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PROVISIONAL SPECIFICATION.

Improvements in Electric Clocks and Time Pieces.

I ROBERT MANN LOWNE of Ravenscroft, Southend Road, Catford, in the County of Kent, Scientific Instrument Manufacturer do hereby declare the nature of this invention to be as follows.

My invention relates to improvements in automatic electric clocks and time-pieces, and has for its object a practicable and reliable method of utilizing the electric current whether from galvanic batteries, storage cells or line current, for driving pendulums or time beating mechanisms by means of electricity combined electrically or electrically and mechanically with mechanism for indicating or recording time.

In carrying my invention into effect I utilize the electric current in such a manner that it may only pass through the wires in circuit during the exact time of performing the necessary work to drive the pendulum or time beating mechanism and the indicating or recording mechanism thereby exactly balancing the quantity of current used against the work performed without any waste, a condition necessary in order that the batteries or storage cells may keep up their potential for the longest periods of time.

According to my invention I construct an automatic electrical pendulum combined electrically with time indicating mechanism as follows. The pendulum itself may be suspended in the usual manner and may be driven by a fork pivoted in the usual way. According to my invention I attach to this fork by means of a lever projecting from the fork or to the fork itself a rod which I will call the escapement rod, this rod is only attached at one end and in such a manner that it is capable of movement on the fork by means of pivots or pivots and springs or springs only in any convenient way. The other end is left free and is capable of coming in contact with a projection carried by the armature of an electro magnet when such armature is close to the poles. This armature is caused to recede from the electro magnet by means of a spring which is arranged in such a manner that its force increases as nearly as possible directly with the force exerted by the electro magnet upon the armature.

The armature carries a lever which is capable of coming in contact with a movable stop when the armature is nearly in contact with the poles of the electro magnet. This stop slightly presses against the lever of the armature in such a manner that when the armature is close to the poles of the electro magnet, it is held there and is released by the escapement rod coming in contact with the projection carried by the armature.

The pendulum fork lever carries a pin which coming in contact with a spring on the stop causes the stop to move away from the lever of the armature thereby allowing the spring of the armature to act upon the escapement rod which being connected with the lever on the pendulum fork or the pendulum fork itself gives the pendulum an impulse during the action of the armature spring; when this action ceases the pendulum fork continues its motion with the pendulum

[*Price* 8*d*.]

which moves the escapement rod away from the projection on the armature and such escapement rod being free to move on the pendulum fork lever or pendulum fork escapes the projection on its return after the impulse and is free to vibrate with the pendulum without touching the projection until the armature is again drawn towards the electro magnet. I preferably control the freedom of the attached end of the escapement rod by means of a spring but it may be controlled by the force of gravity combined with the movement of the fork, the object of the escapement rod being to give the impulse to the pendulum during the action of the armature spring, and to escape the projection at all times when the armature has receded from the magnet. The path of motion of the projection of the armature I preferably arrange in such a manner that the escapement rod can only come in contact with it when the armature is close to the electro magnet, and the path of motion of the escapement rod I preferably arrange so that it automatically escapes from the projection.

If these paths of motion are not so arranged, levers, inclined planes, stops, springs or any suitable device may be employed for causing the escapement rod to come in contact with and escape from the projection, the object always being to impart the power of the armature spring to the pendulum in order to give it its impulse and to leave the pendulum free at all other times.

Instead of using the escapement I have just described I may use any ordinary escapement; in such case I cause the power of the armature to wind up any suitable mechanism in any convenient manner for working an escapement of any kind for beating time.

I will now immediately explain the electrical and mechanical combinations which according to my invention I employ for causing this armature to work in combination with a time indicating mechanism. I construct an arrangement for making electrical contact as follows which I will call the transmitter. In this transmitter I employ a cylindrical axle which I cause in any convenient manner to revolve by the vibrations of the pendulum or escapement, this axle is cut half away or formed like half a cylinder and arranged close to it are two metallic springs or levers which press on the cylindrical part of the axle in such a manner that when the axle revolves each spring or lever is separately released at half its revolution and passes through the cut away part of the axle on to an electrically insulated metallic conductor; there are two of these insulated metallic conductors, one to each spring or lever.

In the time indicating mechanism I arrange two electro magnets; one end of the coils of each magnet is electrically connected with the electrically insulated metallic conductors of the transmitter, each magnet being connected to one conductor; the other end of each magnet is electrically connected to insulated springs or contact breaking pieces in such a manner that an armature which I place between the magnets and is operated by each of them, always breaks the electrical contact with the magnet approached and makes metallic contact with the magnet from which it has receded. The transmitter makes electrical contact first with one of the indicator magnets and then with the other but never breaks electrical contact. The electrical continuity is made in any convenient way from the transmitter metallic springs or levers to a metallic conductor which is connected with the indicator armature and which makes the metallic and breaks the electric contact, but in such electric continuity I include the electro magnet of the pendulum or escapement so that whenever the electric current passes through either of the magnets of the indicator the armature of the pendulum or escapement magnet will be drawn on to the poles of such magnet and will remain there until the electrical contact is broken by one or other of the indicator magnets operating the contact breaking pieces. Immediately the electrical contact is broken the pendulum or escapement magnet armature is electrically released and caught by the stop which holds it in position until the escapement rod sets it free as previously described. In order that it may not be possible for the indicator magnets to operate their armature before the pendulum or

escapement magnet operates its armature I make the last mentioned magnet of higher electrical resistance than the former so that the current passing through the two magnets will operate the pendulum or escapement magnet and not the other. Such being the case I attach to the armature of the pendulum or escapement magnet an arrangement for short circuiting the current which immediately causes the indicator magnet to operate its armature and break the electrical contact. The short circuiting is arranged to occur only when the pendulum or escapement magnet has done its work and its armature is close to its poles.

