N° 23,570 A.D. 1913

(*Under International Convention.*)

*Date claimed for Patent under Patents and Designs Act, 1907, being date of first Foreign Application (in France),* 25th Oct., 1912

*Date of Application (in the United Kingdom),* 17th Oct., 1913

*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,* 21st May, 1914

COMPLETE SPECIFICATION.

# Improvements in Synchronised Electrically Controlled Clocks.

I, CHARLES EDOUARD O'KEENAN, of 112, 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:—

The invention relates to synchronously working electric clockwork systems wherein an electric master-clock or generator clock fed with continuous current from any suitable source and working uniformly, transforms by induction continuous current into single or polyphase alternating current, which is led to a series of secondary clock devices moving synchronously with the main clock. It consists in improvements according to which the uniformity in the movement of the master-clock is effected by connecting its shaft by means of an elastic coupling, such as a coil or spiral spring, to an escapement device, and the converter is constituted by a permanent magnet forming an inductor with an armature turning in the field of this magnet which armature on one side is fed with continuous current from a battery or other source, while on the other side of the armature alternating current is collected which is transmitted to the secondary clocks, whose fixed inductors are constituted by fixed permanent magnets and a movable armature.

The following description with reference to the accompanying drawings will explain how the improved synchronous clockwork system may be carried out in practice.

Fig. 1 represents, diagrammatically, the master-clock or generator clock also a synchronously moving secondary clock which branches off the line of the alternating current produced by the generator clock.

Fig. 2 shows the arrangement on the continuous current side of the armature of the generator-clock having a three segment commutator.

Fig. 3 shows the arrangement on the simple alternating current side of the same converter.

The generator clock may be constituted by one of the current meters described in Specification No. 8832 of 1898 and comprises an armature $a$ having a drum

[*Price* 8*d*.]

or ring as the winding member and turning around a magnetic core fixed in a magnetic field created by the poles *b*, *c* of a permanent magnet. On the armature shaft is fixed on one side the continuous current commutator of a type, for example, having three segments *d* connected in known manner with the armature winding and on which rub the brushes *p*, *q*, branching from the circuit supplied with continuous current from a battery *e*. In the battery circuit is introduced a resistance *f*, which serves to counter-balance the effect of variations in the electromotive force at the source of current, which force in the case of a battery varies with temperature and time. By varying the resistance *f* the difference of potential between the brushes *p* and *q* can be maintained constant. Since the motive couple transmitted is dependent on the intensity of the current, it can be varied by regulating the intensity. If the electromotive force be constant, by varying the resistance *f* the intensity can be regulated in a manner to maintain it between certain practical limits.

The armature shaft may drive the shaft *u* of an escapement wheel *v* in a manner analogous to that described in British Patent Specification No. 1052 of 1911. The driving means here shown comprise a worm *r* meshing with a toothed pinion *s*, and an elastic member *x* coupling the shaft *u* with a spindle *t* operatively connected with pinion *s*. The mean tension of the spring *x* can be varied at will by varying the regulating resistance *f* or the number of cells in battery *e* thereby varying the intensity; in this way the amplitude of the oscillations of the escapement can be varied in a manner to bring it within the technically indicated limits. As these oscillations remain isochronous as long as they do not exceed certain limits (for example an amplitude of from 0° to 4°, with a pendulum) the intensity can also be varied between corresponding limits without interfering with the isochronism of the oscillations.

Theory and practice show that with this arrangement the armature acquires a mean normal speed which is quite constant; it may be said that the revolutions of the armature are isochronised by the escapement. The angular speed is between limits wherein the escapement oscillations remain isochronous, and so independent of the strength of the current. The armature thus isochronised produces a strictly constant ounter-electromotive force which can serve as the standard.

Opposite the commutator *d* in the case of a monophase converter, are fixed on the armature shaft two rings *g*, *h* which are connected, as is seen in the arrangement in Fig. 3, by the conductors *i*, *j* at two diametrically opposite points to the armature winding *k*. On the rings rub the brushes *l*, *m* connected to conductors *n*, *o* of the feed line.

Between these two rings *g*, *h* the rotatable converter produces an alternating potential the frequency of which is quite constant.

The alternating current produced by the generator is led to the secondary clocks which are branched from the line *n*, *o* and of which one is represented in Fig. 1.

The secondary clock device comprises an armature similar to the armature of the generator but does not comprise a continuous current commutator, its shaft being provided with only two rings $h^1$, $g^1$ on which the receiver brushes $l^1$, $m^1$ rub. The armature, by means of a worm $r^1$ mounted on its shaft, worm wheel $s^1$ and other suitable wheels, actuates without any interposed escapement the hour wheels and the striking mechanism, if any.

The alternating monophase current of absolutely constant frequency produced by means of the master-clock or generator clock as has been described and working with a strictly constant mean speed causes a synchronous working of the secondary clocks by virtue of the properties of the alternating current and without any other escapement organ and the system which is the object of this invention allows a series of electric clocks to be established which keep absolute time provided the controlling clock is itself exact.

The system which has been described furnishes a monophase current; if the converter produces for example a triphase current, in order to avoid dead points and permit of easy starting it is necessary to take off the current from the armature from three points situated 120° apart, to employ three collecting rings both for the converter and the receivers or secondary clocks and to employ three leads for connecting them up; in certain cases, however, these three leads may be reduced to two, when a start has been once made, as practice may direct.

