

May 19, 1959

L. M. MEYER

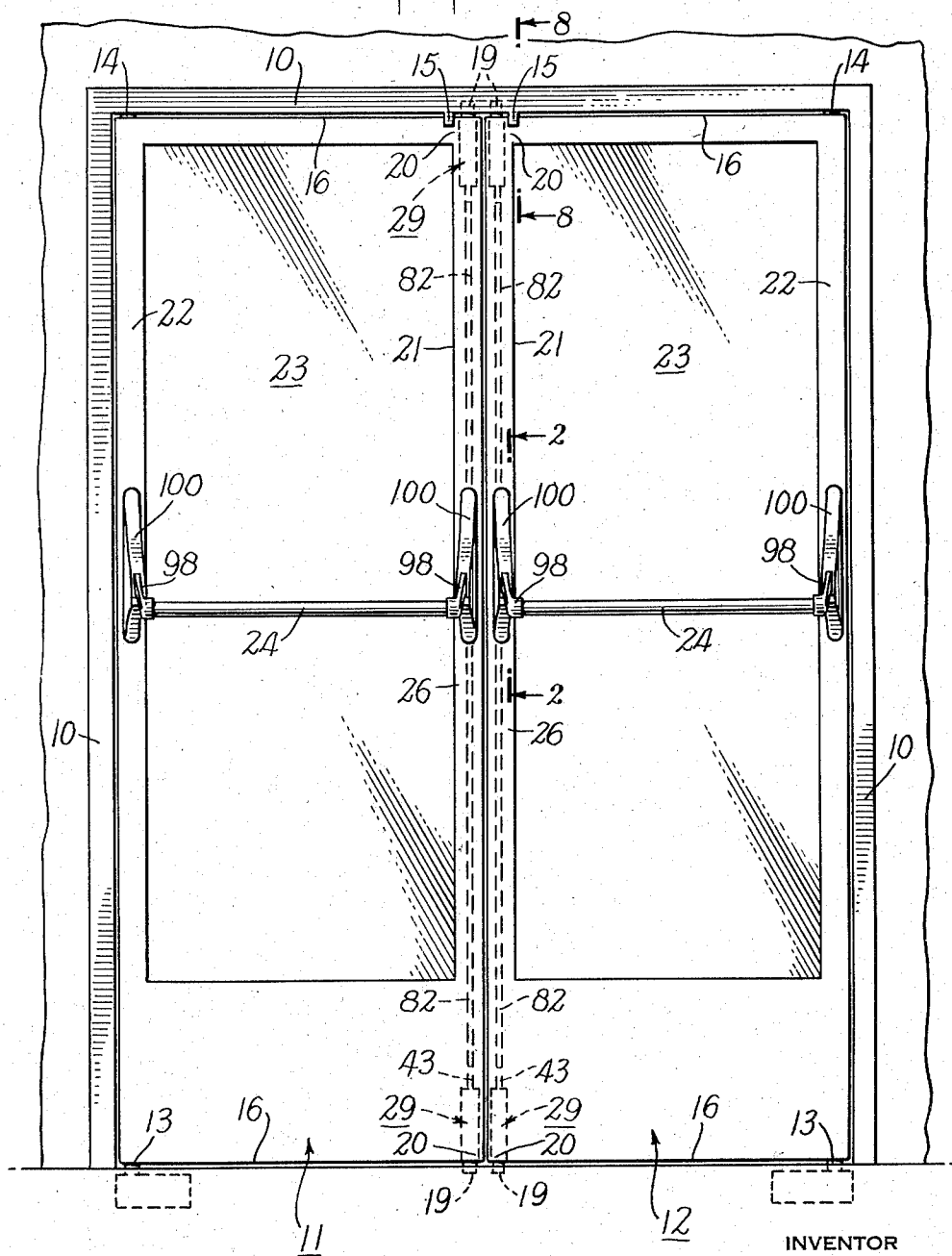
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EXIT DOOR AND LATCH MECHANISM THEREFOR

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5 Sheets-Sheet 1

Fig. 1.



