

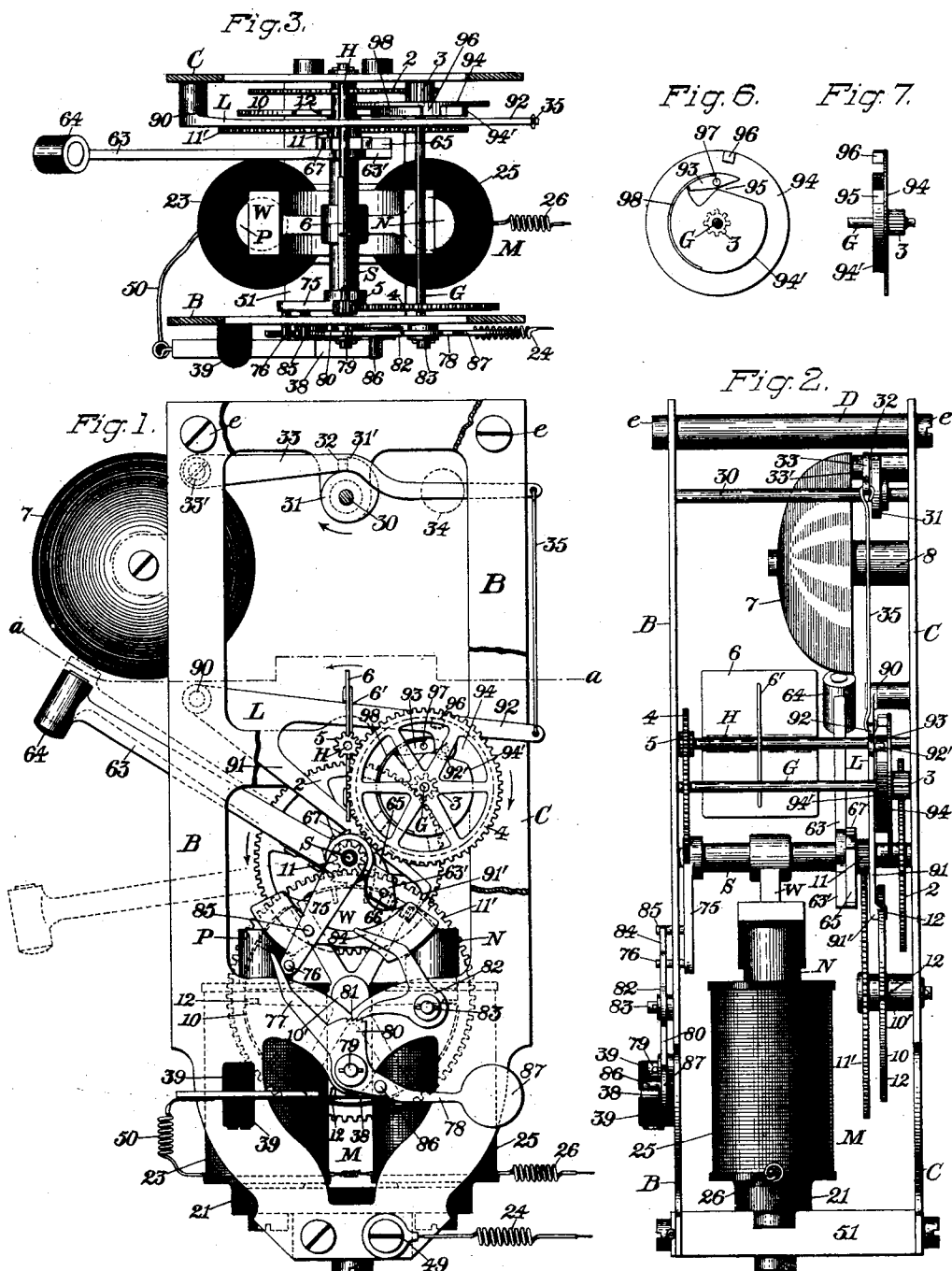
(No Model.)

3 Sheets—Sheet 1.

F. L. GREGORY.
ELECTRIC CLOCK STRIKING MECHANISM.

No. 535,370.

Patented Mar. 12, 1895.



Witnesses:
John L. Edwards Jr.
Fred J. Dole.

