(Model.) 2 Sheets—Sheet 1.

# M. G. CRANE.

## Electric Alarm Bell.

**No. 242,511.** **Patented June 7, 1881.**

Fig: 1.

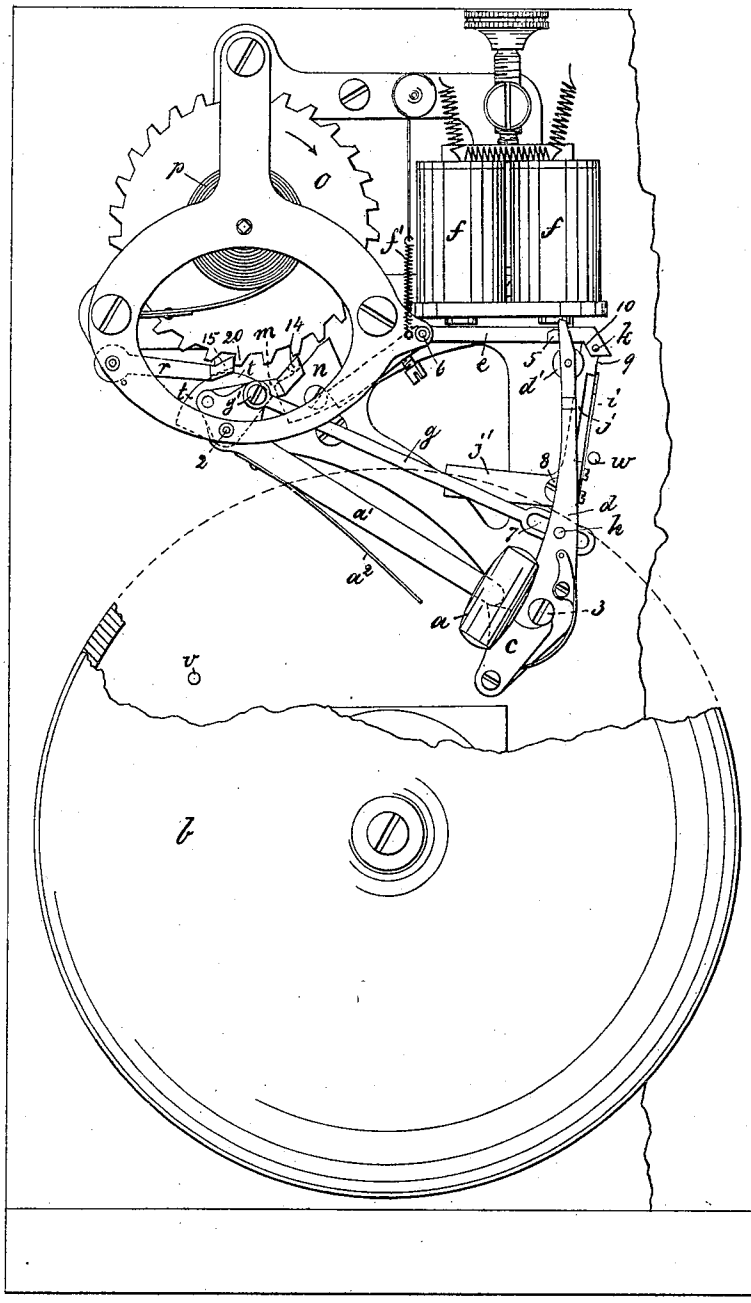
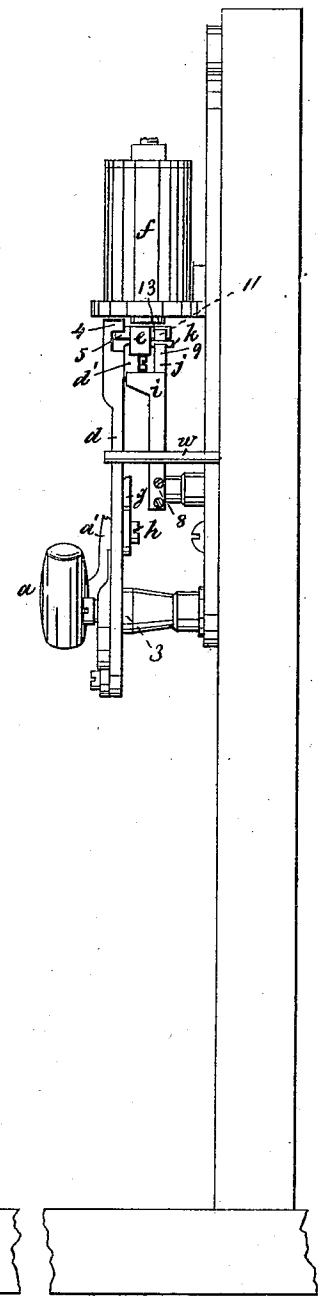