12 INVENTOR
Laurence M. Meyer
BY *J. P. Baseches*
his ATTORNEY

May 19, 1959

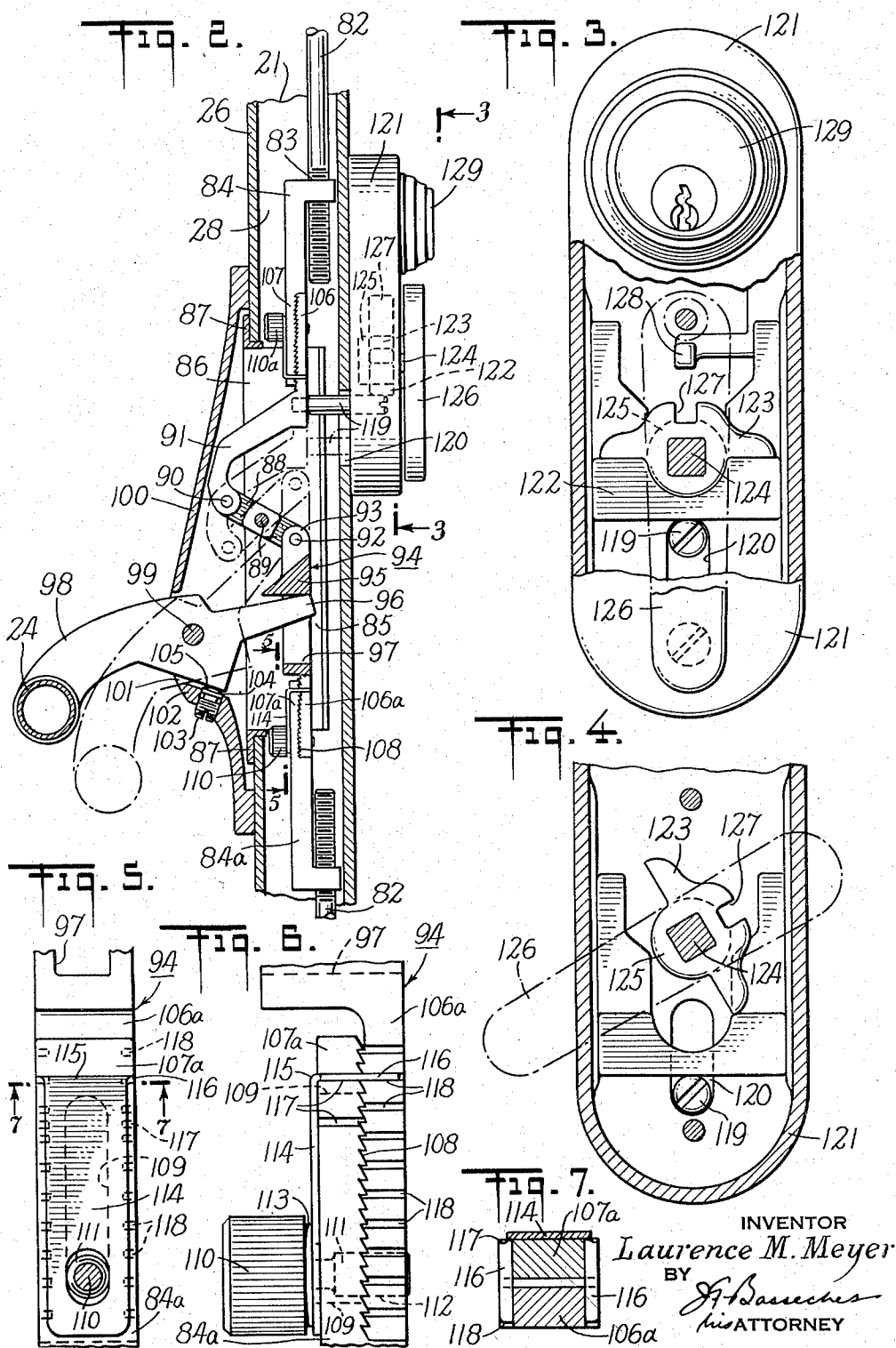
L. M. MEYER

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EXIT DOOR AND LATCH MECHANISM THEREFOR