When employing the pendulum for working the transmitter I arrange a lever centered on the pivots of the pendulum fork in such a manner that a pin moving with the fork will lift it and is free to leave it.

This lever is free to move on the pivots of the fork and has attached to it a lightly balanced click which engages in a ratchet wheel attached to the semi-cylindrical axle of the transmitter, and I also arrange a second lightly balanced click which does not move by the pendulum but rests on the ratchet teeth to prevent a backward movement.

These first and second clicks are close together and arranged in such a manner that the first click on leaving the ratchet tooth slides on the second click, thus ensuring against the possibility of its engaging with a wrong tooth of the ratchet wheel.

I also arrange a stop in such a manner that when the first click moves the ratchet wheel the required distance it blocks the click from moving any further by blocking it against the ratchet wheel, this insures the correct movement of the ratchet wheel. When the first click is blocked from moving any further the pin carried by the fork leaves the lever and continues its course with the fork and again lifts the lever on the return beat of the pendulum.

I preferably arrange a spring to counter-balance any unequal weight of the pendulum fork and instead of the usual fork I may employ only one side leaving the pendulum partially free to swing without the fork in one direction.

In order to obtain the greatest power from a magnet I arrange its armature in such a manner that it never entirely leaves the magnet but is always in metallic contact with it and I keep the armature in position by trammels and prevent it from falling off the magnet by means of a spring combined with a knife edge which holds one edge of the armature down upon the magnet but in such a manner that it is perfectly free to recede from it excepting the edge held down; this insures perfect closeness of the armature to the magnet and at the same time saves the necessity of employing axles or springs.

I arrange the mechanical parts of the time indicating mechanism as follows. Connected with the armature of the indicator magnets I arrange a lever which carries a roller or rollers for operating two levers having curved or inclined planes formed thereon, which as nearly as possible correspond to the lines of force of the magnets; these two levers bear upon the roller or rollers on their curved or inclined planes by the force of gravity or by means of springs in such a manner that the roller lever being moved lifts the one and allows the other to drop, the curved or inclined planes being so arranged that the movement of the roller increases the lifting of the lever in a direct proportion to the power exerted on the armature by the magnet. Attached to each of these curved or inclined plane levers is a pawl which engages in the teeth of a ratchet wheel; these pawls each block upon a stop in a similar manner to that described for the transmitter thus blocking the ratchet wheel when the pawl has moved it the required distance; preferably these pawls move the ratchet wheel the distance of one tooth. Each pawl works independently of the other when released by the movement of the roller. To the axle of this ratchet wheel I preferably fix the minute hand of the time indicator; also to this axle I attach the ordinary wheels for carrying and operating the hour hand in the usual way for denoting time on a dial.

It will readily be seen that according to my invention the time indicating mechanism may be removed any distance from the pendulum or escapement and transmitter, also that one pendulum or escapement and transmitter with one time indicating mechanism will run any number of time indicators in shunt or with slight modification in series, or a relay or relays may be operated by any of the time indicators and a separate electrical circuit or circuits employed thereby increasing the number of time indicators to any extent all being controlled by one pendulum or escapement.

In making a time piece according to my invention I may modify the arrangement and operate a train of wheels combined with any escapement by means of a spring which spring I keep wound up by directly coupling it up with the ratchet wheel axle driven by the pawls, such train of wheels carries or operates the transmitter and may or may not carry the hands.

According to my invention in working very large time indicating mechanisms such as would be required for public clocks I may dispense with the ratchet wheel and pawls and use the two magnets and armature operating the contact breaker and work a suitable relay by such armature for introducing a powerful electric current for working a large time indicating mechanism.

Where levers are stopped in their action by curb pins, according to my invention I arrange such curb pins on a plate which is kept in position on a second plate by a friction spring, the first plate being restricted in its action on the second plate in any convenient way, the object being to allow the curb pins to give way when struck by the lever in order to lessen the blow thereby lessening the noise and preventing the lever from rebounding.

Dated this 12th day of December 1901.

HARRIS & MILLS,
23 Southampton Buildings London, W.C.
Agents.

COMPLETE SPECIFICATION.

Improvements in Electric Clocks and Time Pieces.

I, ROBERT MANN LOWNE, of Ravenscroft, Southend Road, Catford, in the County of Kent, Scientific Instrument Manufacturer, 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:—

My invention relates to improvements in automatic electric clocks and timepieces, and has for its object a practicable and reliable method of utilizing the electric current whether from galvanic batteries, storage cells or line current, for driving pendulums or time beating mechanisms by means of electricity combined electrically or electrically and mechanically with mechanism for indicating or recording time.

In carrying my invention into effect I utilize the electric current in such a manner that it may only pass through the wires in circuit during the exact time of performing the necessary work to drive the pendulum or time beating mechanism and the indicating or recording mechanism thereby exactly balancing the quantity of current used against the work performed without any waste, a condition necessary in order that the batteries or storage cells may keep up their potential for the longest periods of time.

