

(No Model.)

C. M. CROOK.

ELECTRIC WINDING AND SYNCHRONIZING DEVICE FOR CLOCKS.

No. 534,318.

Patented Feb. 19, 1895.

Fig. 1.

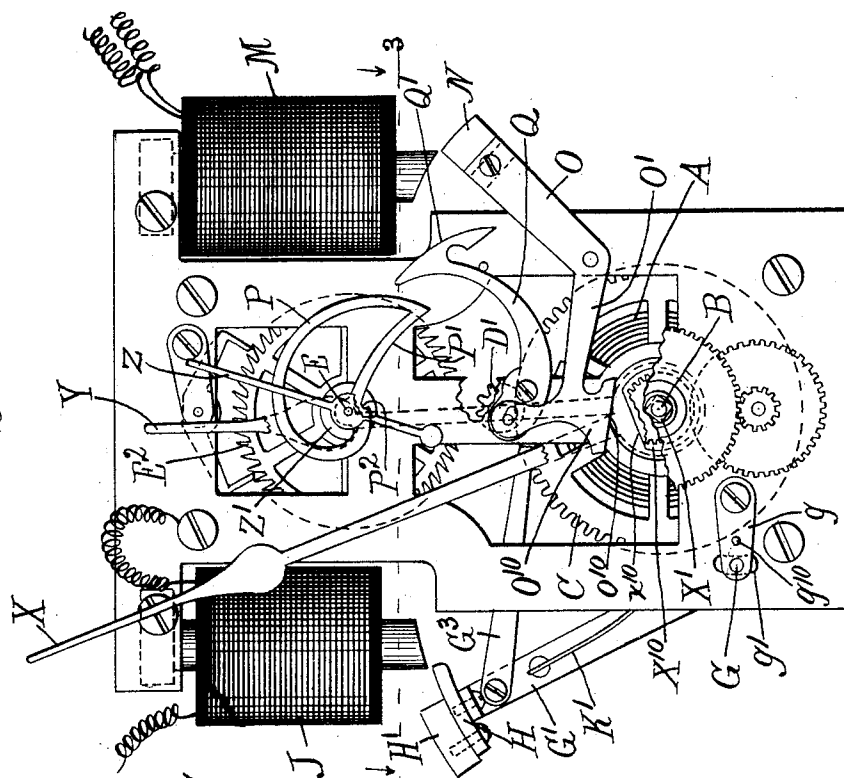


Fig. 3.

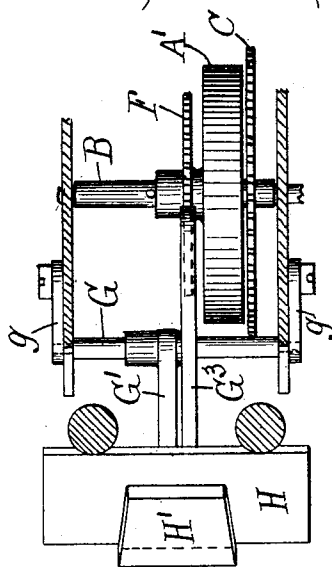
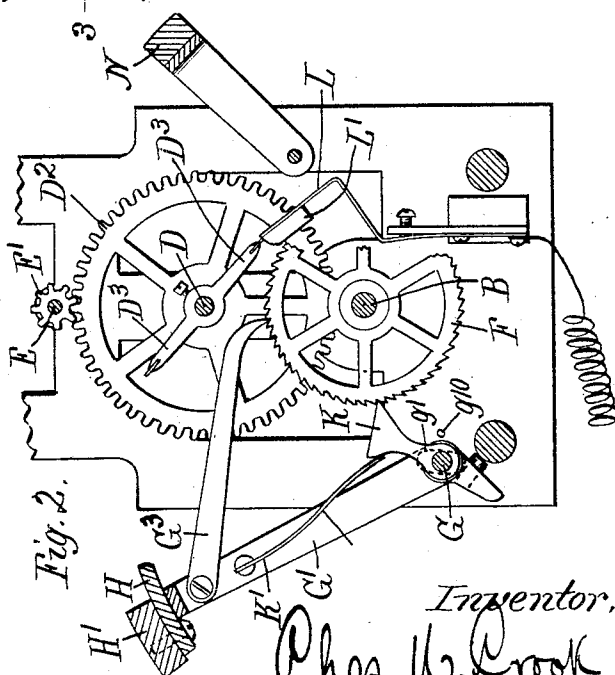


Fig. 2.



