N° 1052 A.D. 1911

(*Under International Convention.*)

Date claimed for Patent under Patents and Designs Act, 1907, being date of first Foreign Application (in France), 18th Jan., 1910

Date of Application (in the United Kingdom), 14th Jan., 1911

At the expiration of twelve months from the date of the first Foreign Application, the provision of Section 91 (3) (a) of the Patents and Designs Act, 1907, as to inspection of Specification, became operative

Accepted, 15th Jan., 1912

COMPLETE SPECIFICATION.

Driving by Friction.

I, CHARLES EDOUARD O'KEENAN, of 132bis, Boulevard Raspail, Paris, France, 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 relates to means for driving by friction clockwork and other mechanisms which may comprise an escapement for ensuring uniformity of motion, of the kind wherein the resulting driving couple cannot exceed a predetermined value, being proportional to the friction and independent of the relative speed of the rubbing parts. It consists in improvements according to which the drive of the motor is transmitted through a brush or brushes which are actuated by the motor and rub on a cylindrical or other surface connected to a spindle to be driven. In the case where an escapement may be employed for controlling the motion of the driven parts, a spiral spring may be interposed between the spindle to be driven and the escapement in order that the latter may be able to operate with a certain amount of elasticity.

The invention may be applied to various apparatus, for example, a clockwork may be driven by a small magneto electric machine, such as that described in British Specification No. 8832/98, supplied for example with current from a dry Leclanché battery. The small motor which consumes only very little current and has a good electrical efficiency, provided that it is constructed to work with a feeble current, will run at a speed which will vary with the E.M.F. of the battery, which E.M.F. is a function of the surrounding temperature and of the degree to which the energy of the battery has diminished. If such a motor were coupled through a train of gearing with clock hands moving over a dial subdivided into hours, the gearing being such that the long hand for example performs one revolution in an hour and the small hand one revolution in twelve hours, it will be found at the end of a comparatively short time, a day for instance, that the clock no longer indicates the time, either because of the variations of the E.M.F. or for other reasons. In fact the least variation of the E.M.F. entails a large relative variation of the time, for a variation of 1 *per cent.* in the speed of the motor means an error of about 15 minutes per day which is too much for a clock.

[*Price* 8*d.*]

If on the other hand the motor is coupled with an ordinary clock escapement, such as a balance wheel escapement or a pendulum escapement through a driving mechanism constructed according to this invention, the clock will be strictly independent of the variations of the E.M.F. of the battery and may continue to go indefinitely without attention provided that the battery can supply the energy for a mean speed of rotation always above a certain critical speed.

The invention will be described with reference to the accompanying drawings in which Fig. 1 is a plan of part of a clockwork in which the operating system according to the invention is adopted, Fig. 2 is an end view of part of the mechanism. Fig. 3 is a detail view of the brush drawn to an enlarged scale, Fig. 4 is an elevation of a mechanism for driving a marine chronometer. Fig. 5 is a plan of a modified mechanism for driving a clock. Fig. 6 is an elevation of a quantity meter to which the invention may be applied.

Referring to Figs. 1—3, *a* is a pinion free on a spindle *b* and driven directly by a worm *c* mounted on the shaft of the motor, which is not shown in the drawings. This pinion does not drive the spindle *b* directly, but through two small metal brushes *d*, d^1 which are rigidly connected with the pinion by metal rods *e*, e^1. These brushes bear with the necessary pressure upon a small cylinder *f*, highly polished and made of metal or not, which is fixed to the spindle *b*. The brushes and the cylinder constitute the driving mechanism.

The brushes, driven by the pinion *a*, rub against the cylinder *f* and tend to drive it and therefore also the spindle to which the cylinder is fixed in the direction of their movement of rotation. The spindle *b* carries, keyed to it, a curved metal rod *g* to which is fixed the end of a small spiral spring *h*, the other end of which is fixed to a pinion *i* free on the spindle. Pinion *i* is engaged by an escapement, which may be a balance wheel escapement or a pendulum escapement, through the intermediary of a wheel *j*; the escapement is not shown in the drawing.

When pinion *a* turns, the cylinder *f*, spindle *b* and rod *g*, are turned by the friction of brushes *d*, d^1 on cylinder *f*; the spring *h* winds up and the escapement operates in the ordinary manner, allowing the spindle *b* to turn only at a mean angular speed; if the pinion *a* drives the brushes *d*, d^1 at an angular speed greater than that at which the cylinder *f* can turn as controlled by the escapement, there is simply a relative sliding movement between the brushes *d*, d^1 and the cylinder *f*.