In order that my invention may be more clearly understood and readily carried into effect I will describe the same by means of the accompanying drawings in which:—

Fig: 1 is a diagrammatic view of the pendulum or time beating mechanism and

Fig: 2 is a rear elevation of the time indicating mechanism shown connected up to the parts shown in Fig. 1.

Fig: 3 is a diagram to an enlarged scale of the transmitter contact makers.

Fig: 4 is an elevation showing the general arrangement of a clock case for containing the pendulum or time beating mechanism and a time indicating mechanism.

Fig; 5 is a side elevation of the same.

Fig: 6 is a view showing part of a clock case connected up with and operating for sets of time indicating mechanisms.

Fig: 7 shows a method of mounting the curb pins employed in this clock.

The various mechanisms shown in the drawings are merely given as examples.

According to my invention I construct an automatic electrical pendulum combined electrically with time indicating mechanism as follows.

The pendulum u u^1 itself may be suspended in the usual manner and may be driven by a fork a pivoted in the usual way. According to my invention I attach to this fork by means of a lever a^1 projecting from the fork or to the fork itself a rod b which I will call the escapement rod, this rod is only attached at one end and in such a manner that it is capable of movement on the fork by means of pivots b^1 or pivots b^1 and springs b^2 or springs only in any convenient way. The other end is left free and is capable of coming in contact with a projection c carried by the armature c^1 of an electro magnet d when such armature is close to the poles. This armature c^1 is caused to recede from the electro magnet d by means of a spring e which is arranged in such a manner that its force increases as nearly as possible directly with the force exerted by the electro magnet d upon the armature c^1.

The armature carries a lever e^1 which is capable of coming in contact with a movable stop f pivoted at f^1 when the armature c^1 is nearly in contact with the poles of the electro magnet d. This stop f is slightly pressed against the lever e^1 of the armature c^1 in such a manner that when the armature is close to the poles of the electro magnet d it is held there by the stop f passing over the upper face of the end of the lever e^1 and is released when the escapement rod b, coming in contact with the projection c carried by the armature lever e^1, depresses this latter somewhat and frees the movable stop f.

The pendulum fork lever a carries a pin or projection a^2 which coming in contact with a spring f^2 on the movable stop f causes the stop f to move away from the lever e^1 of the armature c^1 thereby allowing the spring e of the armature c^1 to act, through the rod e^2 and projection c, upon the escapement rod b which being connected with the lever a^1 on the pendulum fork a or on the pendulum fork itself gives the pendulum an impulse during the action of the armature spring e; when this action ceases the pendulum fork continues its motion with the pendulum which moves the escapement rod b away from the projection c on the armature lever e^1 and such escapement rod b being free to move on the pendulum fork lever a^1 or pendulum fork a escapes the projection c on its return after the impulse, as the projection c has moved out of the path of the end of the escapement rod b, and is free to vibrate with the pendulum without touching the projection c until the armature c^1 is again drawn towards the electro magnet d. I preferably control the freedom of the attached end of the escapement rod b by means of a spring b^2 but it may be controlled by the force of gravity combined with the movement of the fork a the object of the escapement rod b being to give the impulse to the pendulum during the action of the armature spring e and to escape the projection c at all times when the armature has receded from the magnet d. The path of motion of the projection of the armature I preferably arrange in such a manner that the escapement rod b can only come in contact

with it when the armature is close to the electro magnet, and the path of motion of the escapement rod *b* I preferably arrange so that it automatically escapes from the projection *c*.

If these paths of motion are not so arranged, levers, inclined planes, stops, springs or any suitable device may be employed for causing the escapement rod *b* to come in contact with and escape from the projection *c*, the object always being to impart the power of the armature spring *e* to the pendulum in order to give it its impulse and to leave the pendulum free at all other times.

Instead of using the escapement I have just described I may use any ordinary escapement, in such case I cause the power of the armature to wind up suitable mechanism in any convenient manner for working an escapement of any kind for beating time.

I will now immediately explain the electrical and mechanical combinations which according to my invention I employ for causing this armature c^1 to work in combination with a time indicating mechanism.

I construct an arrangement for making electrical contact as follows which I will call the transmitter *g*. In this transmitter I employ a cylindrical axle at g^1 which I cause in any convenient manner to revolve by the vibrations of the pendulum or escapement, this axle at g^1 is cut half away as shown in Fig. 3 or formed like half a cylinder and arranged close to it are two metallic springs g^2 g^2 Figs 1 and 3 or levers which press on the cylindrical part of the axle g^1 in such a manner that when the axle revolves each spring or lever g^2 is separately released at half its revolution and passes through the cut away part of the axle on to an electrically insulated metallic conductor g^3 or g^4, one to each spring or lever g^2.

In the time indicating mechanism shown at Fig: 2 I arrange two electro magnets h h^1 one end of the coils of each magnet being electrically connected with the electrically insulated metallic conductors g^3, g^4 respectively of the transmitter *g* Fig: 1 by wires h^2 h^3: the other end of each of the magnets *h*, h^1 is electrically connected to insulated springs or contact breaking pieces *i*, i^1 in such a manner that an armature *j* which I place between the magnets *h* h^1 and is operated by each of them alternately always breaks the electrical contact with the magnet approached and makes metallic contact with the magnet from which it has receded.

