N° 9675 A.D. 1897

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Complete Specification Left, 11th Jan., 1898—Accepted, 15th Apr., 1898

PROVISIONAL SPECIFICATION.

Improvements in and connected with Electric Clocks.

I, Louis Anatole Auguste Hennequin, of 5, Rue Saint Martin, Compiegne (Oise), in the Republic of France, Electrical Engineer, do hereby declare the nature of this invention to be as follows:—

This invention for improvements in and connected with electric clocks relates to a system of electric timepieces of simple construction in which a primary distributor clock effects the simultaneous working of several receivers and has for its object to provide a distributor and receivers in which the hands and bells are worked in unison, a small quantity of current only being required for the actuation of the several timepieces.

In a distributor clock constructed according to this invention a movement commences at the central axis which controls the escape wheel by the intermediation of another movement as in ordinary clock movements. An electric magnet formed by two bobbins mounted on a metallic plate suitably fixed and held in position in the clock, is provided with a flat armature attached to a flat spring at one end and acting by means of a pawl on the teeth of a ratchet wheel fixed on the central axis. The movement is thus directly actuated by the spring armature. A backward and forward movement of the armature is maintained by a contact of special construction in order to insure regularity of movement of the actuating pawl. A two branch fork fixed to the armature has a conducting arm and an insulating arm between which a contact formed by one arm of an insulated bell crank lever oscillates. The space between the two arms of the contact is equal to the width of a tooth of the ratchet, added to the thickness of the lever contact.

The quantity of electricity used is small, the duration of the current being limited to the speed of attraction of the armature.

The actuating currents flowing an exact number of times per hour the divisions of time are utilised to put in accord the secondary apparatuses or receivers. For this purpose a weight is fitted at the end of a pivoted vibrating lever, moved by a catch fixed to the armature of the electro magnet. When the armature is attracted the lever oscillates and a contact finger comes against an insulated knife momentarily establishing a current which is broken when the armature rises. A spring of ⌈⌈ shape rests and presses on one side on a pin fixed at the end of the other arm of the bell crank lever and with the other end on a pin fixed to an insulating plate, a point at which the bell crank lever is pivoted forms together with the two points on which the ⌈⌈ spring presses, three points for producing instantaneous reciprocations of the fork, the said spring accelerating the motion of the arm when the middle point is on either side of the straight line joining the said three points.

In the striking parts the striking spring is wound by a pinion keyed on the central axis and winds up periodically the same amount as it distends in striking.

[*Price 8d.*]

One end of the spring is fixed to a wheel controlled by the pinion and the other end effects the working of the striking movement.

The bell hammer of the distributor clock carries a contact pin controlling a two branch fork, one branch being insulated and the other a conductor. When the hammer is raised the pin carries the fork by means of the insulated arm but in falling comes against the conducting arm. The fork being connected to one pole and the hammer to the other pole of a battery a current is produced which rings electric vibrating bells at each fall of the hammer such bells being in series or shunt to the circuit and as the hammer after having struck the bell is always arranged so as to rise sufficiently not to disturb the vibrations, the pin is separated far enough from the arm to break the circuit so that the bells only give one stroke although the arrangement of vibrating bells is preserved. A spring exerts a slight pressure on the surface of the two branch fork to ensure the action and prevent the rebound of the fork when the hammer acts.

A special bobbin for avoiding break sparking is used and enables a considerable number of receivers to be fitted in shunt without relays, and also insures a definite duration to the contacts. In constructing the bobbins the wire is wound as in ordinary bobbins but in the course of winding a fine insulated wire from the line is wound at the same time as the ordinary wire. The extremities of the fine wire are connected together after having made at least two rows of turns on the bobbin; the ordinary wire continues and finishes the bobbin. A complete insulated circuit thus exists inside and collects the induction produced by the break extra-current and transforming the static electricity into dynamic electricity thus suppresses the spark.

