N° 6066 A.D. 1905

Date of Application, 22nd Mar., 1905 – Accepted, 22nd June, 1905

COMPLETE SPECIFICATION.

"Improvements in or relating to Electric Clocks".

I, FRANK HOPE-JONES of 32 & 34 Clerkenwell Road, London, E.C., in the County of Middlesex, Electrical Engineer, 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:—

This invention has for its object improvements in the construction of electric clocks, especially of the type set forth in my previous Patents Nos. 1587 of 1895 and 7868 of 1897. These improvements comprise a method of maintaining the vibrations of a pendulum automatic and of transmitting periodic electrical impulses to operate secondary dials or the like; also to obviate certain drawbacks inherent in previous systems of electrically synchronising and propelling clock mechanisms as will be pointed out in detail further on.

In order more clearly to set forth my invention I have illustrated the same in the accompanying drawings, in which

Figure 1 shews diagrammatically a front elevation of my improved mechanism,

Figure 2 a side elevation of the same and

Figure 3 a modification thereof.

In my prior Patent No. 1587 of 1895 the weighted lever or fly wheel adapted to be periodically reset by the electromagnet was normally engaged in driving the pendulum through the medium of an escapement, and was consequently let down slowly and by very small steps into contact with the armature. By my present invention the weighted lever is normally supported by a catch, and is liberated by the pendulum itself not as in the previous patent at every beat but at a given interval. For instance it may be liberated every *fifteen, thirty or sixty* seconds as may be desired and acts as a gravity arm, giving one comparatively long and powerful impulse to the pendulum at the predetermined period of time instead of a short and small impulse at every beat. Further by the improved construction hereinafter set forth I ensure the continued regular action of the mechanism even in the event of failing battery strength because in my present system the pendulum itself will assist the armature in completing the return of the gravity lever. A further advantage arising from this construction is found in the indication given of failing battery strength by the prolongation of the periods of contact at each impulse. Another advantage of my present construction is that in the event of stoppage of the clock from any cause this will occur on open circuit so that electric current cannot be wasted whilst the apparatus is standing still.

Finally I have provided means for more easily advancing or retarding the pointers of the dials without interfering with the normal working of the clock or stopping the pendulum.

Referring now to Figures 1 and 2, A is a pendulum of any ordinary form. B is a gravity arm with weight C centred at B^1 which in conjunction with the armature D and electro-magnet M constitute the essential electro-mechanical part of the switching action shewn in Fig. 2 of Patent No. 1587 of 1895 above referred to and Fig. 1 of Patent No. 7868 of 1897. E is a ratchet wheel adapted to be revolved one tooth at a time by the pawl F pivotted on the pendulum A.

[*Price 8d.*]

F^1 is an eccentric stop mounted just below pawl F and just not touching it when turned into its lowest position. S is a steel spring mounted on the lever B at R. E^1 is a lightly pivotted lever carrying a roller E^2 which is gently pressed against the teeth of the wheel E thereby limiting and defining its progression to exactly one tooth at a time with the minimum of frictional disturbance. G is a small block or pallet fixed upon the weighted lever B by means of which the lever is normally supported on the upright click H centred at J. The click H is provided with spring K pressing it lightly against fixed stop L. A small block N is mounted on click H just sufficiently high to clear the point of pawl F. One tooth O of the ratchet wheel E is not cut as deeply as the rest of the teeth, so that when pawl F mounted on the pendulum A in propelling the wheel E one tooth at each vibration, picks up the shallow tooth O it rides at a higher level and meets the block N on the click H thereby liberating the gravity arm B which then falls with the pendulum A imparting an impulse thereto by means of the spring S. The weighted lever B then meets the contact screw P in the tail of the armature D thereby closing the circuit and causing the magnet M to replace the weight.

The action of the apparatus is as follows:—

When the pendulum A is started swinging it rotates the wheel E by means of pawl F which rides underneath the block N on the click H until tooth O is met with and the pawl rides at a higher level and meets stop N thrusting click H from underneath the block G. The weighted lever then falls and communicates an impulse to the pendulum A through spring S in the manner of an ordinary gravity escapement until it reaches contact screw P in the tail of the armature D thus closing the electric circuit of magnet M and a battery, which circuit may also include a number of step by step electrically propelled dials. The magnet M then attracts the armature D towards it with acceleration, the armature coming up with a rush against the poles of the magnet or other fixed stop and the weighted lever being free to travel further is carried up by its momentum, breaks the circuit rapidly and falls again upon the support H.

