April 23, 1940. R. MARPLE 2,198,549

LOCKING DEVICE

Original Filed Aug. 18, 1937 2 Sheets-Sheet 1

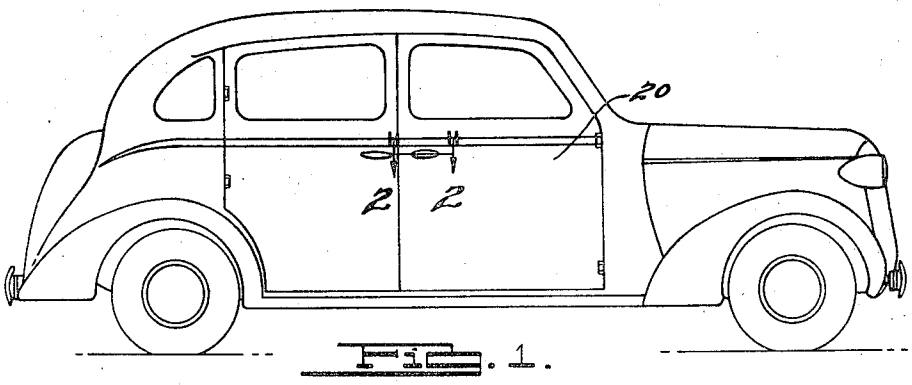

Fig. 1.

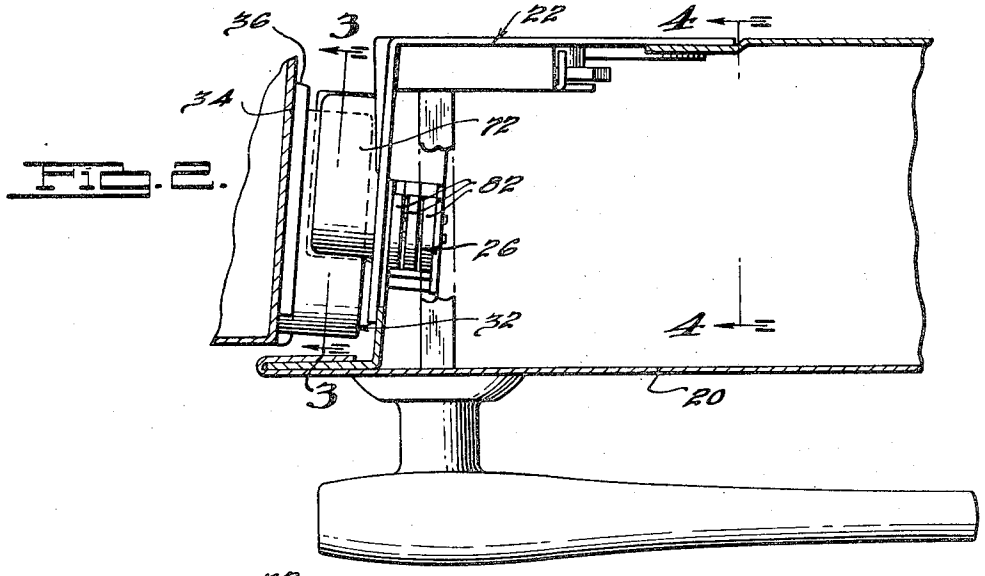

Fig. 2.

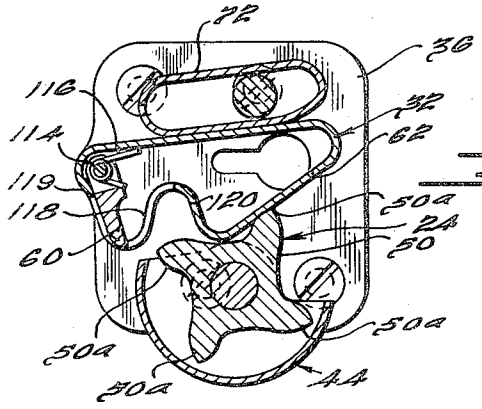

Fig. 3.

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Fig. 4.

