Dec. 29, 1936. H. F. KEIL 2,066,278

ELECTRIC DOOR RELEASE MECHANISM

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Fig. 1.

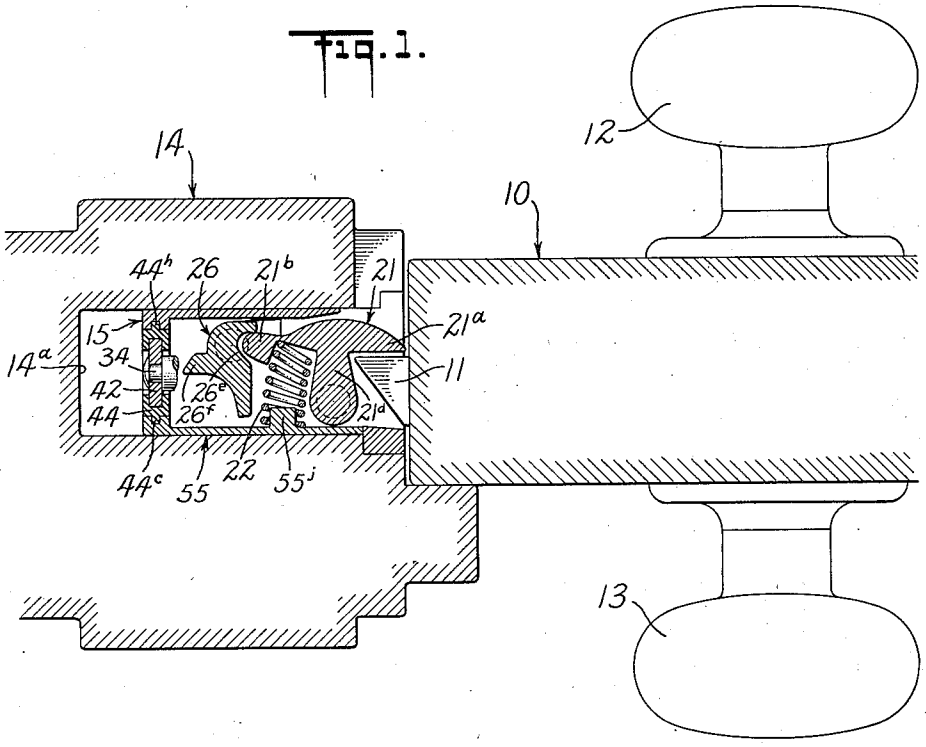

Fig. 2.

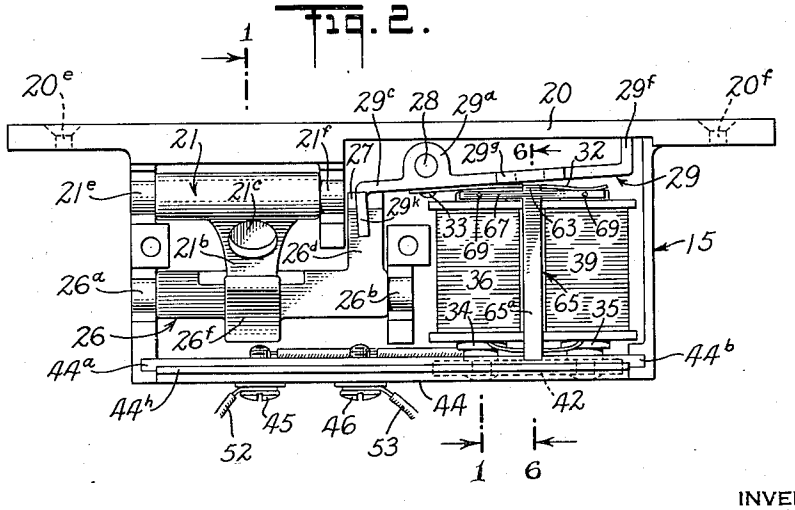

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Fig. 3.

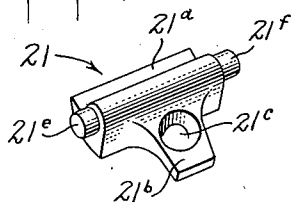


Fig. 4.

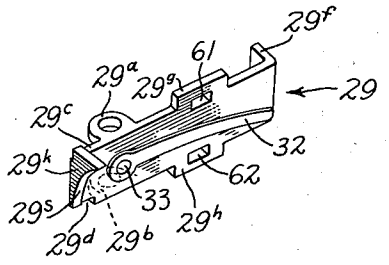


Fig. 5.