Fig: 2.




Witnesses.

Arthur Reynolds

Jos. P. Livermore

Inventor.

Moses G. Crane.

by Crosby & Gregory Attys.

(Model.) 2 Sheets—Sheet 2.

# M. G. CRANE.

## Electric Alarm Bell.

No. 242,511. Patented June 7, 1881.

Fig: 3.

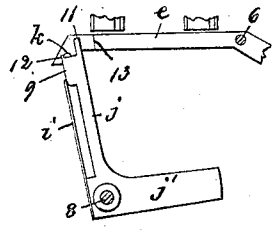



Fig: 4.

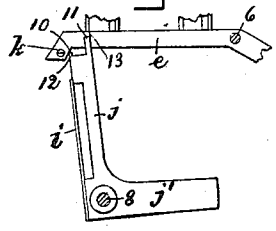



Fig: 5.

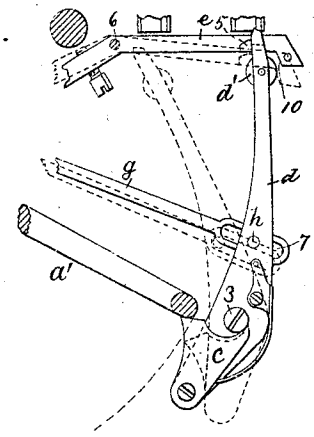
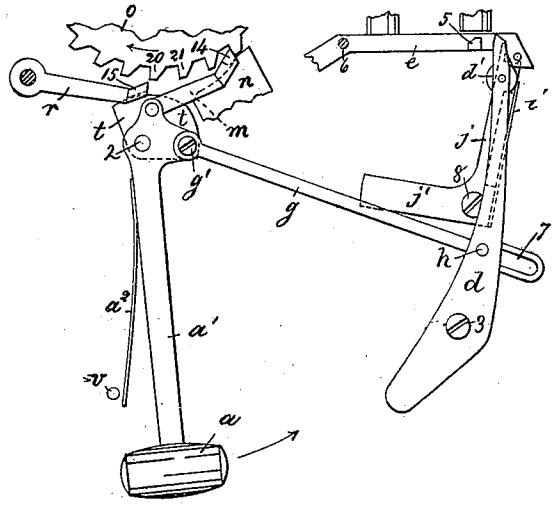



Fig: 6.




Witnesses.

Arthur Reynolds

Jos. P. Livermore

Inventor.

Moses G. Crane

by Crosby & Gregory Attys.

# UNITED STATES PATENT OFFICE.

MOSES G. CRANE, OF NEWTON, MASSACHUSETTS.

## ELECTRIC ALARM-BELL.

SPECIFICATION forming part of Letters Patent No. 242,511, dated June 7, 1881.

Application filed January 3, 1881. (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, in connection with the accompanying drawings, is a specification.

My invention relates to electrical apparatus, and is shown embodied in an electro-mechanical bell, such as employed in fire-engine houses for striking fire alarms, such a bell being also adapted for any use requiring single definite blows to be struck under the control of an electric current applied by an operator controlling the circuit at any point thereof—as, for example, the signal-bells of steam-vessels, and so on.