In constructing the receivers or time meters hereinbefore referred to, a ratchet similar to that of the central clock, having a number of teeth equal to the number of emissions of current by the distributor, controls through gearing, an anchor which is moved by the pressure of the flat spring of the armature of a motor similar to that of the distributor, the armature being separated from the magnets by the space of one tooth of the ratchet and being kept at this distance by a stop pin. When the distributor weight sends a current the armature is attracted, the catch takes a tooth in the ratchet, the contact being then broken by the distributor the armature is freed and forces forward the movement and gives a step to the escapement anchor which moderates the speed. This arrangement avoids the sharp shocks and double jumps of the hands as in ordinary receivers.

When an electrical apparatus has to remain a certain time in operation the armature in contact with the electro magnet may remain adhering thereto a longer or shorter time with a current reduced to one fifth of its strength and an output varying in the same proportion by the following arrangement. A short resistance is attached at one end to the magnet and at the other to a wire from the battery. On passing a current through the magnet little goes through the resistance which is in shunt on two points of the circuit, all the force remaining with the magnet to attract the armature but when the armature touches the magnet the contact being broken the current is obliged to pass through the resistance, causing the armature to still adhere to the magnet.

The resistance may be used with any kind of contact provided that it ceases when the armature is about to touch the magnets so as to force the current through the resistance. In order to enable electrical contacts in connection with the clocks hereinbefore described to effect calls, produce the revolution of discs and give indications which can be repeated periodically; a toothed wheel makes one turn in 24 hours each tooth being displaced in five minutes and corresponding to a particular time in the day. The wheel is situated at the back of one of the receiver movements and actuated by a pinion fixed on the central axis of the movement. A horse shoe shaped piece of brass wire may be fixed between two teeth of the toothed wheel to raise a trailing catch at intervals, which otherwise falls between the teeth, and force an insulated conducting strip into a position where it may come against a small metallic finger on the axis of the receiver escapement wheel

making one turn in five minutes, and complete the circuit of a battery to give a signal as desired.

Dated this 15th day of April 1897.

WHEATLEY & MACKENZIE,
40, Chancery Lane, London, W.C., Agents.

COMPLETE SPECIFICATION.

Improvements in and connected with Electric Clocks.

I, LOUIS ANATOLE AUGUSTE HENNEQUIN, of 5, Rue Saint Martin, Compiegne (Oise), in the Republic of France, 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 for improvements in and connected with electric clocks relates to a system of electric timepieces of simple construction in which a primary distributor clock effects the simultaneous working of several receivers and has for its object to provide a distributor and receivers in which the hands and bells are worked in unison, a small quantity of current only being required for the actuation of the several timepieces.

In a distributor clock constructed according to this invention a movement commences at the central axis which controls the escape wheel by the intermediation of another movement as in ordinary clock movements. An electric magnet formed by two bobbins mounted on a metallic plate suitably fixed and held in position in the clock, is provided with a flat armature attached to a flat spring at one end and acting by means of a pawl on the teeth of a ratchet wheel fixed on the central axis. The movement is thus directly actuated by the spring armature. A backward and forward movement of the armature is maintained by a contact of special construction in order to insure regularity of movement of the actuating pawl. A two branch fork fixed to the armature has a conducting arm and an insulating arm between which a contact formed by one arm of an insulated bell crank lever oscillates. The space between the two arms of the contact is equal to the width of a tooth of the ratchet, added to the thickness of the lever contact.

A spring of special shape rests and presses on one side on a pin fixed at the end of the other arm of the bell crank lever and with the other end on a pin fixed to an insulating plate, a point at which the bell crank lever is pivoted forms together with the two points on which the spring presses, three points for producing instantaneous reciprocations of the fork, the said spring accelerating the motion of the arm when the middle point is on either side of the straight line joining the said three points.

The quantity of electricity used is small, the duration of the current being limited to the speed of attraction of the armature.

The actuating currents flowing an exact number of times per hour the divisions of time are utilised to put in accord the secondary apparatuses or receivers. For this purpose a weight is fitted at the end of a pivoted vibrating lever, moved by a catch fixed to the armature of the electro magnet. When the armature is attracted the lever oscillates and a contact finger comes against an insulated knife momentarily establishing a current which is broken when the armature rises.