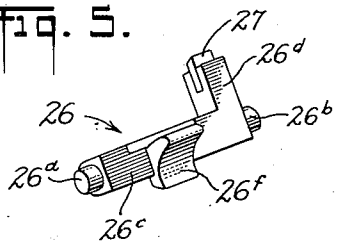


Fig. 6.

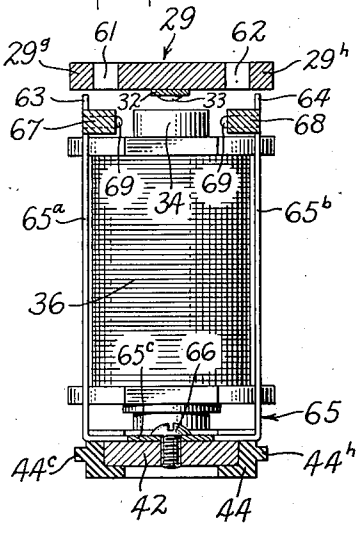
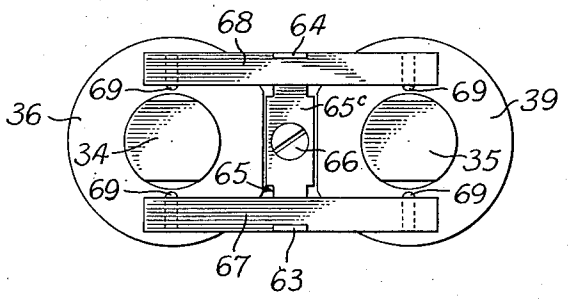


Fig. 7.



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2,066,278

ELECTRIC DOOR RELEASE MECHANISM

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Application April 18, 1935, Serial No. 16,987

2 Claims. (Cl. 70—52)

This invention relates to so-called "electric door openers" and more particularly to the construction of a remotely-controlled keeper for the bolt of a lock on a door or like movable or swinging part.

One of the objects of this invention is to provide a releasable keeper construction in which accidental or unauthorized release of the keeper as, for example, by vibration, jolting, or jarring of the mechanism itself is precluded in a thoroughly practical and dependable manner. Another object is to provide a construction of the above-mentioned character which will be inexpensive, capable of ready manufacture and assembly, and dependably foolproof in construction and action. Another object is to provide a construction of the above-mentioned character which may be reliably employed in apparatus or devices subjected to jarring, jolting, vibration, or the like, without effecting a tripping or release of the keeper, and more particularly, to provide such a construction that will dependably guard against such jarring, jolting, vibration, or the like, irrespective of the direction or directions in which they act or are effective. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings in which I have shown one of various possible embodiments of the mechanical and electrical features of my invention,

Figure 1 is a sectional view, which may be considered a horizontal sectional view, through a frame, such as a door frame, and a member, such as a door, movable relative thereto, illustrative of a practical installation embodying my invention, the sectional view of the keeper construction, as seen in Figure 1, corresponding to the cross-section as seen along the line 1—1 of Figure 2;

Figure 2 is a plan view of the releasable keeper construction as it is seen with one side wall or the cover plate of the casing thereof removed;

Figure 3 is a perspective view of the keeper per se;

Figure 4 is a perspective view of an armature which takes part in controlling the keeper;

Figure 5 is a perspective view of a trip lever through which the armature of Figure 4 controls the keeper of Figure 3;

Figure 6 is a vertical sectional view on an enlarged scale, as seen along the line 6—6 of Figure 2, and

Figure 7 is an elevation of certain of the electromagnetic mechanism, on an enlarged scale, as seen from the top of Figure 2.

Similar reference characters refer to similar parts throughout the several views of the drawings.

As conducive to a clearer understanding of certain features of my invention, reference might first be made to Figure 1 in which I have shown two members 10 and 14, typically a door and door frame, respectively, the door or member 10 being provided with any suitable bolt mechanism, usually of the latch-bolt type, and hence illustratively provided with a spring-projected latch bolt 11. Any suitable means, such as a handle or knob 12, may be provided to operate the latch bolt 11 from the inside of the enclosure of which the members 10 and 14 form a part, the mechanism or means being, however, of such a character that the bolt 11 cannot be operated from the exterior of the enclosure as by the knob, handle, or other device 13. Suitable key-controlled means (not shown) may, of course, be and usually is provided for controlling the actuation of the bolt 11 from the exterior.

