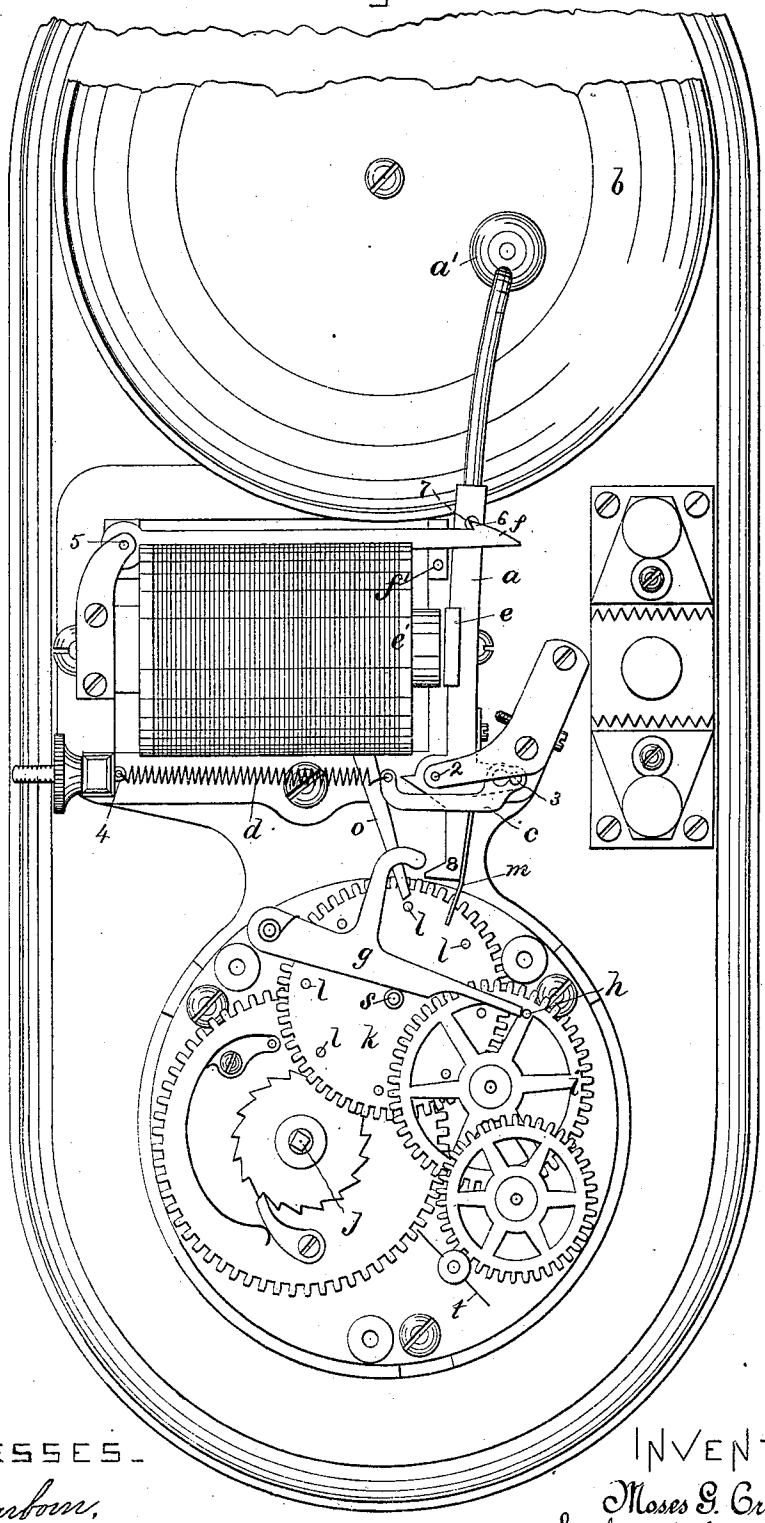
(Model.) 2 Sheets—Sheet 1.

M. G. CRANE.

Electrical Alarm Apparatus.

No. 242,512. **Patented June 7, 1881.**

Fig: 1



WITNESSES-

V. D. Dearborn.

Arthur Reynolds.

INVENTOR-

Moses G. Crane

by Crosby & Gregory Attys.

(Model.) 2 Sheets—Sheet 2.

M. G. CRANE.

Electrical Alarm Apparatus.

No. 242,512. **Patented June 7, 1881.**

Fig: 2.