In the striking parts the striking spring is wound by a pinion keyed on the central axis and winds up periodically the same amount as it distends in striking. One end of the spring is fixed to a wheel controlled by the pinion and the other end effects the working of the striking movement.

The bell hammer of the distributor clock carries a contact pin controlling a two branch fork, one branch being insulated and the other a conductor. When the hammer is raised the pin carries the fork by means of the insulated arm but in falling comes against the conducting arm. The fork being connected to one pole and the hammer to the other pole of a battery a current is produced which rings electric vibrating bells at each fall of the hammer such bells being in series or shunt to the circuit and as the hammer after having struck the bell is always arranged so as to rise sufficiently not to disturb the vibrations, the pin is separated far enough from the arm to break the circuit so that the bells only give one stroke although the arrangement of vibrating bells is preserved. A spring exerts a slight pressure on the surface of the two branch fork to ensure the action and prevent the rebound of the fork when the hammer acts.

A special bobbin for avoiding break sparking is used and enables a considerable number of receivers to be fitted in shunt without relays, and also insures a definite duration to the contacts. In constructing the bobbins the wire is wound as in ordinary bobbins but in the course of winding a fine insulating wire from the line is wound at the same time as the ordinary wire. The extremities of the fine wire are connected together after having made at least two rows of turns on the bobbin, the ordinary wire continues and finishes the bobbin. A complete insulated circuit thus exists inside and collects the induction produced by the break extra-current and transforming the static electricity into dynamic electricity thus suppresses the spark.

In constructing the receivers or time meters hereinbefore referred to, a ratchet similar to that of the control clock, having a number of teeth equal to the number of emissions of current by the distributor, controls through gearing, an anchor which is moved by the pressure of the flat spring of the armature of a motor similar to that of the distributor, the armature being separated from the magnets by the space of one tooth of the ratchet and being kept at this distance by a stop pin. When the distributor weight sends a current the armature is attracted, the catch takes a tooth in the ratchet, the contact being then broken by the distributor the armature is freed and forces forward the movement and gives a step to the escapement anchor which moderates the speed. This arrangement avoids the sharp shocks and double jumps of the hands as in ordinary receivers.

When an electrical apparatus has to remain a certain time in operation the armature in contact with the electro magnet may remain adhering thereto a longer or shorter time with a current reduced to one fifth of its strength and an output varying in the same proportion by the following arrangement: A short resistance is attached at one end to the magnet and at the other to a wire from the battery. On passing a current through the magnet little goes through the resistance which is in shunt on two points of the circuit, all the force remaining with the magnet to attract the armature but when the armature touches the magnet the contact being broken the current is obliged to pass through the resistance, causing the armature to still adhere to the magnet. The resistance may be used with any kind of contact provided that it ceases when the armature is about to touch the magnet so as to force the current to pass through the resistance.

In order to enable electrical contacts in connection with the clocks hereinbefore described to effect calls, produce the revolution of discs and give indications which can be repeated periodically; a toothed wheel makes one turn in 24 hours each tooth being displaced in five minutes and corresponding to a particular time in the day. The wheel is situated at the back of one of the receiver movements and actuated by a pinion fixed on the central axis of the movement. A horse shoe shaped piece of brass wire may be fixed between two teeth of the toothed wheel to raise a trailing catch at intervals which otherwise falls between the teeth, and force an insulated conducting strip into a position where it may come against a small metallic finger on the axis of the receiver escapement wheel making one

turn in five minutes, and complete the circuit of a battery to give a signal as desired.

In the accompanying drawings Fig. 1 is an elevation of the mechanism of an electric clock constructed according to this invention. Fig. 2 is an elevation of signalling apparatus fitted to a receiver. Fig. 3 is a detail view, and Fig. 4 is an elevation of mechanism for actuating the striking movement.

