulum by means of a spring member. According to a modification the conducting member may consist either solely or partly of a long coiled spring acting upon a member, which is rigidly secured to the pendulum.

According to another modification of the invention the conducting member consists of a bimetallic spring, which when heated by an electric current undergoes relatively considerable deformations.

Finally the shunt circuit may be used for actuating the mechanism driving the hands of the clock.

The following are the advantages obtained by the invention:

1. The construction of the electric driving mechanism is extremely simple and therefore the manufacturing costs are low.
2. The working of the mechanism is noiseless.
3. The mechanism may be driven not only by direct current but also by alternating current of arbitrary voltage.
4. The mechanism may be used for several purposes.
5. The fitting up of the mechanism does not require particular accuracy.

In the accompanying drawings several constructional forms of the invention are diagrammatically shown.

Fig. 1 shows a constructional form having a stretched wire for conducting member and a single contact.

Fig. 2 shows a modification having a double contact and a shunt circuit.

Fig. 3 is a modification with a conducting member consisting partly of a stretched wire and partly of a coiled spring.

Fig. 4 is a modification with a conducting member consisting solely of a coiled spring.

Fig. 5 is a modification having the conducting member stretched between two fixed points.

Fig. 6 shows an application of the invention to clock-work having a balance wheel.

Fig. 7 is a diagram, in which the moment of the forces operating upon the pendulum is shown as a function of the amplitude.

Referring to Figure 1, 1 is a pen-

[*Price* 1/-]

dulum having an adjustable weight 2, pivotally secured at the point 3. The pendulum 1 is provided with an electric contact 4, which when swinging to the left abuts against a contact spring 5, which causes a circuit to be closed.

When the pendulum 1 swings to the right, it presses against a resilient member 6, with which it is constantly in contact. Said resilient member 6 is pivoted about a point 7 and is provided with an arm 8 at the end of which one end of a stretched conducting wire 9 is mechanically secured in such a way as to be insulated therefrom. This end of the wire 9 is moreover electrically connected with the contact spring 5, while the other end of the wire 9 is connected to a stationary part of the clock-work.

The electric current may be taken from the mains 10, which may supply direct current or alternating current. One of the two mains is connected by means of a wire 11 to the point of suspension 3 of the pendulum, while a second wire 12 connects the other main with a point of the conductor 9 lying in close proximity to the fixed point of attachment of said conductor 9.

The working of the device is as follows.

When the pendulum swings to the left, the electric contact 4, 5 is closed, in consequence whereof a circuit is formed flowing from one of the mains 10, through the wire 11, and then through 3, 4, 5, 9 and 12 to the opposite main. The wire 9 is heated and expands, so that the arm 8 rotates in anti-clock-wise direction about the point 7 under or assisted by the tension in the spring 6. The circuit is kept closed till the pendulum 1 is again in its neutral position. When the pendulum swings to the right it gradually presses the lower end of the spring 6 towards the right sidewards, so that the tension in the wire 9 gradually increases. At the same time this wire gradually cools again since no current is at this time passing through it. The arm 8 is thus pulled down, so that for this reason also the retarding moment acting upon the pendulum gradually increases after the energy of the pendulum is exhausted, it returns to its neutral position under the influence of gravity and of the pressure of the spring 6 exerted thereon, till all parts have returned to the position shown in Figure 1, whereupon the above described operation is repeated.

In Figure 2 the same device is shown, but with the difference that in addition to the contact 4 the pendulum 1 at the right hand side is provided with a second contact 13, co-operating with a contact 14. From this contact a wire leads to a current consuming device, for example a resistance or a solenoid and from this back to a point on the wire 12.

The arrangement is such, that the two contacts 4, 5 and 13, 14, are both closed when the pendulum is in its central position.

The object of this arrangement is, firstly, to prevent the formation of sparks at the breaking of the contact 4, 5 and further to form a second circuit 15, which may be used for operating one or more auxiliary clocks, or the mechanism driving the hands of the principal clock, or may be used in order to double the driving force by means of a second symmetrically positioned conducting member. This duplication of the driving force may for example be of use in the case of a clock having to perform the work of striking and therefore requiring more energy.