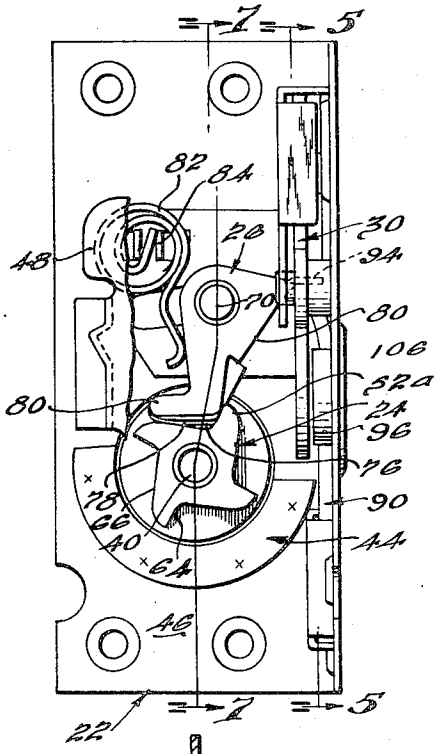
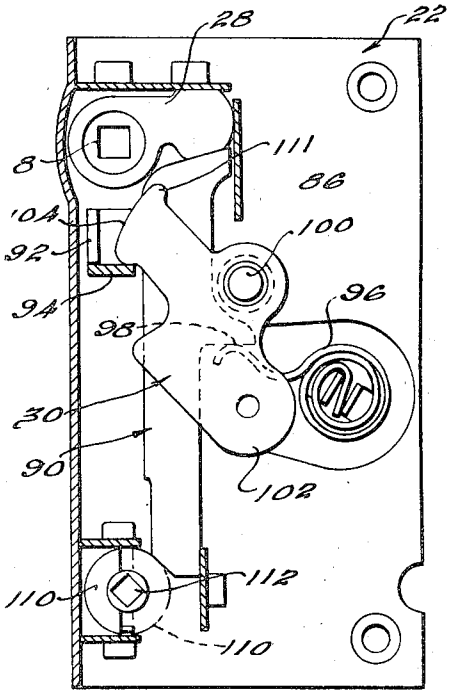


Fig. 5.



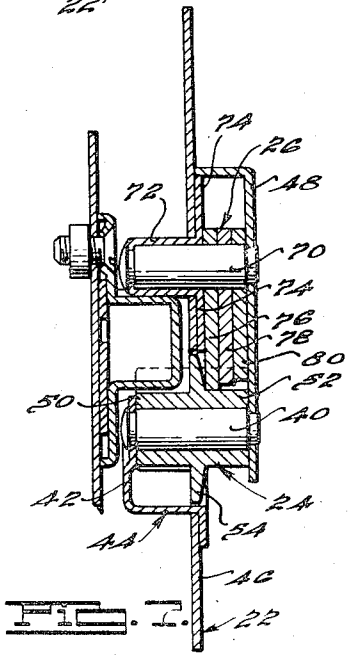
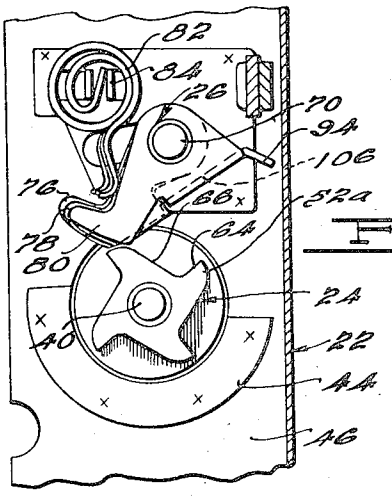


Fig. 7.

Fig. 6.



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UNITED STATES PATENT OFFICE

2,198,549

LOCKING DEVICE

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Original application January 22, 1940, Serial No. 315,122, which is a division of application Serial No. 159,746, August 18, 1937. Divided and this application March 1, 1940, Serial No. 321,608

2 Claims. (Cl. 292—210)

This invention relates to locking devices for vehicle doors or the like, and in particular provides improved constructions of locks of the rotary bolt type, as well as improved constructions of lock-keepers adapted for use with such locks.

The present application is a division of applicant's copending application, Serial No. 315,122, filed January 22, 1940, which, in turn, is a division of applicant's copending application, Serial No. 159,746, filed August 18, 1937, entitled Locking device.

Objects of the invention are to provide an improved door lock and keeper particularly adapted for use on vehicle doors or the like, characterized as being simple in construction, economical of manufacture, and extremely durable and efficient in operation; to provide a lock of the rotary bolt type, embodying an improved construction of rotary bolt, adapted to cooperate in an improved manner with one or a plurality of actuating dogs therefor; to provide a lock of the rotary bolt type embodying an improved construction and arrangement of the several parts thereof, to accommodate the lock to limited space requirements; to provide an improved lock keeper, embodying a main bolt holding portion, and also embodying a retractable safety catch portion, which may be utilized with locks having either rotary bolts or bolts of other types; and to generally improve the construction and operation of vehicle door locks and keepers therefor.