The bolt 11 is spring-projected in back of a keeper generally at 21 (Figure 1), the keeper 21, however, being provided with means, hereinafter described, whereby it may be made releasable with respect to the bolt 11, from any desired remote point. Installations of the general character above described are made, or are frequently necessary, in connection with enclosures, or the like, which, for various reasons, are of such a character or are placed in such use, that they are capable of being jarred or jolted or are actually subjected to vibration, jarring or jolting, frequently of a character sufficient to cause the keeper-controlling mechanism to effect an accidental or an unauthorized release of the keeper. Sometimes the structures or apparatuses in which such installations are made are for temporary use only and are frequently somewhat flimsy, thus lending themselves to such accidental or unauthorized release of the keeper as has just been mentioned. One of the dominant aims of this invention is to provide a releasable keeper in which such accidental or unauthorized release is dependably and reliably precluded.

Accordingly, the members 10 and 14 may, for purposes of better illustration, but not by way of limitation, be regarded as parts of such structures as have just been mentioned, and in accordance with certain features of my invention, I dependably preclude release of the keeper irrespective of the direction in which the forces or the impetus of any vibration, jarring, or jolting may be made to exert themselves. Now the keeper 21 is pivotally mounted in a casing generally indicated at 15 (Figures 1 and 2), and it has a lip 21a which is exposed through a suitable recess or opening

in the front plate 20 of the casing 15, the latter being set into a suitable recess 14a in the wall member 14 and secured thereto as by suitable screws passed through the holes 20e and 20f (Figure 2) in the front plate 20. Thereby the keeper 21 has its lip 21a exposed for coaction with the bolt 11 of the door member 10.

In cross-section, as seen in Figure 1, the keeper 21 is generally T-shaped and its vertical leg 21d is provided with trunnions 21e and 21f (see Figure 2 and also Figure 3), which are rotatably supported in suitable bearings. For details of the casing construction and of the bearings for this keeper member and other members about to be described, reference may be made to my co-pending application Serial No. 757,292, filed December 13, 1934.

To the left of the vertical leg portion 21d of the keeper 21 (Figure 1) is an arm-like portion 21b which coacts with a trip lever 26 (Figures 1, 2 and 5). The trip lever 26 is provided with trunnions 26a and 26b whereby it is rotatably supported in suitable bearings in the casing construction, the axes of pivoting of the keeper 21 and the lever 26 being substantially parallel.

As is better shown in Figure 2, the member 26 comprises an L-shaped part or casting with the trunnions 26a and 26b in the respective ends of the long arm 26c thereof and with a mechanical contact member 27, preferably of a metal adapted to resist wear, such as hardened steel, set into a slot in the outer end of the short arm 26d. This contact member 27 is to coact with the left-hand end portion 29d of an armature 29 (Figures 2 and 4) provided with ears 29a and 29b by which it is pivoted to an upstanding stud 28 (Figure 2) in the casing. Depending upon the position of the armature 29, the trip lever 26 is permitted or prevented, as later described, from swinging about the axis of its trunnions.

Recurring to Figure 1, the left-hand arm 21b of the keeper 21 takes into a recess 26e in the trip lever 26, while the keeper 21 is provided with a recess 21c into which is seated one end of an expansible helical spring whose other end extends about and grips a stud 55j on the inside face of the cover plate 55 of the casing 15.

Spring 22 tends to move and hold the keeper 21 in the position shown in Figure 1 and due to the connection 21b—26e, the trip lever 26 is held in the position shown in Figure 2 in which the short arm 26d thereof virtually rests against the bottom wall of the casing 15 and thus positions the contact member 27 so that the left-hand portion 29c (see Figure 4) of the armature 29 can take over the member 27, that end of the armature being cut out as at 29d to accommodate the member 27. Therefore, arm 26d (Figure 2) is held against swinging upwardly toward the observer, trip lever 26 is held in the position shown in Figures 1 and 2, being locked against rotation, and hence the keeper 21 is dependably held in the position shown in Figure 1; accordingly, the door or other member 10 cannot be swung open without either releasing the keeper 21 or withdrawing the bolt 11.

The parts are held in the above described relation or position so long as the armature 29 remains in the position above described and better shown in Figure 2 from which it will be seen that a leaf spring 32 (see also Figure 4), secured to the armature as by a rivet 33, acts to hold the armature 29 in that position, the armature having a portion 29f at its right-hand end (Figures 2 and 4) which abuts against the front wall 20 and thus limits the action of the spring 32 in swinging the armature 29 in counterclockwise direction, as viewed in Figure 2.

