PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION

Improvements in Electric Clocks

I, FRANK HOPE-JONES, M.I.E.E., F.R.A.S., of 32 & 34, Clerkenwell Road, in the County of London, Electrical Engineer, British Subject, do hereby declare the nature of this invention to be as follows:—

This invention has for its object improvements in electric clocks of the type described in the Specifications of Patents Nos. 1587 of 1895, 6066 of 1905, and 1945 of 1907, and particularly the provision of alternative methods of releasing the gravity lever or switch previously accomplished in those Specifications by a balance wheel escapement or by a pendulum.

Other methods of time measurement requiring neither pendulum nor balance wheel being now available, this invention provides means of applying and combining such methods with systems of electrical impulse dials of the kinds mainly based upon the use of the automatic switch in the Specifications above referred to, and to similar switches containing its peculiar merits.

It is well known that a quartz crystal can be electrically maintained in oscillation at a definite frequency with extraordinary constancy. By heterodyning, the frequency can be reduced and applied to a phonic wheel to produce "the crystal clock".

Low frequency oscillations, produced with or without electro-mechanical interruptions can also be used to obtain rotary motion more or less uniform in speed, and all such may be applied to the hands of a clock. Public supplies of alternating current are now commonly used for that purpose.

The object of this invention is to apply timed rotary motion derived from the above or any such source to release the gravity arms of time switches of the kind described in the Specifications above enumerated, and to substitute one for another automatically in case of failure of either.

The horizontal member of the switch, (which, when used to propel a pendulum is commonly called the gravity arm), normally takes the form of a bell crank lever pivotted at the corner, supported upon a catch and released by a vane on the arbor of a wheel rotated once every half-minute by a pendulum, but in this my invention, the release is accomplished by a synchronous motor, which may in one form, be applied to the same wheel.

It is desirable when the invention takes that form that this wheel should be propelled in steps as heretofore, since the releasing function it has to perform should be accomplished with absolute precision and coincidence relatively to the lowering of the lever gently into contact.

In the Specifications above enumerated, and in other systems of electric clocks of a similar type, the lever or switch arm was lowered by the pendulum itself, and its approach into contact was thus accomplished at a speed which was not quick enough to cause bouncing and yet not so slow as to cause preliminary sparking—the optimum adjustment being dependent upon the position selected for the engagement on the pendulum. According to this my invention, a wheel of a train of wheels driven by the synchronous motor employed to effect the release is placed below the lever and is provided with a cam or other projection upon which the lever falls when it is released from its catch. In one form of this my invention, in which the general design of its predecessors is adopted, this wheel or its cam also carries a pin placed eccentrically to act as a one-leafed pinion which engages the wheel adjacent to it on the arbor of which is carried the vane which discharges the catch normally supporting the lever. The first named wheel is quick moving. If the period of its rotation is once in two seconds, then the adjacent wheel is provided with 15 teeth and will rotate once per half-minute so that its vane will release the catch every 30 seconds. At the moment of release the arm, cam or projection on the quick moving wheel is at the vertical and almost touching the lever or a roller mounted thereon to receive it. The lever falls upon it and falls with it, and if it is a radial arm or projection upon the

wheel it falls at an increasing speed according to the harmonic law, or if a shaped cam is provided the horizontal lever may be made to approach the contact with smooth progressive motion the speed of which can readily be selected, determined and fixed.

By this means, clear indication of impending failure of the battery of the half-minute electrical impulse installation is secured, since if its circuit remains closed owing to the incompetence of the battery to do its work, the arm of the quickly rotating wheel or a cam mounted thereon will assist the switch magnet to replace the lever on to its catch, and the duration of the contact will be increased to an extent dependent upon the selected speed of rotation of the wheel and the contour of the cam.

In the event of "battery warning" being neglected to such an extent that the magnet of the half-minute switch becomes incompetent to replace the lever or arm upon its catch even with the assistance of the synchronous motor, it will be impossible for the half-minute contact to remain in closed circuit, the contour of the cam being so shaped that the switch arm or lever is raised high enough to break its circuit and having been so raised, it will meet with a projection on the cam and stall the motor. It is highly desirable that the motor should be stopped when the battery is incapable of operating the circuit of electrical impulse dials properly.