Witnesses,

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UNITED STATES PATENT OFFICE.

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ELECTRIC WINDING AND SYNCHRONIZING DEVICE FOR CLOCKS.

SPECIFICATION forming part of Letters Patent No. 534,318, dated February 19, 1895.

Application filed June 23, 1894. Serial No. 515,507. (No model.)

To all whom it may concern:

Be it known that I, CHARLES M. CROOK, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Electric Winding and Synchronizing Devices for Clocks, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

The purposes of this invention are to provide improved devices for winding clocks and other mechanism by means of electric energy; and also to provide improved means for synchronizing or setting similarly, or in such relation as desired, by means of one controlling mechanism and an electric circuit which it controls, the indicating devices of a plurality of such mechanisms.

In the drawings:—Figure 1 is a front elevation of a clock mechanism having my improvements, some portions of the frame-work and wheels being broken away to show other parts of the mechanism behind them. Fig. 2 is a vertical section at the plane of the forward surface of the winding ratchet wheel on the main spring staff. Fig. 3 is a sectional detail at the line 3—3 on Fig. 1.

I have shown my improvements applied to clock mechanism involving a simple train which, in itself, constitutes no part of my present invention. The train comprises the barrel A' of the main spring A, and the main spring staff B, the gear wheel C, rigid with the staff, the shaft D having the pinion D' meshing with the gear wheel C, and the gear wheel D² meshing with the pinion E' on the staff E of the escape wheel E². The main spring staff B is also the central staff of the indicator hands X and Y, which are connected by the customary train driven by frictional connection with said shaft at the forward side of the frame. The escape wheel staff E is also the shaft of the second hand Z, whose sleeve Z' is frictionally engaged with said shaft. Rigid with the main spring barrel A' is a ratchet wheel F.

G is a rock shaft suitably journaled in the frame in a manner hereinafter more particularly described, having the lever arm G' carrying at its extremity an armature H H' for the electro-magnet J. To this lever arm is

pivoted the pawl G³, which engages the ratchet wheel F.

K is a detent pawl pivoted on the rock-shaft G, and provided with a spring K' adapted to hold it in engagement with the ratchet wheel F.

Upon some convenient shaft of the train, and, as illustrated, upon the shaft D, I provide a finger or fingers D³ D³, adapted as the shaft rotates to make contact with the insulated spring contact piece L, which constitutes one electrode of a circuit which comprises the coils of the electro-magnet from which the wire passes to the clock frame, so that, upon contact of the finger D³ with the contact-piece L, the circuit is closed through the coils of the magnet and the latter is energized. At the instant of energizing the magnet, it attracts its armature, and thereby causes the pawl G³ to actuate the ratchet wheel and coil the main spring such distance as the throw of the lever arm and pawl permits. In the train, as constructed and illustrated, the wheel D' makes a complete rotation once in eight minutes, and I have provided two fingers D³ D³, one hundred and eighty degrees apart on the shaft D, so that the circuit is closed, the magnet energized and the pawl actuated once in four minutes, and the amount of winding of the spring by the oscillation of the lever and pawl at each such energizing of the magnet is sufficient to restore the tension of the spring as much as it declines during the interval, thus maintaining the spring at substantially uniform tension so long as the battery which energizes the circuit is active.