The friction between the brushes and the cylinder is, as is known, independent of the relative speeds of the rubbing parts; this friction therefore gives rise to a driving couple which is constant in spite of any possible variation of the speed of pinion *a* above the critical speed, and consequently spring *h* operates at a constant mean tension. The amplitude of the oscillations of the balance wheel or pendulum, being a function of the driving couple, and therefore of the driving friction of the brushes, it is always possible, by adjusting the pressure of the brushes upon the cylinder *f*, to obtain the desired amplitude, so that the escapement operates under the best conditions indicated by theoretical considerations.

Since the spindle *b* turns, as already stated, at a constant mean speed controlled by the escapement, it is clear that the clock hands moving over a dial constructed for the purpose may be arranged so as to indicate the time, if the train of gearing connecting the spindle with the hands is suitably selected. It is only necessary that the friction of the brushes should produce a suitable couple, and that the brushes should be driven at an angular speed equal to or greater than that desired for the cylinder *f* and the spindle *b*, which is the critical speed. Instead of two or more brushes, a single brush may suffice; the only disadvantage would be that the pressure due to the brush would not be balanced by the pressure due to another brush, so that there would be a slight additional and useless friction on the bearings of the spindle *b*, which however would not be very important.

It is to be noted that in Fig. 1 the spring *h* plays a part analogous to that of the air reservoir in a fire engine, that is to say, it gives a certain elasticity to the system during the arrests of the escapement when this does not operate continuously, as is the case with escape wheels and pendulums. But even in this case the spring *h* is not indispensible, although generally the pressure of the spring diminishes to a certain degree the consumption of energy necessary for driving a given clock-work, by giving it greater elasticity, so that it is preferable to use the spring.

When the escapement is one operating continuously, as is the case with a fan wheel, or better with a disc or cylinder of copper or constant moving in a powerful magnetic fluid, the spring *h* is not generally necessary.

By means of a drive identical with that already described one can wind up a spring barrel which may serve, for example, to actuate an ordinary clock striking mechanism.

In this case, when the spring barrel is unwound, the motor, through the brushes *d*, *d*¹ and the cylinder *f*, winds up the spring by degrees, without any sliding of the brushes; after a certain time, however, when the spring is sufficiently wound up for the purpose in question (which may be adjusted by suitable pressure on the brushes *d*, *d*¹ and by an appropriate train of gearing) the counter force of the spring balances the friction of the brushes and thenceforth the increase of the tension of the spring ceases and the brushes slide on the cylinder until the spring has become unwound again, for instance when the clock has struck a certain number of times; thereupon the spring winds up again by the amount necessary to recover its lost energy, whereafter sliding begins once more until the next release of the striking mechanism. In order that the rewinding of the spring may occur under economical conditions from the point of view of energy expended, it obviously suffices to provide a mean daily speed for re-winding the spring which only exceeds the mean daily speed of unwinding of the spring by a suitable amount, which may allow for the slowing up due to the drop of the E.M.F. of the battery at the end of a certain time.

This mode of driving may be applied to chronometers as well as to clocks, the wheel work and the friction cylinder being generally smaller. It will be useless, therefore, to give fuller details as to chronometers, since the mechanism just described as applicable to clocks is equally applicable to chronometers.

The case may be considered, however, of a ship's chronometer, the mechanism for which is represented in Fig. 4. Here a spring barrel A wound up by hand acts as the motor and through suitable gearing drives the brushes *d*, *d*¹, the cylinder *f* and, through the spindle *b*, the clock-work of the chronometer. The unwinding of the spring barrel is controlled by means of a disc *n* or of a copper cylinder moving in a magnetic field, the spindle of the disc being mechanically connected with the spring barrel A by a suitable train of gearing *p*. The variations of the speed of this brake disc *n* which occur as the spring barrel unwinds, do not matter provided that the angular speed of the brushes is always above the critical speed.

Fig. 5 shows another application of the invention, a mechanism for driving a clock. It shows a spring *h* fixed rigidly at one end to the spindle *b* by means of a nut *k* held by a lock nut *l*, and at the other end to a brush *m*. This brush *m* rubs against the wheel *a*, the function of which is similar to that of the cylinder *f* in Fig. 1. In this construction the elasticity of the single spring *h* supplies the place of the elasticity of the brushes *d*, *d*¹ and of the spring *h* in Fig 1.