Inventor:
Fred L. Gregory.
By his Attorney,
F. H. Richards

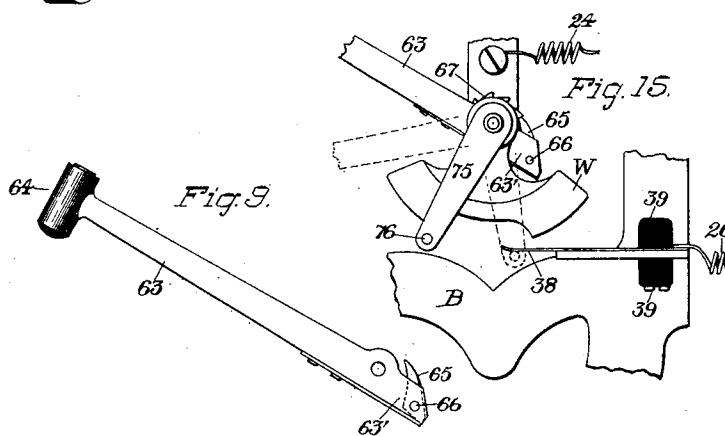
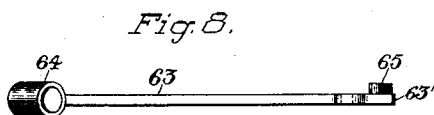
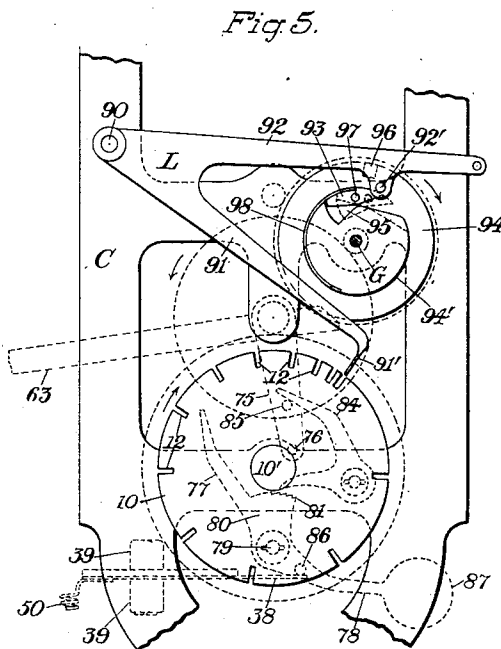
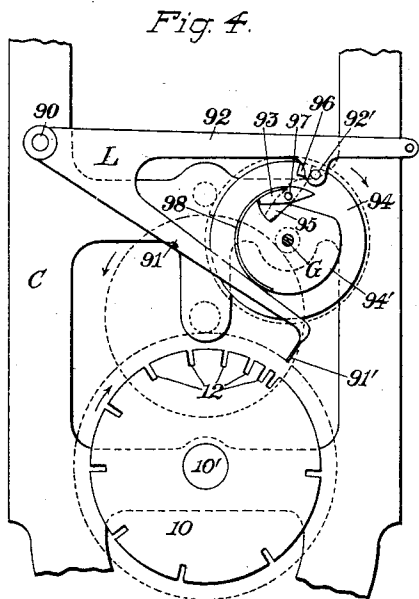
(No Model.)

3 Sheets—Sheet 2.

F. L. GREGORY.
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No. 535,370.

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Witnesses:

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UNITED STATES PATENT OFFICE.

FRED L. GREGORY, OF CHICAGO, ILLINOIS.

ELECTRIC CLOCK STRIKING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 535,370, dated March 12, 1895.

Application filed January 30, 1894. Serial No. 493,521. (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 Striking Mechanisms, of which the following is a specification.

This invention relates to striking mechanisms especially adapted for use in connection with electrically actuated clocks of the class described in United States Letters Patent No. 455,532, granted to me July 7, 1891; my present invention being in the nature of an improvement upon the striking mechanism shown and described in Letters Patent of the United States No. 520,184, granted to me May 22, 1894.

The object of my present invention is to provide an electrically-actuated striking mechanism adapted for use in connection with an ordinary time-piece, or as a separate striking-mechanism, operable independently of the time-piece for tolling fire-alarm signals and for other analogous purposes; and also to so construct and organize the striking mechanism as to actuate the striker at regular predetermined intervals, and to provide means in connection with said striker-actuating mechanism, whereby power will be stored at the termination of each series of beats of the striker, to thus enable the operative parts to be immediately set in motion, mechanically, when "let-off" at predetermined intervals and without the direct expenditure of electrical energy for first starting said mechanism in motion; and to secure to the driving-mechanism its maximum velocity prior to the first and each succeeding beat of the striker, thus causing the striker to act with regularity and insuring uniformity in the intervals of time elapsing between the successive beats of the said striker.

In the drawings accompanying and forming a part of this specification, Figure 1 represents in front elevation a striking-mechanism embodying my improvements in one form thereof, the operative parts being shown in their inactive or normal positions with the striker or power-lever held in a position forward of its retracted position. Fig. 2 is a side elevation of the mechanism as seen from the right-hand in Fig. 1. Fig. 3 is a cross-section

