(No Model.) 2 Sheets—Sheet 1.

F. L. GREGORY.

SECONDARY ELECTRIC CLOCK.

No. 555,090. Patented Feb. 25, 1896.

Fig. 3.

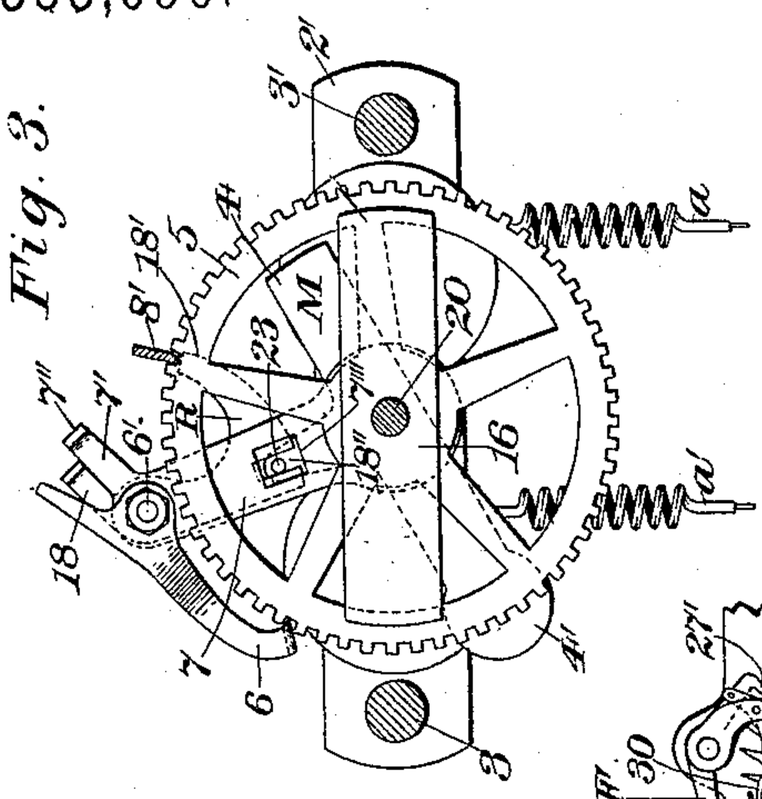


Fig. 6.

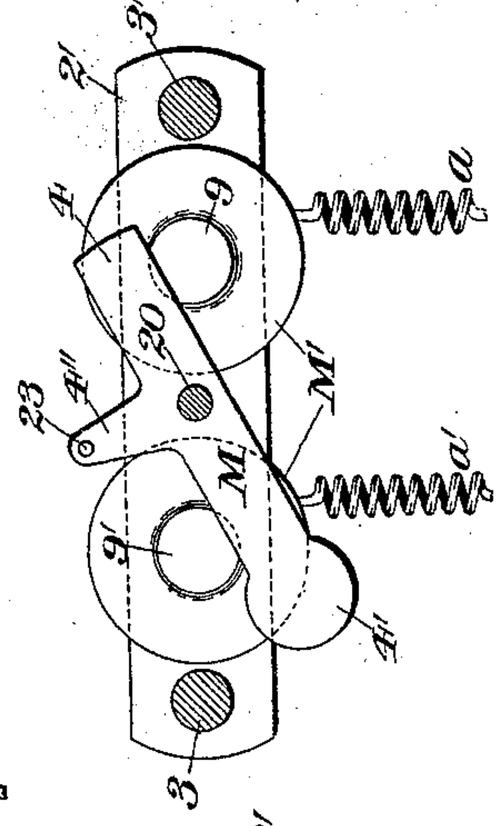


Fig. 2.

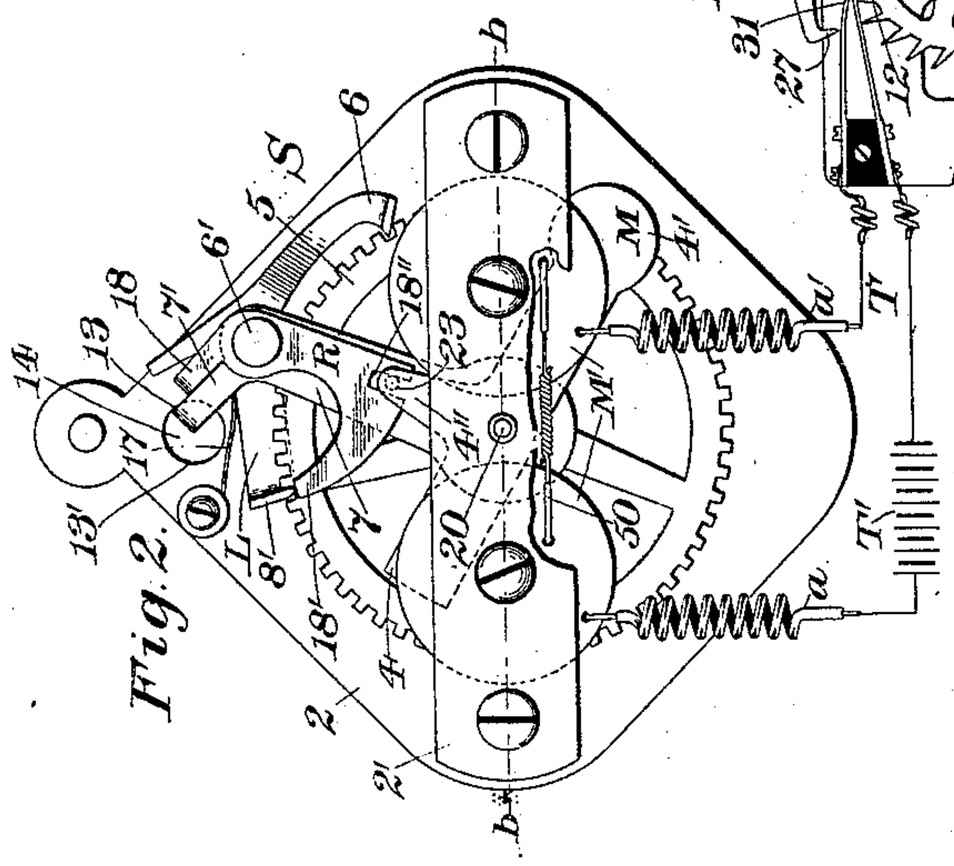


Fig. 4.