With the above, as well as other objects in view, which appear in the following description and in the appended claims, preferred but illustrative embodiments of the present invention are shown in the accompanying drawings, throughout the several views of which corresponding reference characters are used to designate corresponding parts, and in which:

Figure 1 is a view in elevation, illustrating the application of the invention to automobile doors;

Fig. 2 is a view in transverse section, taken along the line 2—2 of Fig. 1;

Fig. 3 is a view in vertical section, taken along the line 3—3 of Fig. 2;

Fig. 4 is a view taken along the line 4—4 of Fig. 2;

Fig. 5 is a view taken along the line 5—5 of Fig. 4;

Fig. 6 is a view corresponding generally to Fig. 4, but showing the parts in a different stage of a door closing movement; and,

Fig. 7 is a view in vertical section, taken along the line 7—7 of Fig. 4.

The improved lock, which is secured within the door 20 of the associated vehicle, comprises generally a casing member 22; a rotary bolt 24; a plurality of dogs designated collectively as 26, for holding the bolt against rotation in a door opening direction; an outside operated roll-back 28, for releasing the dogs 26 from the bolt 24 in response to movement of the conventional outside handle; and an inside retracting member 30, which may be operated in response to the conventional inside door handle, or the like, to release the dogs 26 from operative engagement with the bolt. The keeper 32, which is described in more detail below, is suitably secured to the door pillar 24, as by means of a bracket 36.

The bolt 24 is rotatably journaled in the lock casing upon a trunnion or pin 40. One end of the pin 40 is supported in the flange 42 of a bracket 44, which is suitably secured as by welding to the flange 46 of the previously identified lock casing 22. The other end of the pin 40 is supported in a supplemental casing member 48, which is suitably secured to the inner face of the flange 46.

The bolt 24 is formed to provide a keeper engaging portion 50 which projects externally of the lock casing 22 for cooperation with the keeper 32; an inner or dog engaging portion 52; and a separating fin or vane 54 which is somewhat larger in diameter than the portions 50 and 52, and serves to substantially close the opening 55, which is provided in the flange 46 of the casing 22 to accommodate the bolt. The lower half of the outwardly projecting portion 50 of the bolt 24 is substantially enclosed by the previously mentioned bracket 44, which is given a substantially semi-cylindrical form for this purpose.

As most clearly appears in Figs. 3 and 7, the outer portion 50 of the bolt 24 is formed to provide a plurality of radially extending, equi-angularly spaced keeper engaging teeth or projections of teeth 50*a*, any one of which is effective as described hereinafter to cooperate with either the safety catch 60 associated with the keeper, or the keeper portion 62 associated therewith, to hold the door in either the partially closed or safety position, or the fully closed position, respectively. It will be appreciated that the angular spacing between the projections and teeth 50*a*, relative to the spacing between the safety catch 60 and the keeper portion 62, is such that the bolt 24 can roll over or across the keeper in a manner similar to the cooperation between a gear and a rack.

As most clearly appears in Figs. 4, 6 and 7, the

inner portion 52 of the bolt 24 is formed to provide a number of dog engaging teeth or projections 52*a*, the number and angular spacing between which corresponds to the number and angular spacing of the keeper engaging teeth 50*a*. The teeth 52*a*, however, are angularly displaced from the teeth 50*a*. This relation results in reducing the space requirements of the lock, since the positions of the dogs can thus be determined independently of the rotative positions of the teeth 50*a*. Each tooth 52*a* is formed to provide a generally radially extending dog releasing portion 64, and a locking portion 66.

The dogs 26 are provided to cooperate with the locking portion 66 of the bolt 24 to hold the bolt 24 against rotation in a clockwise or door opening direction, as viewed in Figs. 3, 4 and 6. It is preferred to utilize a plurality of such dogs of progressively increasing length, to provide a take-up action for the lock, as hereinafter described. In the present instance, three dogs are illustrated, although a smaller or a larger number may be utilized if desired.