The present invention consists in novel mechanism for transmitting the power from the actuating weight or spring to the bell-hammer; also, in novel detent mechanism whereby the movements of the mechanism are controlled by the armature of the electro-magnet, the said detent mechanism being applicable to any apparatus operated mechanically and controlled by an electro-magnet. The broad principle upon which this detent is operated is the same as shown in United States Letters Patent No. 223,248, dated January 6, 1880, granted to me and Edwin Rogers, and in another application filed by me October 30, 1880, and consists in causing the mechanism, when released by a large movement of the armature away from the poles of its magnet, to restore the said armature to a position near to the poles of the magnet, and retain it there by a suitable catch until it is attracted by the said magnet, when by the said attraction, and in the further movement of the armature toward the poles of the magnet caused thereby, the said armature is disengaged from the said catch and left free to make its long movement away from the poles of the magnet when released by the demagnetization thereof. In the patent referred to the said catch was disengaged from the armature when the magnet is charged by the magnetic force thereof, it being operated by a secondary armature, by the movement of which toward the poles of the magnet the catch is disengaged from the main armature, so that when the magnet is demagnetized the main armature is free to fall back from the poles of the magnet, and at the same time the catch is released and brought into position to engage the armature when mechanically moved up near to the poles of the magnet. That arrangement required special devices therein described to insure the proper sequence of the movements of the main and auxiliary armatures, and also to overcome the residuary magnetism, both of which are rendered unnecessary by the present invention, in which the catch is operated by a mechanical force, shown as its weight; but it might be a spring which removes it from engagement with the armature as soon as the said armature is attracted, it being held in engagement with the said armature, while unattracted by the back pressure thereof from the magnet due to its retractive force.

In the present embodiment of my invention the bell-hammer in its normal position rests upon the short arm of a detent-lever, which is prevented from turning on its pivot to allow the bell-hammer to move by the engagement of the long arm of the said lever with a projection on the armature of the electro-magnet, when held near to the poles thereof, either by a mechanical catch or by the attraction of the said magnet. The mechanical catch is so arranged as to remain engaged by the armature, preventing its backward movement from the poles of the magnet only when the said armature tends to move backward under the influence of its retractor—in this instance a spring; but it might be its own weight; but as soon as the armature is attracted and moves up to the poles of the magnet the said catch is released and moved aside, leaving the armature free to fall back a considerable distance from the magnet when again demagnetized. When the armature thus falls back it releases the long arm of the detent-lever, which is then turned on its pivot by the hammer acting on its short arm until the said hammer passes off from the said lever and is wholly released. The bell-hammer is in this instance hung as a pendulum, and after striking its blow upon the bell is held by the detent-lever suspended at a point considerably above that which it would assume under the action of gravity alone, so that when released the said bell-hammer makes its back-stroke away from the bell under the action of gravity.

The bell-hammer arm is provided with a wrist-

pin connected with a link connected at its other end with the detent-lever, so that just as the bell-hammer is completing its back-stroke the said link pushes the said lever back to its original position, while the lever itself, after it has passed the projection on the armature, raises the said armature nearly to the poles of the magnet and places the catch beneath it, so that it is in position to be again acted upon by the magnet and moved with a small expenditure of magnetic force, owing to its close proximity to the poles.

An actuating-pawl connected with the bell-hammer is moved thereby in its back-stroke into engagement with a tooth of the main actuating-wheel, the said pawl being guided by a guide fixed to the frame-work, and as it strikes the said tooth with the momentum of the bell-hammer making its back-stroke it causes a slight backward movement of the said wheel, and thus allows a detaining-pawl pivoted on the frame-work, and previously held by the pressure of the toothed driving-wheel in engagement therewith, to disengage the said wheel, which then operates on the actuating-pawl connected with the bell-hammer, and causes the said hammer to make its forward stroke and sound the bell.

A guide connected with the bell-hammer operates, while it is thus making its forward stroke, to place the detaining-pawl in position to engage the next tooth of the wheel to the one it was last disengaged from, so that the actuating-wheel in causing the bell-hammer to make its stroke is moved forward one tooth and then stopped.

