N° 14,614 A.D. 1906

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COMPLETE SPECIFICATION.

"Improvements in or relating to Electric Clocks"

I, HERBERT JOHN HADDAN, of the Firm of Herbert Haddan & Co., 31 & 32 Bedford Street, Strand, W.C. London, Consulting Engineer, do hereby declare the nature of this invention a communication to me from abroad by Kutnow Brothers, of 853 Broadway, New York, United States of America, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to electric clocks and watches in which the oscillations of the balance wheel are maintained by electric energy derived from any suitable source. The principal objects of the invention are to attain the maximum of simplicity in construction, whereby liability to derangement is reduced, and high efficiency in the operation of the mechanism, whereby the amount of battery power required is reduced to a minimum and a battery of sufficient capacity to operate the clock for a long period of time can be enclosed within the clock casing without making the same unsightly or clumsy. Incidentally to these main objects, it has been sought to keep the cost of construction low, to make the entire mechanism with its actuating battery, if one be applied directly to the mechanism, as compact as possible and to secure novelty and attractiveness in appearance. These objects are attained primarily by mounting the actuating magnet upon the oscillating balance wheel and mounting the armature in a fixed position, the electric connections and co-operating devices being combined therewith in a suitable manner. This arrangement of the magnet and armature is contrary to all previous known constructions in which the armature swings and the electromagnet is permanently fixed. The combination of parts referred to enables a high efficiency to be obtained, the poles of the magnet being located at the periphery of the oscillating balance wheel so that the impulse which accelerates or renews its motion is given to it at the instant of its most rapid motion and the maximum amplitude of oscillation is attained. By fixing the distance between the magnet poles and armature to a minimum the waste of energy in starting an armature from a condition of rest at each energization of the magnet is avoided, and the amount of electrical energy required to maintain the oscillations of the balance wheel is so small that a single cell of an ordinary dry battery will suffice to keep the clock in operation for a long period of time. As the magnet poles are in motion the armature has its maximum of energy when contact is made during each oscillation, then the poles of the magnet are closest to the armature whereby the highest efficiency is attained and the battery lasts relatively longer. The shaft on which the balance wheel turns rests in ball bearings to ease its motion. The use of the usual mechanical escapement is dispensed with which simplifies the mechanism. The balance wheel is split to give it the compensating effect of the compensating pendulum which aids in keeping good time. Various details of construction have also been improved with a view to the attainment of the several objects above named, all as will be more fully explained hereinafter with reference to the accompanying drawings in which

Figure 1 is a view in front elevation of a clock which embodies in desirable form the present improvements.

[*Price 8d.*]

Figure 2 is a view thereof in end elevation, the clock face and one of the bearings of the balance wheel being shown in section.

Figure 3 is a detail view in elevation showing the hair spring and regulating device.

Figures 4 and 5 are detail views illustrating the operation of the contact devices.

Figure 6 is a detail view illustrating a slight modification of the devices for transmitting movement from the balance wheel to the clock train.

In the clock represented in the drawings the actuating battery is represented as incorporated with the clock, although, as will be readily understood, in clocks or time pieces of a different type it may be desirable to derive the electric energy from some suitable source remote from the clock mechanism, for instance small or ornamented desk clocks may be operated by a battery concealed within one of the drawers of said desk. In the construction shown a single cell of an ordinary dry battery, sufficiently represented by the terminals at *a*, is placed in a suitable case *b* mounted upon a base b^1 which supports the entire mechanism. A bracket *c*, secured to the case *b*, supports the clock face *d* and a simple clock train *e* which is of ordinary construction and requires no detailed description herein except to note that it is shown as having a worm actuating gear e^1. The latter is engaged by a driving worm *f* on the shaft of which, mounted in a suitable bearing, is a ratchet wheel f^1. The latter is operated by a driving dog *g* which, in the construction shown in Figures 1 and 2, is a rod upon one arm of a bell crank lever *h* and pressed by a coil spring g^1 towards the ratchet wheel f^1, reciprocating in a guide g^2. The bell crank lever *h* is restored by a spring h^1 to normal position after actuation by the balance wheel in the manner hereinafter described.