view in line *a-a*, Fig. 1, showing the parts below said line. Fig. 4 is a front elevation of a portion of the lower part of the back plate of the frame together with the stop-wheel and a portion of the hold-back mechanism, said figure showing the hold-back mechanism as disengaged from the stop-wheel, but as still engaged with the detent-wheel of the resistance-train; this being the position it occupies just prior to its being "let-off" to start the striker. Fig. 5 is a view similar to Fig. 4, showing said parts in the position they occupy during the reciprocation of the striker, said figure also showing in dotted lines the striker in its lowest position and the circuit closed by the switch. Figs. 6 and 7 are front and side views, respectively, of the auxiliary stop-wheel, or detent-wheel. Figs. 8 and 9 are plan and side views, respectively, of the striker or power-lever and connected pawl for actuating the resistance-train. Fig. 10 is a plan view of the striking-mechanism shown in Fig. 1 as provided with a modified form of let-off and hold-back mechanism. Fig. 11 is a front elevation of the same with portions of the mechanism removed. Fig. 12 is a side elevation of the striking-mechanism shown in Fig. 10 as looking from the right-hand in said figure. Figs. 13 and 14 are front elevations of a portion of the back-plate of the frame showing in connection therewith a portion of the stop-wheels and hold-back mechanism, said figures illustrating two successive positions of the hold-back mechanism. Fig. 15 is a front elevation of a portion of the frame, striker, and striker-actuator showing a modified form of contact-maker, the striker being herein shown as electrically connected with one of the terminals of the circuit and carrying an arm adapted for engagement with the other terminal to complete the circuit upon successive reciprocations of the striker.

Similar characters designate like parts in all the figures.

For the purposes of my present improvement, I may employ in connection therewith, as herein shown, a switch-mechanism (together with a magnet and rotary reciprocating armature actuated thereby) such as constitutes in part the subject-matter of United States Letters Patent No. 511,946, granted to me January 2, 1894; but it will be under-

stood however, that any other suitable and well-known form or arrangement of switch, magnet and armature adapted for imparting an oscillating movement to a power-shaft, may be substituted for those herein shown without departing from my invention.

In the drawings, the operative parts of the mechanism are shown carried by a framework consisting, essentially, of the usual front-plate B, and back-plate C, these plates being connected together by pillars D, and screws e, after the usual manner of constructing clock-trains.

The usual clock-train, this not being necessary to an understanding of my present improvement, is not fully shown herein; but in Figs. 1, 2, 3, 10, 11 and 12, I have shown the usual staff, or pointer-shaft 30, of a time-piece journaled in the frame-plates B and C, and carrying on its front end the "let-off" or striker-cam, which cam effects the starting up at the proper time of the striking-mechanism when this is used in connection with a time-piece. This operation of letting-off or starting the striking mechanism is effected by means, preferably, of a lever, 33, which is shown pivotally supported at one end, as at 33', on the back-plate C of the frame, and which lever, may, if desired, be provided with a weight as shown in dotted lines at 34, in Fig. 1, and as shown in full lines in Figs. 11 and 12, whereby its cam-pin, 32, is normally held in contact with the cam 31. When this cam is revolved in the direction of the arrow in Fig. 1, the lever 33 is first gradually raised from its normal position (shown in full lines in said Fig. 1) until the cam-point 32 on said lever reaches and passes off from the point 31' of said let-off cam which allows the lever to then fall into its first, or normal position. Said lever 33 being so actuated by the time-piece (and weight if one is used) operates, through the connecting wire or rod, 35, and by means of some suitable intermediate mechanism substantially as hereinafter described, to let off or facilitate the starting of the striking-mechanism.

The magnet employed for actuating the armature of the striking apparatus consists, in the preferred form thereof herein shown, of the two cores, P and N, connected by the usual bar, 21, and provided with the usual coils 23 and 25, on said cores, respectively. Electricity is supplied to the coils 23 and 25 through the electrical conductors 50 and 26, respectively, in the usual manner. The magnet M is supported by attaching the connecting bar 21 thereof to the lower bar, 51, connecting the two frame-plates B and C, as will be understood by comparison of the several figures of the drawings. The winding of the magnet-coils, and the connection of the same with the source of electrical supply, should, of course, be done in such manner as to actuate the armature in the direction required by the character of the operative parts of the striking-mechanism.

The armature, (which is also herein termed the "striker-actuator" and is designated in a general way by W,) is, as in the patents hereinafter referred to, shown carried by a rock-shaft, S, which is suitably journaled in the frame-plates B and C, and said armature is, on its outer side, substantially concentric with its supporting-shaft, and is held in position to oscillate in close proximity to the poles P and N of the magnet M, as will be understood from the drawings and my aforesaid Letters Patent. The rock-shaft S carries, rigidly fixed thereon, the striker-arm 63, usually provided at its outer end with a hammer, as 64, adapted for striking a bell, as 7, suitably held in proper position therefor. Said bell 7, may be supported on one of the frame-plates, as C, by means of the stud 8, or in some other convenient way. The bell is preferably located above the hammer as shown in the drawings, but in some cases it may be located below the hammer. In the latter case, of course, the blow will be struck on the descent of the hammer; and as this stroke is made by gravity and is usually less rapid than the upward stroke, (which is made directly by the force of the magnet) of course the tone of the bell will vary correspondingly.

The striker-arm 63, in the preferred organization thereof herein shown, constitutes a combined reciprocatory train-actuator and striker; it being supported in position and adapted for actuating the striking-train, as will be hereinafter more fully described, and also performing the functions of an ordinary bell-striker.