The transmitter *g* makes electrical contact first with one of the indicator magnets *h* or h^1 and then with the other. It breaks metallic contact but never breaks electrical contact. The electrical continuity is made in any convenient way from the transmitter metallic springs or levers g^2 to a metallic conductor which is connected with the indicator armature *j* and which makes the metallic and breaks the electric contact, but in such electric continuity I include the electro magnet *d* Fig: 1 of the pendulum or escapement so that whenever the electric current passes through either of the magnets *h*, h^1, Fig: 2, of the indicator the armature c^1, Fig; 1 of the pendulum or escapement magnet *d* will be drawn on to the poles of such magnet and will remain there until the electrical contact is broken by one or other of the indicator magnets *h*, h^1 Fig: 2 operating by means of the armatures *j* and rod *r* the contact breaking pieces *i*. i^1.

Immediately the electrical contact is broken the pendulum or escapement magnet armature c^1 is electrically released and caught by the stop *f* Fig: 1 which holds it in position until the escapement rod *b* sets it free as previously described. In order that it may not be possible for the indicator magnets *h*, h^1, Fig: 2 to operate their armature *j* before the pendulum or escapement magnet *d* operates its armature c^1 I make the last mentioned magnet *d* of higher electrical resistance than the former so that the current passing through the two magnets will operate the pendulum or escapement magnet *d* and not the other. Such being the case I attach to the armature c^1 Fig: 1 of the pendulum or escapement magnet *d* an arrangement *k*, k^1, k^2 for short circuiting the current which, electrically

cutting out the magnet *d* Fig: 1, immediately causes the indicator magnet *h* or h^1 to operate its armature *j* and break the electrical contact.

The short circuiting is arranged to occur only when the pendulum or escapement magnet *d* Fig: 1 has done its work and its armature c^1 is close to its poles.

When employing the pendulum for working the transmitter I arrange a lever *l* Fig: 1 centered on the pivots of the pendulum fork *a* in such a manner that a pin or lever l^1 Fig: 1 moving with the fork will lift it and is free to leave it.

This lever *l* is free to move on the pivots of the fork *a* and has attached to it a lightly balanced click l^2 Fig: 1 which engages in a ratchet wheel *m* attached to the semi-cylindrical axle g^1 of the transmitter *g*. The weight of the lever *l* and its click l^2 actuate the ratchet wheel *m*. I also arrange a second lightly balanced click l^3 which does not move by the pendulum but rests on the ratchet teeth to prevent a backward movement. These first and second clicks l^2 l^3 are close together and arranged in such a manner that the first click l^2 on leaving the ratchet tooth slides on the second click l^3, thus ensuring against the possibility of its engaging with a wrong tooth of the ratchet wheel *m*

I also arrange a stop *n* in such a manner that when the first click l^2 moves the ratchet wheel *m* the required distance it blocks the click l^2 from moving any further by blocking it against the ratchet wheel *m* and this insures the correct movement of the ratchet wheel. When the first click l^2 is blocked from moving any further the pin or lever l^1 carried by the fork *a* leaves the lever *l* and continues its course with the fork and again lifts the lever *l* on the return beat of the pendulum.

I preferably arrange a spring (not shown in the drawings) to counterbalance any unequal weight of the pendulum fork and instead of the usual fork a^3 a^4 I may employ only one side a^3 leaving the pendulum partially free to swing without the fork in one direction.

In order to obtain the greatest power from the magnet *d* Fig: 1 I arrange its armature c^1 in such a manner that it never entirely leaves the magnet but is always in metallic contact with one pole and I keep the armature in position by trammels c^2 and prevent it from falling off the magnet by means of a spring c^3 carried by the frame combined with a knife edge rod c^4 which holds one edge of the armature down upon the magnet but in such a manner that it is perfectly free to recede from it excepting the edge held down; this insures perfect closeness of the armature c^1 to the magnet *d* and at the same time saves the necessity of employing axles or springs.

I arrange the mechanical parts of the time indicating mechanism Fig: 2 as follows:—Connected with the armature *j* of the indicator magnets *h* h^1 I arrange a lever *o* Fig: 2 which carries a roller or rollers o^1 for operating two levers *p* p^1 having curved or inclined planes formed thereon, which as nearly as possible correspond to the lines of force of the magnets, these two levers *p* p^1 bear upon the roller or rollers o^1 on their curved or inclined planes by the force of gravity or by means of springs in such a manner that the roller lever *o* being moved lifts the one and allows the other to drop, the curved or inclined planes being so arranged that the movement of the roller increases the lifting of the lever in a direct proportion to the power exerted on the armature *j* by the magnet *h* or h^1. Attached to each of these curved or inclined plane levers *p* p^1 is a pawl p^2 p^3 which engages in the teeth of a ratchet wheel *q*: these pawls each block upon a stop p^4 p^5 in a somewhat similar manner to that described for the transmitter thus blocking the ratchet wheel *q* when the pawl has moved it the required distance; preferably these pawls move the ratchet wheel the distance of one tooth.

Each pawl works independently of the other when released by the movement of the roller o^1. The lever *o* is operated by the armature *j* by means of a connecting rod *r* and is kept in position by the equalizing spring r^1. To the axle of this ratchet wheel *q* I preferably fix the minute hand of the time indicator and also to this axle I attach the ordinary wheels for carrying and operating the hour hand in the usual way for denoting the time on a dial.

It will be readily be seen that according to my invention the time indicating mechanism may be removed any distance from the pendulum or escapement and transmitter, also that one pendulum or escapement and transmitter with one time indicating mechanism will run any number of time indicators in shunt or with slight modification in series, or a relay or relays may be operated by any of the time indicators and a separate electrical circuit or circuits employed thereby increasing the number of time indicators to any extent all being controlled by one pendulum or escapement.