It will be obvious that the frictional parts, such as the cylinder, brushes, disc or the like, may turn on vertical or inclined axes in cases where such an axis is more advantageous than a horizontal axis.

Referring again to Fig. 1, it is not necessary that the brush carriers *e*, *e*¹

should be fixed directly to the pinion *a*; it suffices that they should be connected rigidly with this pinion whatever may be the mode of connection.

In Fig. 6 the invention is shown as applied to an electricity meter for the purpose of producing a small additional driving couple designed to compensate for injurious friction. The brushes *d*, d^1 rubbing on the cylinder *f* are rotated around the spindle *b* by means of a suitable train of gearing *o*. It is only necessary in this case that the angular speed of the brushes should always be higher than the maximum angular speed of the moving system of the motor in which the disturbing effect of friction is to be corrected.

Motors for use with this frictional coupling may be of any suitable kind. For instead of a small magneto electric motor of the kind referred to above, a dynamo electric motor may be used supplied from an igniting circuit or other circuit; or, if the electric supply is an alternating one, a rotary field motor, a synchronous or an asynchronous motor may be used. Instead of an electric motor a simple spring motor may be used, or indeed any other known kind of motor.

Finally the invention is adapted for transforming very simply any clock, whether controlled by a pendulum escapement or otherwise, which is to be wound periodically, into a clock which will operate automatically and for an indefinite period. It is unnecessary in view of the foregoing description to indicate how such a transformation can be made, the more so because the number of possibilities is very great. Any clock maker acquainted with this invention will be able to transform a clock without difficulty.

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. A frictional driving mechanism of the character referred to, comprising in combination, a motor, a rubbing brush or brushes driven by the said motor, a surface upon which the said brushes bear, and a spindle carrying the said surface, substantially as described.

2. In combination with the mechanism claimed in the preceding claim and which mechanism is correlated with an escapement, a spiral spring interposed between the spindle and the escapement.

Dated this 14th day of January, 1911.

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O'KEENAN'S COMPLETE SPECIFICATION. *(1 SHEET)*

Fig. 1

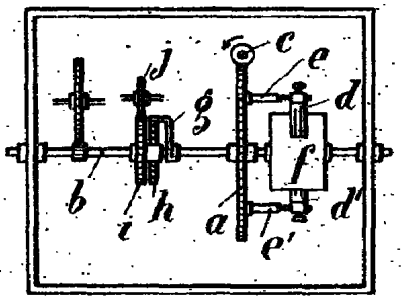


Fig. 2

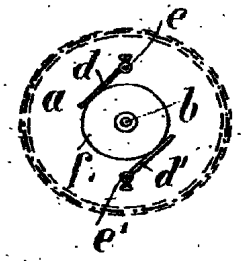


Fig. 3

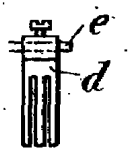


Fig. 5

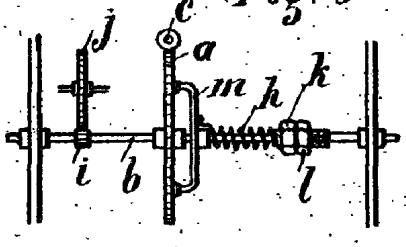


Fig. 4

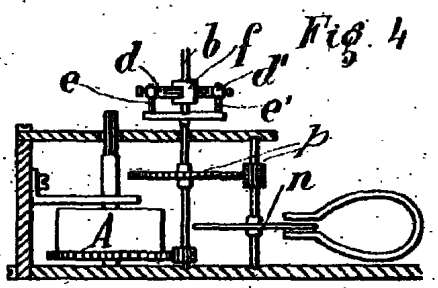
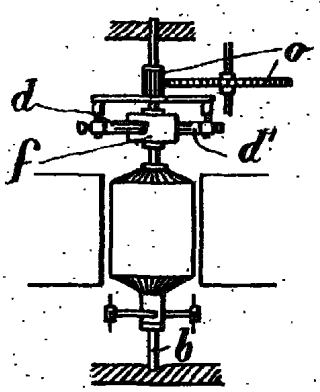


Fig. 6



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