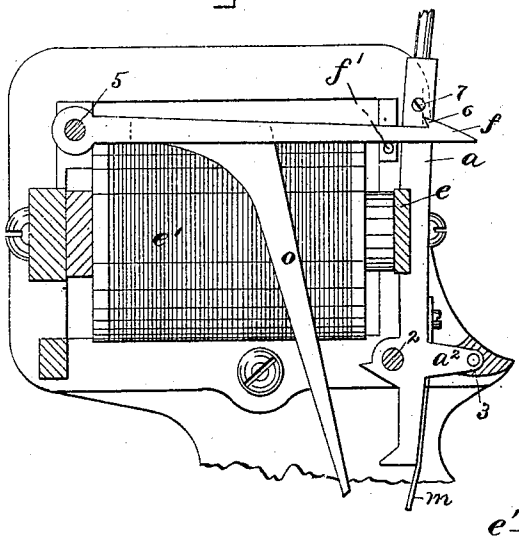


Fig: 3.

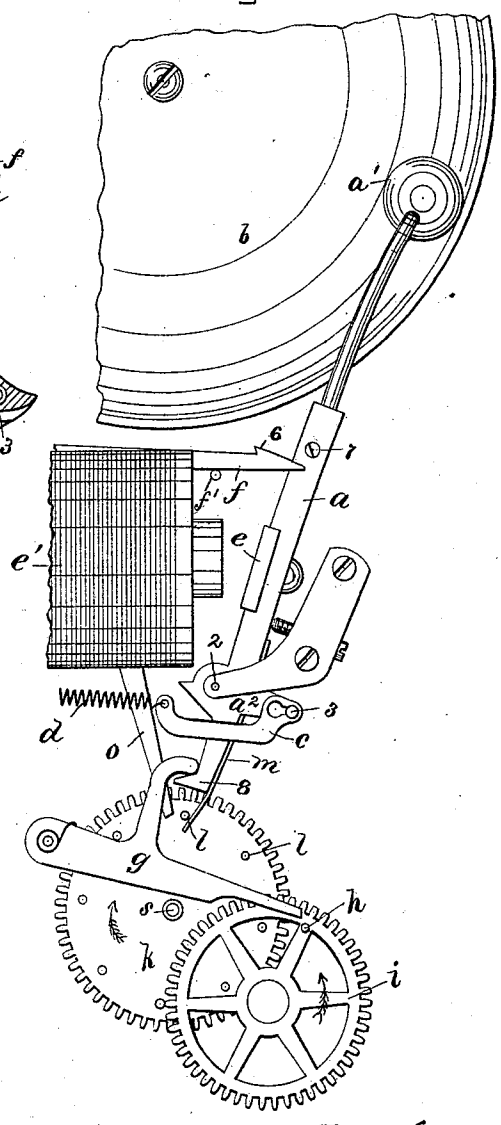


Fig: 4.

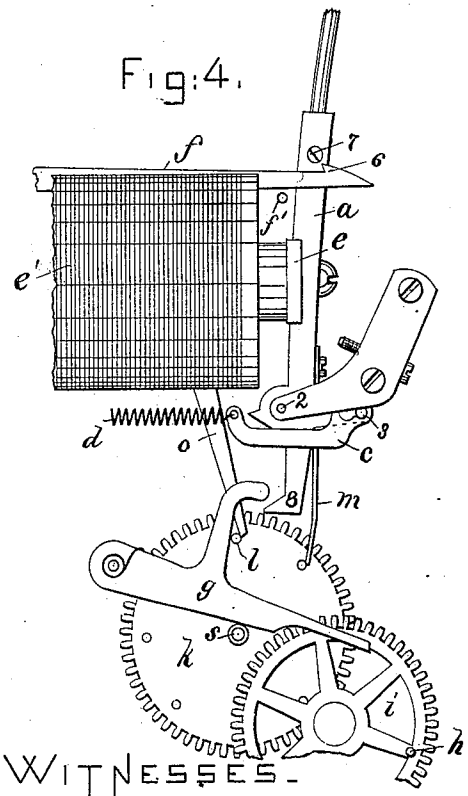


Fig: 5.

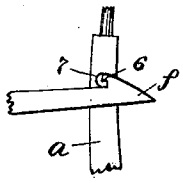
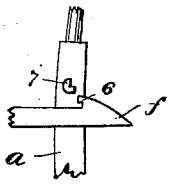


Fig: 6.