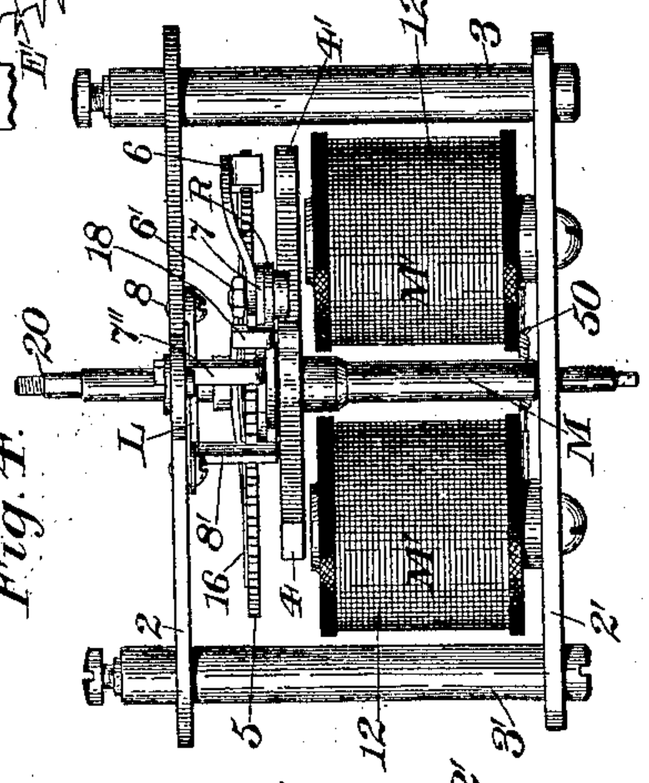


Fig. 1.

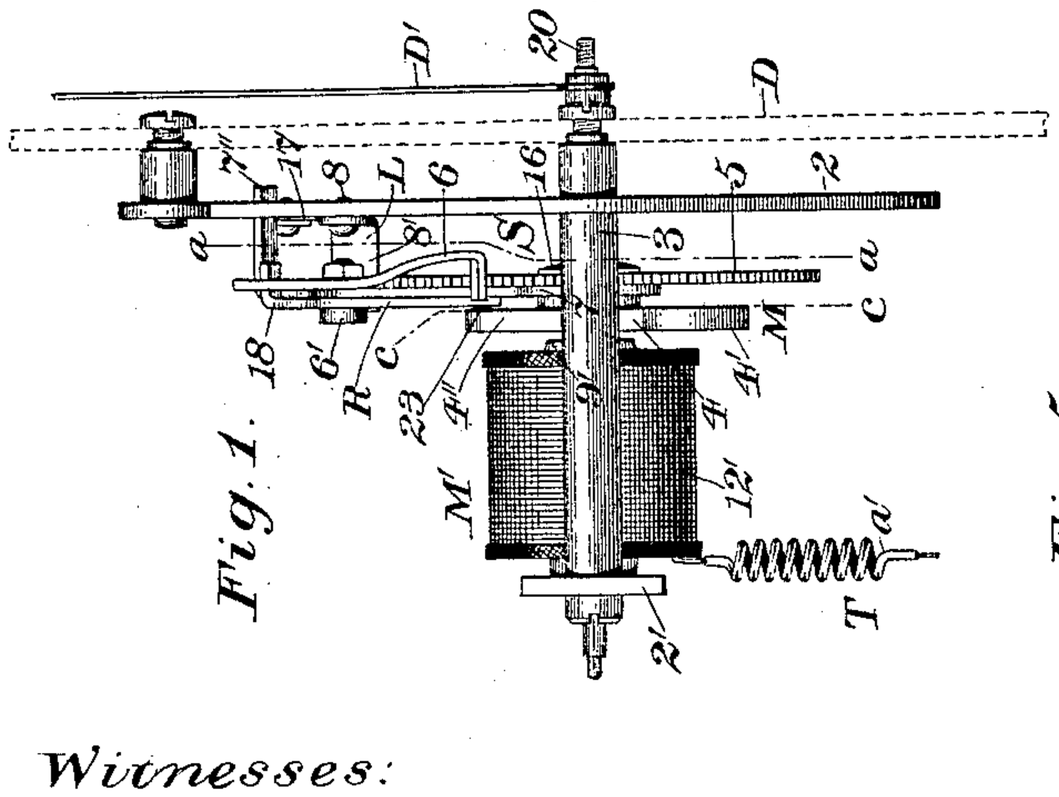
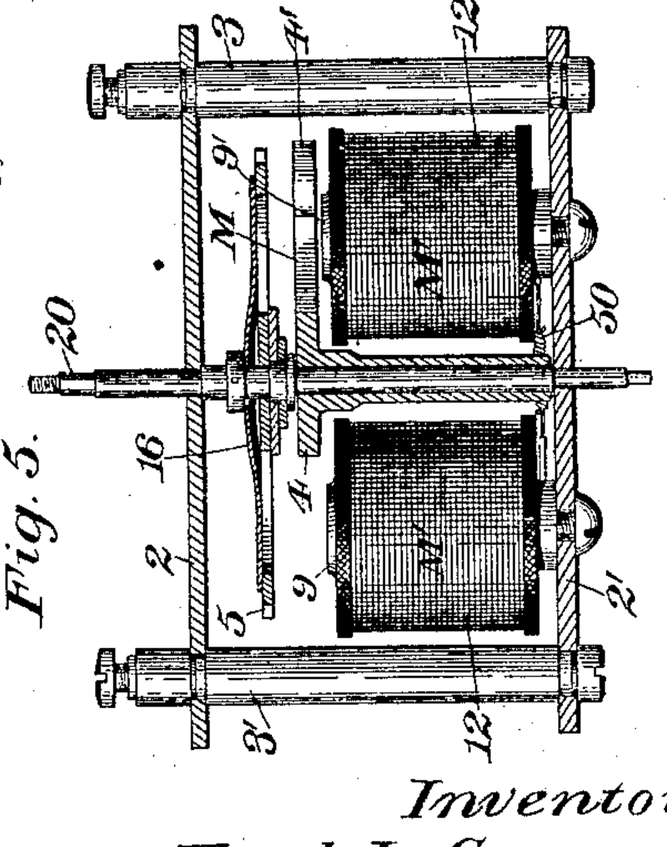


Fig. 5.



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Inventor:
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By his Attorney.
F. A. Richards.

(No Model.) 2 Sheets—Sheet 2.

F. L. GREGORY.

SECONDARY ELECTRIC CLOCK.

No. 555,090. Patented Feb. 25, 1896.

Fig. 10.

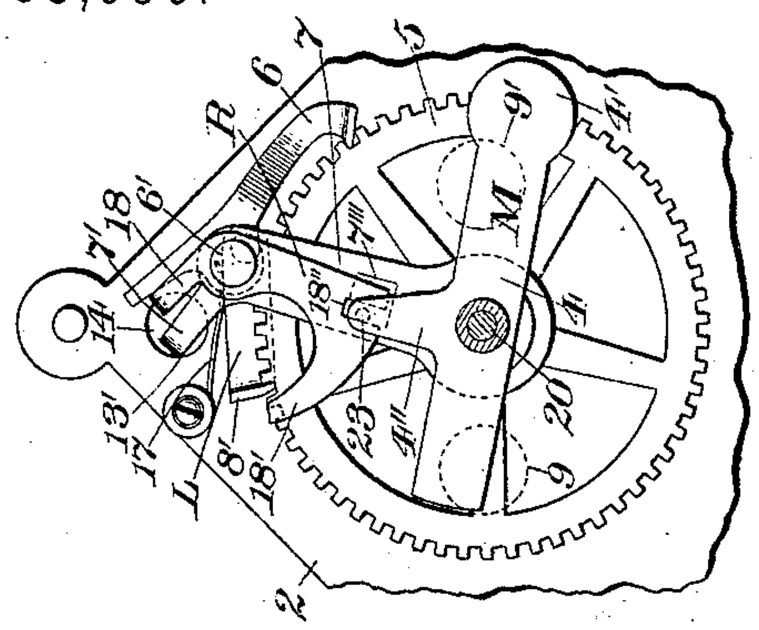


Fig. 9.