In making a time piece according to my invention I may modify the arrangement and operate a train of wheels combined with any escapement by means of a spring which spring I keep wound up by directly coupling it up with the ratchet wheel axle q^1 driven by the pawls p^2 p^3, such train of wheels carries or operates the transmitter and may or may not carry the hands.

According to my invention in working very large time indicating mechanisms such as would be required for public clocks I may dispense with the ratchet wheel q and pawls p^2 p^3 and use the two magnets h h^1 and armature j and work a suitable relay by such armature j for introducing a powerful electric current for working a large time indicating mechanism.

Where levers are stopped in their action by curb pins according to my invention I preferably arrange such curb pins as shown in Fig: 7 on a plate which is kept in position on a second plate by a friction spring, the first plate being restricted in its action on the second plate in any convenient way, the object being to allow the curb pins to give way when struck by the lever in order to lessen the blow thereby lessening the noise and preventing the lever from rebounding.

The electrical connections are as follows:—

The pole s^2 of the battery is connected with one end of the coil of the electro magnet d Fig: 1; the other end of the coil is connected to a screw d^1 which is metallically connected in any convenient manner to the metallic springs g^2, g^3, the continuity is made by whichever of the insulated pieces g^3 g^4 happens to be on. As shown in Fig: 1 the contact is on g^4 connecting the conductor h^2 which leads to one end of the coil of the electro magnet h Fig: 2, the other end of such coil leads to the broken contact between i and i^2, the magnet h having done its work, the armature j having been attracted close to it and metallic contact made between i^1 and i^2.

Before the action of the armature took place the contact would have been between i and i^2 then the circuit would have been completed from s^1 through the conductor s^4 to the battery pole s^3.

When the transmitter insulated metallic conductor g^4 Fig: 1 is disconnected from g^2 and g^3 is connected with g^3 then the conductivity is continuous through h^3 to the electro magnet h^1 and the reverse action of the armature takes place again reversing the contacts i, i^1, i^2 Fig: 2 and this action and reverse action continues to take place as long as the transmitter partly semicylindrical axle g^1 continues to revolve.

Fig: 4 shows the general arrangement of a clock case containing the mechanisms of Figs: 1 and 2 showing two battery cells s s and terminals s^2 t^1 t^2 forming part of the conductors s^2, h^2 and h^3 Figs: 1 and 2

u represents a heavy pendulum bob supported by rod u^1 and spring u^2.

Fig: 5 is a side elevation of Fig: 4 showing side view of dial case v carrying the indicating mechanism shown at Fig: 2.

Fig: 6 shows part of Fig: 4 with the dial and indicating mechanism removed to v^1. The mechanism v^1 carries a relay not shown forming a new electrical circuit operating a second indicating mechanism v^2 similar to Fig: 2.

The relay wires t^3, t^4 and t^5 are tapped by other wires leading to a third indicating mechanism v^3 in parallel or shunt with v^2. In like manner the wires may be again tapped to operate another time indicating mechanism v^4 in parallel with the mechanism v^3. By this system relays may be run from one indicating

mechanism to another or groups in parallel one of which carries a relay for operating a second group and so on to any convenient number of indicators and dials.

In the apparatus above described where a spring or springs is or are employed I may modify the arrangement and employ the force of gravity instead, or where the force of gravity is employed I may use a spring or springs instead.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In an electric time beating mechanism the combination of a pendulum, a pendulum fork, a transmitter operated by said pendulum fork means operated by the transmitter for closing a circuit, an electro magnet in circuit with the transmitter contacts, an armature operated by said electro magnet, means operated by said armature for winding up a spring or weight or deflecting a spring, means for retaining and releasing said armature, means carried by the pendulum fork for receiving an impulse when the spring or weight is released and allowing the pendulum fork to vibrate freely until it receives another impulse and any suitable form of time indicating mechanism operated by the transmitter, substantially as set forth.

2. In an electric clock the combination of a pendulum fork, means operated by said fork for rotating a transmitter, a half cylinder rotated by said transmitter, two springs arranged in close proximity to said half cylinder and operated thereby in circuit with an electro magnet and two other springs arranged close to the first mentioned set of springs with which contact is made alternately for the purpose of energizing an electro magnet for giving an impulse to the pendulum fork and energizing two other electro magnets for operating the time indicating mechanism, substantially as set forth.

3. In an electric clock the combination of a pendulum fork, a pin or projection carried by said fork, a lever pivoted to a fixed part of the apparatus and operated by the said pin or projection, a click or pawl carried by said lever, a check pawl carried by a fixed part of the apparatus a ratchet wheel forming part of the transmitter driven by the first mentioned pawl, and a stop to limit the motion of this latter, substantially as set forth.

4. In an electric clock the combination of a pendulum fork, an escapement rod carried by said fork or a lever thereon, an armature operated by an electro magnet, a spring or weight operated by said armature, a projection carried by said armature which only comes into the path of the escapement rod when the armature is close to the poles of the magnet, means for retaining said armature close to said poles and means operated by the pendulum fork for releasing the same to give an impulse to the pendulum fork, substantially as set forth.

5. In an electric clock, the combination of a pendulum fork, means for operating a transmitter carried by said fork, a transmitter making electrical contact at regular intervals, an electro magnet in circuit with the transmitter for winding up a spring or weight or deflecting a spring which gives an impulse to the pendulum fork, two electro magnets in the same electrical circuit, an armature operating between the poles of the two electro magnets, means operated by said armature for making metallic contact with one of these magnets and breaking it with the other and means operated by said armature for giving motion to time indicating mechanism, substantially as set forth.