The apparatus is composed of a movement which commences at the central axis of ordinary clocks, this axis controls the escape wheel by the intermediation of another movement as in the ordinary clock movements. To replace hand winding and maintain the oscillations of the pendulum an electric motor is fitted to the movement. This motor is constituted by an electro magnet formed by two bobbins U V mounted on a metallic plate S which is attached to the movement on the side piece X by a screw T. The battery is connected to the clock by the wires F^1, G^1. A special contact B is fitted to the motor at Y by means of insulating washers and a flat armature R, actuated by a flat spring Q fixed at one end to the armature and at the other to the motor by two screws Z, acts, by means of a catch O on a ratchet wheel P fixed on the centre axis. An essentially novel arrangement is the actuation of the movement directly by the spring armature R; the arrangements hitherto known having always had for their object to wind a spring either directly or by the assistance of a weight raised at intervals, which does not give currents at fixed times and prejudices the obtaining of a perfect regularity.

To enable the armature to maintain with regularity the working of the movement, that is to say, to actuate the centre axis by the ratchet P by means of the catch O, a backward and forward movement of this armature is produced by the special contact B, a two branch fork fixed at H on the armature has one of its arms C a conductor and the other D an insulator, around B is a coating of silver. The contact square B is pivoted at A, a spring of special shape rests and presses on one side on a pin fixed at F and on another pin fixed at G, it tends always to open out and presses with the other end on the pin G fixed on an insulating plate by horn washers or other insulating materials Y.

The three pivotal points A, F, G produce instantaneous reciprocations of the fork as follows: When the armature is attracted the arm C of the fork forces the contact B round on its pivot A until the point F of the contact is forced out of direct line with the points A, G; the spring E then opens out and forcing the contact B still further brings it against the insulated arm D, breaking the contact with the conducting arm C. When the contact is broken the armature is raised by its spring Q the insulated arm D of the fork being also raised with the armature and carrying with it the contact B which is turned on its pivot until the point F is again in a direct line with the points A G and on this point F being carried slightly further, out of the direct line, the spring E again distends and forces the contact B against the conducting arm C again completing the circuit. At each oscillation of the contact the ratchet P of the movement is advanced one tooth by the pawl or catch O fixed to the armature. In practice the space to be given as play between the two arms C and D must be equal to the width of a tooth of the ratchet plus the thickness of the lever contact B and its silver coating included—such arrangement having been adhered to the contact ceases as soon as the armature touches the magnets. This contact differs essentially from those hitherto used in that instead of destroying the equilibrium of the forces and the resistances, as is produced when the preparatory friction of the said contacts enters into play, it becomes on the contrary softer in proportion as the points A, F, G are brought more into line and as it acts by pressure and not by friction it becomes easy to compensate very exactly for the very small difference of force of the armature spring diminishing in intensity as it distends; thus the motive force, being always equal, gives a perfect regulation. The expenditure of electricity is reduced to its lowest possible quantity, in effect the duration of the current becomes limited to the speed of attraction of the armature and as this attraction operates in the fiftieth part of a second, the current ceases as soon as it

is completely operated and as only one or two currents are produced per minute according as the centre ratchet has 60 or 120 teeth, the rest time of the battery becomes 60 × 50 or 30 × 50 times longer than the time of emission, which reduces the output to 6 watt hours *per annum*, the current strength required being $^1/_2$ amp., the E.M.F. 3 volts and the resistance of the magnets 5 or 10 ohms.

In the striking clock the spring 1, for the striking is rewound by a pinion 2 keyed on the central axis of the movement which while carrying the hands forward winds up the spring periodically by the same amount as it distends when released. The spring 1, of which one end is fixed to a wheel 3 controlled by the pinion 2 and the other end is fitted to the wheel 4 of the striking movement and effects the working of the striking movement each time the release of the hours and half hours permits it. The striking movement is the same as in ordinary clocks.