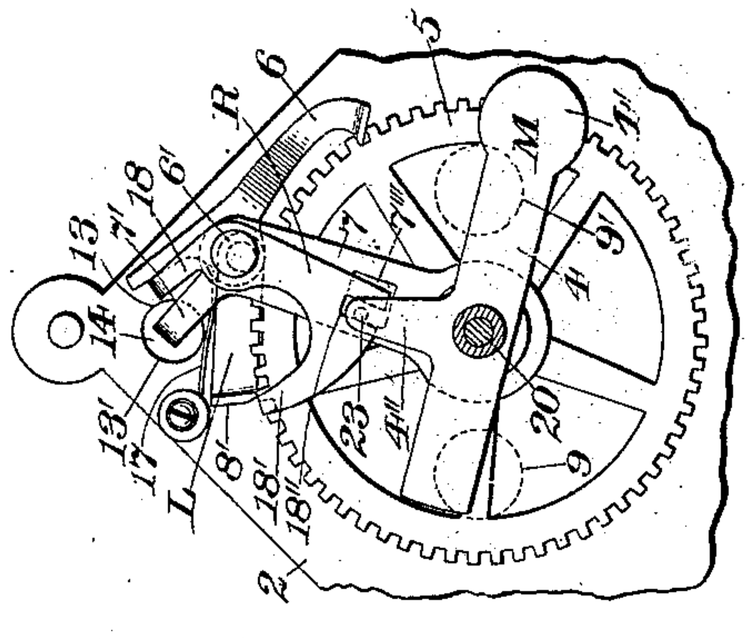


Fig. 8.

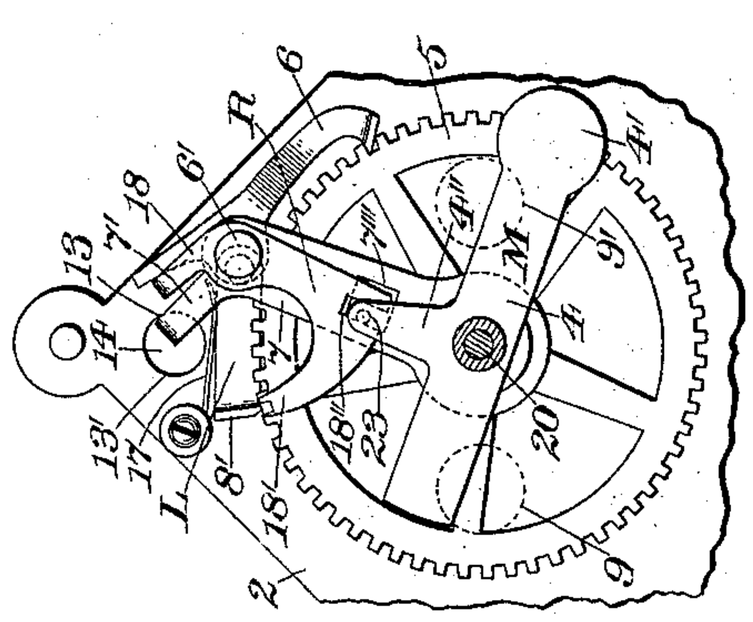


Fig. 7.

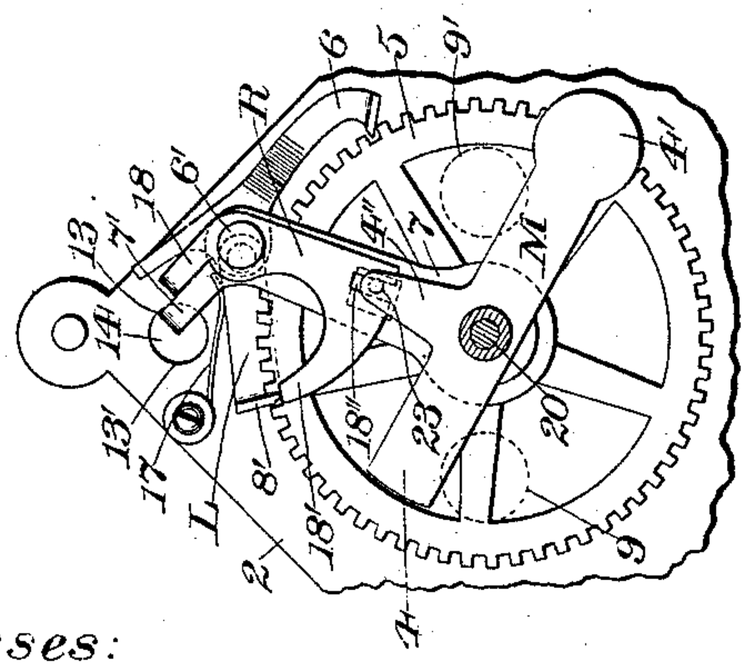


Fig. 17.

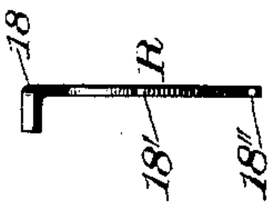


Fig. 19.

Fig. 16.

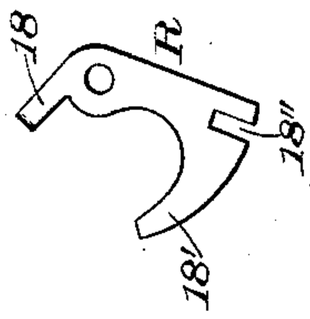


Fig. 18.

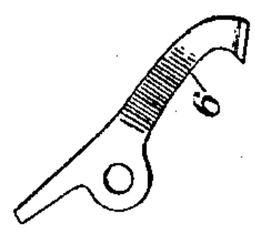


Fig. 14.

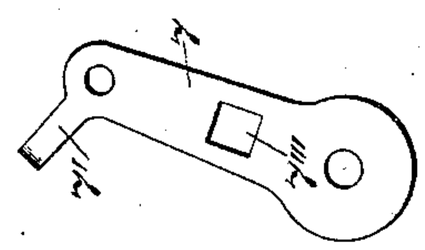


Fig. 15.

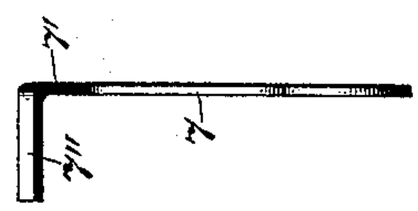


Fig. 12.

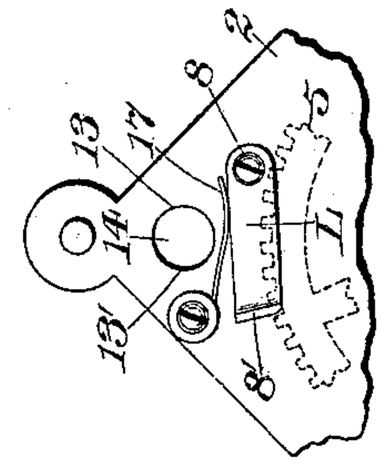


Fig. 13.