And should the source of the alternating current applied to the motor fail, then again the half-minute switch cannot remain in closed contact since if its battery is sufficient it will throw up the arm on to its catch and if insufficient, it will be supported by the cam clear of the contact although at a lower level.

And if the source of alternating current fails, a relay is provided in the circuit of the synchronous motor which is normally held in one position by an electro-magnet. This magnet when released will switch on an alternative supply or other means of time measurement.

Dated the 24th day of September, 1935.

FRANK HOPE-JONES.

COMPLETE SPECIFICATION

Improvements in Electric Clocks

I, FRANK HOPE-JONES, M.I.E.E., F.R.A.S., of 32 & 34, Clerkenwell Road, in the County of London, Electrical Engineer, British Subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention has for its object improvements in electric clocks of the type described in the Specifications of Patents Nos. 1587 of 1895, 6066 of 1905, and 1945 of 1907, in which impulses are periodically imparted to a pendulum by a gravity arm or lever which is released periodically by a count wheel and particularly the provision of alternate methods of releasing the gravity lever or switch previously accomplished in those specifications by a balance wheel escapement or by a pendulum.

Other methods of time measurement requiring neither pendulum nor balance wheel being now available, this invention provides means of applying and combining such methods with systems of electrical impulse dials of the kinds mainly based upon the use of the automatic switch in the Specifications above referred to, and to similar switches containing its peculiar merits.

It is well known that a quartz crystal can be electrically maintained in oscillation at a definite frequency with extraordinary constancy. By heterodyning, the frequency can be reduced and applied to a phonic wheel to produce "the quartz crystal clock".

Low frequency oscillations, produced with or without electro-mechanical interruptions can also be used to obtain rotary motion more or less uniform in speed, and all such may be applied to the hands of a clock. Public supplies of alternating current are now commonly used for that purpose.

The object of this invention is to apply timed rotary motion derived from the above current supplies or any such source to release the gravity arm of time switches of the kind described in the Specifications above enumerated, and to substitute one for another automatically in case of failure of either.

The horizontal member of the switch, (which, when used to propel a pendulum is commonly called the gravity arm), normally takes the form of a bell crank lever pivotted at the corner, supported upon a catch and released by a vane on the arbor of a wheel rotated once every

half-minute by a pendulum, but in this my invention, the release is accomplished by a synchronous motor, which may in one form, be applied to the same wheel.

It is desirable when the invention takes that form that this wheel should be propelled in steps as heretofore, since the releasing function it has to perform should be accomplished with absolute precision and coincidence relatively to the lowering of the lever gently into contact.

In the specifications above enumerated, and in other electric clocks of a similar type, the lever or switch arm was lowered by the pendulum itself, and its approach into contact was thus accomplished at a speed which was not quick enough to cause bouncing, and yet not so slow as to cause preliminary sparking—the optimum adjustment being dependent upon the position selected for the engagement on the pendulum. According to this my invention the pendulum is dispensed with and a wheel of a train of wheels driven by the synchronous motor employed to effect the release is placed below the lever and is provided with a cam or other projection upon which the lever falls when it is released from its catch. In one form of this my invention, this wheel or its cam also carries a pin placed eccentrically to act as a one-leafed pinion which engages the wheel adjacent to it on the arbor of which is carried the vane which discharges the catch normally supporting the lever. The first named wheel is quick moving. If the period of its rotation is once in two seconds, then the adjacent wheel is provided with 15 teeth and will rotate once per half-minute so that its vane will release the catch every 30 seconds. At the moment of release an arm, cam or projection on the quick moving wheel is at the vertical and almost touching the lever or a roller mounted thereon to receive it. The lever falls upon it and falls with it, and if it is a radial arm or projection upon the wheel it falls at an increasing speed according to the harmonic law, or if a shaped cam is provided the horizontal lever may be made to approach the contact with smooth progressive motion the speed of which can readily be selected, determined and fixed.