The arrangement shown in Figure 3 differs from that shown in Figures 1 and 2 in that the resilient member, which is in the form of a coiled spring 16, also forms part of the conducting member. The remaining part of the conducting member consists of a thin stretched wire 9, whilst the complete conducting member is stretched between two fixed points of the clock-work casing. The pendulum 1 is provided with a fixed insulated projection 26, which, when the pendulum swings to the right displaces the wire 9 so that the tension in this wire and also in the spring 16 increases. Otherwise the working of this device is the same as that of the devices shown in the Figures 1 and 2.

In the case of the arrangement shown in Figure 4 the conducting member proper consists solely of a coiled spring 91 through which the current periodically passes, one end of said spring being mechanically connected to an arm 6 of the pendulum, but electrically insulated therefrom, and the other end of said spring being mechanically connected to a fixed point of the clock casing. The working of this device also is the same as that of the devices already described.

In the case of the arrangement shown in Figure 5, the conducting member again consists of a wire 9, stretched between two stationary points. The pendulum acts upon this member by means of a spring member 61, which for example by means of a forked end engages on the wire 9. The working of this arrangement is also identical with that of the devices described above.

In the case of a clock with a balance wheel, as shown in Figure 6, the balance

wheel 21, is mounted upon a spindle 31 provided with a contact pin 41, which when the balance wheel swings in one direction comes into contact with the contact spring 51. A circuit containing the stretched wire 9 is closed thereby. One end of this wire 9 is connected to a fixed point and the other end of the wire acts upon a lever, comprising a rigid arm 81 and a resilient arm 66, the whole lever being pivoted about the point 71.

The upper end of the arm 66 acts upon the balance wheel by means of a thin wire 17, wound upon a drum 19 on the spindle of the balance wheel.

The oscillating movements of this shaft are counter-acted in both directions by a coiled spring 18. The operation of this arrangement is analogous to that of the previous devices.

Figure 7 is a diagram showing the relation between the magnitude of the moment acting upon the pendulum and the angular position of the pendulum. This moment is composed of two parts, the first being that exerted by gravity, which part is the same for the forward and for the return movement of the pendulum, while the second part is the moment exerted by the conducting member upon the pendulum acting through resilient or non-resilient parts as the case may be.

For a given angular position this latter moment is always greater for the return movement than for the forward movement, this being due to the cooling of the conductor in the intervening period.

Though the drawing only shows the application of the invention to principal clocks, it will be understood, that the present invention also applies to the driving of electric auxiliary clocks. In this case the periodical electric currents controlled by the principal clock are passed through a stretched wire or spiral thread, which in consequence thereof undergoes periodical changes in its length, and this is used for imparting energy to an oscillating member, in the same way as is described with reference to principal clocks.

The said oscillating member, whose natural period of oscillation should be approximately equal to that of the pendulum of the principal clock, may then be used to directly or indirectly operate the mechanism driving the hands of the auxiliary clock.

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. An electrically driven mechanism having periodical movement, characterised in that the member controlling the period (pendulum, balance wheel or the like) or the spring, or the weight operating the periodically moving mechanism is periodically driven or wound or impelled by means of the deformation of a conducting member which is with the periodicity of the said period-controlling member heated by an electric current.

2. An electrically driven periodically moving mechanism as claimed in Claim 1 in which the member controlling the period (pendulum 1, balance wheel 21) when it swings in one direction, closes an electric contact (4, 5), which forms part of a circuit containing the conducting member (9).

3. An electrically driven periodically moving mechanism as claimed in Claim 1 in which the controlling member (pendulum, balance wheel) alternately closes two contacts, the one (4, 5) when swinging in one direction, the other (13, 14) when swinging in the other direction, said contacts being respectively placed in the circuit of the conducting member (9) and in a shunt circuit (15), the arrangement being such, that the two circuits are never open at the same time.

4. An electrically driven periodically moving mechanism as claimed in Claims 1, 2 or 3 in which the conducting member consists of a thin stretched metal wire (9) acting upon the pendulum (1) or the balance wheel (21) by means of a resilient member (6 in Figures 1, 2 and 6).

5. An electrically driven periodically moving mechanism as claimed in Claims 1, 2 and 3, in which the conducting member solely or partly consists of a long coiled spring (9, 16 in Fig. 3 and 91 in Fig. 4) and acts upon a member (26 in Fig. 3 and 6 in Fig. 4), rigidly secured to the pendulum or balance wheel.