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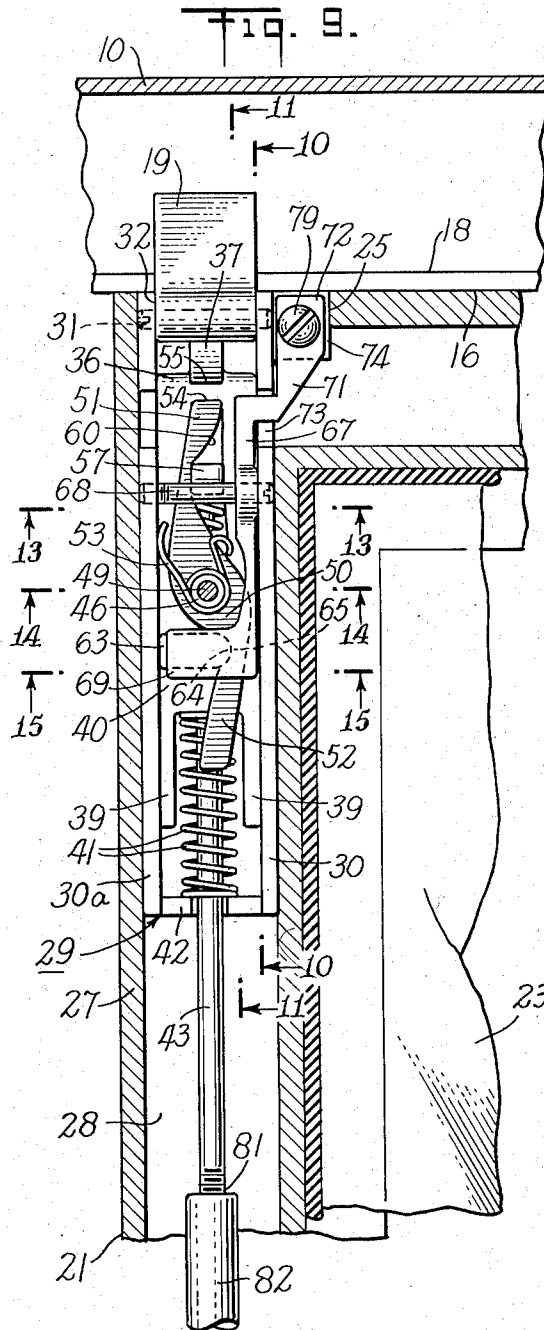
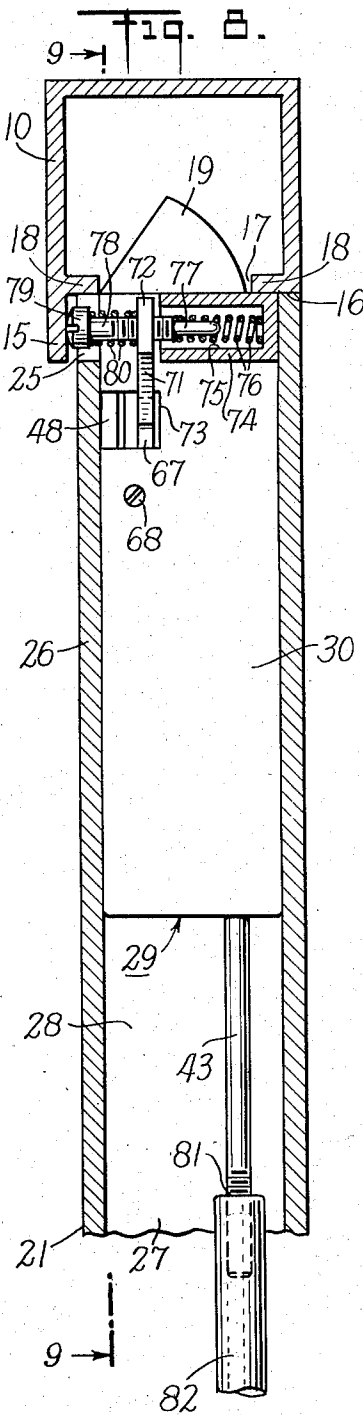
L. M. MEYER