The stop-wheel 10, the construction of which will be hereinafter fully described, is shown journaled on a stud, 10', fixed in the frame-plate C, and is intermittently actuated from and by the movements of the shaft S, and striker-arm 63, through the medium of an ordinary pawl-and-ratchet device, which, in the form thereof herein shown, consists of the ratchet-wheel, 67, loosely mounted on said shaft S, and carrying a pinion, 11, which meshes with the teeth of a spur-wheel, 11', operatively connected with or forming a part of the stop-wheel 10; and the pawl 65 pivoted at 66 to the projecting end 63' of the striker-arm for engaging the teeth of said ratchet-wheel. On the reciprocatory movement of the armature-shaft S and striker-arm 63, by the action of the armature W, the pawl 65 engages the ratchet-wheel 67 on the downward stroke of the striker-arm which turns forward the stop-wheel. This stop-wheel 10 and spur-wheel 11', will, preferably, be constructed in one piece.

As a means for properly limiting the velocity of the striker-arm during its downward stroke, so as to cause a sufficient time to elapse between successive strokes of the hammer, an ordinary fan-train may be provided, as shown in the drawings, which fan-train is arranged as follows: Fixed on one end of the loosely mounted pinion 11 (carried on the aforesaid

shaft S) is a relatively large spur-wheel, 2, which meshes with the pinion 3 of an intermediate shaft, G, that is journaled in suitable bearings in the frame-plates B and C, and carries another spur-wheel, 4, meshing with the pinion 5 of the fan-shaft H. This shaft is provided with the usual fan 6, which may be held thereon by means of the ordinary clamp-wire 6', in a well-known manner understood by clock-makers.

It will be understood that a fan-train of substantially the construction and organization shown, in connection with the striking-mechanism, is not essential to the apparatus, as any ordinary escapement or like device for regulating the velocity of the striker-mechanism may be employed without departing from my present invention.

When the armature is swung forward (toward the left hand) to the position shown in Fig. 1, the pawl 65 passes over one of the teeth of the ratchet-wheel 67, and on the descent of the striker-arm 63, as by a reverse or backward movement of the armature, said pawl engages a tooth of and turns said ratchet-wheel, and through it and the intermediate gearing, drives the fan-train, which in turn limits the velocity of the return stroke of the striker-arm and armature for the purpose hereinbefore mentioned. The operation of these parts as so far described substantially coincides with the operation of like parts in Patent No. 520,184 hereinbefore referred to.

The electrical circuit for energizing the magnet M consists of the two terminals 24 and 26, one of which, 26, is shown leading directly to the spool 25, while the other one, 24, is connected at 49 to the metallic frame. Connection is made with the other spool 23, through the wire 50, which leads to the contact-point or spring 38. A switch will preferably be provided to complete the electrical circuit by engagement with said contact-point, as will be hereinafter more fully described.

For the purpose of making and breaking the circuit for actuating the striking-mechanism, a circuit-breaker or switch of the locking variety is provided, which, in the preferred form thereof herein shown, and as described in my aforesaid patent, No. 520,184, is constructed and organized as follows: The switch-lever 78, carrying the contact-point 86, for making the electrical circuit through the terminal 38, is pivotally supported at 79, on the front frame-plate B. Said switch has means, as for instance, the weight 87, fixed thereto or formed integral therewith, for automatically moving it to close the circuit, as shown, for instance, by dotted lines in Fig. 5, when the switch is released from its locking device; and is provided with a suitable detent-rim, as the segment 80, for engaging with the detent-pawl or switch-lock 82 (that is pivoted on a stud 83 fixed in the frame-plate B) which switch-lock has an arm, 84, whereby it may be unlocked from the switch, as shown in said figure. The switch, also, has suitable means,

as for instance, a projecting arm, 77, for operating the same on the retractive movement of the striker-arm and its carrier. As a means for effecting this operation, the striker-arm-carrier, or shaft S, carries a switch-actuating-arm, 75, which is provided with a pin or projection, 76, for engaging said switch-arm 77, on the retractive stroke of said striker-arm, and with another pin or projection, 85, for engagement with the arm 84 of the switch-lock 82 for opening said switch-lock to release the switch on the retractive movement of said striker-arm to thus allow the switch to drop into contact with the terminal 38 and complete the circuit. In some cases, if it be so preferred, one other projection (not herein shown) on the arm 75 and located between the positions of the pins 76 and 85, (the arms 77 and 84 being suitably shaped therefor,) may be substituted for said separate pins 76 and 85. The detent segment or locking rim 80 is herein shown as consisting of a series of ratchet-teeth, 81, (see Figs. 1 and 5) arranged in the form of a segment concentric with its supporting pin, 79; but in lieu of this device I may in some instances use a well-known detent-device consisting of a friction-rim operating in connection with a frictional detent-pawl or detent-cam.

The electrical terminal 38 is shown consisting of a spring which is supported between blocks, 39, of insulating material secured to the front-plate B.