6. An electrically driven periodically moving mechanism as claimed in Claims 1, 2 and 3, in which the conducting member consists of a bimetallic spring.

7. An electrically driven periodically moving mechanism as claimed in Claims 3 to 6 in which the shunt-circuit (15) serves to operate the mechanism driving the hands of the clock and/or the striking mechanism.

8. The improved electrically driven periodically moving mechanism, constructed and operating substantially as hereinbefore described and as illustrated in the accompanying drawings.

Dated this 11th day of September, 1922.

MARKS & CLERK.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1923.

Fig. 1.

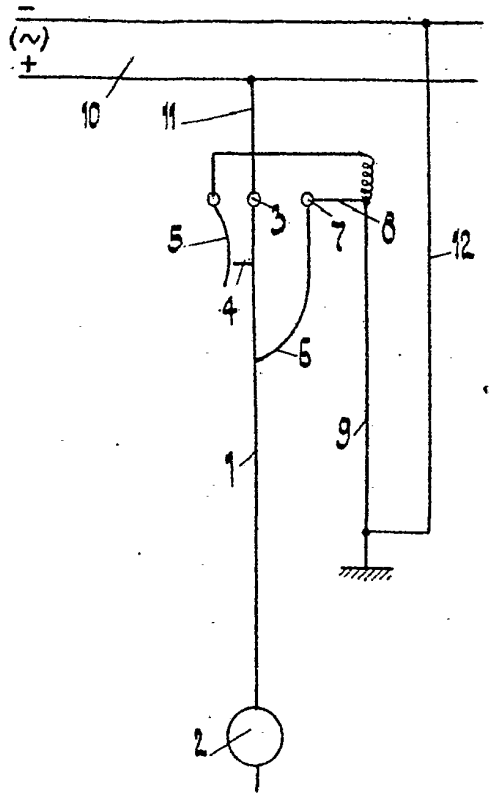
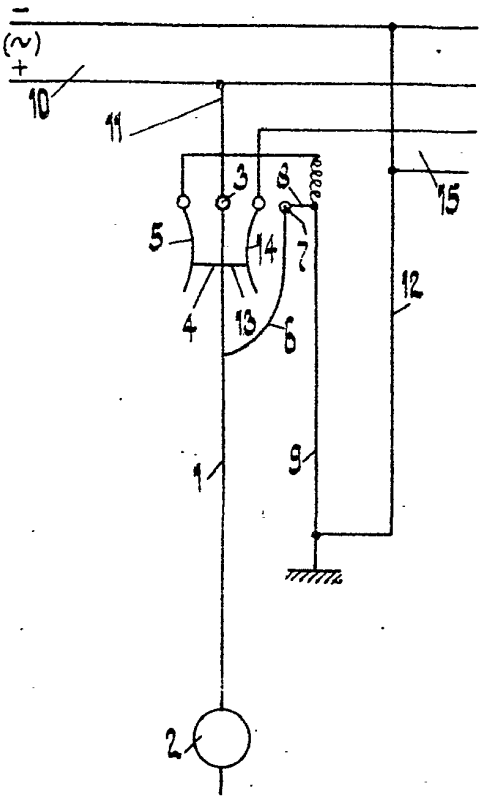


Fig. 2.



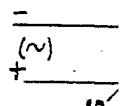


Fig. 3.

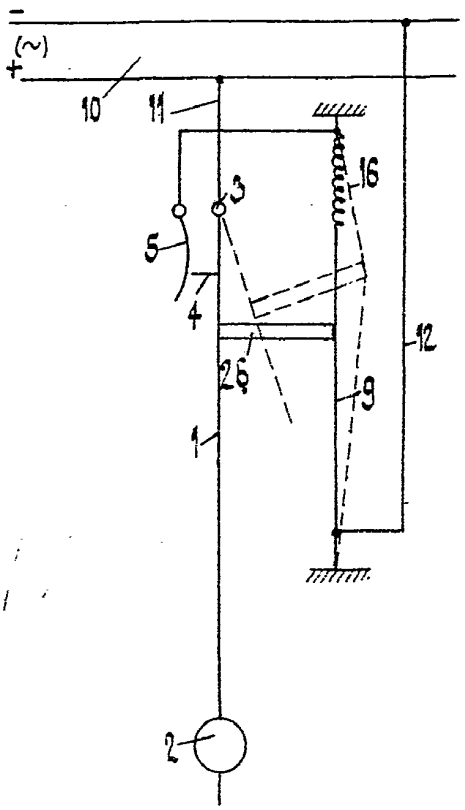


Fig. 4.