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 a synchronously working electric clock-work system comprising a master clock or generator clock fed with continuous current and generating alternating current, the arrangement wherein the movement of said generator clock is controlled by a pendulum or watch escapement by means of an elastic coupling, such as a spring interposed between the escapement and the shaft of the generator.

2. An electric clockwork system as claimed in Claim 1, in which the generator clock is constituted by an armature turning around a magnetic core fixed in the field of a permanent magnet, the armature being fed on one side with continuous current by a commutator while from its other side alternating current is collected and led to secondary clockwork devices.

3. An electric clockwork system according to Claim 2, in which the secondary clockwork devices comprise each an armature turning around a magnetic core fixed in the field of a permanent magnet and fed through collecting rings with alternating current, the spindle of the armature actuating, by means of suitable gear, the train of wheels and striking mechanism, if any, of a secondary clockwork device.

4. An electric clockwork system according to Claim 1, in which there is disposed in the continuous current circuit feeding the generator clock a supplementary resistance for counterbalancing the effect of variation in current direct variation of potential at the source of the continuous current and for regulating the intensity of the current so as to maintain it within practical limits and consequently for controlling the motive couple transmitted.

Dated this 17th day of October, 1913.

ABEL & IMRAY,
Bank Chambers, Southampton Buildings, London, W.C.,
Agents for the Applicant.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1914.

A.D. 1913. Oct. 17. No. 23,570.

O'KEENAN'S Complete Specification.

( 1 SHEET )

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

Fig. 1.

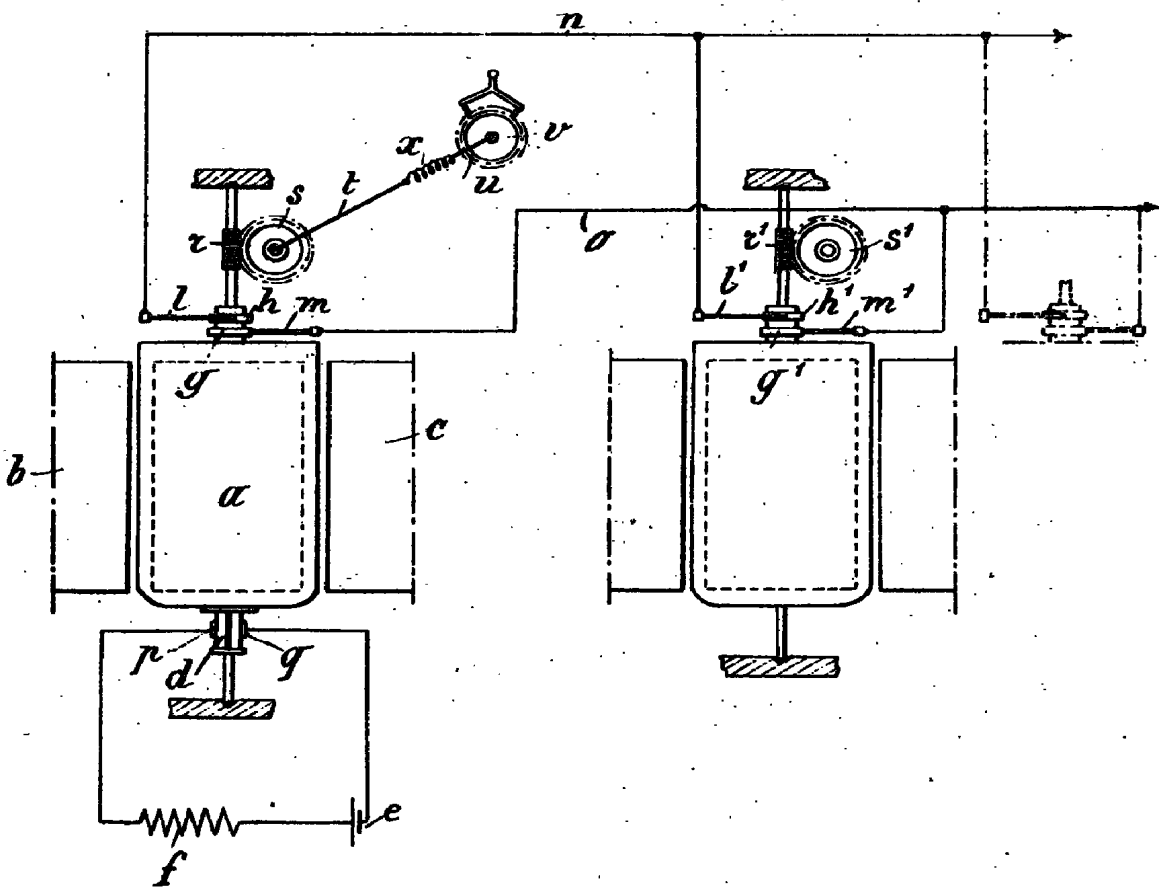



Fig. 2.

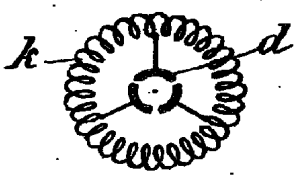
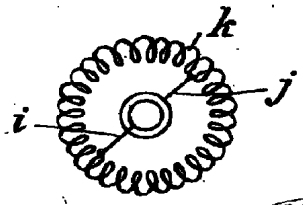



Fig. 3.






Malby & Sons, Photo-Litho.