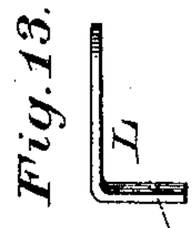
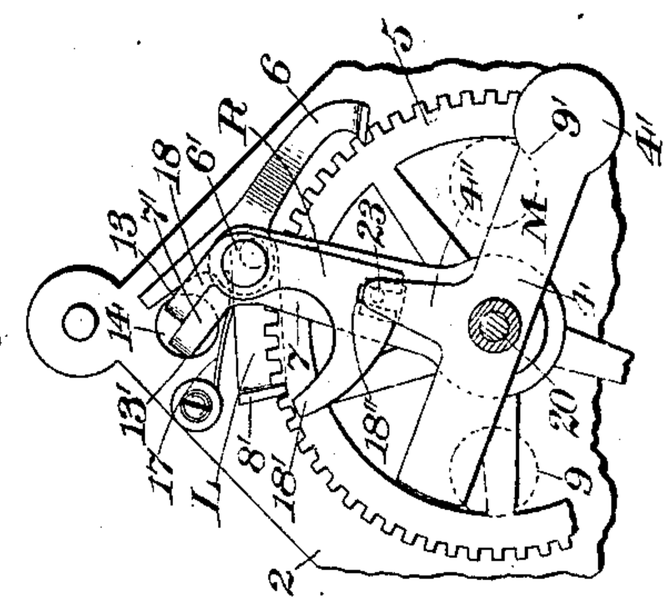


Fig. 11.



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Inventor:
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UNITED STATES PATENT OFFICE.

FRED L. GREGORY, OF CHICAGO, ILLINOIS.

SECONDARY ELECTRIC CLOCK.

SPECIFICATION forming part of Letters Patent No. 555,090, dated February 25, 1896.

Application filed May 11, 1895. Serial No. 548,932. (No model.)

To all whom it may concern:

Be it known that I, FRED L. GREGORY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electromechanical Clock Systems, of which the following is a specification.

This invention relates to time telegraphy or electromechanical clock systems, and has special reference to improvements in apparatus for actuating the secondary-dial mechanism in "synchronous" clock systems of the class specified, and for analogous purposes.

In clock systems of the class above specified, and more especially in so-called "synchronous" clock systems, or clock systems having a plurality of secondary electromechanical clocks in circuit with and controlled by a primary clock or master-timepiece it is desirable, for the purpose of securing synchronism in the operations of all the clocks in the circuit, that the effective operations of the secondary clocks shall result from the circuit-closing movement of the primary clock rather than from the circuit-opening movement of said clock, to thereby effect a relatively instantaneous and coinciding registration of the pointers or hands of all the clock mechanisms, and it is also desirable that each secondary-clock mechanism shall be positively locked against movement simultaneously with each opening of the circuit or immediately upon the completion of the effective operation of said clock mechanism.

The object of my present invention is, primarily, to furnish an improved electromechanical clock system embodying an electromechanical secondary clock or dial mechanism having actuating apparatus in circuit with a primary clock or master-timepiece, and of such construction and organization as to insure a positive registering movement of the secondary-clock mechanism, substantially instantaneous with the circuit-closing movement of the primary clock, and with the greatest precision and with the least possible expenditure of electrical energy, and also to provide, in connection with the secondary-clock mechanism, an automatically-operable locking device in position and adapted for positively locking the secondary-clock mechanism against movement immediately upon the completion of the effective operation of said mechanism, and in substantial synchronism with the circuit-opening movement of the primary clock.

In the preferred embodiment thereof herein shown and described my invention consists, in part, of a secondary clock having actuating apparatus embodying a peripherally-toothed power-wheel, a power-shaft concentric to and driven by said power-wheel, an oscillatory actuator, an impulse-pawl carried by the actuator in normal operative engagement with the power-wheel, a combined locking and releasing device in position and adapted for locking the power-wheel against movement during the idle or ineffective movement of the actuator, and for releasing the same simultaneously with and during the effective movement of said actuator, and means in position and adapted for intermittently operating the actuator, as will be hereinafter more fully described.

In the drawings accompanying and forming part of this specification, Figure 1 is a side elevation of a portion of a secondary clock of an electromechanical system embodying my present improvements, said figure showing the dial of the clock in dotted lines and showing the power-wheel and power-shaft only of the dial mechanism. Fig. 2 is a rear elevation of the secondary-clock mechanism in connection with a portion of a primary-clock mechanism and electrical circuit and an intermittently-operable circuit-maker. Fig. 3 is a vertical cross-section of the secondary clock, taken in dotted line *a a*, looking toward the left in Fig. 1. Fig. 4 is a plan view of a secondary clock as seen from above in Fig. 2. Fig. 5 is a horizontal cross-section of the secondary clock, taken in line *b b* and as seen from above in Fig. 2. Fig. 6 is a vertical cross-section taken in line *c c* and looking toward the left hand in Fig. 1. Figs. 7, 8, 9, 10 and 11 are operative views of a portion of the clock, showing the five successive positions assumed by the parts of the motor during the effective movement thereof. Fig. 12 is a rear elevation of a portion of the framework of the secondary clock, showing a portion of the power-wheel of the clock mechanism in dotted lines and also showing the locking device in position for engagement

with the power-wheel. Fig. 13 is a plan view of the locking-detent detached. Figs. 14 and 15 are face and edge views, respectively, of the combined impulse-pawl carrying-arm and actuator-stop. Figs. 16 and 17 are face and edge views, respectively, of the pawl-locking and detent-releasing device. Figs. 18 and 19 are face and edge views, respectively, of the impulse-pawl for the power-wheel.

Similar characters represent like parts in all the figures of the drawings.

In the drawings only so much of a time telegraphy system or electromechanical clock system is shown as is deemed necessary for clearly illustrating the application and mode of operation of my present invention.

Briefly stated, one form of a time telegraphy system or electromechanical clock system, as shown in Fig. 2 of the drawings, may comprise a primary actuator or master-timepiece (designated in a general way by P) embodying an intermittently-operable circuit-maker 12, a secondary clock (designated in a general way by S) embodying an electrically-propelled actuator, (designated in a general way by M,) an electrical circuit (designated in a general way by T) embodying the electrical conductors *a* and *a'* having the electrical terminals or contact-points 30 and 31 in the path of movement of the primary circuit-maker 12, an electromagnet M' adjacent to the motor M and an electric battery T', as will be hereinafter more fully described.

The time-trains or dial mechanisms of the primary clock P and the secondary clock S, which may be of any usual or suitable construction or organization, are not fully shown herein, as a complete illustration thereof is deemed unnecessary to an understanding of my present invention.

