(No Model.)

I. H. FARNHAM.

ELECTRO MAGNETIC ARRESTING AND RELEASING MECHANISM.

No. 375,544. Patented Dec. 27, 1887.

Fig. 1.

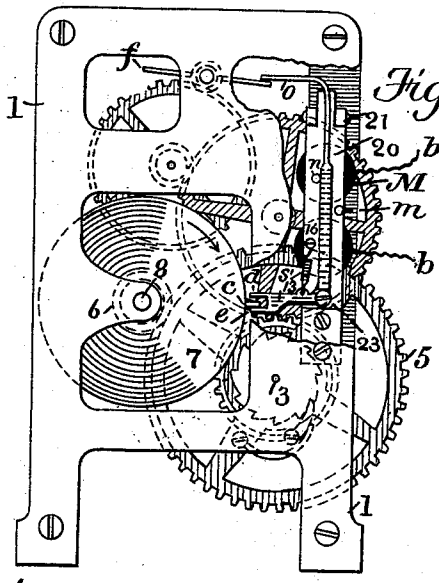


Fig. 2.

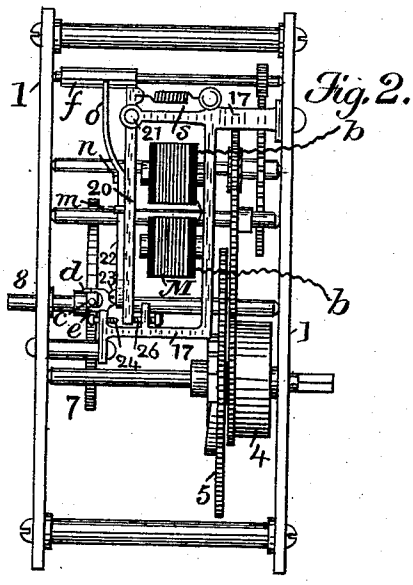


Fig. 4.

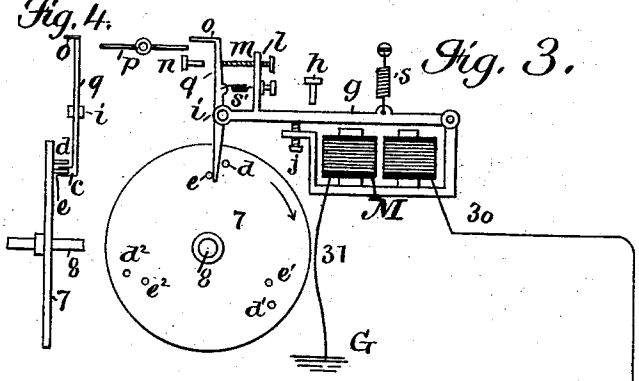


Fig. 3.

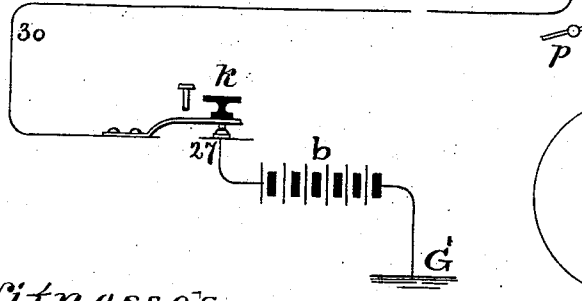
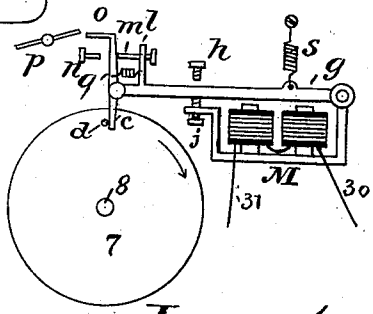


Fig. 5.



Witnesses.

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ELECTRO-MAGNETIC ARRESTING AND RELEASING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 375,544, dated December 27, 1887.

Application filed March 26, 1887. Serial No. 232,523. (No model.)

To all whom it may concern:

Be it known that I, ISAIAH H. FARNHAM, residing at Malden, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Electro-Magnetic Arresting and Releasing Mechanisms, of which the following is a specification.