Referring to Figure 3 in which equivalent parts are denoted by the same letters, the moment of inertia of the weighted lever B is increased by adding to its mass and partly counterbalancing it by the arm B^2.

The power of the electro-magnet is more equalised upon the armature D by pivotting the latter in the centre at D^1 between the pole-pieces M^1 of the magnet M. The gravity arm B communicates its thrust to the pendulum by means of the spring S as in Figure 1.

The number of impulses imparted to the pendulum in a given time may of course be varied. In both the illustrations, the periodicity is every half minute. In Figure 1 this is obtained by means of a ratchet wheel with fifteen teeth, only one of which causes the release of the gravity arm B, while in Figure 3 in which the pendulum beats half-seconds, the wheel has thirty teeth. In each case the number of teeth may be doubled or quadrupled and two or four releasing teeth may be provided if half minute periodicity is required. Whereas if minute periodicity is required the number of teeth would be doubled without further alteration, and if quarter-minute periodicity is required, the wheels would remain as drawn, and the releasing tooth would be duplicated across the wheel.

Apart from the well known advantages in accuracy of time-keeping resulting from the use of a free or almost entirely free pendulum receiving its impulse from a gravity arm, which advantages are here secured in their entirety, there are many unique and previously unattained advantages resulting from the novel combination of a periodically released gravity arm with the switching and self-winding actions described in Patents Nos. 1587 of 1895 and 7868 of 1897 above referred to. I find these advantages result in the perfect synchronous propulsion of simple single acting step-by-step indicator dials such as those described in the latter patent, and I enumerate them as follows:—

The weighted lever is let down by the pendulum with a clear and steady move-

ment straight into contact with the contact screw P in the tail of the armature D at a fairly rapid rate but not too rapid so as to cause it to bounce, chatter or vibrate, whereas in the first patent referred to, it approached slowly and in very small steps, with the obvious disadvantage that during the second or part of a second immediately preceding contact, the air gap between the two moving members of the switch might be immeasurably small.

The stroke of the weighted lever is considerably increased, with the result that the stroke of the armature and the distance of the travel in company of these two moving parts may also be increased. This gives more control of the duration of the contact and tends to increase it, which is found to be desirable. In the patent above referred to the duration of the contact was mainly dependent upon the time constant of the circuit and the moment of inertia of the two moving members of the switch. The considerable increase or variation of the travel in company provides a third means of controlling the duration of the contact.

The wearing away or burning of the surfaces of the contact which in course of time is found to be troublesome in switches the movement of whose parts has a small amplitude, and to require re-adjustment, will cause little trouble where the amplitude is greatly increased, and such attention will seldom if ever be required.

Any gradual failure of the source of electricity such for instance as the rise of internal resistance and / or drop of voltage of a primary battery will not at once stop the clock nor will it under any circumstances upset the circuit of propelled dials by throwing them out of step. In this respect it is a great improvement upon Fig. 2 of Patent No. 1587 of 1895 which was open to the objection that failing current caused the switch to "chatter". On reference to the drawings it will be observed that when the gravity arm B falls upon the armature at P if the electrical energy developed is insufficient to replace it at once, the pendulum A in its return swing will assist the electro-magnet by raising the gravity arm B for some distance until the armature having approached the poles of the magnet more closely, the energy is sufficient to complete the operation of resetting the weight. It is found in practice that the increased duration of contact resulting from this practically compensates for the reduced ampere-rate in the circuit of dials, and that the latter will continue to work perfectly. At the same time every instrument in the circuit performs the function of a battery indicator and gives warning of impending failure by the long duration of contact.

Another important advantage which this invention is designed to secure is that in the event of the above automatic warnings having been disregarded, with the result that the clock eventually stops, the stoppage does not leave the switch closed as was the case in the patent above referred to, but the battery is saved.

Another advantage of this invention is the convenience with which the circuit of electrically propelled dials may be accelerated or retarded without interference with the pendulum itself. The wheel E being perfectly free may be rotated by hand in a forward direction at any moment thereby advancing the shallow tooth nearer towards the supporting click H; each tooth advancement being equivalent to two seconds in a seconds pendulum and one second in a half seconds pendulum.