6. In an electric clock the combination of a pendulum fork, means for operating a transmitter making electrical contact, an electro magnet in circuit with the transmitter, an armature operated by said electro magnet for winding up a spring or weight or deflecting a spring, means for retaining the armature in close contact with the poles of the magnet, means for short circuiting the magnet immediately the armature is retained, means carried by the pendulum fork or a projection thereon for releasing the armature, and an escapement operated by

the pendulum fork and receiving an impulse when the armature and spring are released, substantially as set forth.

7. In an electric clock, the combination of a pendulum fork, a transmitter operated by said pendulum fork, and electrical contacts operated by the transmitter with an electro magnet in circuit with the said contacts, the armature of which is held in position at one end by means of trammels, a knife edge and a spring in such a manner that the armature is always in metallic contact with one pole of the battery, substantially as herein shown and described.

8. In an electric clock a transmitter for operating two electro magnets in combination with an escapement wound up by said magnets and operating said transmitter, substantially as set forth.

9. In an electric clock a transmitter operated by an escapement wound up by an electro magnet in combination with two electro magnets for alternately making and breaking contact substantially as set forth.

Dated this 12th day of September 1902.

HARRIS & MILLS
23 Southampton Buildings London. W.C.
Agents:—

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1902.

A.D. 1901. Dec 12 N° 25,374.
LOWNES Complete Specification

[1 Sheet.]

Fig:1.

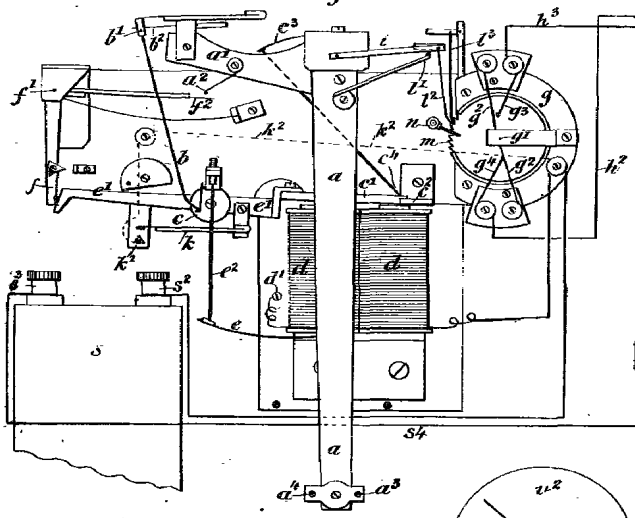


Fig:2.

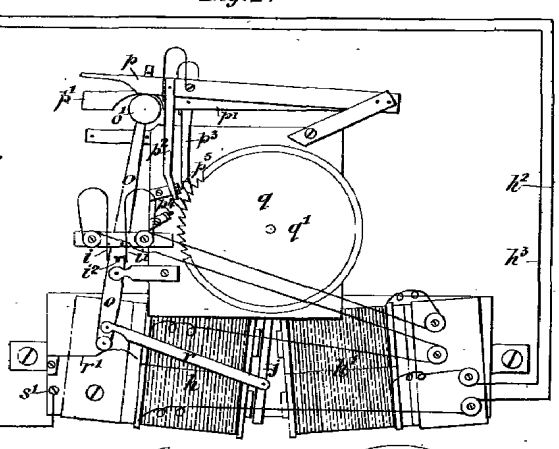


Fig:6.

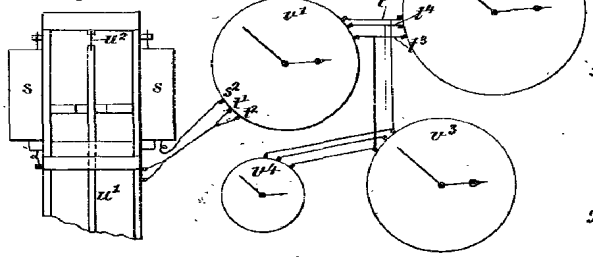


Fig:3.

Fig:5.

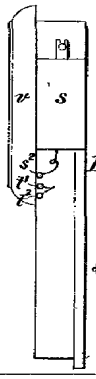


Fig:7.