In suitable standards *i* is mounted the shaft *k* of the divided, compensating balance wheel *l* which has mounted therein so as to oscillate therewith the actuating magnet *m*, the poles of which are at the periphery of the said balance wheel. The shaft *k* is provided with an arm *n* in which is mounted a contact pin *o* insulated from the arm *n* by a fibre bushing o^1, which is cut away to expose the pin to contact on one side, as shown in Figures 2, 4, and 5. Upon the supporting frame work is mounted an insulated contact spring *p* having an L-shaped head p^1, the shank of the head standing directly in front of a pin and roller h^2 carried by the bell crank lever *h*. Head p^1 of the spring *p* is so placed with reference to the path of movement of the pin *o*, as it oscillates with the balance wheel, that in the oscillation to the right, indicated in Figure 4, the pin *o* with its bushing o^1 pass to the right of the spring head, throwing the spring to the left slightly, as indicated by dotted lines in Figure 4, the pin *o* making no electrical contact therewith by reason of the interposition of the bushing o^1. The bell crank lever *h*, likewise, is not actuated during this movement as the spring *p* is thrown away from the pin and roller h^2. In the oscillation to the left, however, as indicated in Figure 5, the pin *o* comes up in front of the spring head p^1 and makes electrical contact therewith, at the same time throwing the spring back against the pin and roller h^2 and rocking the lever *h* upon its pivot, as indicated in Figure 5, and thereby driving the dog *g* in a direction to actuate the ratchet wheel f^1 and so give the clock train a forward movement. When one or a few contacts are slipped the clock does not stop as those of other constructions do, the balance wheel will continue to oscillate because it is heavy on account of the magnet therein which imparts quite a momentum. The contact spring *p* may be made of three laminae of different lengths well pressed together. The one to the left which has the L-shaped head is longest and therefore the head moves easily to and fro. The middle one is of medium length and the one to the right is shortest. By virtue of this arrangement good contact is made and there is little resistance when the pin returns. This requires less power when the pin returns

and gives high efficiency both electrically and mechanically and the spring is quickly brought to rest.

The shaft *k* on the balance wheel has applied thereto a hair spring *r* provided with the usual regulating device r^1, as shown in Figure 3. The hair spring gives the return movement of oscillation to the balance wheel after the energy of the actuating magnet *m* has been expended, the energy of such magnet acting upon an armature *s* which is fixed to the supporting frame and in very close proximity to the path of movement of the poles of the magnet *m*. As shown in Figure 2, the armature *s* is of extended length and on the same radial line as the poles of the magnet *m*, so that the magnet, in its oscillation with the balance wheel, has time to discharge its magnetism and thereby avoid any retardation which might be occasioned by residual magnetism and so decrease the efficiency of the mechanism, and influence the time-keeping quality of the clock.

As will be understood by reference to Figure 1, one pole of the battery is connected by a suitable conductor a^1 to the binding post a^2 on the supporting frame work. Thence current is conducted through the supporting frame work and the hair spring *r* to the balance wheel *l* and from a binding post l^1 thereon directly to one end of the magnet coil *m*, the other end of such coil being connected to the insulated pin *o*. The other pole of the battery is connected by a suitable conductor a^3 to an insulated binding post a^4, from which connection is made, as indicated at a^5, to the insulated contact spring *p*. The pin *o* is so placed with respect to the poles of the magnet that it makes contact with the contact spring *p*, as indicated in Figure 5, just as the pole of the magnet approaches the fixed armature *s* near enough to include it within the magnetic field, and breaks the contact just as the magnetic pull upon the balance wheel attains its maximum, so that there is no retardation. By these means the balance wheel receives, through the momentary energization of the magnet *m*, an impetus just sufficient to maintain the oscillation of the balance wheel. When that impetus is expended the hair spring *r* acts to return the balance wheel to the limit of its movement in the opposite direction and then again to give movement in the forward direction until the pole of the magnet again approaches the armature.

It will be observed that the arrangement of the oscillating magnet and balance wheel upon the horizontal axis, with the armature stationary beneath the balance wheel, permits a very close adjustment of the armature with respect to the poles of the oscillating magnet to be maintained without regard to any looseness of fit that there may be of the shaft in its bearings, so that the efficiency of the mechanism can be maintained at its maximum. Furthermore, this arrangement permits the employment of a feature of construction which is not only useful but adds to the attractiveness of the mechanism. That is to say, the shaft of the balance wheel is supported not only in general bearings, but with an end thrust pivot bearing, so that the clock will run in any position, and at the same time the ball or roller journal bearing is visible, forming an attractive feature.