In Fig. 2 of the drawings I have shown a portion of the framework which carries the time-train of the primary clock, together with the escapement-wheel E, mounted in the usual manner upon the escapement-shaft E', journaled in the framework, and also the escapement-anchor F, the pallets 27 and 27' of which alternately engage the teeth of said wheel E. This escapement-shaft E' is shown carrying the circuit maker and breaker, or, as it will be hereinafter termed the "circuit-closer." This circuit-closer, which is designated by 12, is in the nature of an arm carried upon the escapement-shaft E' with the outer end thereof in position for engaging and for effecting a contact between the electrical terminals 30 and 31, and thereby closing the circuit, a contact being effected at each complete rotation of the escapement-wheel E and its shaft E'. Ordinarily, the circuit-closer will be periodically effective for closing the circuit, the length of time between effective actions thereof being governed by the regulation of the timing mechanism, through the medium of which said circuit-closer is actuated. This circuit-closer and the actuating mechanism therefor may be substantially the same as the circuit-closer and the actuating mechanism shown and described in my prior patent, No. 525,704, dated September 11, 1894, to which reference may be had.

The electrical terminals 30 and 31 are herein shown in the nature of resilient springs, one located above the other and secured to a block of insulating material fixed to the framework of the primary clock, the contact ends of said terminals being in close proximity to each other, and one being projected into the path of movement of the circuit-closer, as shown in Fig. 2 of the drawings.

The framework of the secondary clock, which may be of any usual or suitable construction for carrying the clock mechanism, is herein shown consisting of the front and back plates 2 and 2', respectively, connected together by pillars 3 and 3', after the usual manner of constructing clock-frames. The back 2' of said framework, as herein shown, also constitutes a connecting-bar for the electromagnets M', which in the present instance constitute the direct actuating means for the motor M.

To avoid complication, only the dial D, the minute-hand or pointer D', and the pointer-shaft 20 of the dial mechanism are shown in the drawings.

As a convenient means for moving the pointer of the secondary clock progressively forward with an intermittent or step-by-step movement, I have provided, in connection with the dial mechanism of the secondary clock, actuating apparatus embodying an electrically-propelled actuator M, loosely mounted for oscillatory movement upon the pointer-shaft 20, which shaft is journaled at its ends in bearings in the front and back plates, 2 and 2', of the framework, and practically constitutes what will be hereinafter termed the "power-shaft of the secondary clock-actuating apparatus;" a peripherally-toothed power-wheel 5, mounted upon the power-shaft 20; an impulse-pawl 6 in normal operative engagement with a tooth of the power-wheel; an impulse-pawl carrier 7, operatively connected with the actuator M and adapted to have a limited amount of free oscillatory movement relatively and in the plane concentric to the plane of oscillatory movement of the actuator; a spring-actuated detent or click L in position and adapted for automatically engaging in a tooth-notch in the power-wheel; a combined pawl-locking and detent-releasing device R, pivotally carried by the impulse-pawl carrier and operatively connected with the actuator M and having arms in position and adapted one for locking the pawl in engagement with the power-wheel and the other for simultaneously releasing the detent L from engagement with said power-wheel, and means, substantially as hereinafter described, for limiting the work-

ing stroke of the actuator M and the impulse-pawl 6, all of which will be hereinafter more fully described.

In the organization thereof herein shown the actuator M, which also constitutes the magnet-armature, and which will sometimes be referred to herein as an "actuating-armature," is propelled in one direction by the electromagnetic attraction of the poles 9 and 9′ of the electromagnet M′, which magnet is carried by the framework and has its poles 9 and 9′, respectively, located at the opposite sides of and in a plane parallel to the axis of oscillation of the actuating-armature, the ends of said magnet-poles being in close proximity to the path of movement of said armature, as will be readily understood by reference to Figs. 2, 4, 5, and 6 of the drawings.

The magnet for propelling the armature or actuator M has the usual coils 12 and 12′ surrounding the cores 9 and 9′, respectively, said magnet being energized by electricity supplied to the coils 12 and 12′ through the electrical conductors *a* and *a′* in the usual manner of energizing electromagnets. One of said conductors is shown leading to the coil 12, and the other of said conductors is shown leading to the coil 12′, connection being made between the coils 12 and 12′ through the wire 50, as shown most clearly in Fig. 2 of the drawings.

The winding of the magnet-coils of the secondary clock and the connection of the same with the source of electrical supply (which supply will usually be a primary battery which supplies electrical energy to a series of secondary clocks, in a circuit of which this clock forms a unit) should, of course, be done in such manner as to propel the magnet armature or actuator M in the direction required by the character of the operative parts in connection with and to be operated by said actuator. This actuating-armature is shown supported to oscillate in close proximity to the poles 9 and 9′ of the magnet and in a plane transversely of the axial plane of said magnet, and is preferably weighted at one end thereof, as shown at 4′, to effect a return stroke thereof by gravitation.

The impulse-pawl carrier 7 is preferably loosely mounted at its inner end upon the power-shaft 20 and is provided at or near its outer end (at which end the impulse-pawl 6 is pivotally carried) with laterally-projecting stop-arm 7′ in position and adapted for coacting with stop-abutments 13 and 13′ upon the front plate, 2, of the framework of the clock, said stop-arm, in conjunction with the abutments 13 and 13′, limiting the working stroke of the impulse-pawl carrier, and consequently limiting the effective movement of the power-wheel 15 and power-shaft 20.

The stop-abutments 13 and 13′ for the stop-arm 7′ of the impulse-pawl carrier are shown in Fig. 2 as formed by the two opposing walls of a recess 14, formed through the front plate, 2, of the framework, the stop-arm having a lateral projection 7″ at the outer end thereof that extends into the recess 14 in position to alternately engage the opposite abutments 13 and 13′.

It will of course be understood that the construction and organization of the means herein described for limiting the effective or working stroke of the impulse-pawl carrier and the mechanisms actuated thereby may be modified without departure from my invention.

As a convenient means for effecting an operative connection between the power-wheel and the power-shaft and at the same time provide for the rotation of the power-shaft independently of the power-wheel—as, for instance, when it is desired to "set" the hands without moving the other parts of the dial mechanism—I have provided a frictional driving-connector between the power-wheel and the power-shaft. This connector (designated by 16) in the form thereof herein shown is in the nature of a curved oblong spring carried upon the shaft 20 and bearing at its inner face at the outer ends thereof against the face of the power-wheel near the periphery thereof and bearing at its outer face near the middle portion thereof against a fixture (herein shown as a collar) upon the shaft 20.

It will be understood that the frictional driving-connector will be constructed to exert a frictional driving stress somewhat in excess of the natural working resistance of the mechanism actuated by the power-wheel, so that during the operation of the actuator an advancing movement of the power-wheel will insure a synchronous and coinciding movement of the power-shaft and the mechanism carried thereby, and it will furthermore permit an independent rotative adjustment of the power-shaft, it being simply necessary to apply sufficient rotative force to the power-shaft, while the power-wheel is locked against movement, as will overcome the resistance of the frictional driving-connector.

The impulse-pawl 6 is in the nature of a lever fulcrumed near the middle portion thereof upon a stud 6′ carried at the outer end of the pawl-carrier 7, as shown in Fig. 2, and is herein shown organized to exert a pulling action upon the power-wheel, and will be so constructed as to automatically assume an operative engagement with the power-wheel by its own gravity. It will, of course, be understood that the construction and organization of the impulse-pawl may be modified within the scope and limits of my invention and that independent means might be provided for effecting a positive engagement of the pawl with the power-wheel.