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EXIT DOOR AND LATCH MECHANISM THEREFOR

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INVENTOR
Laurence M. Meyer
BY
J. Basseches
ATTORNEY

May 19, 1959

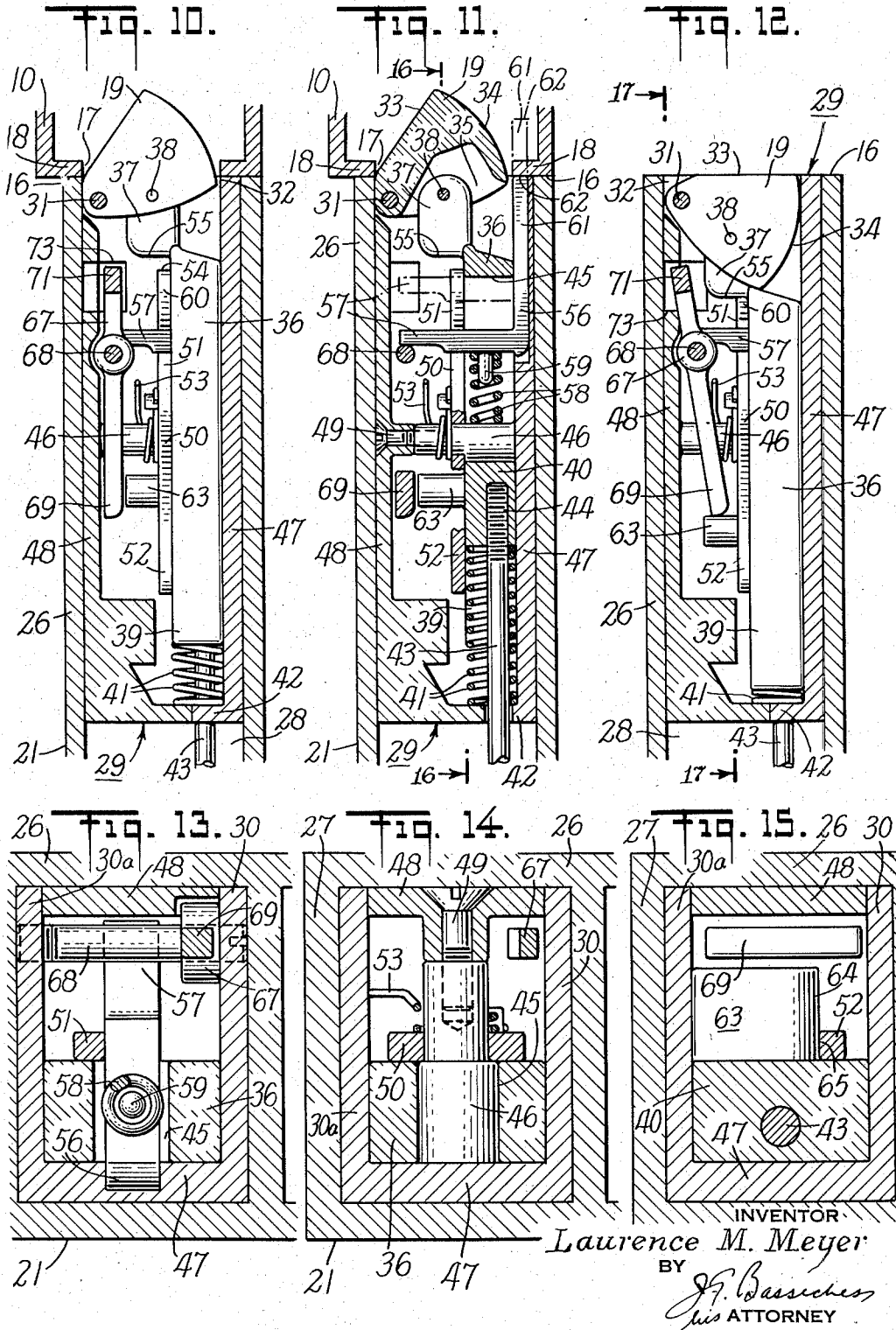
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EXIT DOOR AND LATCH MECHANISM THEREFOR