The short arm of the detent-lever is provided with a pawl, which turns aside to let the bell-hammer pass in its forward stroke, but then immediately engages it to prevent it from making another back-stroke, or operating further, until it has been released by the movement of the detent-lever and connected pawl together, which takes place after the attraction and release of the armature by the magnet, as hereinbefore described.

Figure 1 is a front elevation of a bell-striking apparatus embodying my invention, the parts being in their normal position and no current flowing through the electro-magnet; Fig. 2, an end elevation thereof, showing the detent mechanism at the right hand of Fig. 1; Fig. 3, a detail showing a rear view of the armature and its catch in the position shown in Fig. 1; Fig. 4, a detail of the same parts, but in the position assumed when the magnet is charged and the catch consequently disengaged therefrom; Fig. 5, a detail illustrating the operation of the detent-lever, the full lines showing its long arm engaged by the armature and its short arm holding the bell-hammer arm, the hammer itself being removed, and the dotted line showing the armature back and the detent-lever turned aside to release the hammer-arm; and Fig. 6, a detail showing the hammer just at the end of its back-stroke, away from the bell, the detent-lever and armature restored to their normal position, and the actuating-pawl connected with the hammer-arm engaged with the actuating-wheel, and the detaining-pawl disengaged therefrom, to cause the hammer to make its forward stroke.

The bell-hammer *a* is supported on an arm, *a'*, pivoted at 2 in a proper position to swing back and forth in the bell or gong *b* and strike the edge thereof in its forward stroke. After the bell-hammer *a* has made its forward stroke and sounded the bell, *a* is engaged, as shown in Fig. 1 and full lines. Fig. 5, by the spring-catch *c*, pivoted upon the short arm of the detent-lever *d*, itself pivoted at 3, and is thus prevented from making another back-stroke, preparatory to again striking the bell, until the said lever is turned on its pivot, as shown in dotted lines, Fig. 5, to allow the hammer-arm to pass by the end of the said catch. The detent-lever is prevented from thus turning under the weight of the hammer *a* thereon by the engagement of a projection, 4, at the end of its long arm with a projection, 5, on the armature *e*, pivoted at 6 and controlled by the electro-magnet *f* and retracting-spring *f'*.

The projections 4 5 are so situated that they engage one another while the armature is near or attracted to the poles of its magnet; but when the said armature, after being attracted, is released by the demagnetization of the said magnet it falls far enough back from the poles thereof, as shown in dotted lines, Fig. 5, to carry the projection 5 beyond the range of the projection 4 on the detent-lever, leaving the said lever free to turn on its pivot under the action of the weight of the bell-hammer, resting on the catch *c*, sufficiently to allow the said hammer to pass by the said catch, as indicated by dotted lines, Fig. 5, and fall, under the action of gravity, to the position shown in Fig. 6, thus making its back-stroke.

A connecting bar or link, *g*, pivoted at one end to a wrist-pin, *g'*, connected with the hammer arm *a'*, is provided at its other end with a slot, 7, embracing a stud, *h*, on the detent-lever *d*, the said stud resting at about the middle of the said slot when the parts are in their normal position, as shown in Fig. 1, so that the detent-lever is free to turn, as indicated in Fig. 5, to release the hammer-arm, the said stud being brought in this movement to the end of the said slot, which limits the movement of the detent-lever in this direction.

In the downward movement of the hammer in making its back-stroke, as just described, the bar *g* is moved toward the said stud and carries it and the connected detent-lever back from the position shown in dotted lines, Fig. 5, to its original position, (shown in Figs. 1 and 6,) the projection 4 of the said lever passing above the projection 5 of the armature, which still remains in its lower position, remote from the poles of the magnet. The detent-lever is provided with a friction-roller, *d'*, which, when the said lever is thus moved back or restored to its original position, as just described, first comes against a spring, *i*, con-

nected with the armature-catch *j*, pivoted at 8, thereby pressing the upper edge, 9, of the said catch against a pin, *k*, on the side of the armature *e*, and immediately thereafter the said roller engages an incline, 10, on the under face of the said armature and raises it toward the poles of the magnet, lifting the pin *k* above the edge 9 of the catch *j*, so that the said catch is permitted to turn on its pivot to bring its end beneath the said pin, and thus retain the armature in its position near to the poles of the magnet. A stop-pin, *w*, limits the movement of the detent-lever when pushed back by the bar *g*. The projection 5 of the armature is by this operation brought and retained in line with the projection 4 of the detent-lever, which will consequently be engaged thereby, as shown in Fig. 1.