The locking-detent L is in the nature of an arm pivoted at one end, as at 8, upon the front plate of the framework and having its opposite end bent outwardly to form a catch 8′, adapted for successively engaging in the tooth-spaces of the power-wheel, said detent being normally held in locked engagement with the power-wheel, preferably by means of

a spring 17, secured at one end to the front plate, 2, and bearing at its free end upon the upper edge of the detent, as shown in Fig. 12.

The pawl-locking and detent-releasing device R is somewhat in the nature of a U-shaped lever, and is pivotally carried, near the outer end thereof, preferably by the stud 6′, that carries the impulse-pawl, said lever having at the outer end thereof a pawl-locking arm 18 which extends under and is in position for lifting the inoperative end of the impulse-pawl 6, so as to throw the operative end thereof into engagement with the tooth of the power-wheel, and also having at the inner end thereof a detent-lifting arm 18′ in position and adapted for engaging and lifting the detent out of locking engagement with the power-wheel.

In practice with an apparatus of the construction and organization herein described it is desirable that in operation the pawl-locking and detent-releasing device shall have a slight lead in its movements over the movements of the impulse-pawl carrier, so that said device will effect a disengagement of the detent from the power-wheel before the pawl-carrier effects an advancing movement of the impulse-pawl, and will also effect an engagement of the detent with the power-wheel before the pawl-carrier effects a retractive movement of the impulse-pawl, to thereby insure a positive locking of the power-wheel at all times against movement other than when the impulse-pawl is in effective operation.

As a convenient means for actuating the locking-detent L slightly in advance of the impulse-pawl 6, the pawl-locking and detent-releasing device R has a relatively small slot 18″ formed therein, preferably near the inner end thereof, and the impulse-pawl carrier 7 has a relatively large slot 7‴ formed therein in position to register with the slot 18″ in the pawl-locking and detent-releasing device, and the oscillatory actuator M (which is the principal actuator of the motor, of which the elements above named constitute a part) carries, preferably at the end of an arm 4″, a pin or projection 23, which extends through the slots or openings 18″ and 7‴ in the pawl-locking and detent-releasing device R and the impulse-pawl carrier 7, respectively, as shown most clearly in Figs. 2 and 3 of the drawings. This pin 23 practically constitutes the actuating-connector between the impulse-pawl carrier 7 and the oscillatory actuator M of the actuating apparatus. By this construction and organization it will be seen that upon the beginning of the working stroke of the actuator M the actuating-connector 23, together with the pawl-locking and detent-releasing device is moved from the position shown in Fig. 7 of the drawings to that shown in Fig. 8 and lifts the detent from its locked to its unlocked positions, as shown in said figure, before said connector acts upon the impulse-pawl carrier to effect a working movement of the impulse-pawl, this, of course, being due to the difference in the relative widths of the slots 18″ and 7‴ in the detent-actuator and impulse-pawl carrier, respectively, the play or free movement of the connector 23 and pawl-locking and detent-releasing device R, relatively to the impulse-pawl carrier being substantially equal to the distance traversed by the locking-detent in one complete stroke thereof, which will be readily understood by a comparison of Figs. 7 to 11, inclusive, of the drawings.

After the actuator M (during its working stroke) has carried the pawl-locking and detent-releasing device R from the position shown in Fig. 7 to that shown in Fig. 8 the actuating-connector 23 effectively engages the impulse-pawl carrier 7, and during the continued or remaining portion of the stroke of the actuator M carries the impulse-pawl 6 from the position shown in Fig. 8, successively, to the positions shown in Figs. 9 and 10, respectively, and in the meantime the pawl-locking and detent-releasing device R will have been successively carried to the positions shown in Figs. 9 and 10, which completes the effective stroke of the impulse-pawl and the locking-detent. When the parts are in the position shown in Fig. 10, the detent L is immediately thrown into locked engagement with the power-wheel, which prevents accidental movement of the power-wheel and the mechanism actuated thereby. It is desired to state in this connection that simultaneously with the effective action of the pawl-locking and detent-releasing device R upon the locking-detent L the arm 18 of said pawl-locking and detent-releasing device R is thrown into engagement with the inoperative end of the impulse-pawl, which throws the operative end of said pawl into positive engagement with a tooth of the power-wheel and prevents accidental disengagement of said pawl from the power-wheel during the effective stroke of the pawl, and, simultaneously with the retractive movement of the pawl-locking and detent-releasing device, caused by the retractive movement of the oscillatory actuator M of the actuating apparatus, the arm 18 of said pawl-locking and detent-releasing device is immediately disengaged from the inoperative or free end of the impulse-pawl, as will be understood by a comparison of Figs. 10 and 11 of the drawings, which leaves the impulse-pawl free to vibrate during its retractive or backward movement.

It will be understood that at each energization of the magnet M, which is effected by the closing of the electrical circuit through the medium of the intermittently-operable circuit-closer, the actuator M will instantaneously move from the position shown in Fig. 7 to that shown in Fig. 10 of the drawings, and through the medium of the connecting mechanism hereinbefore described the power-shaft is rotated the requisite part of a complete rotation, this part being usually a "min-

ute-arc" distance or a distance necessary to advance the minute-hand of the secondary clock a distance equal to a minute-division of the dial D, and upon the opening of the circuit by the circuit-closer carried by the primary-clock mechanism P the actuator M will drop by its own gravity from the position shown in Fig. 10 to that shown in Fig. 11 of the drawings, the power-wheel and the mechanism actuated being thereby maintained locked until the next effective action of the actuator M.

In practice the power-wheel will usually have its periphery divided by the tooth-spaces into sixty aliquot parts corresponding to the minute divisions (not shown) of an ordinary clock-dial, as D, and the escapement-wheel shaft that carries the primary circuit-closer will be so timed in its movements as to make one complete rotation at intervals of one minute, and through the medium of the circuit-closer close the circuit once every minute, and thereby cause the motor of the secondary clock to carry the minute-hand a one minute-arc distance, as will be readily understood by those skilled in the art to which this invention appertains.

It is desired to state in this connection, however, that the actuating mechanism of the secondary clock may be constructed and organized to operate intermittently, without regard to the length of time between operations thereof; and also that said mechanism constitutes a mechanical apparatus adapted to be employed with and for actuating any mechanism other than a clock mechanism in which it is desirable to attain a progressive step-by-step movement.

It will be observed by reference to the drawings that the power-wheel, impulse-pawl, and impulse-pawl actuator have, as hereinbefore inferred, working movements about a common center, their axes of movement being preferably coincident, and for this reason I am enabled to secure the requisite range of movement of said parts in a very compact organization of mechanism and with the least possible frictional resistance.