A clear indication of impending failure of the battery of the half-minute electrical impulse installation is secured by increased duration of impulse plainly visible in the master clock and all dials, since if its circuit remains closed owing to the incompetence of the battery to do its work, the arm of the quickly rotating wheel or a cam mounted thereon will assist the switch magnet to replace the lever on to its catch, and the duration of the contact will be increased to an extent dependent upon the selected speed of rotation of the wheel and the contour of the cam.

In the event of "battery warning" being neglected to such an extent that the magnet of the half-minute switch becomes incompetent to replace the lever or arm upon its catch even with the assistance of the synchronous motor, it will be impossible for the half-minute contact to remain in closed circuit, the contour of the cam being so shaped that the switch arm or lever is raised high enough to break its circuit and having been so raised, it will meet with a projection on the cam and stall the motor. It is highly desirable that the motor should be stopped when the battery is incapable of operating the circuit of electrical impulse dials properly.

And should the source of alternating current applied to the motor fail, then again the half-minute switch cannot remain in closed contact since if its battery is sufficient it will throw up the arm on to its catch and if insufficient, it will be supported by the cam clear of the contact although at a lower level.

And if the source of alternating current fails, a relay may be provided in the circuit of the synchronous motor the armature of which is normally held in one position by the winding thereof. This armature when released will switch on an alternative supply or other means of time measurement.

According to this my invention, wherever in electric master clocks or time transmitters a lever requires to be let down periodically upon the armature of an electro-magnet, (which electro-magnet restores it to its original position) the time-spacing, the release and the lowering of the lever are accomplished by a synchronous alternating current motor instead of by a pendulum or balance wheel.

In order that the invention may be more fully understood reference is hereby made to the accompanying drawings in which like letters represent like parts.

Fig. 1 shows an electric time transmitter or master clock of known type with pendulum removed and a synchronous motor substituted for the purpose of releasing the gravity lever and allowing it to fall into contact every half-minute by means of a wheel with 15 teeth and a cam on an intermediate wheel which stalls the motor under certain conditions.

Fig. 2 shows a similar switching device with dial indicating seconds in which the gravity lever is let down by a radial arm

in harmonic motion.

Fig. 3 shows an electric time transmitter of known type in which the release and letting down of the lever is accomplished by a high-speed self-starting synchronous motor of known type.

Fig. 4 shows an electric time transmitter of known type showing how the dials are advanced or retarded and how a counterbalance is used to vary the current rate.

Referring now to Fig. 1. The cranked lever G centred at G^1, normally held up by catch pin K and carrying a roller R, together with the armature A of the electro-magnet M, centred at A^1 and normally resting against stop E, constitutes a switch or electric time transmitter of known make, as commonly used with a pendulum to operate circuits of electrical impulse dials, but now with the pendulum removed. The lever G is adapted to be released and let down at every half-minute upon the armature A by means of a self-starting alternating current synchronous motor, not shown which rotates wheel B centred at B^1 in a clockwise direction at such a speed that it will rotate wheel C to which it is geared, in a counter-clockwise direction once every two seconds. This wheel C is centred at C^1 and carries on the same arbor a cam C^2. The cam C^2 carries a pin C^3 acting as a one-leafed pinion and adapted to pick up one tooth at a time of the 15 tooth wheel D centred at D^1 and provided with a vane F passing through its arbor. A light spring is provided at L to serve as a backstop and to prevent the wheel from flirting forward. The catch K^1 centred at K^2 and normally held against K by a spring, projects at its lower end into the path of the vane F.

The action of the apparatus is as follows:—the rotation of the wheelwork having brought the vane F up into the position shown, the pin C^3 will pick up another tooth of the wheel D and cause the vane F to release the catch K^1 from the pin K. The lever G will then fall and its roller R will rest upon the longest radial of the cam C^2 which is then immediately under it. As C^2 revolves in a counter-clockwise direction, the lever G will continue to fall at a speed designed to enable its lower arm to sail into contact with A at a suitable speed. That was one of the functions performed in former constructions by a pendulum now dispensed with.