If it is desired to accelerate the circuit of electrically propelled dials to the extent of some minutes or hours instead of only a few seconds the eccentric stop F^1 in Fig. 1 is turned so as to raise the pawl F to the level it occupies when riding in the tooth O. The pawl F will then release the gravity arm B and the switch will propel the dials at each complete vibration of the pendulum instead of at each 15th vibration.

To set back the circuit of dials any desired amount the cam F^1 in Figs. 1 and 2 is turned further so as to raise the pawl F entirely out of engagement with wheel E or block N, thus stopping the clock for as long as may be required without touching the pendulum or interfering with it in any way.

Hope-Jones's Improvements in or relating to Electric Clocks.

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. Improved electric clock mechanism comprising a gravity propelling lever normally supported by a spring catch, a releasing wheel operated directly by a pawl on the clock pendulum said wheel constructed to direct the said pawl periodically against the spring catch and release the gravity lever, a spring on said gravity lever adapted to come in contact with the pendulum on the fall of the lever, an electric circuit through a magnet to throw up the gravity lever to its initial position and a dial or dials electrically propelled and operated by the said pendulum, substantially as set forth.

2. In an electric clock mechanism of the kind set forth, the arrangement of parts for producing the electric circuit through the gravity lever, dial circuit, magnets and armature so that the duration of contact at each impulse will be decided by the self-induction, and the eventual stoppage of the clock will be in open circuit, substantially as described.

3. In an electric clock mechanism of the kind set forth the combination and arrangement of parts whereby the duration of the contact between the gravity arm B and the armature D is determined in addition to the influence of the self-induction of the electric circuit and the moment of inertia of the aforesaid moving parts, by the relatively large range of motion in company of the said parts B and D.

4. In an electric clock mechanism of the kind set forth the arrangement of the pendulum A, the gravity arm B, and the armature D so that in the event of the electrical energy developed being insufficient to raise the said gravity arm sooner, the return stroke of the pendulum will assist the action of the current and the increased duration of contact will automatically indicate the impending failure of current, substantially as described.

5. In electrical clock mechanism of the type set forth, the combination with an electrically actuated dial circuit of the pendulum A the leaf spring S, the pawl F, the stop F^1, the gravity lever B the escape wheel E, the check E^2, the support H, the magnets M the armature D, substantially as and for the purpose described and shewn in Figs. 1 and 2 of the accompanying drawings.

6. In combination with apparatus of the kind set forth in Claim 4 the pole pieces M^1 of the electro-magnets and the armature D^1, substantially as described and shewn in Fig. 3 of the accompanying drawings.

7. In combination with an electric clock mechanism of the type set forth, the eccentric stop F^1, substantially as and for the purposes described and illustrated in the drawings.

Dated the 21st day of March 1905.

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Patent Agents for the Applicant.

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HOPE—JONES' Complete Specification.

(1 SHEET)