The stop-wheel, which practically consists, as herein shown, of the spur-wheel 11', and the stop-wheel proper 10, differs somewhat in construction from that shown in Patent No. 520,184, hereinbefore referred to. In the present instance, the spur-wheel 11', which controls the movement of the stop-wheel proper, has a multiplicity of teeth equal in number to the number of strokes it is desired that the hammer shall make at each complete revolution of said wheel. This stop-wheel proper has formed in its periphery a series of notches 12 herein shown as twelve in number, they being arranged successively, with relation to the spur-wheel, a distance apart equal to the distance between from one to twelve teeth successively of said spur-wheel. Thus it will be seen that inasmuch as at each descent of the striker-arm the spur-wheel being carried thereby the distance of one tooth, an effective stroke of the striker-arm is made each time said wheel revolves the distance of one tooth. The operation of this wheel being intermittent, and being timed in its movements, by the let-off cam and its connected mechanism, the striker-arm will, during the rotation of the actuating-mechanism, have a regular reciprocatory movement which will be interrupted at predetermined intervals by suitable mechanism as will be hereinafter fully described.

As a means for interrupting the successive strokes of the striker-arm, and for detaining the stop-wheel and regulating mechanism in

their movements, and also for insuring the retention of the striker in a retracted position at the termination of each series of its successive strokes, I have provided in connection with said stop-wheel, and its driving and retarding-mechanism, a "hold-back" device adapted for engagement with the stop-wheel immediately after the striker has made the last stroke of each series, and adapted for holding said wheel against rotation the length of time requisite between successive series of strokes. In the present instance, the mechanism is organized, and the stop-wheel constructed for repeating the striking operation at intervals of one hour, the let-off cam, in this instance, being adapted for making one complete revolution per hour to release the hold-back mechanism, and the stop-wheel is intended to make one complete revolution every twelve hours, it being started in motion by the let-off cam once every hour and continuing in its revolution until the striker has made the requisite number of beats to designate the hour of the day, after which the hold-back will immediately engage and stop the stop-wheel, in a manner hereinafter more fully set forth, holding the striker in an elevated position ready to descend by its own gravity to set the mechanism in motion when the hold-back is released by the let-off cam of the time-train. This operation causes a storage of power at the end of each successive series of strokes of the striker sufficient to start the mechanism mechanically and secure to the striking-mechanism its maximum velocity before the next upward stroke of said striker, thus insuring regularity in the movements of the striker and uniformity in the intervals of time elapsing between successive strokes of said striker.

The hold-back mechanism, in the preferred form thereof as shown most clearly in Figs. 4 and 5, consists of a compound stop-lever, designated in a general way by L, pivoted at 90 to one side of the back-plate C and comprising the arms 91 and 92, respectively, the one 91 of which has, at one end thereof, a stop-pin or projection, 91', adapted for engagement with the notches 12 of the stop-wheel 10, and the one 92, having a detent-pin or projection, 92', adapted to be engaged by a catch, 93, upon a detent-wheel, 94, carried upon the shaft 3, of the time-train or retarding-mechanism. This detent-wheel constitutes an independent supplemental locking device or supplemental hold-back for the stop-wheel-actuating mechanism it being adapted for locking said mechanism against movement for a relatively short period of time after the release of the hold-back from the stop-wheel as will be hereinafter more fully described. This detent-wheel or supplemental locking device is so constructed, and is so organized and timed in its movements with relation to the stop-wheel as to make one entire revolution during the travel of the stop-wheel (or the spur-wheel 11' secured thereto) the distance of one tooth, or the length of the arc between two successive teeth, and the stop-lever L is so constructed and arranged with relation to the stop-wheel and detent-wheel that the stop-pin 91' of the arm 91 will engage in a notch 12 in the stop-wheel, and the detent-pin 92' of the arm 92 of said lever will be engaged by the catch 93 of the detent-wheel 94 simultaneously, to lock the stop-wheel and the retarding-mechanism, directly, against movement at the termination of the last beat of the striker whether it strikes once to designate one o'clock, or twice to designate two o'clock, or at the termination of each successive series of beats, as will be readily understood by reference to the drawings. This will also apply when the mechanism is used for striking fire-alarm signals, or for other analogous purposes. This detent-wheel in the form thereof shown most clearly in Figs. 6 and 7, is constructed to have a circular track, 94', upon which the detent-pin 92' of the lever-arm 92 rides during the rotation of said wheel in the direction of the arrow as shown in Fig. 1. This track is notched or cut away as shown at 95, and is provided at a point above said notched portion with an abutment, or detent-stop, 96, which overlies the track 94'.

Pivotal support at 97 within the notch 95 is the catch 93 whose outer face coincides, when in its normal position, with the track 94'. This catch is somewhat in the nature of a pawl and is held by means of a spring, 98, with its forward end projected into the path of movement of the detent-pin 92' of the stop-lever L. The abutment or stop 96 is so located upon the detent-wheel that its forward face will be contiguous to the forward end of the catch 93 when the same is slipped upward at its forward end by the detent-pin upon the lever-arm 92, when said lever is lifted by the let-off cam 31 and connected lifting devices.