This invention relates to controlling clock-work motors and like mechanisms electrically; and its object is to provide means whereby any such motor or system of clock-work actuated by a spring or weight may be controlled or released and arrested electrically with great accuracy and certainty of operation by devices of simple character and construction, and with a much smaller amount of battery or other electric power than has heretofore been required.

It consists in a novel starting and stopping mechanism for electro-mechanical appliances, (such as fire-alarm-gong strikers, railroad starting-gongs, and other analogous applications of clock-work,) and is especially applicable to such instruments as, once started, have to be stopped with precision at predetermined points or at regular intervals—for instance, at one or more periods in a single revolution of the center or governing wheel.

More specifically, it comprises the combination, with the governing-wheel of the mechanism to be controlled, which is provided with pins, cams, or projections at as many stopping-points as may be desired, of means actuated by such projecting pins for instantaneously engaging the fan or fly of the mechanism and for maintaining such engagement as long as desired, whereby not only is the mechanism arrested with great precision at the proper point by means of the stop-pins representing such point or points, but is also adapted to be started again when necessary with ease and facility and with the use of comparatively low power, since the governing-wheel stop is not used to hold the machine at rest, but only to throw into and maintain in action a second stop, which, engaging and arresting the mechanism at its fan, where little pressure or friction is exerted upon the stop, can consequently be disengaged for the purpose of once more releasing the motor mechanism without the necessity of applying an uneconomical degree of power for that purpose.

The details of the mechanism which I employ comprise, as usual, a controlling electro-magnet for starting or stopping the clock-work by means of an electric current and an armature therefor. Upon the armature is a pivoted lever having an arm at both ends bent or extended at an angle from its main stem. One of these arms projects normally into the path of detent-pins or equivalent projections arranged on the surface or periphery of a stop-disk placed on any suitable arbor or shaft of the mechanism, and is normally held there by a counter-spring. The other arm projects from the lever toward the fan of the machine, which, as usual, is geared to a high speed. It is not normally, however, within range of the said fan. The pin of the stop-disk strikes the first arm with considerable power, and if the engagement of the said pin with the arm were maintained or were depended upon to hold the motor at rest it would require the exercise of more power than is conveniently attainable through the agency of an ordinary electro-magnet with a reasonable amount of battery-power.

It is sometimes desirable to so arrange electrical stop mechanism that after the motion is first arrested it will require both an opening of the circuit or an intermission of electricity, succeeded by a closure of the circuit or a new passage of the current, before it can be again started; or, per contra, it may require to be oppositely arranged, first to stop the motor when the circuit is open and the magnet-armature retracted, and thereafter to need a closure and a reopening of the circuit before the motor mechanism is released for further progress.

In an application for Letters Patent No. 232,522, filed contemporaneously herewith, I have described such a double-stop mechanism in association with a motor-impelled circuit-changer arranged to transfer the terminal of a main circuit successively to a number of auxiliary circuits. The double stop may thus be utilized to insure the periodical arrest of a motor mechanism at one or more predestinated points, whether the electrical controlling-circuit be at the instant closed or open, and also to insure against running the mechanism down in the event of an accidental continuous clos-

ure of the circuit, due to contact of the main-circuit wires with other lines carrying battery-currents. I may avail myself of either of two ways of effecting this double stop. I may place two stop-pins near together at each stopping-point of the center arbor or controlling-disk and mount the pivoted lever so that it will engage the forward one when the armature is attracted, and upon the retraction of the said armature allow the forward pin to slip by and then to catch the second pin. A second attraction will then be required to finally release the disk and motor, which will then continue to run until the next stopping-pin arrives at the pivoted lever-arm. This arrangement is of course, as hereinbefore explained, reversible; or, alternatively, I may place but one pin on the stop-disk at each stopping-point and provide the lever-arm with a forked end, one of the tines of the fork being in advance of the other in the direction of rotation and behind the other with reference to the front of the mechanism, so that one tine of the fork will be adapted to engage the stop-pin when the armature is attracted to its electro-magnet, and when the armature is retracted the first tine of the fork releases the pin, which thereupon advances but a short distance, and is then caught upon the second. After successively escaping or being disengaged from both pins, the motor moves until the next stop-pin is arrested in the same way. This plan is also reversible with reference to the opening and closing of the circuit.