If, however, and disregarding certain other features of my invention about to be described, the construction thus far described is given a blow or is jarred or subjected to sufficient vibration, there is a real danger of bringing about the relatively slight clockwise swinging of the armature 29 (see Figure 2) necessary to cause the left-hand end 29c thereof to ride off of the contact member 27 of the trip lever 26, and in such case release of the keeper 21 with subsequent release of the door 10 is effected. However, and as already above indicated, my invention positively precludes any chance of such release.

Accordingly, it might first be pointed out, as already above inferred, that the armature 29 is movable in clockwise direction (Figure 2) by electromagnetic means preferably comprising a U-shaped core of magnetic material, the core being made up of core legs 34 and 35 suitably secured as by riveting to, or heading over upon a cross core member 42 (Figures 1, 2 and 6). The cross core member 42 is in the form of a plate embedded, as by molding it into, in a wall member 44 of the casing 20, wall member 44 being made up of bakelite, hard rubber, fiber, or the like, and being provided with end flanges 44a—44b (Figure 2) and longitudinally extending flanges 44h and 44c, respectively, receivable in the end and top and bottom walls of the casing 20, all as more clearly described in my above-mentioned application. The core legs 34—35 are provided with windings 36 and 39, respectively, the latter being provided with suitable conductors (Figure 2) leading to binding posts or binding screws 45—46 (Figure 2) whereby the windings may be connected to the conductors 52—53 of the electrical circuit by or through which the energization of the magnet windings is to be controlled.

The relation of the parts is such, clearly shown in Figure 2, that the free ends of the core legs 34—35 are juxtaposed to the right-hand lever arm portion of the armature 29, spring 32 being interposed therebetween, and thus the armature 29 is made to form part of the magnetic circuit, the normal air gap between the armature and the core ends being lessened or substantially closed excepting for the brass spring 32, when the windings 36—39 are energized, thus releasing the trip lever 26. Deenergization of the windings permits the spring 32 ultimately to effect return of the armature 29 to substantially the position shown in Figure 2.

However, the armature 29 (see now Figure 4) is provided with lateral extensions 29g and 29h alined crosswise of the armature and substantially midway between the ends of the cores 34—35 (Figures 2 and 6) and in these lateral extensions are provided recesses 61 and 62, respectively.

Coacting with these two lateral extensions of the armature are stop or blocking members 63—64, respectively, better shown in Figure 6, and these stop members are yieldably mounted so as to assume positions normally out of respective juxtaposition to the recesses or apertures 61 and 62. Preferably I achieve this arrangement and action by causing the stop members 63 and 64 to be constituted out of the free ends of a U-shaped strap 65, of relatively small cross-section, made preferably of spring steel. The member 65 has, therefore, upstanding spring arms 65a and 65b whose ends 63 and 64, respectively, form the

above-mentioned stop members, and a base portion 65c which extends crosswise of the core part 42 in between the core legs 34—35, being secured to the core part 42 as by a screw 66 (Figure 6). As is clearly indicated in Figures 2 and 6, the side wall member 44 is slotted or cut away so that the base portion 65c may be snugly seated against the core part 42 and also so that the U-shaped member 65 cannot rotate or be swung about the axis of the screw 66.

Normally, therefore, the stop members 63 and 64 are held by their respective arms in the positions, with relation to the armature 29, better shown in Figure 6. Stop member 63 is to the left of the recess 61 and stop member 64 is to the right of recess 62. The parts are so dimensioned (see Figures 2 and 6) that, with the stop members 63—64 positioned as just described, armature 29 can partake of substantially no movement in clockwise direction, as viewed in Figure 2, or downwardly, as viewed in Figure 6.

Accordingly, if it is attempted to trip the trip lever by jarring, vibrating, or jolting the mechanism, armature 29 is securely held by these stop members 63—64 against partaking of any movement in response thereto.

If the reaction of the jarring or jolting is in a direction normal to the plane of the paper as Figure 6 is viewed, the tendency is to bend the arms 65a and 65b out of that plane. But the substantially rectangular cross-section thereof (see Figure 7) precludes such bending or movement and even if it took place, the stop members 63—64 would simply be moved lengthwise of the lateral extensions of the armature 29 but still and always clear of the recesses 61—62, respectively.