By this construction and organization, it will be seen that as the cam 31 is revolved in the direction of the arrow in Fig. 1, the lever 33 will be raised gradually, and, through the medium of the rod or connection 35, will lift the stop-lever L (assuming the parts to be in the position illustrated in Fig. 1) which will withdraw the stop-pin or projection 91' from the stop-notch, and at the same time carry the detent-pin 92' upward to the position illustrated in Fig. 4, this operation releasing said detent-pin from its engagement with the spring-held catch 93, but leaving it in engagement with the abutment or stop 96 which will still prevent the rotation or movement of the mechanism until the detent-pin 32 of the lever 33 has passed over the point 31' of the let-off cam, when said lever L will drop into the position illustrated in Fig. 5, with the detent-pin 92' resting upon the track 94' of the detent-wheel and the stop-pin 91' resting upon the face of the stop-wheel, at which time the striker-arm will descend from the position shown in Fig. 1 to the position shown in dot-

ted lines in Fig. 5, thus imparting motion to the driving mechanism. The descent of the striker carries the switch-actuating arm into contact with the switch-lock, releasing said lock from the switch which immediately drops with its contact-point into engagement with the terminal 38 which will complete the electrical circuit, thus energizing the magnet and actuating the striker-carrier to elevate the same, which operation will continue regularly until the stop-wheel has traveled a sufficient distance to bring one of its stop-notches in registration with the stop-pin 91' of the stop-lever, when said pin will immediately drop into said stop-notch and hold said wheel against further rotation until said stop-lever is again operated by the let-off cam, the detent-pin 92' of the lever-arm 92 being at this time in the position illustrated in Fig. 1 of the drawings. By this construction and organization of stop-mechanism, and its operating device, I am enabled to let off and start the mechanism with slight expenditure of power, and it will also be seen that even though the stop-pin 91' has been completely withdrawn from the stop-wheel notch before the detent pin of the lever 33 has passed over the point 31' of the let-off cam, the mechanism cannot start, owing to the contact of the detent-pin 92' with the abutment or stop 96 of the detent wheel and until the cam 31 has completed an entire revolution, and the detent-pin on the lever 33 has passed over the point 31' of said cam, and the detent-pin 92' has reached a position intermediate to the track 94' and the abutment 96 upon the detent-wheel as illustrated in Fig. 5 of the drawings, thus positively insuring a movement of the mechanism at regular predetermined intervals, and obviating any accidental movement thereof between such intervals.

In Figs. 10 to 14 inclusively, I have shown a slightly modified construction and organization of hold-back mechanism in connection with the striking-mechanism. In the form shown in said figures, a stop-lever L is provided which is similar to the stop-lever shown in Fig. 1, and a detent-wheel 94 is also provided which is also similar to the detent-wheel shown in Fig. 1, the spring-held catch 93, however, being dispensed with. The operation of this lever and detent-wheel is substantially the same as like parts shown in Fig. 1, with the exception that instead of operating the said lever L directly from the let-off lever, I have provided an auxiliary device, designated in a general way by O, for actuating said lever L. This actuating-device O, consists of an arm, 100, pivotally supported at one end intermediate to the arms 91 and 92 of the stop-lever and connected at its opposite end by means of a suitable rod, 35, to the end of the let-off lever 33. This actuator 100, underlies the detent-pin 92' and the detent-pin 92' lies out of engagement with the stop-wheel and detent-wheel, respectively. As a means for preventing the accidental starting

of the mechanism before the detent-pin of the let-off lever passes over the point 31' of the let-off cam, I have provided the actuating arm 100 with a projection, 101, adapted upon the upward movement of said actuator, to be brought into the path of movement of a stop-abutment, 102, upon a wheel, 103, secured to the shaft II of the fan-train. This wheel 103 will be so timed in its movements relative to the detent-wheel and stop-lever actuator, as to come into contact with the stop-pin 101 of said actuator when said actuator has been raised sufficiently to throw the stop-lever out of engagement with the stop-wheel and detent-wheel, thereby preventing the movement of the mechanism until the actuator 100 is allowed to drop out of engagement with the stop-abutment on the wheel 103 by the let-off cam 31.

It is not desired to limit this invention to the particular construction and organization of hold-back mechanism shown in either Figs. 1 to 7 or in Figs. 10 to 14, as either construction and organization is practicable for the purpose intended and are simply slight modifications of one another.

Having thus described my invention, I claim—

1. In a striking-mechanism, the combination with a stop-wheel and a resistance-train in operative connection therewith, of a combined stop-wheel-actuator and striker in operative connection with the stop-wheel and adapted for periodically rotating said stop-wheel, means for imparting a reciprocatory movement to said striker, an independently operable hold-back device in position and adapted for periodically engaging and arresting the movement of the stop-wheel, and means in position and adapted for operating said hold-back device at predetermined intervals to release the mechanism and permit the actuation thereof by the striker, substantially as described.

2. In a striking-mechanism, in combination, a stop-wheel, a combined reciprocatory stop-wheel-actuator and -striker, striker-actuating mechanism, and means substantially as described for periodically arresting the movement of the striker and for holding the same in a mid-stroke position, or in a position slightly forward of its extreme retractive position, substantially as described and for the purpose set forth.