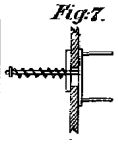
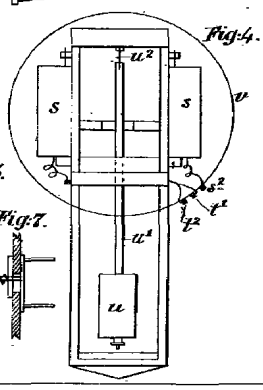
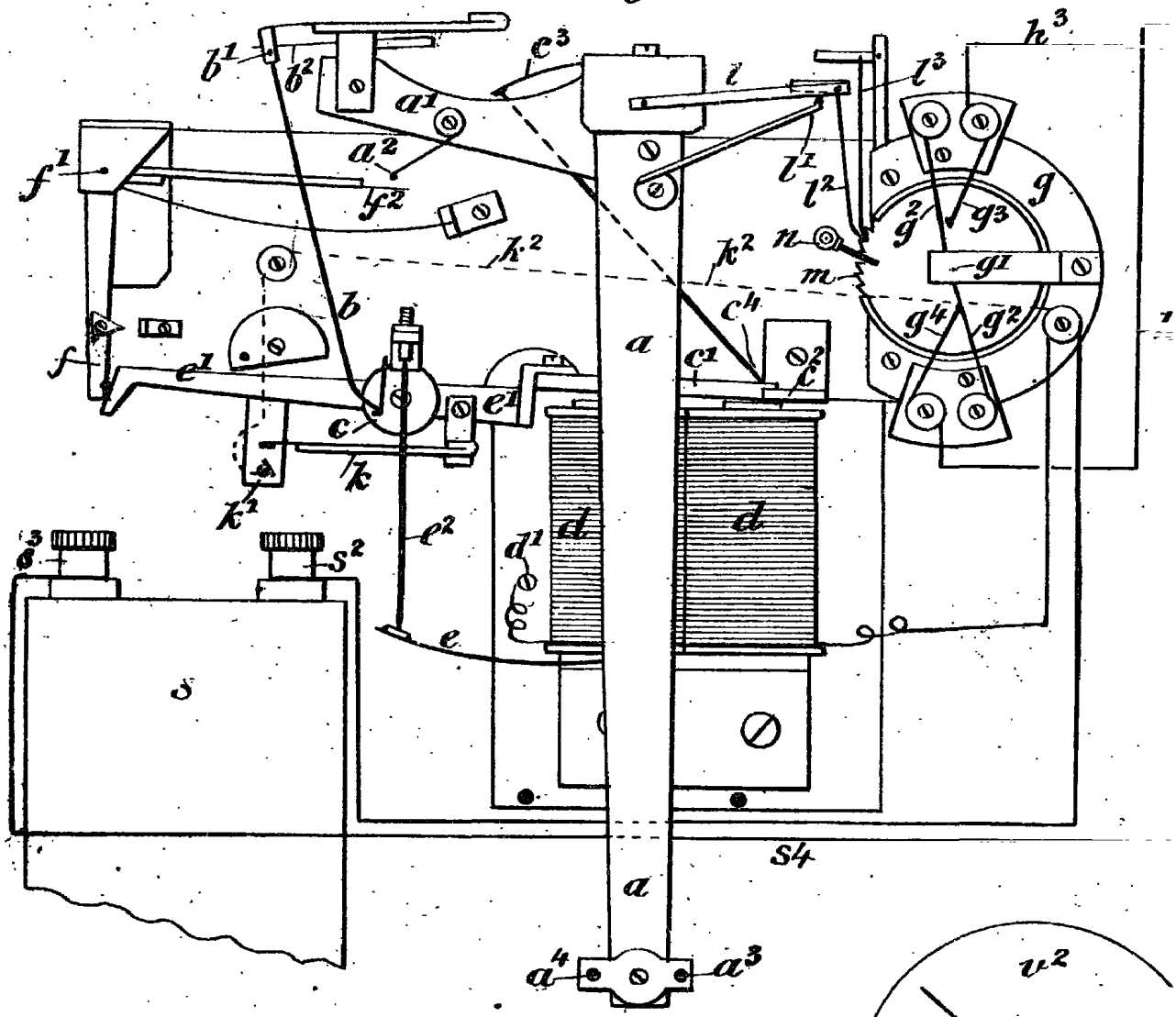


Fig:4.



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

Fig:1.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b2
c3
a1
a2
f1
f2
k2
b
f
e1
c
k
k2
e2
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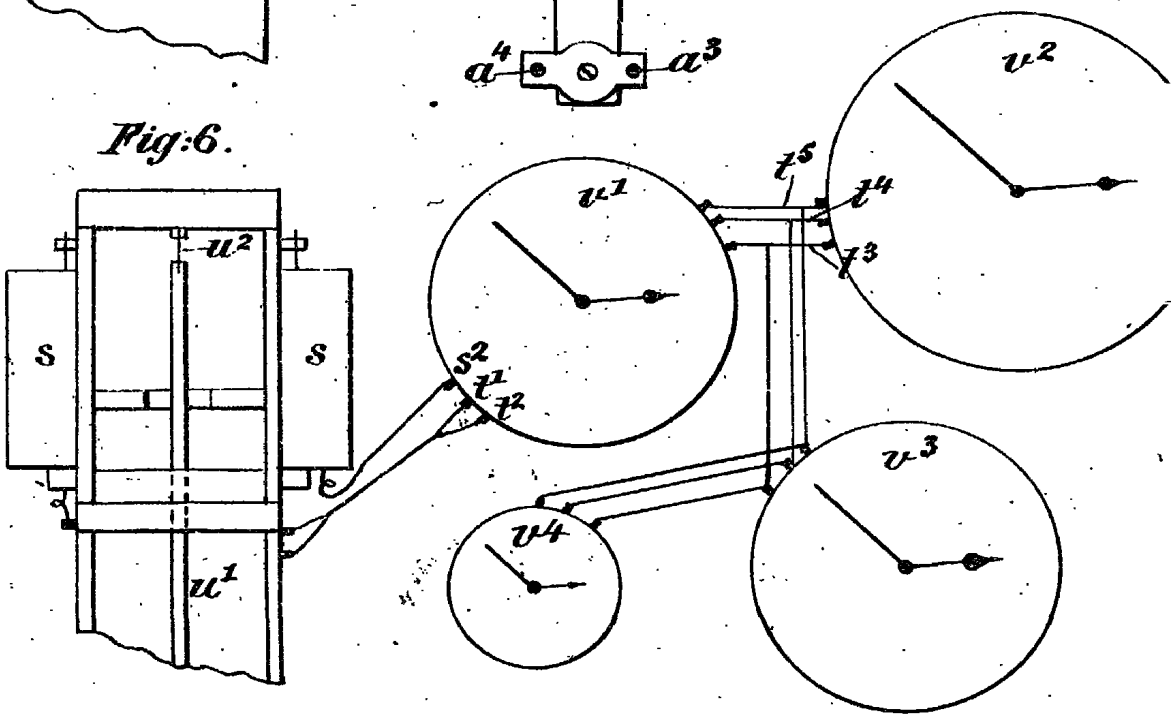
e
s
s2
s3
s4
a
a4
a3
l
l3
l1
l2
h3
g
g2
g3
g1
g4
k2
n
m
c4
c1
c2