WITNESSES.

P. D. Dearborn.

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INVENTOR.

Moses G. Crane

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UNITED STATES PATENT OFFICE.

MOSES G. CRANE, OF NEWTON, MASSACHUSETTS.

ELECTRICAL ALARM APPARATUS.

SPECIFICATION forming part of Letters Patent No. 242,512, dated June 7, 1881.

Application filed October 30, 1880. (Model.)

To all whom it may concern:

Be it known that I, MOSES G. CRANE, of Newton, county of Middlesex, State of Massachusetts, have invented a new and useful Improvement in Electrical Apparatus, of which the following description, with the accompanying drawings, is a specification.

My invention relates to mechanical apparatus controlled by electricity, and is shown embodied in a mechanical electric bell or one in which the bell-hammer is actuated to strike the blow by mechanical forces, its movement being controlled by an electric current; but the invention is also applicable to other apparatus in which a blow is to be struck at definite times, controlled by an electric current—as, for example, to release the detent of the motor for operating the heavy bell-hammer for fire-alarm purposes.

In the present embodiment of my invention a lever provided with a bell-hammer and pivoted so as to be swung to strike a blow on a bell is acted upon by a spring so arranged that when the said lever is in its normal position waiting to be released to strike the blow the said spring draws very nearly directly across the pivotal point of the said lever, so that its force has but slight tendency to swing or turn the said lever upon its pivot. The lever is provided with an armature, and its movements are controlled by the operation of an electro-magnet, as hereinafter described. When the lever is in its normal position with the spring, having only a slight tendency, as described, to turn it on its pivots in one direction, and consequently offering but slight resistance to its movement in the other direction toward the magnet, a very feeble current, vitalizing the said electro-magnet, is sufficient to attract the said armature, and thereby control the movement of the lever to strike the bell, as hereinafter described. The lever is mechanically held, as hereinafter described, with the armature thereon close to the poles of a magnet, by a mechanical detent or catch, and when the said magnet is charged and the armature attracted thereto, the said catch is by this operation released, so that when the current is again broken and the magnet demagnetized the lever is free to swing, so as to strike the bell or other desired object under the action of its actuating-spring, which, as before stated, is at first slight, since it draws nearly across or in line with the pivotal point of the said lever; but as the said lever moves the point of attachment of the said spring moves therewith out of the line with the said pivotal point, and consequently the line of action of its force passes farther and farther from the said pivotal point, the said spring thus acting with a constantly-increasing leverage on the said lever to make it strike a powerful blow. Just at the end of the movement of the lever, when the blow is struck, the said lever releases and throws into operation a restoring mechanical motor, which, acting in opposition to the actuating-spring of the said lever, restores it to its normal position, with the armature close to the poles of the magnet, and just at the end of this movement of restoration throws the catch in position to engage the said lever and mechanically hold it in this position with its armature close to the magnet. This catch is so arranged and shaped that while the actuating-spring is operating on the lever, with a tendency (slight at this time, as before stated) to make it strike another blow, the said catch is retained in engagement by this tendency; but as soon as the electro-magnet is charged to draw the armature through the slight space up to its poles, overcoming the said slight rotating power of the actuating-spring, the catch, being no longer held thereby, falls out of engagement with the said lever, leaving it free to be moved by the actuating-spring as soon as the magnet ceases to hold its armature.

Figure 1 is a front view of a signal apparatus embodying my invention, the parts being shown in their normal position, the electro-magnet demagnetized, and the hammer-lever in the position assumed after having struck its blow and been restored to its normal position and retained there by the catch; Fig. 2, a sectional view of a portion thereof on a plane between the two helices of the electro-magnet, which is shown as charged, and with the armature attracted thereto and the mechanical catch disengaged from the hammer-lever; Fig. 3, a detail showing the parts in the position assumed when the bell is just struck and the mechanical motor released to restore the hammer-lever to its normal position; Fig. 4, an-

other detail, showing the motor near the end of its movement to restore the said lever and beginning to operate on the catch to throw it into engagement with the hammer-lever; and Figs. 5 and 6, a modification of the lever-catch, the former figure showing it engaged and the latter disengaged.