The armature-catch *j* has a finger, 11, at its upper end, which, by its engagement with the pin *k* on the armature, prevents the end of the armature from being carried beyond the said pin by the pressure of the roller *d'* on the spring *i*, and the said catch is provided with a counter-weight, *j'*, which tends to turn it on its pivot in the opposite direction to that in which it is moved by the roller *d'*.

When the hammer *a* begins to make its up or forward stroke to sound the bell, as hereinafter described, the bar *g* is moved away from the stud *h*, and the detent-lever allowed to turn back until stopped by the engagement of the projections 4 5, after which, in the further movement of the bar *g*, its slotted part 7 merely travels over the said stud. In this movement of the detent-lever from its extreme forward position, shown in Fig. 6, to its normal position, Fig. 1, the roller *d'* first recedes from the incline 10 and allows the armature to rest with the pin *k* on the end of the catch *j*, as shown in Fig. 3, after which the said roller recedes from the spring *i* of the said catch, which is, however, prevented from falling from beneath the pin *k*, under the influence of the counter-weight *j'*, by the friction of the said pin on the end of the catch, or by the slight projection 12 at the end of the edge 9. The armature and catch thus remain engaged, and the former prevented from receding from the magnet, as shown in Fig. 3, as long as the said armature tends to move in this direction under the influence of its retracting force; but as soon as the armature is attracted and drawn wholly up to the poles of its magnet the pin *k* is removed from the end of the catch *j* and raised above the projection 12 thereon, so that the said catch turns on its pivot, under the influence of the weight *j'*, until arrested by the finger 11 coming in contact with a shoulder, 13, on the armature *e*, as shown in Fig. 4, the said catch being thus removed from the path of the pin *k*, so that the armature is free to fall when released by the demagnetization of the magnet *f*.

The function of the spring *i* is to permit the roller *d'* to operate it in its forward movement without moving the stop *j* until the said roller has subsequently raised the armature and allowed the catch to move under the secondary action of the spring, so that in the return movement of the said roller *d'* the armature may be dropped by the disengagement of its incline 10 before the catch is permitted to move back by the said roller—a necessary sequence of operations which would not take place if the catch were positive'y engaged by the said roller.

An actuating-pawl, *m*, connected with the hammer-arm *a'* near its pivotal point, and provided with a guide-pin, 14, engaging a guide, *n*, fixed to the frame-work, is brought in the back-stroke of the hammer, just after the detent-lever has been moved back to its normal position, (shown in Fig. 1,) and the armature raised and caught, as previously described, into engagement with a tooth of the actuating-wheel *o*, connected in the usual manner with a mainspring, *p*, or equivalent motive force, tending to turn it in the direction of the arrow. The momentum of the hammer in its downward or back stroke causes the wheel *o* to turn back a short distance in a direction opposite to the arrow thereon, when the actuating-pawl *m* strikes its tooth, and by this backward movement the pressure of the tooth 20 is removed from the detaining-pawl *r* pivoted to the frame-work, and the said pawl drops until a projection, 15, thereon rests upon the guide *t* connected with the bell-hammer arm *a'*. The actuating-wheel is thus released, and by its pressure on the pawl *m* causes the hammer to make its forward stroke to hit the bell *b*, and in the same movement the guide *t* raises the detaining-pawl after the tooth 20, previously held thereby, has passed it, so that just as the hammer has nearly reached the bell the said detaining-pawl engages the next tooth, 21, of the wheel *o*. The hammer completes its stroke by the momentum acquired, and the pawl *m* is drawn slightly away from the tooth that has just actuated it and falls out of engagement therewith, it again resting on the guide *n*, by which it will be carried in the next movement of the hammer into engagement with the tooth following the one last acted upon. In its forward stroke the bell-hammer turns the spring-catch *c* aside on its pivot, the said catch springing back as soon as the hammer has passed, and thus preventing its back-stroke until the detent-lever turns on its pivot 3, as before described; and it will be seen that in its normal condition, as shown in Fig. 1, the actuating-wheel *o* is entirely disconnected from the pawl *m* and the bell-hammer.