In each of the two standards *i* is mounted a sleeve *t* which forms a cup for bearing balls t^1, the end of the shaft *k* being reduced as at k^1 to bear on the balls. The end of the sleeve *t* is closed by a disc *u* of flint glass, which is held in place by a bezel or beaded sleeve *v* which has a screw threaded engagement with the sleeve *t*. The extremity of the shaft *k* is tapered to a point, as at k^2, to have a pivot bearing against the glass disc *u*. If the clock, therefore, is tipped forward or back the mechanism will continue to operate without retardation and the ball bearings being visible through the glass form an attractive and ornamental feature.

It is obvious that various changes may be made in details of construction and arrangement without departing from the spirit of the invention. One such modification of the transmission devices is illustrated in Figure 6, wherein the

worm f is arranged vertically and the ratchet wheel f^1 thereof is engaged by a dog g^2 which oscillates upon a pivot g^3. The upper end of the dog g^2 carries an insulated head g^4 which stands behind the insulated contact spring p^2, with which the contact pin o of the balance wheel makes contact in its movement in each direction, thus effecting the energization of the magnet once in each complete oscillation and actuating the clock train e, through the worm wheel e^1, twice for each complete oscillation. Various other modifications in detail will suggest themselves, and it is to be understood that the invention is not limited to the precise construction and arrangement of the parts shown and described herein.

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. In an electric clock, the combination of a clock train, a balance wheel, means for transmitting motion from the balance wheel to the clock train, an electro magnet mounted with the balance wheel, a stationary armature and circuit connections and contacts whereby the magnet is momentarily energized as its pole approaches the armature.

2. An electric clock as in Claim 1 having a contact pin carried by the balance wheel, and a contact spring located in the path of movement of the pin for the purpose set forth.

3. An electric clock, as in Claims 1 and 2 wherein the contact pin carried by the balance wheel is insulated on one side and the contact spring has a broad L-shaped head located in proximity to the path of movement of the pin whereby the pin passes on one side of said head in one direction and on the other side of said head in the other direction.

4. An electric clock, as in Claims 1 and 2, transmission devices having a portion located in proximity to the contact spring to be actuated thereby for the purpose set forth.

5. An electric clock as in Claims 1 and 2 having a lever mounted in proximity to the contact spring to be actuated thereby, and means whereby the movement of the lever is made to actuate the clock train.

6. An electric clock as in Claim 1 wherein the balance wheel is mounted upon a horizontal axis and has roller journal bearings and end thrust bearings.

7. An electric clock as in Claim 6 wherein glass sheets close the outer ends of the roller journal bearings and the shaft of the balance wheel has pivot bearings against said glass sheets through which the roller bearings are visible.

Dated this 26th day of June 1906.

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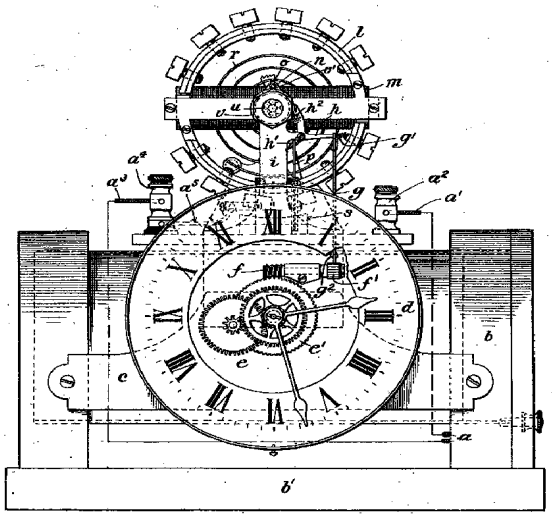
HADDAN'S COMPLETE SPECIFICATION.

3 SHEETS

SHEET 1.

Fig. 1.



SHEET 2.

Fig. 2.