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

Fig.1

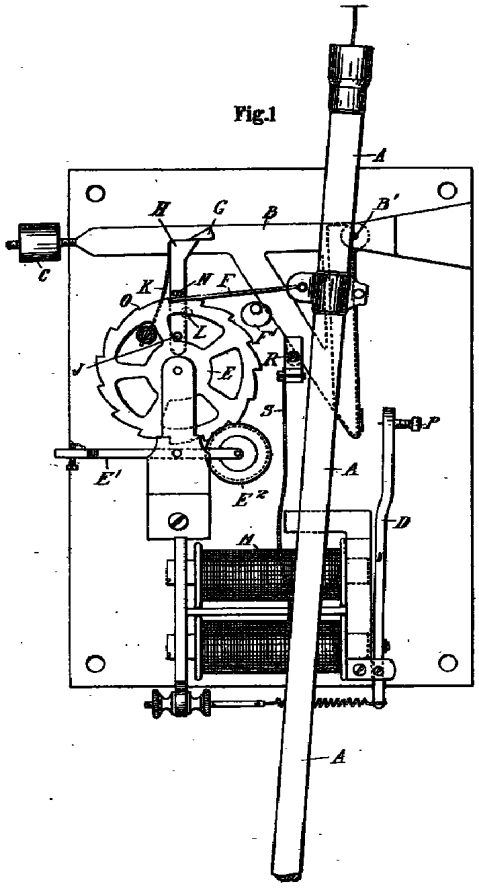


Fig.2

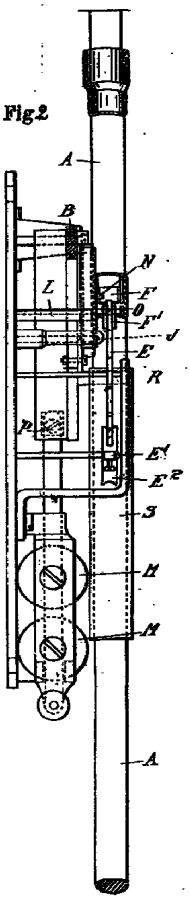
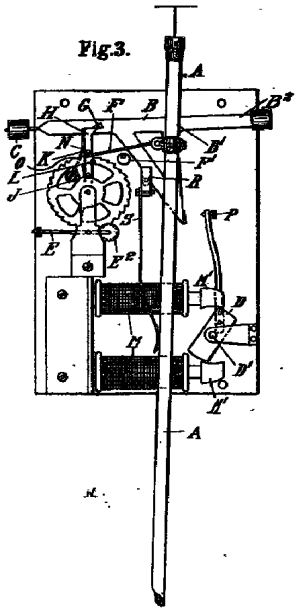
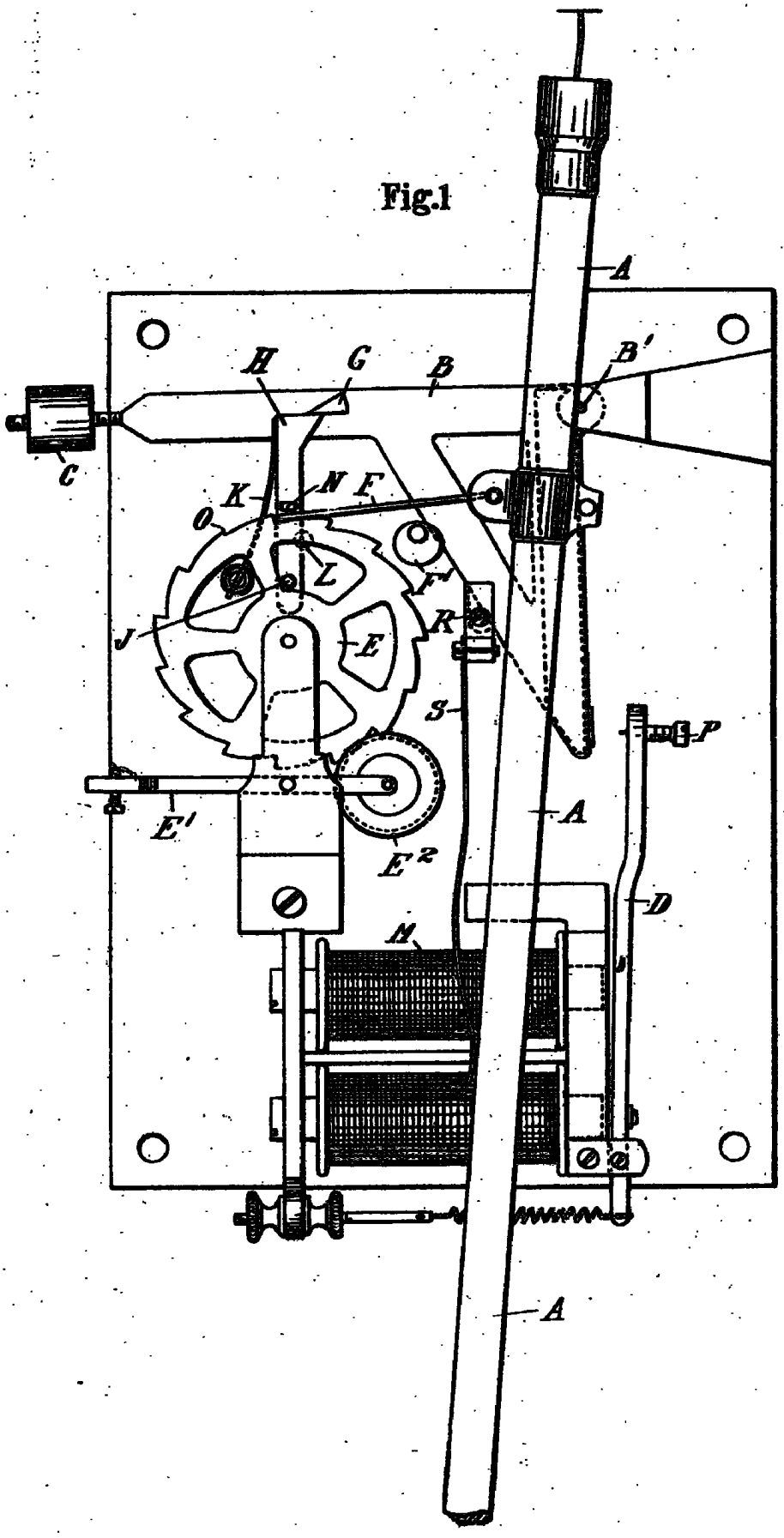


Fig.3.