Having thus described my invention, what I claim is—

1. In an apparatus of the class specified, the combination with the framework, and with the power-shaft revolubly carried on said framework; of a peripherally-toothed power-wheel mounted upon, and adapted for rotating, the power-shaft; an oscillatory power-wheel-actuating armature having its axis of movement coincident with the axis of the power-wheel; an impulse-pawl in normal operative engagement with the power-wheel, and actuated by the armature to intermittently rotate said power-wheel; a locking-detent in normally-locked engagement with the power-wheel; a pawl-locking and detent-releasing device controlled by the armature, and having means in position and adapted for simultaneously actuating the pawl and detent to lock the former in, and release the latter from, engagement with the power-wheel; an electromagnet in position for impelling the armature; and means for intermittently energizing said magnet, substantially as described.

2. In an apparatus of the class specified, the combination with the framework; of a power-shaft journaled in said framework; a peripherally-toothed power-wheel revolubly mounted upon, and adapted for rotating, said power-shaft; a frictional driving-connector between, and operatively connecting, the power-shaft and power-wheel; an intermittently-operable oscillatory actuator; an impulse-pawl controlled by said actuator, and in normally-loose engagement with, and adapted for intermittently rotating, the power-wheel; a locking-detent in normally-locked engagement with the power-wheel; a pawl-locking and detent-releasing device controlled by the actuator, and adapted for simultaneously actuating the pawl and detent to lock the former in, and unlock the latter from, engagement with the power-wheel; and means for intermittently oscillating the actuator, substantially as described.

3. In an apparatus of the class specified, the combination with the power-wheel, and with an actuator, and with means for intermittently operating said actuator; of a reciprocally-effective impulse-pawl and locking-detent, the former of which is in normally-unlocked engagement with the power-wheel, and the latter of which is in normally-locked engagement with said power-wheel; and an oscillatory pawl-locking and detent-releasing device controlled by the actuator, and adapted for simultaneously actuating the pawl and detent to lock the former into engagement, and unlock the latter from engagement, with the power-wheel, upon the inauguration of the working stroke of the actuator, substantially as described, and for the purpose set forth.

4. In an electric-clock mechanism, the combination with a suitable framework; of a rotary power-wheel; a reciprocally-effective impulse-pawl and locking-detent in position and adapted for reciprocally actuating and locking the power-wheel; an intermittently-operable actuating-armature supported for oscillatory movement in juxtaposition to the poles of a magnet; means in connection with, and controlled by, the armature for simultaneously actuating the pawl and detent to lock the former in, and release the latter from, engagement with the power-wheel, and for effecting a working stroke of the impulse-pawl simultaneously with the release of the detent; an electromagnet in position for impelling the armature; and means for intermittently energizing said magnet, substantially as described, and for the purpose set forth.

5. In an electric-clock mechanism, the combination with the framework, and with the peripherally-toothed power-wheel, and the shaft actuated by said power-wheel; of a re-

ciprocally-effective impulse-pawl and locking-detent, the former of which is in normally-unlocked engagement with the power-wheel, and the latter of which is in normally-locked engagement with the power-wheel; and intermittently and electrically propelled actuating mechanism in operative connection with, and adapted for simultaneously locking, the impulse-pawl and unlocking the detent relatively to the power-wheel, and for effecting a working stroke of the impulse-pawl simultaneously with the release of the detent, substantially as described, and for the purpose set forth.

6. In an apparatus of the class specified, the combination with the framework, and with the peripherally-toothed power-wheel having its shaft journaled in said framework; of a reciprocally-effective impulse-pawl and locking-detent in position and adapted for reciprocally actuating and locking the power-wheel; an oscillatory impulse-pawl carrier; and an oscillatory pawl-locking and detent-lifting device adapted for simultaneously actuating the pawl and detent to lock the former in, and release the latter from, engagement with the power-wheel; and means, substantially as described, for oscillating the pawl-locking and detent-lifting device and the impulse-pawl carrier, the former in advance of the latter, substantially as described, and for the purpose set forth.

7. In an apparatus of the class specified, the combination with the framework, and with the power-wheel having its shaft journaled in said framework; of a reciprocally-effective impulse-pawl and locking-detent; an impulse-pawl carrier supported upon the shaft of the power-wheel, and having a relatively wide transverse slot therethrough; a pawl-locking and detent-lifting device suitably supported upon the pawl-carrier in position and adapted for simultaneously actuating the pawl and detent to lock the former in, and release the latter from, engagement with the power-wheel, and having a relatively narrow slot in the lower end thereof in register with the slot in the pawl-carrier; an oscillatory actuator having a projection extending through the registering slots in the pawl-carrier and pawl-locking and detent-lifting device, and adapted for oscillating the pawl-locking and detent-lifting device in advance of the pawl-carrier; and means for intermittently oscillating said actuator, substantially as described.

8. In an electric-clock mechanism, the combination with the peripherally-toothed power-wheel and with the oscillatory actuator; of a gravity-pawl pivotally supported upon a carrier in position for engaging a tooth of, and for advancing, the power-wheel; an oscillatory pawl-carrier in operative connection with the actuator; an oscillatory pawl-locker carried by, and adapted for a limited amount of movement independent of, the pawl-carrier, and also adapted for locking the pawl into engagement with the power-wheel; a movable connection between the pawl-locker and pawl-carrier; and means for intermittently oscillating the actuator, substantially as described, and for the purpose set forth.

9. In an apparatus of the class specified, the combination with the framework; of the power-shaft journaled in said framework; the peripherally-toothed power-wheel in frictional driving connection with said shaft; the oscillatory actuator; the oscillatory impulse-pawl carrier carried upon the power-shaft for movement concentric to the power-wheel, and in operative connection with the actuator; the impulse-pawl pivotally carried at the outer end of the pawl-carrier in position for engaging a tooth of, and adapted for intermittently advancing, the power-wheel; the spring-actuated detent in normally-locked engagement with the power-wheel; the pawl-locking and detent-lifting device pivotally carried by the pawl-carrier, and adapted for simultaneously locking the pawl in, and releasing the detent from, engagement with the power-wheel; an actuating-connector between the pawl-locking and detent-releasing device; the pawl-carrier for operating the pawl-locking and detent-lifting device and pawl-carrier, the former in advance of the latter; and means for intermittently operating the actuator, substantially as described, and for the purpose set forth.

10. In an apparatus of the class specified, the combination with the framework; of a power-shaft journaled in the framework; a peripherally-toothed power-wheel carried upon said shaft; an oscillatory actuator; electric mechanism, substantially as described, for intermittently oscillating said actuator; an oscillatory impulse-pawl carrier in radial disposition relatively to the power-wheel and in operative connection with the actuator; a stop-arm on the pawl-carrier adapted for engaging stop-abutments on the framework to limit the effective throw of said carrier; stop-abutments upon the framework located within the path of movement of the stop-arm upon the carrier; an impulse-pawl pivotally carried at the outer end of the pawl-carrier in position for engaging a tooth of, and adapted for intermittently advancing, the power-wheel; a locking-detent in normally-locked engagement with the power-wheel; a pawl-locking and detent-lifting device pivotally carried by the pawl-carrier, and adapted for simultaneously locking the pawl in, and releasing the detent from, engagement with the power-wheel; and an actuating-connector between the pawl-locking and detent-releasing device and the pawl-carrier for operating the pawl-locking and detent-releasing device and pawl-carrier, the former in advance of the latter, substantially as described, and for the purpose set forth.