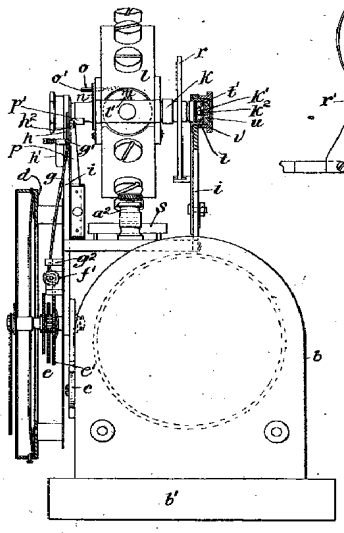


Fig. 3

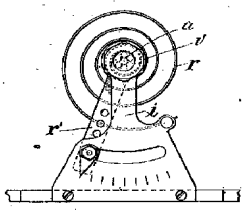


Fig. 4.

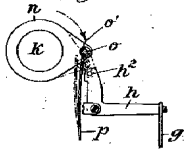
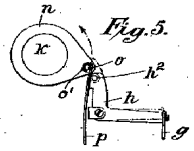


Fig. 5.



Mudge & Sons, Photo-Litho.

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

Fig. 1.

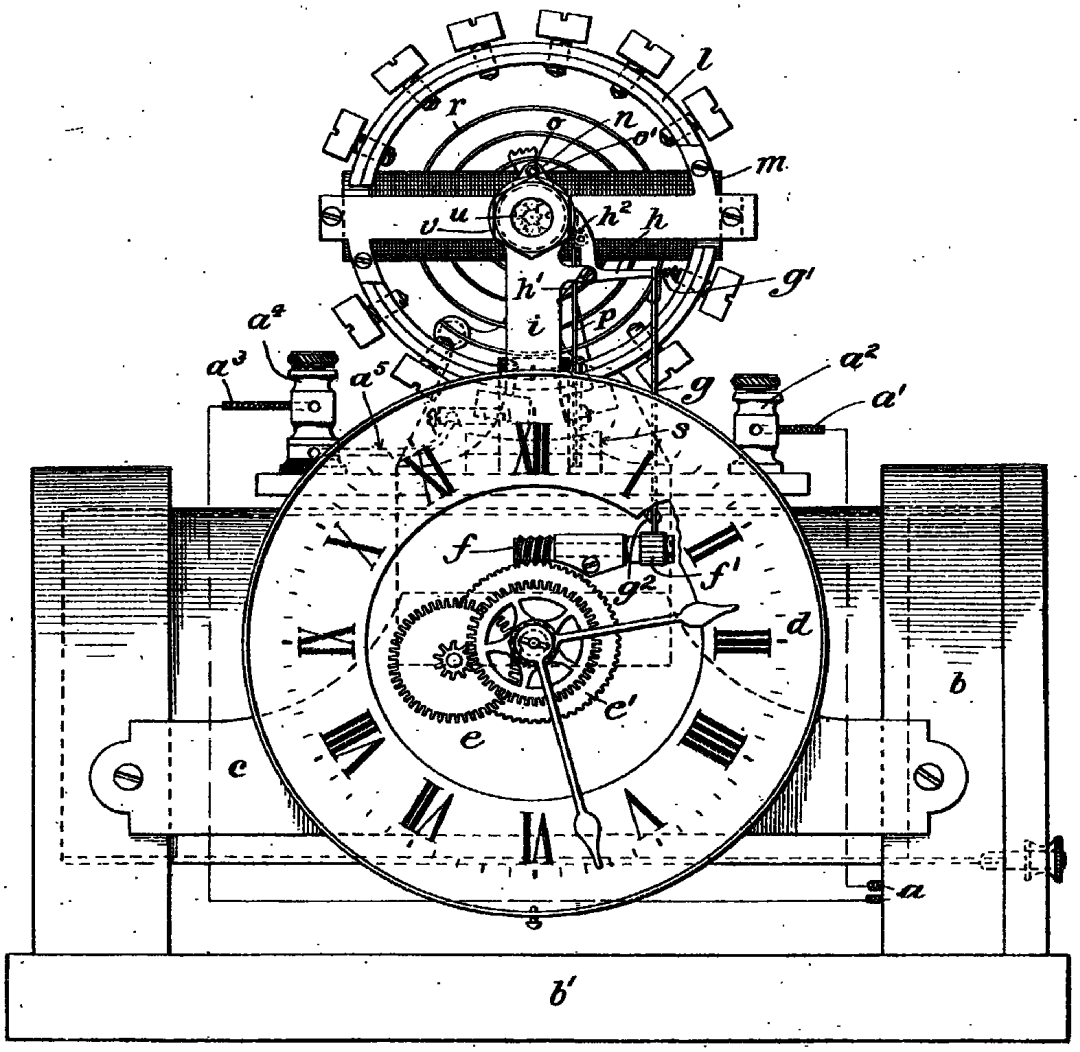


Fig. 2.