The three dogs, designated as a whole as 26, are rotatably supported in the lock casing upon a pin or trunnion 70, which extends parallel to but spaced from the previously mentioned bolt supporting pin 40. The outer end of the pin 70 is supported in a member 72, the inner flanges 74 of which are secured to the inner face of the casing flange 46, and the outwardly extending body portion of which serves, as most clearly appears in Figs. 3 and 7, as a dove-tail member. The inner end of the pin 70 is supported in the previously mentioned supplemental casing member 48. Each of three dogs, which are individually designated as 76, 78, and 80, includes a downwardly extending body, which terminates in a laterally offset foot. The dog 76 is slightly longer than the dog 78, and the dog 78, in turn, is slightly longer than the dog 80. Each of the dogs 76, 78, and 80 is provided with a biasing spring 82 individual thereto. One end of each spring is secured between a pair of lugs 84, which are inwardly struck from the casing flange 46, and the free end of each spring 82 bears against the edge of the associated dog and so continuously urges it in a counterclockwise or locking direction, as viewed in Figs. 4 and 6.

The outside roll-back 28 is illustrated as being conventionally pivotally supported in the base 86 of the casing 22, for rotation by the conventional door spindle 88. The outer end of the roll-back member 28 normally bears against a retracting link 90, which is slidably supported adjacent the casing base 86, and also serves, as hereinafter described, to cooperate with the locking mechanism to lock the outside roll-back 28 against actuation. The link 90 is provided with a laterally offset foot 92, which normally bears against a rearwardly extending shoulder 94 formed on the dog 80. A spring 96, suitably secured to the casing base 86, continuously bears against a second shoulder 98, formed on the link 90, and so urges it, as well as the roll-back 28, to the illustrated normal or locked position.

The inside retracting link 30 is pivotally supported upon the base 86 of the casing 22, as by means of a pin 100. One end 102 of the link 30 is adapted for connection to the conventional link mechanism (not shown) which may extend to an inside door operating handle. The other end 104 of the inside actuating link is formed as a foot, for cooperation with the previously mentioned dog shoulders 94.

In order to render the dogs 76 and 78 responsive to the movement of the dog 80, as influenced by the shoulder 94 provided thereon, the dog 80 is provided with a laterally turned portion 106, which extends around and behind the rear edges of the dogs 76 and 78. With the just described arrangement, it will be appreciated that clockwise rotation of the outside roll-back 28, as viewed in Fig. 5, causes the link 90 to move downwardly. The engagement between the foot 92 of the link 90 and the shoulder 94 associated with the dog 80, causes the downward movement of the link 90 to be accompanied by a clockwise rotation of the three dogs 76, 78, and 80, as viewed in Figs. 4 to 6, thereby releasing the dogs from the bolt 24, and permitting the latter to be rotated in a clockwise or door opening direction. The same action also results from a counterclockwise rotation of the inside link 30, and the end 104 whereof bears against the shoulder 94 associated with the dog 80. Upon releasing either the outside roll-back 28 or the inside contracting ring 30, however, as the case may be, the springs 82 associated with the several dogs are effective to urge the dogs to the locking position shown in Fig. 4.

In order to lock the link 90 against downward movement, and so render the outside roll-back 28 ineffective to actuate the dog, the segmentally formed locking device 110 is provided. It will be appreciated that the member 110 is pivotally supported in the base 86 of casing 22, for rotation in response to a key-actuated spindle 112. In the unlocked position, shown in full lines in Fig. 5, the segmental member 110 is out of the path of the lower end of the link 90, so that it is ineffective to prevent or control such movement of the link 90. If the member 110 is rotated to the position shown in dotted lines in Fig. 5, however, the body thereof is disposed in the path of movement of the lower end of the link 90, and prevents downward movement thereof. In addition to the foregoing locking arrangement for the outside roll-back 28, it will be noted that the inside retracting link 30 is provided with a projection 111. Upon rotation of the links 30 in a clockwise direction, as viewed in Fig. 5, the projection 111 is moved into the path of and in blocking relation to the outside roll-back 28, thereby preventing rotation thereof in an unlocking direction. To release the roll-back 28 from the just-mentioned locking action, the link 30 may be returned to the position shown in Fig. 5.