It is furthermore to be understood that this mechanism is capable of being operated in several ways. It may be arranged to stop on the first pin or tine for any desired period before being transferred to the second; or the transfer may be made without the lapse of any appreciable time; or it may be arranged that a closure of the circuit of the electro-magnet shall be required to start the mechanism, and that such closure shall be continued until the first part of the next arrest is made, in which case the opening of the circuit will operate to transfer the stop to its second stage, and a reclosure will effect the final release.

I will now proceed to describe the invention with reference to the drawings.

In the drawings which accompany this specification, Figure 1 is a side and Fig. 2 an end elevation of a clock train, movement, or motor mechanism fitted with my invention. Fig. 3 is a modification of my electro-magnetic starting and releasing mechanism, together with an electric circuit and operating devices therefor. Fig. 4 is a side elevation of a detail thereof, and Fig. 5 is a modification of Fig. 3.

I will first describe Figs. 3, 4, and 5, these being simple in appearance and well adapted to elucidate the principle of the invention.

In Fig. 3 is represented the controlling, governing, or center arbor-disk, 7, of any suitable clock train or movement, (not shown,) provided with three sets of double-stop points or pins, *d e*, *d' e'*, and *d² e²*. This disk is mounted upon the center arbor, 8, of the said clock-movement. Of course it is not essential that the form of a disk should be adopted, though it is most convenient, as it is presumable that the number of required stops may from time to time be varied. A light lever, 9, pivoted at the point *i* on the end of the combined armature and armature-lever *g* of a controlling electro-magnet, M, has an inwardly-projecting foot, *c*, adapted to engage the pin *d* or the pin *e*, according to the attracted or retracted position of the armature, as clearly shown in Fig. 4, and upon such engagement to arrest the motion of the disk 7 and its motor mechanism. The armature *g* has a back limit-stop, *h*, a front stop, *j*, and the usual retracting-spring, *s*. The pivoted lever *g* has also a counter-spring, *s'*, attached to it at a point between its fulcrum and its upper arm, *o*, and also a front limit-stop, *n*, and a back limit-stop, *m*, the latter being mounted in a standard, *l*, fixed upon the armature *g*. The governing-disk 7 has the direction of its movement indicated by the arrow. The projecting arm *o* of the pivoted lever is shown as being closely approximated to the fan or fly *p* of the clock-motor, and about to be advanced into the range thereof. It should be observed that although I have shown a front stop, *n*, for the pivoted lever, this is not absolutely necessary, since the moment the arm *o* engages the fan all tendency of the said arm to farther advance is neutralized.

I have shown the controlling-magnet M as being included in an electric circuit, 30, the length of which is of course within reasonable limits immaterial. The said circuit 30, beginning at the earth G, leads by wire 31, electro-magnet M, and wire 30 to a circuit-closing device, *k*, and when the said circuit is to be closed *via* contact-piece 27 and battery *b* to earth at G'.

The operation of my stopping and starting device will readily be understood. It is assumed that the circuit is closed and that the stop *e* on the motor-disk 7 has just engaged the foot *c* of the pivoted lever. The motor-power thus presses against the foot *c*, and, overcoming the counter-force of the spring *s'*, brings the arm *o* into the path of the fan *p*, thus effecting and maintaining the arrest of the clock-train as long as the circuit remains closed; but inasmuch as the fan *p* is connected by a considerable amount of speeding-gear with the prime mover, it is evident that the power, friction, or strain which the said fan exerts upon the arm *o* is but trifling, and that thus, when the circuit is reopened, the said arm can be readily and without the expenditure of much power disengaged from the fan. It is also obvious that while it is true that for an instant at the moment of stopping the whole force of the motor, as represented by the disk 7, was exerted upon the foot *c*, it is also true that the action of such force was utilized not to maintain the stop, but merely to throw an