11. In a secondary electric-clock mechanism, the combination with a rotative toothed power-wheel; of an actuator; an impulse-pawl in operative connection with, and adapted to

be operated by, the actuator, and in position for engaging the teeth of the power-wheel; a locking-detent in position and adapted for engaging and locking the power-wheel intermediate to successive operations of the impulse-pawl; a pawl-locking and detent-releasing device in position and adapted for simultaneously actuating the pawl and detent to lock the former in, and release the latter from, engagement with the power-wheel; and means for intermittently operating the actuator, substantially as described, and for the purpose set forth.

12. In an apparatus of the class specified, the combination with the framework; and with the power-shaft and power-wheel operatively connected together; of an impulse-pawl in position and adapted for intermittently engaging and rotating said power-wheel; a locking-detent in position and adapted for engaging and locking the power-wheel intermediate to successive rotations thereof; and an intermittently-operable oscillating actuator co-operative with, and reciprocally effecting a co-operative engagement between, the impulse-pawl and power-wheel, and having the axis of the working stroke coincident with the power-wheel axis, the locking-detent, and the power-wheel, substantially as described, and for the purpose set forth.

13. In an apparatus of the class specified, the combination of the framework; of a power-shaft; a power-wheel; and an oscillatory actuator having coincident axis of movement; a reciprocally-effective impulse-pawl and locking-detent in position and adapted, one for actuating, and the other for locking the power-wheel; means movable with the actuator, and adapted for simultaneously releasing the detent and locking the impulse-pawl into engagement with the power-wheel, and effecting the working stroke of said impulse-pawl, substantially as described.

14. In an apparatus of the class specified, the combination with the framework; of a concentrically-disposed power-shaft and power-wheel in frictional driving connection, one with the other; a reciprocally-effective impulse-pawl and locking-detent in position and adapted for reciprocally actuating and locking the power-wheel; an intermittently-operable oscillatory actuator having its axis of movement coincident with the axis of the power-wheel, and adapted for reciprocally releasing the detent, and effecting a working stroke of the impulse-pawl; and means for intermittently oscillating the actuator, substantially as described, and for the purpose set forth.

15. In an apparatus of the class specified, the combination with the framework, and with the peripherally-toothed power-wheel, and the shaft actuated by said power-wheel; of an impulse-pawl in normal operative engagement with a tooth of the power-wheel, and having the axis of its working stroke substantially concentric to the axis of the power-wheel; a locking-detent in position and adapted for engaging in a tooth-notch in the power-wheel, and for locking said power-wheel against movement intermediate to effective operation of the impulse-pawl; an oscillatory impulse-pawl carrier having its axis of movement concentric to the power-wheel; an oscillatory actuator; an actuating-connector between and connecting the impulse-pawl carrier and oscillating actuator; means for intermittently oscillating the actuator; and means for simultaneously engaging, and locking and releasing the impulse-pawl and locking-detent, respectively, relatively to the power-wheel, substantially as described, and for the purpose set forth.

16. In an apparatus of the class specified, the combination with the framework and with the peripherally-toothed power-wheel and the shaft actuated by said power-wheel; of an impulse-pawl in normal operative engagement with a tooth of the power-wheel; a locking-detent in position and adapted for engaging in a tooth-notch in the power-wheel, and for locking said power-wheel against movement intermediate to effective operation of the impulse-pawl; an oscillatory impulse-pawl carrier having its axis of movement coincident with the axis of the power-wheel; means for limiting the effective stroke of the impulse-pawl carrier; a pawl-locking and detent-releasing device carried by the impulse-pawl carrier in position and adapted for simultaneously locking the pawl into, and releasing the detent from, engagement with the power-wheel; and an electrically-propelled oscillatory actuator in operative engagement with the impulse-pawl carrier, and adapted for intermittently actuating said impulse-pawl carrier, and also in operative engagement with, and adapted for actuating, the pawl-locking and detent-releasing device, substantially as described.

17. In an apparatus of the class specified, the combination with the framework, and with the power-shaft revolubly carried in said framework; of a peripherally-toothed power-wheel revolubly mounted upon said power-shaft; a frictional driving-connector intermediate to, and co-operatively connecting, the power-shaft and power-wheel; an impulse-pawl carrier loosely mounted upon the power-shaft; an impulse-pawl carried by said carrier in normal operative engagement with a tooth of the power-wheel; a locking-detent in normal locked engagement with the power-wheel; a pawl-locking and detent-releasing device carried by said pawl-carrier, and adapted for simultaneously locking the pawl into, and releasing the detent from, engagement with the power-wheel; an oscillatory actuator revolubly mounted upon the power-shaft, and carrying an actuator-connector in operative engagement with the impulse-pawl carrier, substantially as described, and for the purpose set forth.

18. In an apparatus of the class specified,

the combination with the framework and with the power-shaft journaled in said framework; of a peripherally-toothed power-wheel mounted upon, and adapted for rotating, said shaft; an impulse-pawl carrier mounted for oscillatory movement upon said shaft, and carrying an impulse-pawl in normal operative engagement with the power-wheel; a locking-detent in normal locked engagement with the power-wheel; a combined pawl-locker and detent-lifter pivotally mounted upon the impulse-pawl carrier, and adapted for simultaneously engaging and effecting a locking and releasing movement of the pawl and detent relatively to the power-wheel; an oscillatory actuator revolubly mounted upon the power-shaft, and carrying an actuating-connector in movable engagement with the combined pawl-locker and detent-lifter and with the impulse-pawl carrier, and adapted for limited amount of ineffective movement relatively to the pawl-carrier; and means for intermittently actuating said carrier, substantially as described, and for the purpose set forth.

19. In an electromechanical clock system, a secondary-dial mechanism embodying in combination a suitable framework; a dial; a pointer-staff carrying a pointer at one end thereof adjacent to said dial; a power-wheel in frictional driving connection with said pointer-staff; an impulse-pawl in normal operative engagement with, and adapted for intermittently advancing, the power-wheel; a locking-detent in normal locked engagement with the power-wheel; an impulse-pawl carrier supported for oscillatory movement upon the pointer-staff; a combined pawl-locker and detent-lifter pivotally carried upon the impulse-pawl carrier, and adapted for simultaneously engaging the impulse-pawl and locking-detent, to effect a simultaneously locking and releasing movement of said pawl and detent, respectively, relatively to the power-wheel; an oscillatory actuating-armature in operative connection with the impulse-pawl carrier and the combined pawl-locking and detent-releasing device, and having its axis of movement substantially coincident with the axis of the power-wheel; a magnet having the poles thereof in position to attract the armature; a normally-open electrical circuit in connection with the magnet, and having the contact-terminals thereof adjacent to the circuit-closer; an intermittently-operable circuit-closer adjacent to the contact-terminals; and a master-timepiece in operation with, and adapted for intermittently actuating the circuit-closer, to thereby intermittently close the circuit, energize the magnet of the secondary-dial mechanism, and intermittently oscillate the actuator, and effect a parti-rotation of the power-wheel and the pointer-staff, substantially as described.

FRED L. GREGORY.

Witnesses:
RAYMOND GREGG,
HARRY GROOM.