If the reaction of the jolting or vibrating force is in a direction from the left, as viewed in Figure 6, so as to tend to swing the stop member 64 to the left and toward juxtaposition to the hole 62 in the armature, stop member 63 is likewise swung to the left and hence away from its hole 61 in the armature 29 and hence it remains always in a stopping position even though the other stop members 64 might be brought into alinement with the recess 62.

If the reaction of the jarring or jolting force is toward the right, as viewed in Figure 6, a reverse action from that just described takes place, and though stop member 63 might thus be brought toward juxtaposition to the recess 61, the companion stop member 64 is not moved toward its recess 62 but in a direction always to keep it underneath the armature and in stopping position.

Accordingly, no matter what the direction of the reaction of any jolting or vibrating force may be, armature 29 is effectively barred from being thereby actuated to release the keeper.

Now these stop members 63—64 are, in accordance with other features of my invention, positively controlled and accordingly I arrange to move them toward each other, and hence in opposite directions, and into respective juxtaposition to the recesses 61 and 62 whenever it is desired, from the point of remote control, to actuate the armature 29 to release the keeper. This I achieve preferably by securing to the spring arms 65a and 65b (Figures 6 and 7) armatures 67 and 68, respectively, these being preferably in the form of bars preferably of a length to be brought into coaction with both core members 34 and 35. They may be secured to the spring arms in any suitable manner; illustratively, each armature 67—68 may be provided with a slot in its side snugly to receive the arms 65a and 65b, respectively, being secured thereto as by riveting, clamping or any other suitable means.

Thereby the armatures 67 and 68 extend across the free ends of the windings 36 and 39 but each to one side of the free ends of the cores 34—35 which are, as is better shown in Figure 7, preferably cut away along chords of their circular cross-section, thereby to provide flat side faces for better coaction with the armatures 67 and 68.

Also, I preferably mount pins 69 (Figure 7) in the respective ends of the armatures 67—68, making the pins of a suitable non-magnetic material, such as brass, and allowing them or their heads to project slightly from those faces of the two armatures which would otherwise contact the flat faces of the cut away ends of the cores 34—35. Thereby, I assure that, when the armatures 67—68 are drawn toward the cores 34—35, there remains a slight air gap between them and the cores as determined by the protruding portions of the pins 69, and thus the sticking or "freezing" of the armatures to the cores is dependably prevented.

Accordingly, when the windings 36—39 are energized, the armatures 67—68 are quickly and promptly drawn toward each other, thereby moving the stop members 63—64 (Figure 6) into juxtaposition to the recesses 61—62, respectively, thereby quickly removing them out of stopping positions. This action takes place very rapidly for the armatures 67—68, where they extend into coacting relation to both the core legs 34—35, are positioned in the air gap across the latter, and thus there is available a powerful magnetomotive force to start them moving and to move them out of stopping position. Also, a number of auxiliary or independent magnetic circuits, of which the U-shaped member 65 where the latter is made of spring steel, forms a part, are brought into action.

However, the brass or non-magnetic pins 69 (Figures 7 and 6) also act to maintain a sufficient air gap between the armatures 67—68 and the cores 34—35 so as not to shunt away so much magnetic flux as would make what is left insufficient to actuate the armature 29; accordingly, the actuation of the armature 29 follows quickly and dependably the actuation of the much lighter and smaller armatures 67—68, and thereby the armature 29 swings in clockwise direction (Figures 2 and 4) to release the trip lever 26 and hence to release the keeper 21.

Accordingly, upon swinging, the door or other member 10 (Figure 1) upwardly, as viewed in Figure 1, keeper 21 swings to the left against the action of spring 22 and swings the trip lever 26 in clockwise direction, as viewed in Figure 1, its short arm 26d (Figures 2 and 6) swinging upwardly, having been released by the armature 29; its range of swing is, however, limited by the projection 26f thereof (Figures 1 and 5) which contacts the top wall of the casing 15, and these actions of the keeper 21 and of the trip lever 26 are made to bring about the prevention of a counter-clockwise swinging of the armature 29 (as viewed in Figures 2 and 4) under the action of the armature spring 32. This I achieve by providing the left-hand end of the armature 29 (see Figure 4) with a transverse extension 29k, as by bending or stamping a portion of the strap metal of which the armature 29 may be made out of its plane and providing that extension 29k with an arcuate or cam-shaped or edge face 29s, as is well shown in Figure 4.