obstacle into the path of the fan. Upon the accomplishment of this function the motor is now held inert by the presence of the arm *o* under the wing of the fan *p*, and the power of the motor is relaxed from the foot *c*, only a sufficient amount of strain remaining thereon to overcome the counter-spring *s'* and to hold the arm *o* in operative position. Should the circuit be now opened, the armature *g*, retracting under the influence of the spring *s*, elevates the pivoted lever *g*, which raises its foot *c* from the pin *e* and permits the counter-spring *s'* to relax. The upper arm, *o*, is thus withdrawn from the fan *p* and the motor is released. It continues now to move until the pin or stop d^2 strikes the foot *c*, this being during the retraction of the armature in the path thereof. When this engagement is effected, a repetition of the above operation takes place and the motor remains quiescent until the circuit is closed. When this occurs, the disk is permitted to advance a short step, the foot *c* releasing the stop d^2 only to engage the second stop, e^2, with once more the result as above stated. Another opening of the circuit now finally releases the motor for another partial revolution, or until another series of stops reaches the pivoted lever. It is evident, therefore, that when this form of my stop mechanism is employed the motor, when stopped either upon an open or closed circuit, requires both an opening and closing of the said circuit before it can again resume its motion.

In Fig. 1 I have shown my invention in a slightly-different embodiment applied to a clock-movement mounted in a frame, 1, partly broken away, and actuated by a spring motive power inclosed in a drum, 4. On the main arbor 3 is the main spur-wheel 5, gearing with a pinion, 6, on the central arbor, 8, which also carries the controlling-disk 7. The disk 7 rotates in the direction of the arrow, and has a stop-pin, *c*, projecting from its periphery. A fan, *f*, is provided at the end of the clock-train, which, by means of speeding-gears, rotates at a high speed, but with little power.

M is the controlling electro-magnet, adapted by leading-out wires *b* for inclusion in an electric circuit, and 20 is an armature mounted in trunnions 21 within or upon the frame on a standard, 17. It works between limit-stops 24 and 26, and is provided with a retracting-spring, *s*. To this armature a rocking lever, 22, is attached, and rocks upon a pivot or fulcrum, 23, between limit-stops *n* and *m*, although the former is not essential. The rocking lever 22 is provided at both ends with a laterally-projecting arm, and in addition to its own movement participates (as does its congener in Fig. 4) in the to-and-fro motion of the armature. The lower arm, 13, has a forked end, and from it a spiral counter-spring extends to a fixed point, 16, on the armature 20. This spring serves to hold the rocking lever normally in such a position on its pivot as to bring its forked end into the path of the pin *c* on the edge of the disk 7. The tine *e* of the fork is placed a short distance in advance of the tine *d* with respect to the revolution of the disk 7, and also a short distance behind the tine *d* from the front of the instrument. Thus when the circuit is closed and the armature attracted the tine *d* will be in line with the pin *c* of the disk, and will engage the same as it comes round, while when the circuit is open and the armature retracted the tine *e* will be in line with the pin *c* and will engage it. The disk-pin is shown as resting upon the tine *e*, the circuit being open. The upper arm, *o*, is shown as being in engagement with the fan *f*, having been forced into such engagement by the action of the pin *c* upon the tine *e* against the counter-force of the spring *s'*, this action having moved the lever 22 on its pivot 23 in the manner and for the purposes already specified in describing Fig. 3.

The operation of the mechanism in this example is identical with that first described, the only difference being that in Fig. 1 the double-stopping device is a feature of the pivoted lever, while in Fig. 2 it is a feature of the disk.

In many cases the double-stopping arrangement would be unnecessary. Fig. 5 is an example of such a case. It in every respect resembles the mechanism shown in Fig. 2, except that in place of the two stops *d* and *e* it has but one, *d*. It may, however, be provided with as many of such single-stop devices *d* as may be required. This arrangement is particularly adapted for such motors as are intended for substantially continuous revolution, only needing to be stopped occasionally, whereas the other forms I have shown are especially adapted for mechanisms which are required to stop automatically one or more times in each revolution of their working or operative arbor.

It will be seen that the mechanism in Fig. 5 will be stopped whenever the circuit 30 of the electro-magnet, including, of course, some constant source of electricity, is closed, while it will be released and remain in motion while the said circuit is open.