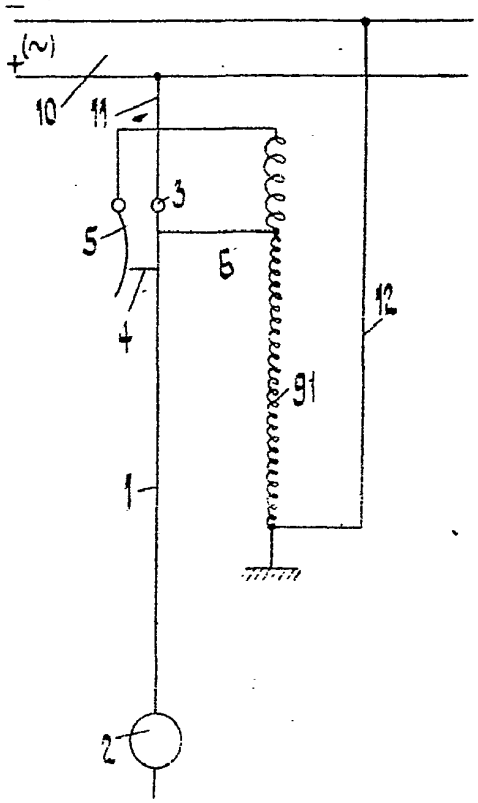
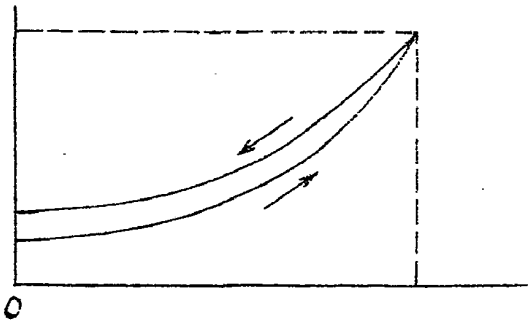


Fig. 7.



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[This Drawing is a reproduction of the Original on a reduced scale]

Fig. 1.

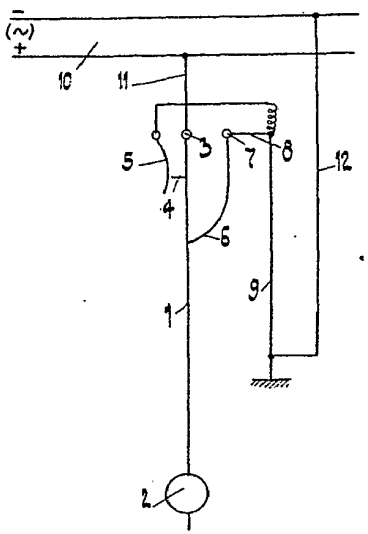


Fig. 2.

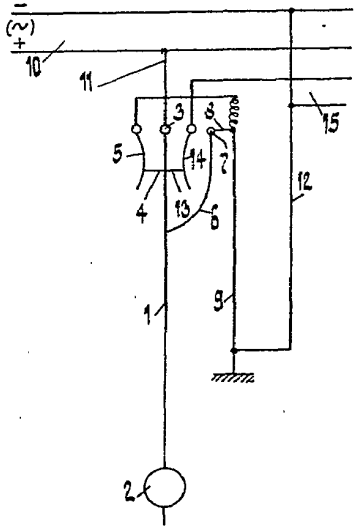


Fig. 3.

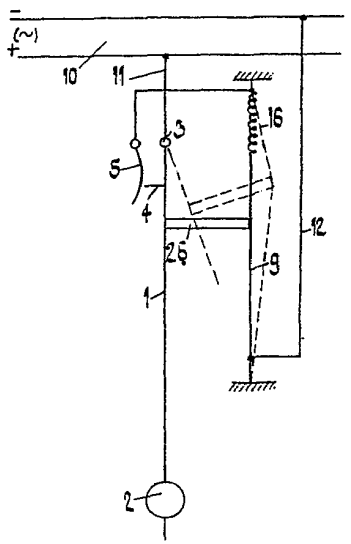


Fig. 4.