3. In a striking-mechanism, in combination, a stop-wheel, a combined vertically-reciprocatory striker and stop-wheel-actuator, means for periodically imparting a reciprocatory movement to said striker, a hold-back device for periodically arresting the movement of and for temporarily holding the striker in a mid-stroke position, and means for operating said hold-back device at predetermined intervals to release said striker, substantially as described and for the purpose set forth.

4. In a striking-mechanism, a stop-wheel, an electrically-propelled combined reciproca-

tory stop-wheel-actuator and striker, an independently operable hold-back device adapted for engagement with and for periodically holding the stop-wheel against movement, and means for operating said hold-back device at predetermined intervals to release the stop-wheel and permit the same to be again actuated by the actuator or striker, substantially as described.

5. In a striking-mechanism, in combination, a stop-wheel, an electrically-actuated reciprocatory stop-wheel-actuating striker, a let-off or starting-device, and mechanism in operative connection with said let-off or starting device and in position for engagement with the striker and adapted for periodically engaging said operative parts and holding the striker in a mid-stroke position or in a position slightly remote from its extreme retracted position, substantially as described and for the purpose set forth.

6. In a striking-mechanism, in combination, a striking train embodying a stop-wheel, a combined reciprocatory striking-train-actuator and striker, an electro-motor in position and adapted for periodically propelling said striker, a hold-back and let-off mechanism substantially as described for periodically holding and releasing the striking-train to periodically stop the striker at its mid-stroke position and to start the same at predetermined intervals, substantially as described and for the purpose set forth.

7. In a striking-mechanism, the combination with a striking-train embodying a stop-wheel, of a combined reciprocatory stop-wheel-actuator and striker, an electro-motor for operating said striker and embodying a magnet, a switch in circuit with the magnet and in position to be operated by the striker, an independently operable hold-back device adapted for engagement with and for holding the stop-wheel against movement at proper intervals, a supplemental locking-device in position and adapted for locking the striking-train against movement for a relatively short period after the release of the hold-back from the stop-wheel, and means for periodically operating said hold-back device, substantially as described and for the purpose set forth.

8. In a striking-mechanism, the combination with the striking-train embodying a stop-wheel, and with the train-actuating striker, of periodically operable hold-back-mechanism comprising two independent train-locking devices in position and adapted for simultaneously engaging and locking successive members, respectively, of said train against movement, and a periodically operated device for successively releasing said locking-devices from said successive members, respectively, to insure the effective inauguration of movement of the striking train at predetermined periods, substantially as described.

9. In a striking-mechanism, the combination with a striking-train embodying a stop-wheel, of a combined train-actuator and bell-

striker, an electro-mechanical striker-actuator, a hold-back device constructed for periodically engaging and arresting the movement of said stop-wheel, a supplemental locking-device in position and adapted for engaging another member of the striking train and for holding said member and the stop-wheel against movement after the release of the hold-back device from the stop-wheel, and means substantially as described for periodically and successively actuating the hold-back and supplemental locking device to successively release them from engagement with their respective connected members, substantially as described.

10. The combination with an electrical circuit comprising an electro-magnet and a circuit-maker-and-breaker, of a striking mechanism comprising a reciprocatory striker-carrying armature, a striker carried by said armature, means connected with the striker-carrier or striker for operating the circuit-maker-and-breaker, a resistance-train in connection with and operated by the striker-carrier, and a compound hold-back device consisting of two independently operable locking-devices in position and adapted for simultaneously engaging different members of and locking the resistance-train, and a let-off device in position and adapted for simultaneously or successively releasing said locking-devices from engagement with the respective members, substantially as described and for the purpose set forth.

11. The combination with an electrical circuit having terminals and comprising an electro-magnet and a circuit-maker-and-breaker, of a striking-mechanism consisting of a reciprocatory striker-carrying armature, a combined resistance-train actuator and striker carried by said armature, means connected with the striker for operating the circuit-maker-and-breaker, a resistance-train in operative connection with said striker-carrier, a hold-back device for periodically engaging and for releasing said resistance-train for starting and stopping the striker, and a supplemental locking device and means for releasing the supplemental locking device subsequently to the release of the hold-back, substantially as described and for the purpose set forth.

12. The combination with an electrical circuit embodying an electro-magnet and a reciprocatory armature or striker-carrier, of a striker carried by said armature, a switch intermediate to said armature and the electrical terminals of the circuit, means connected with said striker-carrier for actuating the switch, a hold-back device adapted for engaging and arresting the movement of the striker-carrier at predetermined intervals and at its mid-stroke position, and means for periodically releasing said carrier, substantially as described and for the purpose set forth.

13. The combination with an electrical circuit embodying an electro-magnet having a

reciprocatory striker-carrying armature, of a striker carried by said armature, a resistance-train in operative connection with said striker, a switch in circuit with the magnet and in position to be operated by the striker to make and break the circuit, an independently operable hold-back device located in position to engage the resistance-train to arrest the movement of the striker, a supplemental train-locking device adapted for releasing the train subsequently to the release of the hold-back, and a let-off device operatively connected with the hold-back and supplemental locking device and adapted for periodically and successively disengaging said hold-back and locking-device from the resistance-train to facilitate the starting of the striker, substantially as described and for the purpose set forth.