The portion H of the armature H H' is shaped in the arc of a circle about the pivot of the arm which carries it, so that as it oscillates past the ends of the poles of the magnet, it preserves its uniform distance therefrom. It will be evident that when a line at the middle of the width of the portion H of the armature coincides with the plane which cuts the axis of the poles of the magnet, the magnetic attraction can draw the armature no farther, and it will move farther only under the impetus received while being drawn to that point, and that the attraction of the magnet for its armature operates more and more at a disadvantage as to power of communicating movement or overcoming resist-

ance as the armature approaches that position; and that if the momentum of the armature carries it past that point, the force of its movement rapidly diminishes because resisted by the counter-attraction of the magnet tending to draw it back to that middle position. This portion of the magnet is made of considerable breadth in order that at the most remote position its edge may be quite near the poles of the magnet, so that its motion may be initiated quickly and surely when the magnet is energized; but, at the best, only a short pull can be obtained by this expedient, and a defect familiar in this class of devices is that the movement of the armature by which it actuates the winding mechanism is produced by the attraction of the magnet at the time when that attraction is least by reason of the distance of the center of the armature from the plane of the poles of the magnet, and diminishes both in extent and force as the attraction of the magnet increases by reason of the approach of the armature to the latter, so that the greater portion of the force of the magnet is not made available for the purpose of winding. To overcome this defect I provide the armature with the portion II', which is of such length as to permit it to pass between the poles of the magnet, and is of considerable thickness relatively to the portion II, and which is of truncated wedge-form in the plane of its oscillation with the narrower end forward toward the magnet, so that that end enters between the poles as the magnet attracts it. This thicker and shorter portion II' is set back from the portion II so that the longitudinal line of its center of gravity, which is the line of the center of attractive action of the magnet upon it, is considerably back of the corresponding line of the portion II.

The region of maximum magnetic force is located a little back from the extremities of the poles. This portion II' oscillating between the poles, and a little back, therefore, from their extremities, is in the plane of the greatest force, so that after the middle line of the portion II' has been drawn to the plane of the axis of the poles, the magnet will operate farther upon the armature, and draw it farther in the same direction until a longitudinal line through the center of gravity of the portion II' reaches the plane of the poles, in which movement, the portion II will be carried quite beyond the position at which it would naturally halt if alone subject to the attractive force of the magnet. By this means I am able to obtain a long pull for the armature, and one whose force increases rather than diminishes after the middle line of the portion II has passed the plane of the axes of the poles. Such increase is especially desirable because the spring, which is being wound by the action of the armature, offers greater resistance as it is tightened toward the end of the stroke of the latter.

The face of the armature toward the poles

of the magnet should be shaped in the arc of a circle about the axis of the lever, and in order that throughout its stroke it may be at uniform distance from the ends of the poles and not actually touch them, which would cause its motion to be arrested by the friction of the armature of the mold, it is desirable also that the path of this face of the armature should be as close to the poles as possible without touching them. In order to facilitate adjusting the armature as closely as possible and as accurately as possible with respect to both poles to avoid the necessity of effecting this result by dressing the poles, I mount the rock shaft G in short swinging bearing pieces *g g*, pivotally attached to the frame, which is slotted at *g' g'*, for a rock shaft to pass through it and obtain bearing in the arms *g g*, the slots being sufficiently elongated to allow for all necessary adjustment of the arms *g* to vary the position of the rock-shaft, and thereby of the armature, with respect to the magnet poles. When the proper position has been obtained, the steady pins *g¹⁰* may be set through the arms and frame bars to secure the former in their proper position.

In order not to waste the energy of the battery, since only a momentary energizing of the electro-magnet is necessary to the operation of the device, the contact of the finger D³ with the contact piece L' should only last for the briefest possible time, and to insure this result, I face the contact piece L on the side which first receives the touch of the finger with a non-conducting shield piece L', which may be made of bone or like material, which is rounded as illustrated, so that the finger bears against its rounded end, and springs the contact piece up as the finger revolves until the latter passes the crest of the rounded insulating piece, and allows the contact piece to spring back past the end of the finger, and to touch the finger for an instant in passing, and in that instant, the circuit is established, the magnet energized and the armature actuated, and the winding mechanism operated thereby.

I will now describe the synchronizing device which constitutes part of my invention.

M is an electro-magnet mounted in the frame, and which is adapted to be in circuit with the controlling clock at a distance.