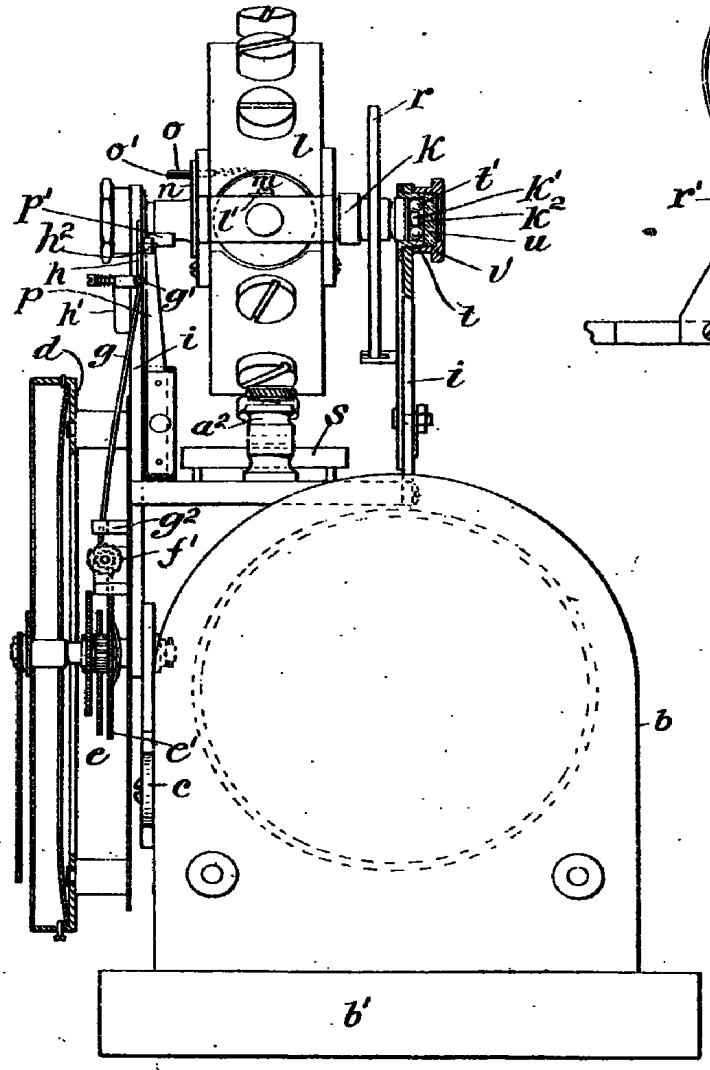


Fig. 3

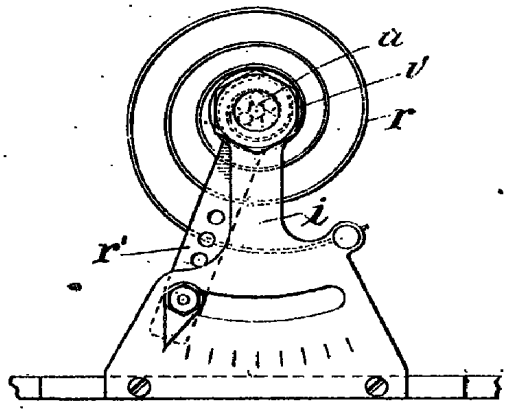


Fig. 4.

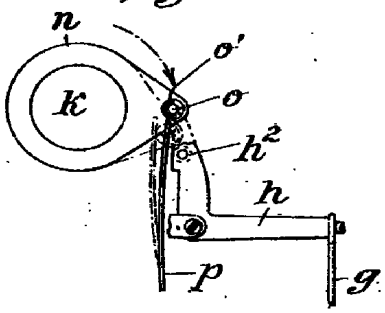
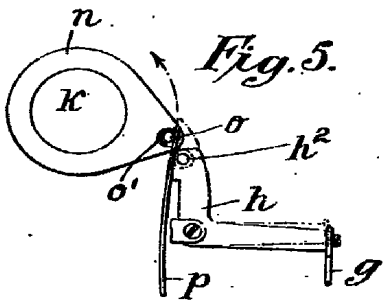


Fig. 5.