14. In a striking-mechanism, in combination, a reciprocatory striker-carrier, a striker carried thereby, a resistance-train operatively connected with the striker-carrier and embodying a stop-wheel having a series of stop-faces or notches at points corresponding to the required stopping-times of the mechanism; means for advancing the stop-wheel on the successive movements of the striker-carrier, an independently operable hold-back device located in position for engaging successive members of the resistance-train to arrest the movement thereof, and means substantially as described for operating said hold-back to periodically and successively release said members to facilitate the starting up of the resistance-train, substantially as described and for the purpose set forth.

15. The combination with an electrical circuit having terminals, of an electro-mechanical striking-mechanism comprising an electro-magnet, a reciprocatory striker-carrying armature, a striker carried thereby and provided with means for opening and closing the circuit upon successive reciprocations thereof, a resistance-train in operative connection with said striker-carrier and embodying a stop-wheel, an independently operable hold-back device consisting of a stop-lever and a supplemental locking-device located in position respectively for engagement with said successive members of the resistance-train to arrest the movement of the striker and means for actuating said lever and supplemental locking-device to release the same successively from engagement with said successive members of the resistance-train, substantially as described and for the purpose set forth.

16. In an electro-mechanism striking-apparatus, in combination, an electrical circuit having terminals, an electro-magnet, a reciprocatory striker-carrying armature, a striker carried thereby, a resistance-train in connection with and operated by the striker, a circuit-closer adjacent to the terminals of the electrical circuit and adapted to be operated by the reciprocations of the striker, a hold-back device adapted for engaging and holding the striker at its mid-stroke position, a

supplemental locking-device adapted for engagement with another member of said resistance-train, and means for periodically and successively releasing said hold-back and supplemental locking-device to inaugurate the operation of the striker, substantially as described and for the purpose set forth.

17. In a striking-mechanism, the combination with an electrical circuit having two terminals and an electro-magnet, of a reciprocatory striker-actuator, or armature, a striker carried thereby and in electrical connection with, or constituting the contact-point of, one of said terminals and carrying means for engaging and disengaging the other of said terminals to make and break the circuit upon successive reciprocations of said striker, an independently operable hold-back device and supplemental locking-device in position and adapted for engagement with successive members of the resistance-train for stopping the same at predetermined intervals, and a let-off device for successively releasing said hold-back and supplemental locking-device respectively from their engagement with the successive members of the resistance-train, substantially as described and for the purpose set forth.

18. In a striking-mechanism, the combination with the reciprocatory striker, the resistance-train, or regulating-mechanism connected therewith, of a combined resistance-train actuator and striker and a hold-back mechanism consisting of a stop-wheel and a detent-wheel connected with said resistance-train, a lever having stop-pins adapted for simultaneously engaging the detent-wheel and stop-wheel, and means substantially as described for periodically and successively releasing said stop-wheel and detent-wheel, substantially as described and for the purpose set forth.

19. In a striking-mechanism, the combination with the combined reciprocatory train-actuator and striker and its actuating mechanism, of a regulating-train in operative connection therewith, a stop-wheel having a series of stop-faces, a detent-wheel having a spring-held catch, a stop-lever having a detent-pin to be engaged by the catch of the detent-wheel, and having a stop-pin to engage the successive stop-faces of the stop-wheel, and a let-off device connected with said lever for operating the same to successively release the stop-wheel and detent-wheel respectively, substantially as described and for the purpose set forth.

20. In a striking-mechanism, in combination, a stop-wheel, a reciprocatory stop-wheel-actuating striker in operative connection with and adapted for periodically rotating said stop-wheel, an independently operable hold-back device in position and adapted for periodically engaging and arresting the movement of the stop-wheel, a revoluble hold-back-actuator in operative connection with and adapted for periodically operating the hold-

- back device to release the same from engagement with the stop-wheel, and a supplemental locking-device in position for engagement with the hold-back device and adapted for locking the stop-wheel against movement for a relatively short period after the release of the hold-back from engagement with the stop-wheel, substantially as described and for the purpose set forth.
21. In a striking-mechanism, the combination with the striker and means for imparting a reciprocatory movement to said striker, of a stop-wheel in operative connection with said striker, a hold-back device in position and adapted for periodically engaging and arresting the movement of the stop-wheel, a let-off cam in operative connection with and adapted for operating the hold-back device at predetermined periods to release the same from engagement with the stop-wheel, and an independent locking-device in operative connection with the stop-wheel and in position and adapted for engagement with the hold-back to prevent movement of said stop-wheel after the release of the hold-back from said stop-wheel and until said hold-back is let off by the let-off cam, substantially as described and for the purpose set forth.
- FRED L. GREGORY.
- Witnesses:
JNO. G. RICH,
P. S. TOWNSEND.