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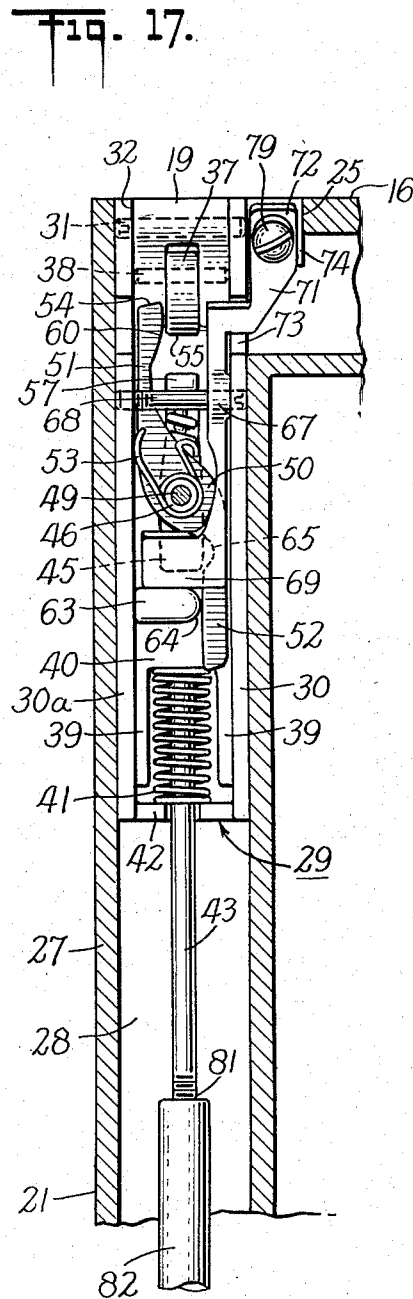
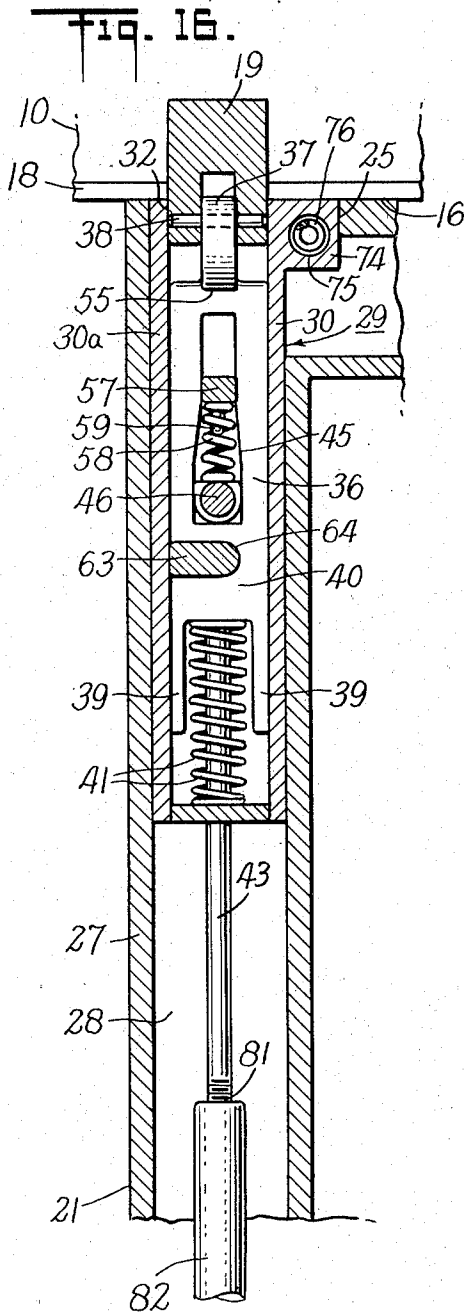
L. M. MEYER

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EXIT DOOR AND LATCH MECHANISM THEREFOR

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5 Sheets-Sheet 5



INVENTOR
Laurence M. Meyer
 BY
J. B. [Signature]
 ATTORNEY

1

2,887,336

EXIT DOOR AND LATCH MECHANISM
THEREFOR

Laurence M. Meyer, Leominster, Mass., assignor to Independent Lock Company, Fitchburg, Mass., a corporation of Massachusetts

Application March 16, 1954, Serial No. 416,542

6 Claims. (Cl. 292—21)

This invention relates to exit door constructions and more particularly to panic exit doors and still more particularly to latch controls for such closures.