This curved cam edge 29s is of such extent and such curvature that, with the armature 29 in actuated position, this face 29s defines the locus of movement of the end edge of the contact member 27 (Figures 2 and 5) of the trip lever; accordingly, once the trip lever is released by the armature 29, the member 27 of the former always maintains contact with this cam face 29s no matter what its position about the axis of swinging of the trip lever 26, within the range of swinging movement of the latter. And thereby the armature 29 cannot return to its normal position (the position shown in Figure 2) so long as the keeper 21 is itself not returned to its own normal position (the position shown in Figure 1).

By this action, therefore, the stop members 63—64 (Figure 6) remain entered into the recesses 61 and 62, respectively, and are thus prevented from interfering with the subsequent resetting of the trip or contact member 27 of the trip lever 26 with respect to the notch 29d of the armature. Furthermore, and bearing in mind that the energization of the windings 36—39 is usually controlled by a push button and that the operator, as is customary and common practice, rarely holds the push button switch in actuated position but rather gives the push button switch a series of short successive actuations and thereby sends into the windings 36—39 a like succession of impulses, it will be seen that the armature 29 would have to follow these impulses with results somewhat like these:—Upon the first impulse, stop members 63—64 are drawn out of stopping positions and armature 29 is actuated to release the trip lever 26; if the door 10 is immediately moved so as to move the keeper 21 and the trip lever 26, the cessation of that first impulse, or of the last of the series of impulses, would cause the deenergization of the windings with the restoration of the armature 29 to its normal position, as shown in Figure 2, and with the restoration of the stop members 63—64 to stop positions as shown in Figure 6. The stop members 63—64 would thus effectively block such movement of the armature 29 as would be necessary to reset the trip member 27 with the notch 29d of the armature 29, and thus resetting of the keeper 21 could not be achieved and keeper 21 would remain released.

However, the actuation of the keeper 21, as already described, due to its coactions with the armature 29 by way of the trip or contact member 27 and the cam face 29s of the armature, insures that, no matter whether the push button switch or other control effects energization of the windings by one long impulse of electrical energy or by a long or short series of short impulses, such undesirable stopping action of the stop members 63—64 is precluded and dependable and reliable resetting of the mechanism with consequent dependable anchoring of the keeper 21 itself is insured.

Thus, it will be seen that there has been provided in this invention a construction in which the various objects heretofore noted, together with many thoroughly practical advantages, are successfully achieved. It will be seen that the construction is dependably fool-proof and tamper-proof, is of dependable action, and is of simple yet reliable construction.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawings, is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In construction of the character described in which there is a movable member for coacting with a door bolt or latch, an electromagnet, a pivoted armature therefor, a movable armature stop for holding said armature against actuation in response to said electromagnet, said stop having means operatively related to said electromagnet for moving said stop out of armature-stopping position in response to said electromagnet, said stop and said armature having coacting portions such that said armature holds said stop in actuated position if said armature is held in actuated position, and a trip movable with said member but normally held against movement by said armature, said trip having a certain range of movement subsequent to its release by said armature after the latter is actuated by said electromagnet, the combination with said trip and movable armature of cam means and follower means, one related to said armature and the other related to said movable trip, and having a range of action commensurate with the range of movement of said movable armature subsequent to actuation of the latter by said electromagnet for holding said armature in actuated position throughout the range of movement of said movable trip, and thereby holding said armature stop ineffective, throughout all positions of said movable member beyond or out of its normal position.

2. In construction of the character described, in which there is a movable member for coacting with a door bolt or latch, an electromagnet, a pivoted armature therefor, a movable armature stop for holding said armature against actuation in response to said electromagnet, said stop having means operatively related to said electromagnet for moving said stop out of armature-stopping position in response to said electromagnet, said stop and said armature having coacting portions such that said armature holds said stop in actuated position if said armature is held in actuated position, and a trip movable with said member but normally held against movement by said armature, said trip having a certain range of movement subsequent to its release by said armature after the latter is actuated by said electromagnet, said trip being pivotally mounted to swing about an axis at right angles to the axis of pivoting of said armature, the combination with said armature and said trip of an arcuate cam carried by said armature and of an arcuate extent equivalent to the range of swing of said trip about its axis subsequent to release of said trip by said armature, actuation of said armature by said electromagnet positioning said cam to permit swinging of said trip about its axis and said cam having such a curvature that retrograde movement of said armature is blocked by said cam and trip throughout the operative range of swing of said trip subsequent to its release.

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