It will be observed that if the battery of the series circuit of electrical impulse dials between A and G becomes insufficient to enable the electro-magnet M to throw up lever G and lodge it upon catch pin K, the cam is so shaped that it will assist the magnet M in the raising of the gravity lever G. With that assistance, the magnet will be able to complete the re-setting of the gravity lever G on catch K unless and until its battery ultimately becomes too weak to operate the circuit of electrical impulse dials with certainty. The gravity lever would then remain in closed contact with the armature, which would be unable to re-set it, but the cam is so shaped that it will then lift the gravity arm out of contact with the armature A, and will stall the motor by means of a scallop hook C^5 which will engage roller R, holding the contact open.

Referring now to Fig. 2, instead of cam C^2, a radial arm C^4 is fixed on arbor C^1 of wheel C and this arm carries the roller R immediately underneath the cranked lever G whereby it is let down into contact with A in true harmonic motion.

The wheel D is provided with 60 teeth and the wheel C carries two pins C^3 to act as a two-leafed pinion thereby revolving wheel D once per minute. The vane F may serve as a pointer indicating seconds on the dial D^2 and the switch will be released every minute. Alternatively a separate seconds hand may be provided and a double ended vane used to release the switch every half-minute.

Referring now to Fig. 3, N is a self-starting synchronous motor of known type whose rotor revolves once every cycle and therefore at 3000 r.p.m. on a periodicity of 50 cycles per second. It is geared with any appropriate train to wheel C carrying arm C^4 and roller R mounted thereon. Wheel D centred at D^1 and carrying vane F unlatches catch K once every half-minute and allows gravity lever G of a known type of electric time transmitter to fall in harmonic motion on to its armature A which replaces the gravity lever G on to its catch K.

Referring now to Fig. 4 a synchronous motor operates wheel C and arm C^4 carrying roller R as before. The gravity lever G is partly counterbalanced by the adjustable weight G^2 which enables its moment of inertia to be varied. It also carries a flat steel spring G^3 which is gapped at the left hand end to rest on catch K^1 and is replaced thereon by any suitable form of armature and magnet such as A and M.

The setting forward and backward of the circuit of electrical impulse dials is accomplished by the handle H centred at H^1 which snaps into one of three positions, indicating Retard, Normal and Advance on an engraved plate. When turned to R, the top H^3 of the lever H supports the spring blade G^3 on lever G

and by preventing closure of A and G prevents impulses being sent to the impulse dials. When the lever H is in the central or normal position as shown, it is entirely inoperative, but when turned to A, advance, the bracket H^2 on the right hand side of the upper part of lever H is raised and brings the cranked lever P centred at P^1 on the bracket H^2 into a position in which its top end is to the left of catch K^1 so that it will be tripped by the one-leafed pinion C^3, thereby causing the release of the gravity lever at every revolution of the wheel C revolving once every two seconds, regardless of wheel D and vane F. Thus the circuit can be readily advanced and conveniently retarded for such purposes as the summer-time change of one hour.

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 an electric time transmitter or master clock in which a gravity lever or a switch arm is periodically lowered into contact with an armature of an electro-magnet, and is thereby re-set a synchronous motor adapted to release the said switch arm or lever periodically letting it down into contact substantially as described with reference to Fig. 1.

(2). In an electric master clock or time transmitter as claimed in Claim (1), a cam, rotated by a synchronous motor, so shaped that it will lower the switch lever into contact at the desired speed and will assist the electro-magnet to re-set the lever if its battery is insufficient, and will stall the motor if their combined efforts fail to reset the switch lever substantially as described with reference to Fig. 1.

(3). In an electric master clock or time transmitter as claimed in Claim (1) a wheel rotated by the synchronous motor, said wheel carrying a radial arm and a pin or pins adapted to rotate another wheel in seconds, the said radial arm being adapted to let down the switch lever into contact, and to assist to replace it if called upon to do so substantially as described with reference to Fig. 2.