It is an object of this invention to provide in exit doors, particularly panic exit doors, actuating means for the latch bolts thereof and mechanism for actuating the latch bolts and latch installation, in a door frame which are concealed, in no way detracting from the ornamental appearance of narrow frame stiles employed in such doors, including actuating mechanism for releasing the latches, including novel adjustment means to take care of imperfections and tolerances in installation, wear and tear of use, and warping or displacement of the door and frame, thereby to assure proper operation during the useful life of such doors and the latching mechanism.

Still more particularly it is an object of this invention to provide exit door latching mechanism and actuators therefor in which double latch mechanism may be mounted in concealed condition in a door frame, particularly door frames of channel construction employing relatively narrow stiles and to include full throw latch bolts to provide a relatively large throw of a latch bolt which, when mounted upon the door, may be thrown into the keepers or strike plates thereof without causing any damage due to the abuse to which such long throw latches are normally exposed, including the provision of mechanism for retaining the latch bolt in retracted position during movement in closing the door, and including combined therewith mechanism for dead-bolting the latch bolt thus operated, to prevent jimmying or depression of the projected latch bolts from the exterior side of the door.

Still more particularly it is an object of this invention to provide in an exit door device having double bolt latches, actuating means for the latch bolts which may be installed quickly and maintained in properly adjusted condition when installed concealed within channel-shaped frames of doors, and including latches operated thereby having a large throw or door strike entering displacement, combined with mechanism which retains the latch bolt in depressed position, to restrain entry of the latch into the keeper aperture until the door is closed, and to include in the same action, auxiliary latch mechanism likewise held in the depressed condition, to be projected into dogging position of the main bolt when the door is closed, thereby to prevent jimmying or unauthorized tampering to depress the latch bolt to open the door.

Still further objects of this invention are to provide in an exit door, particularly doors carrying double bolts actuated by pressure bars, locking control mechanism for such actuators which are easy to install and simple in operation, yet are effective during the rigorous use to which such devices are subjected, particularly in heavy doors employing narrow metal frames, whereby to provide the desired ruggedness without interfering with the aesthetic appearance of such doors whether assembled and fitted with metal or glass panels.

To attain these objects and such other objects as may

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appear herein or be hereinafter pointed out, reference is made to the accompanying drawing forming a part hereof, in which—

Figure 1 is a front elevation of an exit door in accordance with my invention;

Figure 2 is a magnified section taken on the line 2—2 of Figure 1;

Figure 3 is a fragmentary sectional view, still further magnified, taken on the line 3—3 of Figure 2;

Figure 4 is a fragmentary view similar to Figure 3, with the bolt throwing mechanism in retracted position;

Figure 5 is a magnified view taken on the line 5—5 of Figure 2;

Figure 6 is a side elevation of the same;

Figure 7 is a section taken on the line 7—7 of Figure 5;

Figure 8 is a fragmentary magnified section taken on the line 8—8 of Figure 1;

Figure 9 is a section taken on the line 9—9 of Figure 8;

Figure 10 is a section taken on the line 10—10 of Figure 9;

Figure 11 is a section taken on the line 11—11 of Figure 9;

Figure 12 is a view similar to Figure 10 with the latch bolt in retracted position;

Figure 13 is a section taken on the line 13—13 of Figure 9;

Figure 14 is a section taken on the line 14—14 of Figure 9;

Figure 15 is a section taken on the line 15—15 of Figure 9;

Figure 16 is a section taken on the line 16—16 of Figure 11;

Figure 17 is a section taken on the line 17—17 of Figure 12.