By a change in position of the stop-pin *d*, and by adopting the form of lever-foot *c* shown in Fig. 4, it is obvious that the arrangement can readily be reversed, so that the motor will run when the circuit is closed, and will be arrested when it is open; and it is also obvious that without the exercise of invention such a reversal of action can be also applied to the other organizations which I have hereinbefore described. Of course, either a weight or spring can be employed as a source of power; or, if desired, the power can be applied from an external source.

Although I have in this specification described the mechanical element arrested by the second stop as being the fan or fly of the mechanism, it must be understood that I do not thereby restrict myself to any special form of such mechanical element, and that the said fan may be replaced by any fast-moving wheel

or pinion with arms or wings to be arrested by the said second stop.

Having now fully described my invention, I claim—

1. The combination, substantially as hereinbefore described, with a clock motor or movement having a disk provided with stop pins or projections, of an electro-magnet adapted to be included in an electric circuit, an armature therefor, a pivoted lever mounted thereon and having two arms, one held normally by means of a counter-spring in the path of the motor stop-pins and adapted to be struck by the same, and the other normally held by the said counter-spring or its equivalent out of range of the fan or fly of the said motor, but adapted to be brought within range and to stop the said fly when the first arm is struck by the stop pins, whereby sufficient strain only is left on the said first arm to maintain the engagement of the last, the said pivoted lever being governed by the electro-magnet and arranged to arrest or start the motor by the action thereof.

2. The combination, with a clock-work motor having a stop wheel or disk whereby the said motor can be stopped at any predetermined point of the revolution of the arbor carrying the said disk, and a fan or fly hung on a speeded arbor of the said motor, whereby the quiescence of the said motor can be maintained at an arbor having low power, of a double initial stopping device consisting of two stop-pins mounted on the said disk and a stop-arm mounted on trunnions on the armature of an electro-magnet and capable thereby of movement both in a vertical and horizontal plane, and adjusted, as described herein, to engage and release the said pins successively upon the attraction and retraction of the armature, or vice versa, and a secondary stopping device comprising a stop-arm, also pivoted on the armature and held normally in disengagement by a counter-spring, but adapted to be actuated by the first stop-arm when struck by either stop-pin, and thereupon to engage the speeded fly of the motor, and thus to effect a stop on an arbor of low power, the strain of the motor upon the first arm being thereafter only sufficient to overcome the said counter-spring and to maintain the engagement of the fan and secondary stop as long as desired, substantially as herein described.

3. The combination, substantially as hereinbefore described, with a clock-work motor having a fly or foot moving wheel, and a stop wheel or disk whereby the said motor can be stopped at any desired point of the revolution of the arbor carrying the said disk, of a double initial stopping device therefor, comprising two stop-pins arranged upon the said disk, a stop-arm adapted to be moved into the path of said fly or foot moving wheel, and a second stop connected with the first and mounted in trunnions on the armature of an electro-magnet, and adjusted to engage one of the said pins when the armature is retracted to release the said pin and to engage the second pin when the said armature is attracted, the motor-disk having meanwhile advanced a short distance in its orbit, and to finally release the second pin and permit the motor to move until the paired stop-pins again reach the said stop-arm, for the purposes specified herein.

4. The hereinbefore-described electro-mechanical starting and stopping mechanism for clock motors or movements, comprising an electro-magnet adapted for inclusion in an electric circuit, an armature therefor, and a lever trunnioned upon the free end of said armature and provided with two stop-arms, as described herein, and with a counter-spring maintaining one of the said stop-arms normally in a position of disengagement, combined with a stop-disk and pins mounted thereon, the said disk being mounted on a working-arbor, and the said pins being adapted to engage the uncontrolled arm of the pivoted lever, and thereby to effect a preliminary stop, and a fan or fly mounted on a speeded arbor of the motor and adapted to be engaged by the spring-controlled arm, the latter being advanced for the purpose against the force of said spring by the pressure of the stop-pins on the initial stop-arm, the said pressure being by the second stop relaxed until sufficient only to retain the said second arm in engagement against the power of the counter-spring, the whole being arranged and adjusted, as described, to stop the motor at predetermined intervals at a given and certain point or points, and to start the same again without requiring an objectionable amount of electrical power, as described herein.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 19th day of March, 1887.

ISAIAH H. FARNHAM.

Witnesses:

GEO. WILLIS PIERCE,

FRED J. F. SCHWARTZ.