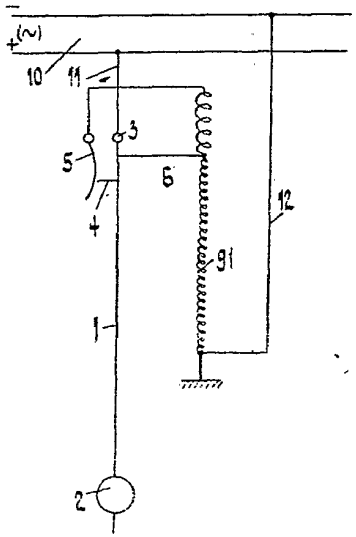
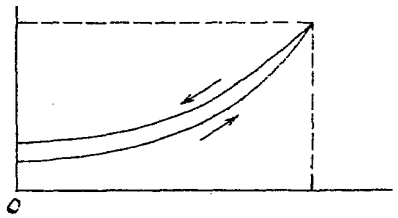


Fig. 7.



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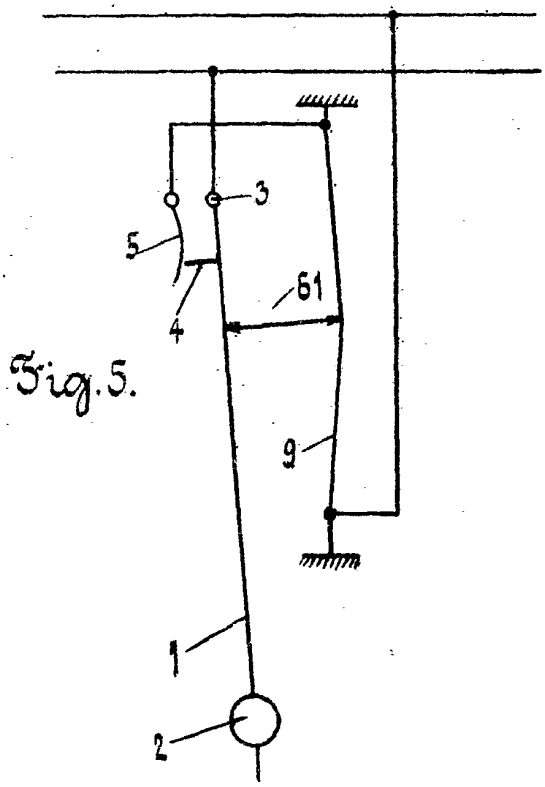

Fig. 5.

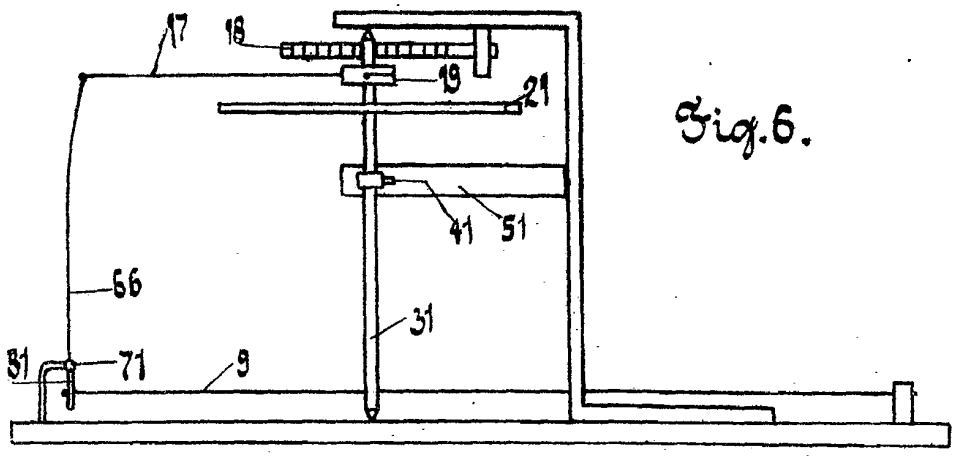

Fig. 6.

Malby&Sons, Photo-Litho