The main vibratory lever *a* (shown in this instance as provided with a bell-hammer, *a'*, to strike blows on the bell or gong *b*) is pivoted at 2 in suitable bearings in the frame-work, and provided with a short arm, a^2, having at its extremity a stud, 3, to be engaged by a link, *c*, connected with the actuating-spring, *d*, secured at 4 to the frame-work. The arm a^2 is placed in such position on the lever *a* that when the said lever is in its normal position, waiting to strike a blow, as shown in Figs. 1 and 2, the points 2, 3, and 4 are nearly in line, so that the line of action of the spring *d*, which passes through the points 3 and 4, is only a trifle at one side of the pivotal point 2 of the lever *a*, and consequently, in accordance with well-known mechanical laws, the force of the spring *d* has only a slight tendency to turn the said lever *a* on the said pivot. The lever *a* is provided with an armature, *e*, to be attracted by an electro-magnet, *e'*, and when the lever is in its normal position, as shown in Fig. 1, the said armature is very near to the poles of the magnet, so that a slight magnetic force is sufficient to attract it and move the lever against the force of the spring *d*, which, as before stated, in this position affords extremely small resistance to such movement.

When in the position shown in Fig. 1 the lever *a* is held by a catch-arm, *f*, pivoted at 5 and provided with a catch or hook, 6, which engages a projection, 7, on the lever *a*, and is under-cut or inclined, as shown on its engaging-surface, so that the pressure between the engaging-surfaces derived from the tendency of the lever to turn on its pivot 2, under the action of the spring *d*, retains the catch 6 in engagement with projection 7, so that there is a mutual action between the catch and the lever, the former preventing the lever from striking its blow and the latter retaining the catch in engagement as long as it is not attracted by the magnet.

In Figs. 5 and 6 the catches are made shouldered instead of inclined, such form being preferable for some purposes, they being less likely to become disengaged by an accidental jar.

When the magnet is vitalized by an electric current it draws the armature *e* and the connected lever *a* up to its poles, as shown in Fig. 2, and thus removes the projection 7 from the catch 6 in the catch-arm *f*, which, being no longer held by the engagement of these parts, as hereinbefore described, falls by its own weight upon the stop *f'*, by which movement the catch 6 is carried out of range of the projection 7, so that when the magnet is demagnetized, as by breaking the circuit, the lever *a* is free to turn on its pivot 2, under the action of the actuating-spring *d*, to strike the blow, as shown in Fig. 3; and in this movement the point 3 moves away from the line joining the points 4 and 2, so that the leverage of the spring *d* or its power to turn the lever *a* is greatly increased, and the blow is struck by the bell-hammer *a'* with the full force of the said spring. When the lever *a* is at the end of this movement caused by the spring *d*, a tripping toe, 8, thereon engages a stop-arm, *g*, and lifts it out of engagement with a stop-pin, *h*, on a wheel, *i*, of a train of wheel-work constituting a mechanical motor operated in the usual manner by the action of the weight or spring on the shaft *j*, Fig. 1, squared at its end to receive a key to wind the said motor in the usual manner. When the motor is thus released the train of wheels is set in movement, and one wheel, *k*, thereof is provided with a series of pins, *l*, so arranged that the said wheel passes over the spaces between two of the pins while the wheel *i* is making a complete revolution. One of the pins *l* is, at the moment that the stop-arm *g* is tripped by the toe 8 of the lever *a*, in position to immediately engage a spring-arm, *m*, connected with the said lever *a*, and in the rotation of the wheel *k* the pin *l*, pressing against the said spring-arm, turns the lever *a* on its pivot 2 back to its original position, as shown in Fig. 4, the armature *e* being brought up to the poles of the magnet and stopped thereby, after which the spring *m* yields to allow the further movement of the wheel *k* in which the pin *l*, following the one acting on the said arm *m*, strikes a lifting-arm, *o*, extended down from the catch-arm *f* between the coils of the magnet *e* and turns the said catch-arm on its pivot 5, bringing the catch 6 up in line with the projection 7, which has been carried past it, as shown in Fig. 2, when the pin *l*, which was acting on the arm *m*, passes by the said arm, leaving the lever *a* free to turn back under the action of the spring *d*, when the projection 7 thereon is engaged by the catch 6, and, owing to the inclined or undercut shape thereof, retains the said catch in engagement with the said projection after the pin *l* has passed beyond the lifting-arm *o*, as shown in Fig. 2, when the motor is again stopped by the stop-arm *g*, from which the toe 8 has been removed, so that it rests in its normal position, supported by the shaft *s* of the wheel *k* in the path of the stop-pin *h*.