N is an armature carried by the arm O of the bell-crank-lever O O', and adapted to oscillate toward and from the poles of the electro-magnet M. The arm O' of the bell-crank-lever O O' has the finger O¹⁰ terminating in the straight edge *o¹⁰*, which overhangs the shaft B and the sleeve X' of the minute hand X. Rigid with said sleeve I provide the disk X¹⁰, which has a small segment which is cut away at one side at a chord of about sixty degrees, forming the straight edge *x¹⁰*. This disk is in the plane of oscillation of the finger O¹⁰, and when the straight edge of said finger rests upon and coincides with

the straight edge x^{10} , the minute hand is at the hour, or point on the dial selected for synchronizing the clocks in the circuit. The controlling clock is arranged at that point to close the circuit, whereby the electro-magnet M is energized and the armature M attracted, and the bell-crank lever rocked in a direction to carry the finger down toward the disk X¹⁰, and if the minute hand is in precisely correct position, the two straight edges,—to wit, of the finger and the disk, will coincide upon coming in contact; but if the minute hand is slightly out of position, the pressure of the straight edge of the finger upon one end of the straight edge of the disk will force the disk, and thereby the sleeve and hand, around until the two straight edges coincide, thereby rectifying the position of the hand. The degree to which such rectification can be effected may be made more or less by the number of degrees cut off by the chord x^{10} , but a correction of five minutes either way being ample, I deem it unnecessary to provide for any greater correction than that, for which it is sufficient to cut away sixty degrees of the circumference of the disk by the straight edge. It will be understood that the rectification of the hour and minute hands by this means has no effect upon the seconds hand, and if it should chance that the correction required and made in this manner should involve a fraction of a minute, or several minutes and a fraction, the seconds hand would thereby be out of time with the minute hand; and in order to rectify this hand also, I provide upon its sleeve the spiral cam P, and on the pivoted frame I provide a finger Q, whose outer edge Q' is an arc about its pivot. This finger is connected to the bell-crank-lever O O', and actuated thereby, the connection being made by a pin q engaging in the slot q^2 . When the seconds hand is at the minute point, the edge P' of the spiral cam P coincides with an arc struck about the pivot of the finger Q with the radius of the length of that finger; and the movement which the finger receives from the bell-crank-lever O O' when the armature is attracted by the magnet, is such as to throw its point in along that arc to the inner end of the spiral. If the seconds hand is at any other point than the one to which it should stand, the point of the finger will strike the spiral periphery of the cam P, and will throw the hand Z around to the minute point in the direction in which it is carried by the rotation of the train. If the finger catches the outer point of the spiral, and fails by the least, therefore, to pass by that point and in along the edge P' to the root of the spiral, it will cause the spiral to make almost a complete revolution, the point of the finger at the end of the stroke lodging at the root of the spiral where a sharp notch P² is provided, in which the point seats. Wherever the finger strikes the spiral, it will crowd it around in the same direction until the point rests at the root of the spiral and the latter is stopped against the edge Q' of the

finger, and thereby, the seconds hand will be brought accurately to the minute point. The notch P² is important because it prevents the cam P from rebounding as it otherwise might when its edge P' strikes and coincides with the edge Q'. It also enables the finger, even upon a slow stroke, to bring the cam P "home,"—that is, with its edge P' resting against the edge Q' more effectually than might be done without the notch.

The direction of the path of the point of the finger Q is in general inward toward the shaft of the cam P, but at the inner part of its path when it is acting against the smaller curve of the spiral, it is more effective and more certain to bring the cam "home" if its pressure is not directly toward the axis, but a little aside therefrom, so that it acts against the spiral with the advantage afforded by the distance of its path or direction of pressure away from a parallel path through the axis, so that at that point it not only crowds the spiral around in the right direction, but also positively carries it around in the same direction. This result might be attained if the finger moved in a straight path not directly radial, but this would be at a disadvantage as to commencement of the action against the outer and larger curve; but by pivoting the finger and giving its point thereby a circular path which at the inner part has the direction and relation to the spiral and to the center which is desired, the outer part of the same curved path is made at an angle to the outer portion of the spiral curve so acute as to be very favorable for the crowding or cam-action, which makes the initiation of the movement very easy.

I claim—

1. In combination with a train and a mechanical motor for the same and winding mechanism therefor, a fixed electro magnet having its poles in juxtaposition, a vibrating armature for such magnet connected to the winding devices and operating the same by its vibration, said armature comprising a portion adapted to pass between the poles of the magnet and a portion rigid with the first portion and extending beyond it at the ends in position to pass the ends of the poles as the armature vibrates.