The currents of the distributor or control clock taking place at a fixed time and an exact number of times per hour, these divisions of time are utilised to put in accord a whole series of secondary apparatuses called receivers. For this purpose a weight L Fig. 1 is fitted at the end of a vibrating lever pivoting at M; this lever is moved by a catch N fixed to the armature R. When the armature R is attracted the lever oscillates and the finger of the contact K meeting the blade J, a current is momentarily established, the weight L falls by gravity and the break is produced. The blade J is insulated and fixed close to the escapement bridge I.

The hammer A^1 of the distributor clock, pivoting in H^1 carries at C^1 a contact pin controlling a two branch fork pivoting at B^1, one branch D^1 is insulated the other E^1 is a conductor; when the hammer is raised the pin C^1 carries the fork by means of the non conducting arm D^1, when the hammer falls the conductor E^1 is brought in contact, the fork which is insulated from the other parts of the clock being connected to one pole of the battery and the hammer to the other pole, a current is produced which can ring electric vibrating bells at each fall of the hammer such bells being in series or shunt to the circuit, and as the hammer after having struck the bell is always arranged as to rise sufficiently not to disturb the vibrations, the pin is separated sufficiently from the arm E^1 to cut the circuit—in this way the bells only give one stroke although the arrangement of vibrating bells is preserved.

On the external rotating surface of the two branch fork of the bell contact, a spring fixed to the plate of the movement exerts a slight pressure to insure the action and prevent the rebound of the fork when the hammer acts.

An automatic resistance which may be inserted in an electric circuit for the purpose of reducing a current which has effected its principal object is arranged as follows:—At T under the screw is fixed one extremity of a resistance wire (if the magnet has 5 ohms resistance for example, the additional resistance may be at least 25 ohms), the other extremity of this wire is fixed at G^1. When the current is sent through the magnet little goes through the resistance, which is in shunt on two points of the circuit, this being due to the difference of this resistance as compared with that of the fraction cut out; all the force therefore remains with the magnet which attracts the armature R; but when this armature touches the magnets the contact ceasing the current is obliged to pass through the resistance. The armature nevertheless continues to adhere, the attractive force having still sufficient power to maintain it, it will therefore be seen that the necessary intensity of a current to release an apparatus may be considerably economised by this arrangement when the useful effect is produced.

The signal arrangement shown in Figs. 2 and 3 enables electrical contacts to effect calls, produce the revolution of discs and give any useful indications which have to be repeated at chosen and periodical moments: A wheel F with a certain number of teeth say 288 makes one turn in 24 hours, each tooth is displaced in five minutes, and corresponds to a particular time in the day. The wheel F situated at the back of a receiver movement is actuated by a pinion E fixed on the centre axis; pins L of brass wire can penetrate in a portion of the toothed part between two teeth; a trailing catch K rests on the teeth. Each time that

the catch K meets one of the pins or pegs L it is raised instead of falling in the space between the teeth; if at this moment a conducting strip R insulated from the body by any suitable insulating material and fixed on the catch in an insulator, is met by a small metallic finger fixed to the axis of the escapement wheel of the receiver making one turn in five minutes, a contact is produced which may complete the circuit of a battery and may give any signals or electrical effects for a period which may be regulated as desired. When the catch falls into the hollow between the teeth, the spring which is subordinated thereto has not sufficient height to be met by the contact finger. The contact may be regulated once for all and continue for the space of a second, half a minute or a minute accordingly as the finger remains for a longer or shorter time pressing on the insulated strip.

It will be understood that the width of the teeth of the pinion E or that part of the teeth running on the wheel F is so regulated that the pins L inserted between the teeth of the wheel F do not come in the path of or obstruct the pinion, thus if the wheel F has a thickness of six millimetres the pinion E is arranged to take up two millimetres and the pins L three millimetres leaving a space one millimetre wide between the pinion and pins.

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 electric clock in which the movement is effected from an electric motor consisting of an electro magnet having a flat armature attached to a spring and acting by means of a pawl on the teeth of a ratchet wheel fixed on the central axis of the clock substantially as described.