(4). In an electric master clock or time transmitter as claimed in Claim (1) a wheel rotated by a self-starting synchronous motor, said wheel carrying a radial arm and a pin or pins adapted to rotate another wheel in seconds, the said radial arm being adapted to let down a switch lever into contact and to assist to replace it if called upon to do so substantially as described with reference to Fig. 3.

(5). In an electric master clock or time transmitter as claimed in Claim (1) a wheel rotated by a synchronous motor, said wheel carrying a radial arm and a pin or pins adapted to rotate another wheel in seconds, the said radial arm being adapted to let down a switch lever into contact and to assist to replace it if called upon to do so, a lever capable of movement from normal into two other positions, one to advance the circuit of electrical impulse dials which receive impulses through the switch lever, by causing the switch to operate more frequently, such as two seconds instead of every 30 seconds and one for temporarily stopping them by preventing its operation, substantially as described with reference to Fig. 4.

Dated the 21st day of September, 1936.

F. HOPE-JONES.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1937.

FIG. 1

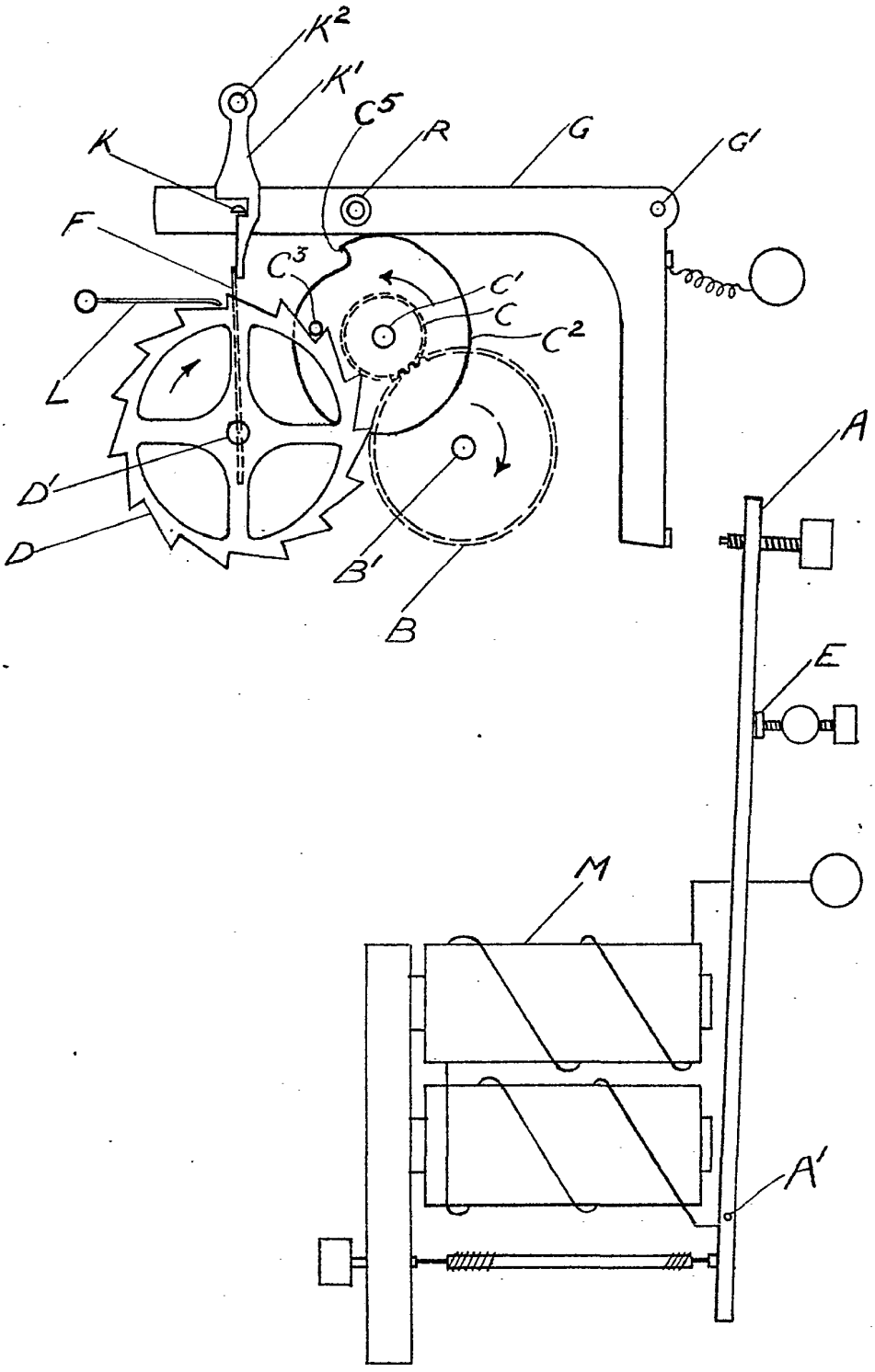
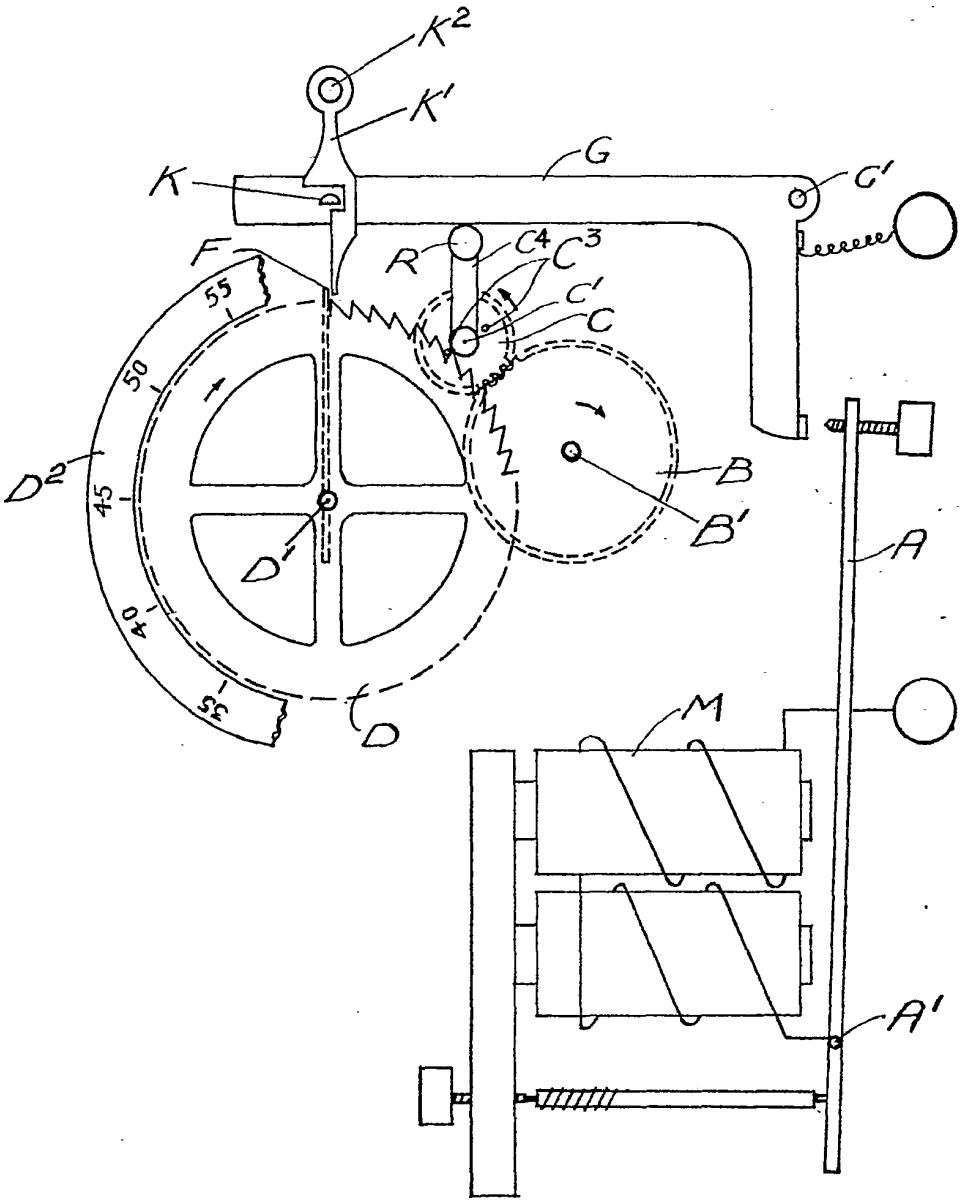