2. In combination with a train and a mechanical motor for the same and winding mechanism therefor, a fixed electro magnet having its poles in juxtaposition, a vibrating armature for such magnet connected to the winding devices and operating the same by its vibration, said armature comprising a portion adapted to pass between the poles of the magnet and a portion rigid with the first portion extending beyond it at the ends and at the forward side, adapted to play past the ends of the poles of the magnet throughout a longer arc than that throughout which the first portion plays between the poles.

3. In combination with the train, a fixed electro-magnet having its poles in juxtaposi-

tion; a vibrating armature for the same connected to the winding mechanism of the train and adapted to wind the same by its vibration, said armature comprising a portion
 5 adapted to pass between the poles of the magnet, and a further portion rigid with the first and extending forward of the same and beyond its ends, and adapted thereby to vibrate past the ends of the poles and prolong the period of effective action of the magnet upon
 10 its armature; the circuit which energizes such magnet comprising an insulated contact piece and an arm or finger in the train adapted as the train revolves to make only instantaneous
 15 contact with said contact piece, whereby the instantaneous energizing of the magnet produces a long pull of the armature upon the winding mechanism: substantially as set forth.

20 4. In combination with the train and a mechanical motor for the same, and devices for winding the motor and a lever which operates such winding devices, an electro-magnet and a circuit which energizes the same comprising
 25 the train and its supporting frame and an insulated contact-piece mounted thereon, a shaft of the train having a circuit making and breaking arm or finger adapted to make only instantaneous contact with said contact
 30 piece; an armature for the magnet mounted on the lever arm which operates the winding devices, comprising a portion which enters between the poles and a portion which vibrates past the ends of the poles and extends
 35 forward of the first portion to prolong the period of effective action of the magnet upon the armature; whereby a long pull of the magnet upon the armature is produced by an instantaneous energizing of the circuit: substantially
 40 as set forth.

5. In combination with the train and its winding mechanism, an electro-magnet having its poles in juxtaposition; the electro-magnet and the vibrating armature for the
 45 same connected to and adapted to operate the winding mechanism; the circuit which energizes said magnet comprising the train and the frame which supports the same; the insulated spring contact-piece having the non-conducting shield piece L' ; the train having
 50 an arm or finger adapted as the train rotates to come into periodic contact with said shield-piece and flex the spring and make instantaneous contact with the end of the latter as it

reacts from such flexure, whereby an instantaneous energizing of the magnet is caused: substantially as set forth.

6. In combination with the train and the indicator hand having frictional connection therewith; a spiral cam rigid with the indicator hand; a finger supported on the frame; means for advancing it against the spiral periphery of the cam; the innermost part of the path of the finger being in a line which, produced, would pass at a distance from the axis of the shaft of the hand on the side of said axis toward which the point of the cam's periphery with which the finger is there in contact is moved by the pressure of the finger thereon: substantially as set forth.

7. In combination with the train and the indicator hand having frictional connection therewith, the spiral cam rigid with the indicator hand; a finger supported on the frame, and means for advancing it against the spiral periphery of the cam, the innermost part of the path of the finger being in a line which produced would pass at a distance from the axis of the cam at the side thereof toward which the point of the cam's periphery there pressed by the finger moves under such pressure being a little to one side of the axis, the periphery of the cam being at that point provided with a notch P^2 : substantially as set forth.

8. In combination with the train and an indicating hand having frictional connection therewith, a spiral cam rigid with the indicator hand; a finger pivoted on the frame and having its point adapted to oscillate in the plane of the cam against the spiral periphery thereof, the distance from the pivot to the point of the finger being a little less than the distance from the same pivot to the axis of the hand: whereby the angle of its path to the spiral periphery diminishes in acuteness from the outer to the inner portion of the spiral and at the innermost point of its path the finger presses upon the cam on the side of the axis thereof toward the finger's pivot: substantially as set forth.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 20th day of June, 1894.

CHAS. M. CROOK.

Witnesses:

CHAS. S. BURTON,
 JEAN ELLIOTT.