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

Fig.1



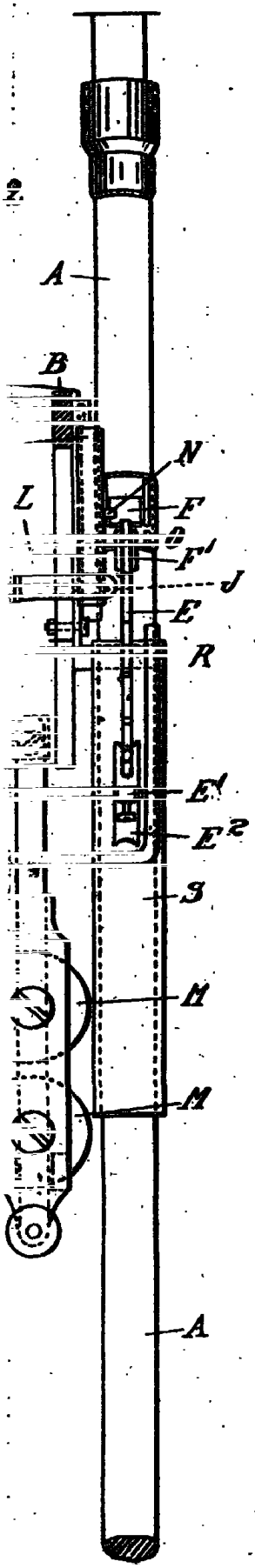
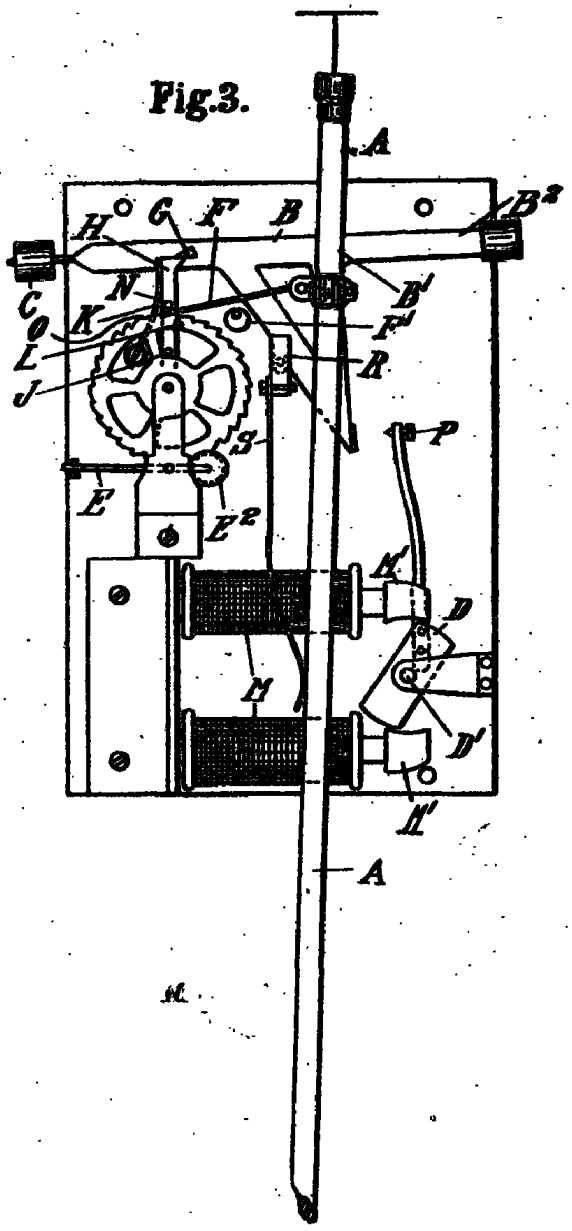


Fig.3.



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