Referring particularly to Fig. 3, the keeper 32 comprises a body, which may be and preferably is formed as a relatively heavy metal stamping, and which is formed to define the previously mentioned bolt engaging surface 62. The previously mentioned safety catch 60 is and may be formed as a die casting, or the like, and is pivotally supported upon a pin 114, which extends between and is supported in the opposite side wall of the keeper 32. A spring 116 is connected between the catch 60 and the keeper body, and continuously urges the safety catch 60 to the active position shown in Fig. 3. It will be noted that the otherwise continuous body of the keeper 32 is cut away, as indicated at 118, to afford a slot or opening through which the safety catch may move from the active position shown in Fig. 3 to a retired position. It will be noted that the back of the safety catch 60 abuts the portion 119 of the body of the striker plate 32, so that such portion 119 forms a limit stop to the rotation thereof under the influence of the spring 116.

Also, as clearly appears in Fig. 3, when the door is in a closed position, the keeper 32 is in a position between the rotary bolt 24 and the previously mentioned dovetail member 72. The upper surface of the keeper 32, as well as the under surface of the dovetail member 72, are downwardly inclined in the direction of a door closing movement. With this relation, the dovetail member 72 tends to serve as a stop to movement of the keeper 32 in the leftward or door closing direction as influenced by the bolt 24. The members 24, 32, and 72, accordingly, function in accordance with the functioning of the usual separately formed door dovetails associated with locks of the conventional slidable bolt type, and permit such separate dovetail structures to be entirely dispensed with in the practice of the invention.

Considering the operation as a whole of the embodiment shown in Figs. 1 through 7, the parts are shown in Figs. 2, 3, 4, 5, and 7 in position occupied thereby when the door is in a fully or tightly closed position. Under these circumstances, the upper tooth 50*a* of the outer portion of the rotary bolt 20 bears solidly against the cooperating surface 62 of the keeper 32, forcibly wedging the latter between the bolt 24 and the dovetail member 72. At the same time, the foot of the longest dog 76 bears solidly against the upper substantially horizontally disposed locking surface 66 associated with the inner portion of the bolt 24. Dog 76 is thus effective to entirely prevent any clockwise rotation of the bolt 24, so that the door is positively held in the just mentioned fully or tightly closed position.

To open the door, either the outside roll-back 28, or the inside operating link 30 may be actuated, to force the shoulder 94 associated with the dog 80 downwardly, thereby rotating all three of the dogs 76, 78, and 80 in a clockwise direction as viewed in Figs. 4 and 6. This rotation of the dogs, which takes place in opposition to the forces of their associated biasing springs 82, moves the feet thereof out of range of the teeth 52*a* of the inner portion of the rotary bolt 24, thereby permitting the latter to be freely rotated in a clockwise or door opening direction, in response to the movement thereover of the keeper surface 62 and the safety catch 60.

Upon release of the inside retracting link 30 or the outside roll-back 28, which may be expected to occur shortly after the keeper safety catch 60 passes beyond the bolt 24, the springs 82 again become effective to return the dogs to the position shown in Fig. 4, in which they are effective to hold the bolt in the corresponding illustrated position.

The return movement of the dogs, also causes the outside roll-back 28 and the inside link 30 to resume the position shown in Fig. 5. The movement of the roll-back 28 is also influenced by the spring 96, and the movement of the link 30 may also be influenced by the conventional return spring mechanism (not shown) associated therewith.

During a door closing movement, the bolt 24 moves to the right relative to the keeper 32 as viewed in Fig. 3. As the vehicle door approaches a partially closed position, corresponding to the conventional safety position, the safety catch 60 engages the right-hand face of the upper tooth 50*a* associated with the rotary bolt 24. Continued door closing movement causes the catch 60 to apply a rotative force to the bolt 24. The springs 82, however, associated with the locking dogs, are stronger than the spring 116 associated with the safety catch 60, so that no rotative movement of the bolt 24 occurs. Instead, the safety catch 60 rotates in a clockwise direction relative to the keeper 60 to a retired position, in which the keeper 32 may be moved past the upper tooth 50*a*. As soon as the end of the safety catch 60 passes beyond the upper bolt tooth, the spring 116 associated therewith is rendered effective to cause the safety catch to return to the active position shown in Fig. 3, in which position it is effective to cooperate with the left-hand face of the upper bolt tooth 50*a* and positively prevents the door from again being fully opened, without again actuating the dogs designated collectively as 26 to release the bolt 24.