It is obvious that the force of springs might be used, instead of gravity, to operate the bell-hammer in its back-stroke, and to withdraw the catch *j* from beneath the armature; and the moving parts might, if needed, be all counterbalanced when thus operated by springs, so as to work independently of their position, as would be desirable for ship-signals.

A spring, $a^2$, on the back of the bell-ham-

mer serves, in co-operation with a stop-pin, *v*, on the frame-work, to stop the bell-hammer and prevent it from hitting the other side of the bell in its back-stroke, the recoil of the said spring assisting the actuating-wheel in producing a strong blow in the forward stroke.

In operation, if the circuit of the magnet *f* is normally open, the parts will be as in Fig. 1, the armature being held up by the catch, as in Fig. 3, and when the circuit is closed, or if it remains normally closed, as in fire-alarm systems, the armature will be attracted, as in full lines, Fig. 5, and the catch *j* withdrawn therefrom, as in Fig. 4. When the circuit is now broken the armature falls back from the magnet, releasing the detent-lever, which turns and lets the hammer make its back-stroke, during which the detent-lever and armature are restored to their normal position, Figs. 1 and 6, and at the end of which back-stroke the actuating-wheel is brought into engagement with the actuating-pawl and hammer, and at the same time released, and thereafter causes the hammer to make its forward stroke and hit the bell, after which the parts remain in the position shown in Fig. 1 until the circuit is closed, and then broken when another blow is struck. By this detent mechanism the bell or other mechanism is retained motionless after once being operated, whether the circuit is closed or open, and is again operated only when the circuit is opened after having been previously closed. The magnetic force is never required to move the armature but a short distance, its other movements being caused by its retractor and the restoring mechanism.

I claim—

1. The actuating-wheel and the retaining-pawl therefor, combined with the bell-hammer arm and the actuating-pawl, and guide for the actuating-pawl, connected with the said arm, and the guide for the actuating-pawl, fixed upon the frame-work, arranged and to operate substantially as described, and for the purpose set forth.

2. The actuating-wheel, the hammer-arm and detent therefor, and the actuating-pawl connected with the said hammer-arm, the said parts being arranged in combination, as described, whereby the said pawl is disengaged from the wheel while the hammer-arm is engaged by its detent, substantially as described.

3. A mechanical motor and detent-lever therefor, and an electro-magnet and its armature, combined with the catch or prop for the said armature, provided with a counter-weight, or equivalent, and restoring mechanism operated by the said motor, whereby the said detent-lever is restored into engagement with the armature and the armature engaged by its catch in the movement of the motor, which takes place on the release of the detent, substantially as described.

4. The detent-lever, armature, and catch or prop therefor, and the restoring device connected with the said lever, whereby the movement of the lever into engagement with the armature causes the said armature to be moved up to the poles of the magnet and engaged and held there by the said catch, substantially as described.

5. The electro-magnet and its armature, movable between a back-stop and a position near to the poles of the magnet, combined with the catch or prop for the said armature, properly arranged to engage and hold it, when in its position near to the poles of the magnet, but unattracted thereby, and the counter-weight, or equivalent, to remove the said catch from engagement with the said armature when attracted by the magnet, substantially as and for the purpose described.

6. A detent-lever, and armature-lever and stop therefor, provided with a spring to be engaged by the detent-lever, the said armature being provided with a pin to engage the said catch, and with an incline to be engaged by the detent-lever, the said parts being arranged in combination, as described, whereby, when the detent-lever is moved into engagement with the armature, it raises the said armature up to the poles of its magnet and brings the catch into engagement with the pin thereof to retain it there, substantially as described.

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

Witnesses: MOSES G. CRANE.

JOS. P. LIVERMORE,

BERNICE J. NOYES.