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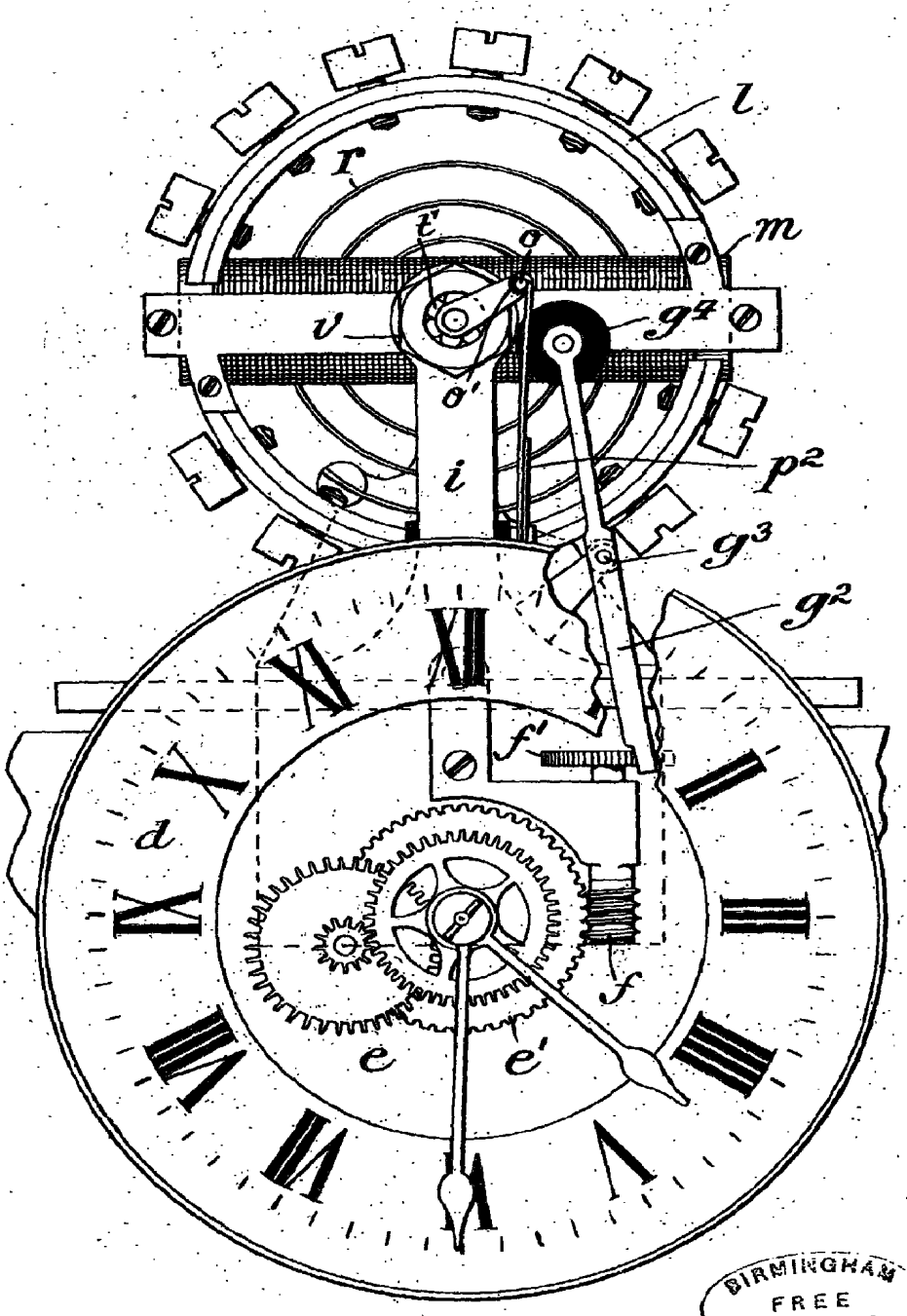
[This Drawing is a full-size reproduction of the Original.]

Fig. 6.



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