FIG. 2



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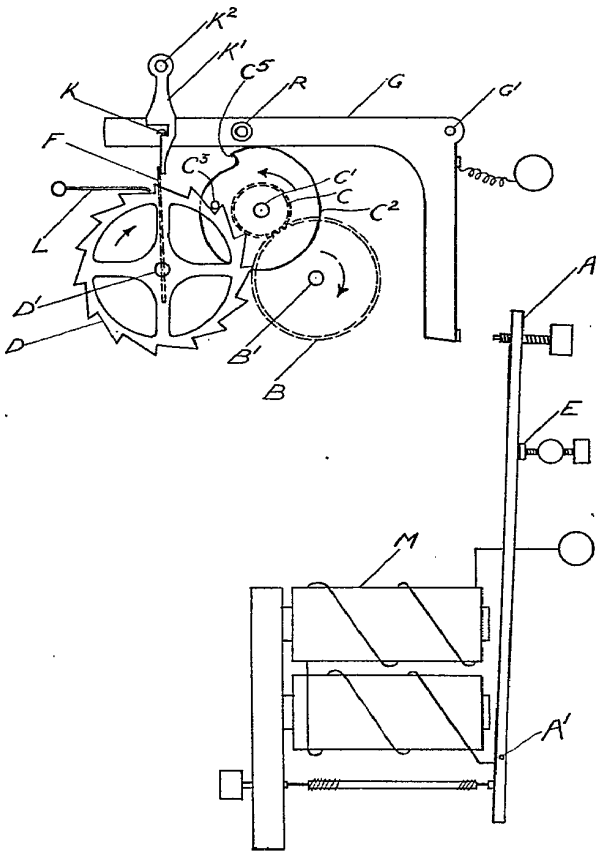
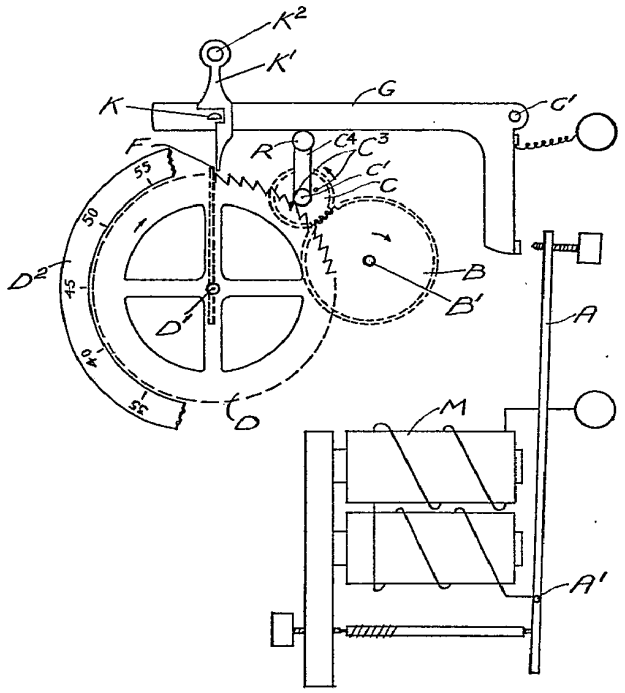
SHEET 1