If the door closing movement is continued beyond the safety position just described, the sloping face 120 of the keeper 32 is brought into engagement with the right-hand face of the upper bolt tooth 50*a*, and applies a positive rotative force to the bolt 24. Due to the fact that the bolt holding effect of the dogs, designated collectively as 26, results from the cooperation between the feet thereof and the bolt faces, and not from the strength of the biasing springs 82, it is possible to utilize springs 82 which are relatively weak. Accordingly, a minimum of door closing force is required to render the keeper face 120 effective to rotate the bolt 24 in a clockwise direction, as viewed in Figs. 3, 4, and 6. During such movement, a leading face 64 of an inner bolt tooth 52*a* bears against the rear edges of the dogs, and turns these dogs from the positions shown in Fig. 4 to positions corresponding to those shown in Fig. 6.

When the door reaches a substantially closed position, the just mentioned inner bolt tooth face 64 passes beyond the heel of the shorter dog 80, permitting the latter to ride up over the rounded end of the dog engaging bolt face 66. As soon as this action takes place, the spring 82, associated with the dog 80, becomes effective to rotate the latter in a counterclockwise direction, as viewed in Fig. 6, and forcibly continue the rotation of the bolt 24 in the counterclockwise or door closing direction. At slightly spaced stages in the continued door closing movement, the bolt face 64 successively passes beyond the heels of the dogs 78 and 76, rendering the springs 82 associated with these dogs successively effective to continue the counterclockwise or door closing rotation of the bolt 24.

It will be appreciated that at any stage of the door closing movement at which the inner bolt face 64 passes beyond the heel of a selected dog, rendering such dog effective to assume the position shown in Fig. 4, such dog becomes effective to prevent a clockwise or door opening movement of the bolt 24. In such instance, any tendency of the bolt to rotate in a clockwise direction applies a substantially radial force to the particular dog. The parts are preferably so adjusted that the shorter dog 80 reaches the just mentioned blocking position as an incident to each door closing movement. Accordingly, even though the vehicle door is only very lightly closed, a positive lock is applied to the door.

With the dog 80 in the blocking position, the two longer dogs 78 and 76 occupy positions in which the springs 82, associated therewith, are still effective to continuously urge the bolt 24 in a counterclockwise or door closing direction. In addition to being positively held against an opening movement, accordingly, the door is continuously urged to a further closed position.

In certain instances it may be found that the forces of the springs 82 acting upon the associated longer dogs 76 and 78 will be effective to cause the door closing movement to continue to a point at which the intermediate dog 78 is in the blocking position. In other instances, as where the resistance to further door closing movement is sufficient to prevent such continued movement, it is found that road shocks or the like cause the door to momentarily move inwardly a slight amount relative to the vehicle body. Any such inward movement immediately relieves the otherwise existing resistance to continued counterclockwise movement of the bolt 24, and is immediately taken up by a movement of the intermediate dog 78, or the final dog 76 to the blocking position. It will be seen, accordingly, that the several dogs being of slightly different length, assume the blocking positions thereof at different substantially closed positions of the door, and that a minimum expected closing force of the door is sufficient to render at least the shortest dog 80 effective to reach the blocking position, leaving the remaining dogs effective to take up any additional closing movement.

From the foregoing, it will be appreciated that the present invention provides extremely effective door lock and keeper constructions, which are simple and economical of manufacture, and which are exceptionally efficient and satisfactory in operation. It will also be appreciated that the specifically described embodiments are illustrative, and that various modifications in the form, number and arrangement of the described parts may be made within the spirit and scope of the invention.

What is claimed is:

1. In a latch mechanism for association with relatively movable members, a securing means carried by one member for engagement with a part carried by the other member, a plurality of cam elements arranged to cooperate with said securing means, said cam elements being so arranged relative to said means that they have a progressive camming action on said means and maintain said means in engagement with said part with a continuous camming effect, one of said cams having first and second projections thereon one whereof extends transversely of another of said cams so that a retracting movement of said one cam causes a corresponding movement of another said cam, and a retracting member engageable with the other projection for effecting said retracting movements.

2. In a latching device of the rotary bolt type, the combination of a casing member, a bolt rotatably mounted on said casing for rotation, said bolt having a series of tooth-like projections positioned externally of said casing for cooperation with an associated keeper, and having a second series of dog engaging projections positioned internally of said casing, a plurality of cams positioned within said casing for cooperation with said second series of projections, one of said cams having first and second portions extending therefrom one whereof lies transversely of another of the cams so that a retracting movement of the one cam causes a retracting movement of said another cam, and a retracting member carried by the casing and engageable with the other portion for effecting the retraction of said cams from cooperative relation to said projections.

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