The train of wheel-work of the motor terminates in a regulating-fly, *t*, as usual, and the arms *m* and *o* are so arranged that the movements caused by the pins *l* engaging them will be properly timed, as described, to cause the arm *a* to be caught by the arm *f* and held thereby in such proximity to the poles of the magnet that only a small current is necessary to attract the armature *e* thereon.

An essential feature of the invention consists in the arrangement of the actuating-spring relative to the pivotal point of the lever *a*, so that it offers only a slight resistance to the attraction of its controlling magnet or other control-

ling mechanism, while the said lever is waiting to be released by the said magnet and controlling mechanism; but when it is so released and moved the full force of the said actuating-spring is developed to powerfully operate the said arm.

It is obvious that this part of my invention can be applied to an arm controlled by somewhat different mechanism, as by the usual detent-lever, in which case the pressure on the detent is made lighter in proportion to the effective strength of the spring by this arrangement. The saving in the controlling power by this arrangement is so great that about one-sixth the battery-power needed to control the movements of mechanically-operated bells of the same size and loudness of sound of ordinary construction will be sufficient to operate a bell or similar mechanism constructed in accordance with my invention.

The operation may be briefly described as follows: Starting with the parts in the position shown in Fig. 1 and calling the pin *l* which engages the arm *m* the first pin, and the one engaging the arm *o* the second pin, the magnet *e'* is magnetized, the armature *e* and the lever *a* drawn up to its poles, and the catch-arm *f* allowed to fall. The magnet is then demagnetized, releasing the armature *e*, when the lever *a* swings under the stress of the spring *d*, and as it strikes the bell *b* the toe 8 trips the stop-arm *g*. The wheel *k* rotates under the stress of its actuating spring or weight, and the first pin *l* carries the lever *a* back against the magnet and allows the stop-arm *g* to fall. The second pin *l* raises the catch-arm *f*, and then the first pin passes by the arm *m*, and the lever *a* falls back under the action of the spring *d*, its projection 7 engages the catch 6, and the second pin *l* passes from the arm *o*, and the train is stopped by the engagement of the pin *h* with the arm *g*, the parts being now in their original position.

I do not herein broadly claim the combination with the armature-lever of a catch to hold it up to the poles of the magnet when unattracted thereby and adapted to be withdrawn from the said armature-lever as soon as attracted, as this will be shown and claimed in another application.

I also do not claim, broadly, the combination, with an electro-magnet, of a mechanically-operated device controlled thereby and arranged to bear lightly upon the said magnet or its armature when held thereby, and to develop increased force in its movement, which takes place when the said device is released, and allowed to operate by the said magnet.

I claim—

1. In an electrical apparatus, the pivoted lever and electrically-operated controlling mechanism to engage it and control its movements, combined with the actuating-spring connected with the said lever at a point located in relation to its pivoted point, as described, to cause the force of the said spring to be exerted nearly in line with the pivot of the said lever when engaged by the said controlling mechanism, to thereby exert but slight force upon the said mechanism, and thereafter, when the arm is released, to have increased leverage and develop increased power as the said lever turns on its pivot, substantially as and for the purpose described.

2. The electro-magnet and pivoted lever and armature mounted thereon and movable therewith between two definite points, one near to and one remote from the poles of the magnet, combined with the actuating-spring for the said lever, and the catch or prop arranged, as described, to engage and hold the said lever with its armature in the position near to the poles of the magnet when demagnetized and adapted to release the said lever when the armature is attracted by the magnet, to thereby leave said armature free to assume the position remote from the magnet when subsequently demagnetized, substantially as and for the purpose set forth.

3. In an electrical apparatus, a pivoted lever, an actuating-spring therefor, and catch to hold it in position to be turned by the said spring when released, combined with a mechanical motor and stop-arm therefor, to be tripped by the said pivoted lever when it has made its movement under the action of the spring, and mechanism operated by the said motor when thus released to restore the pivoted lever to its normal position and place the catch in position to engage it, substantially as described.

4. The main pivoted lever and actuating-spring therefor, combined with the catch-arm and catch, undercut, as described, whereby, while the lever tends to move in the direction toward the said stop, it retains the said stop in engagement with it, and its movement is thereby prevented, but when it moves in the other direction it permits the said stop to become disengaged and thereafter offer no opposition to any of the movements of the said lever, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

MOSES G. CRANE.

Witnesses:
EDWIN ROGERS,
JOS. P. LIVERMORE.