FIG. 1



SHEET 2

FIG. 2



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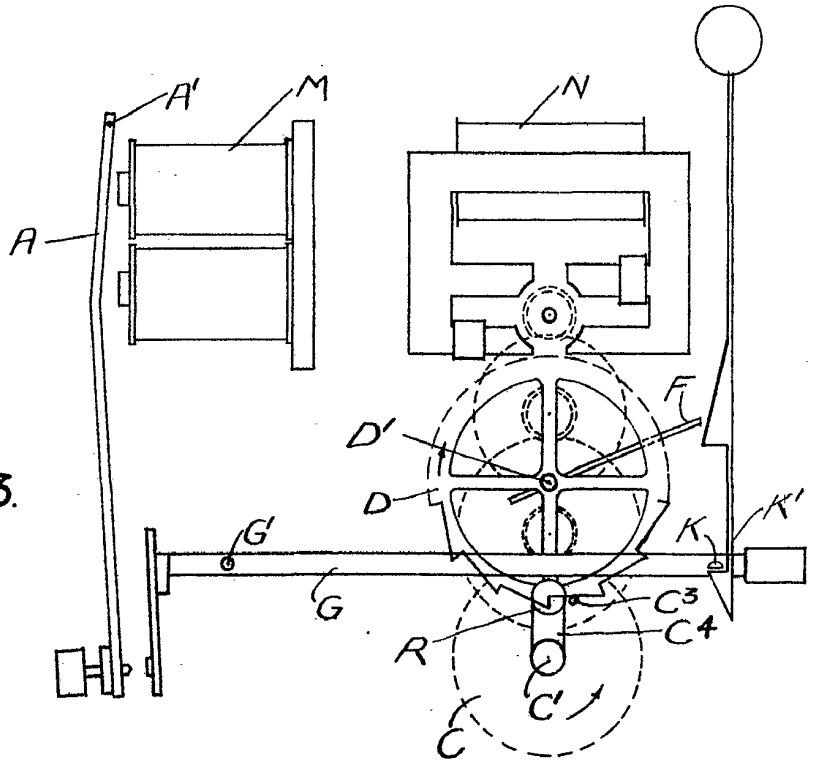

FIG. 3.

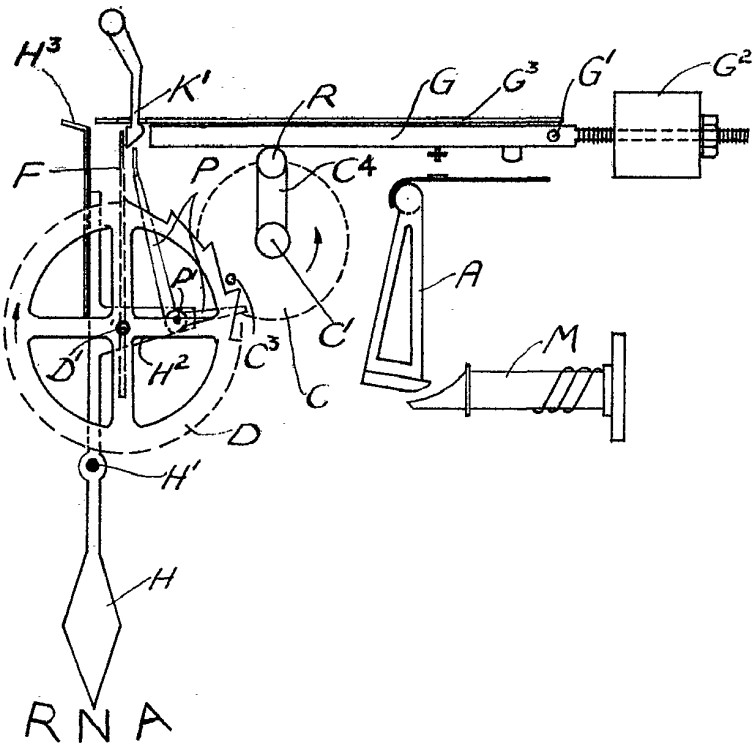

FIG. 4.

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