Fig:6.


u2
s
s
u1
s2
t1
t2
v1
t5
t4
t3
v2
v3
v4

(1 SHEET)

Fig:2.

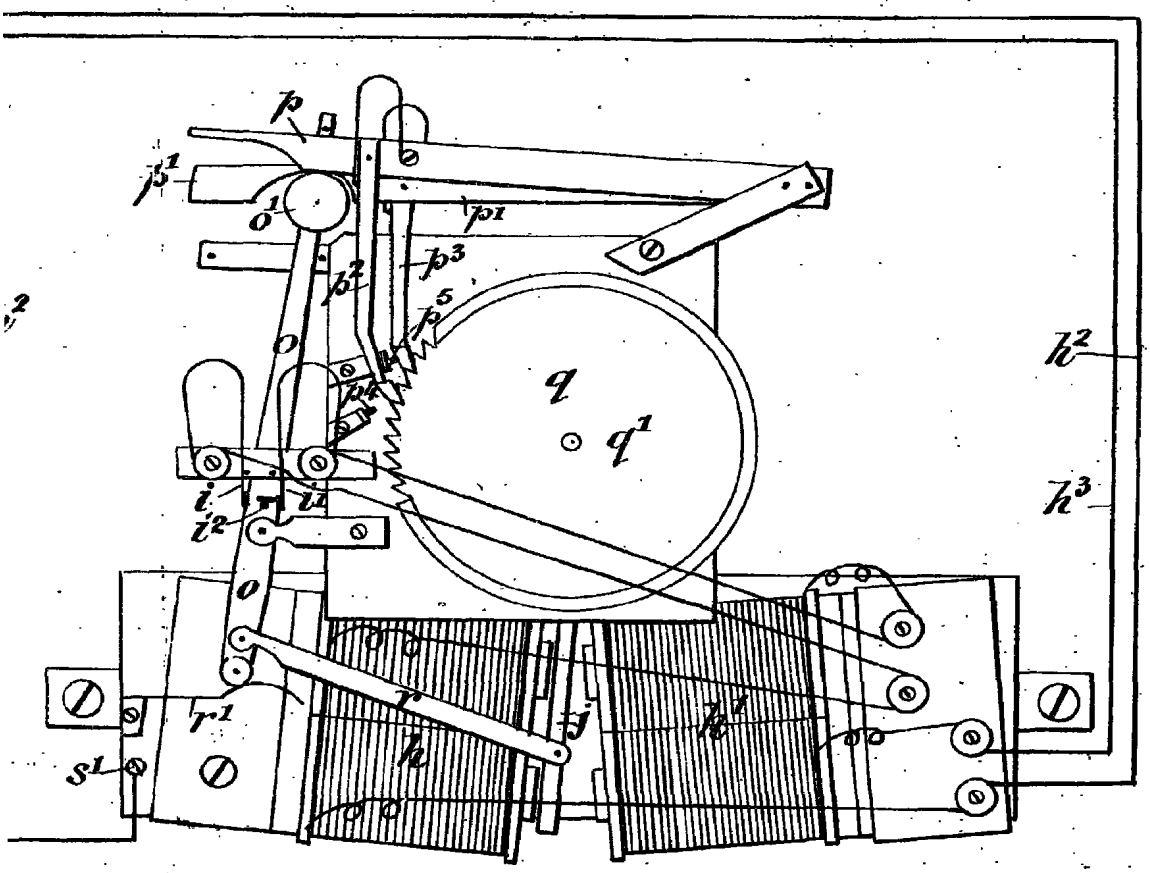
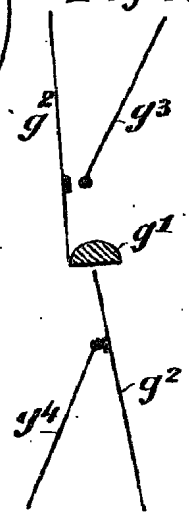


Fig:3.



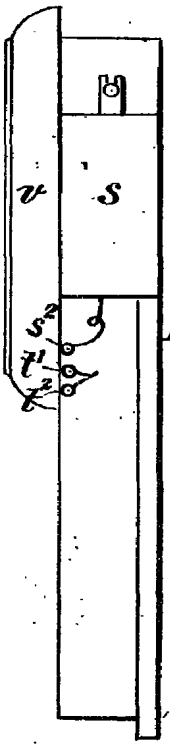


Fig:5.

Fig:7.

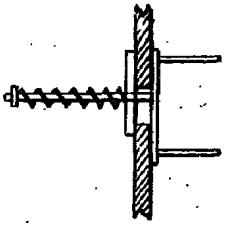


Fig:4.