2. In electric clocks maintaining the backwards and forwards movement of the armature of the motor by means of a fork having a conducting arm and an insulating arm and a spring for producing instantaneous reciprocation of the fork substantially as described.

3. In electric clocks the means for actuating a series of secondary apparatus or receivers by means of a weighted vibrating lever actuated by the armature of the magnet to make and break contact with an insulated blade substantially as described.

4. The receivers or time meters in connection with electric clocks arranged and constructed substantially as described.

5. In electric clocks the system of unification of bells substantially as described.

6. In electric clocks the bobbin for suppressing break sparking arranged and constructed substantially as described.

7. In electric clocks an automatic resistance for inserting in the electric circuit for reducing a current substantially as described.

8. The signal arrangement for adaptation to receivers arranged and constructed substantially as described.

9. The improvements in and connected with electric clocks substantially as described with reference to the drawings.

Dated this 4th day of January 1898.

WHEATLEY & MACKENZIE,
40, Chancery Lane, London, W.C., Agents.

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HENNEQUIN'S Complete Specification. (1 SHEET.)

FIG. 1.

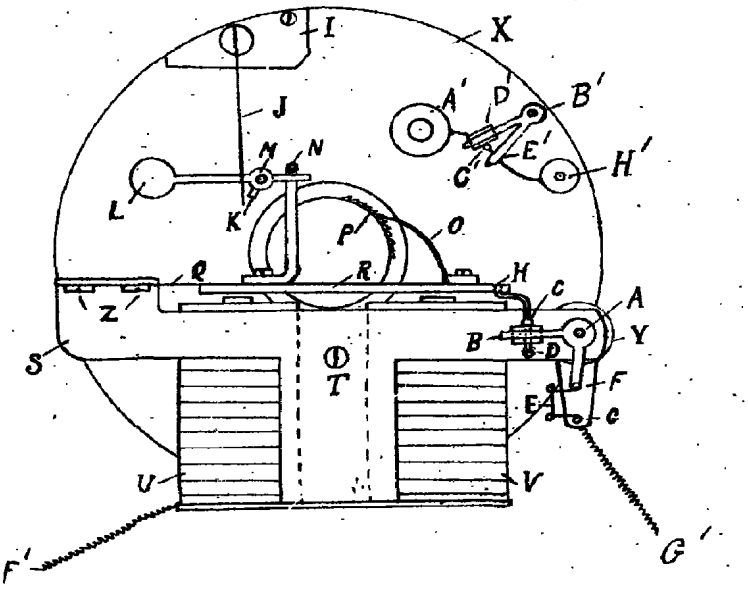


FIG. 2.

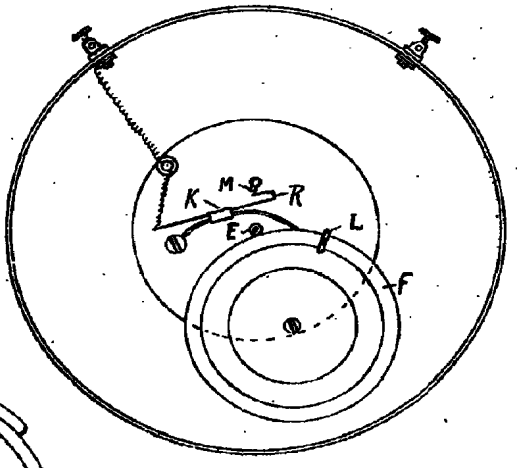


FIG. 4.

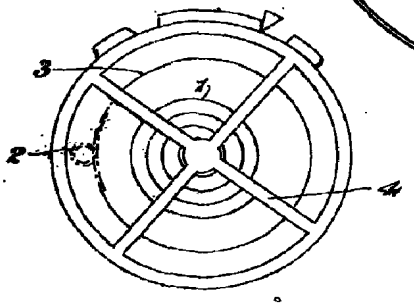
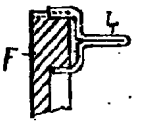


FIG. 3.



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

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