Making reference to the drawing, I show a door frame 10 having a pair of exit doors 11 and 12, hinged by vertical pintles 13 and 14 in concealed borings at the sill and head of the door frame. The frame exemplified may be extruded tubular metal, such as aluminum alloy, to provide an aesthetic trim for the wall and includes an inner bead 15 to limit the inward swinging of the door, clearance being provided at the edge 16 for outward swinging of the door, as will be readily understood.

The head channel 10 and the sill 16 each includes keepers or latch bolt apertures 17 in the lower web 18 to receive the latch bolts 19, extending adjacent the corners 20 of each of the doors.

The doors exemplified are likewise formed of relatively shallow narrow tubular vertical stiles 21 and 22, particularly where the panels 23 are made of plate glass, thereby to provide lights of maximum dimension. Aluminum alloy metal may be used for the doors described.

In accordance with this invention, it is proposed to confine the latch actuating mechanism concealed within the stiles 21 and to support the horizontal press or cross bars 24 on the inner stiles 21 and the outer stiles 22 of each door.

Reference will now be made to Figures 8 and 17 where each of the doors has cutouts or sockets 25 in the edge web 26 adjacent the end web 27 and aligned with the channel running throughout the length of the door in the vertical stiles 21. Through these cutouts and within the chamber 28, a latch bolt casing 29 is mounted. The casing has side walls 30, 30a between which the latch bolt 19 is pivotally mounted on the pin 31 adjacent the casing opening 32. The latch bolt has a cam edge 33 and an arcuate abutment face 34 comprising a quadrant of sufficient extension to supply a relatively large throw which, in the example illustrated, is intended to provide

at least a three quarter inch throw or protrusion beyond the door edge.

The latch bolt 19 has its lower face 35 cutout to provide spaced walls connected to the retractor slide 36 by the knuckle 37 which is connected to the latch bolt 19 by the pin 38. The slide 36 has spaced tail pieces 39 to each side of the cross web 40 to house the projecting spring 41 bearing against the end wall 42 at one end and against the cross web 40 at the other. A draw rod 43 has its head 44 (see Figure 11) connected by screw threaded engagement with the cross web 40 and sleeved through the spring 41, thereby to provide a spring projected latch mechanism.

The slide 36 is formed with a guide slot 45 through which the post 46 projects, being fixedly positioned on the bottom wall 47 and extending to the cover member 48 which is supported to the post by the headed screw 49. The post 46 pivotally supports the dogging pawl 50 between the side walls 30, 30a in a plane parallel to the bottom wall 47 and includes oppositely positioned arms 51 and 52 which may be biased by the spring 53 to lie adjacent the side walls 30, 30a in one position (see Figure 17) or to swing the nose portion 54 into dogging position beneath the shoulder 55 of the knuckle 37 (see Figure 9).

Movement of the pawl 50 to the dogging position adjacent the shoulder 55 is controlled by the auxiliary latch or plunger 56, having a branch 57 guided in the slot 45. The auxiliary plunger 56 is spring projected by the extension spring 58, bearing at one end on the post 46 and on the other end being centered on the lug 59, extending from the branch 57. The branch 57 bears against the arm 51 which is formed with a camming face 60.

In the outwardly projected position of the branch 57, the dogging pawl 50 has the nose 54 cammed in the position shown in Figure 17 out of the path of the shoulder 55. In the depressed position of the plunger or auxiliary latch 56, the branch 61 has its nose 62 held in depressed position as when it may engage the web 18 of the door frame (see Figure 11). In this position of the auxiliary latch or plunger, the branch 57 is positioned adjacent the lowest dwell edge of the cam 60 to permit the nose 54 to move to the dogging position behind the shoulder 55, as shown in Figure 9.

The dogging pawl 50 may likewise be depressed to the position shown in Figure 17, upon retraction of the slide 36 by the draw bar 43. For this purpose, there is provided integral with slide 36 a camming lug 63 (see Figures 16 and 17) which has a nose 64 arranged to enter the camming cutout 65 formed in the branch 52 of the dogging pawl 50 when the latch bolts and slide actuated thereby are in the projected position, as shown in Figure 9.

Upon drawing the draw rod 43 to retract the latch bolt, the cam lug 63 tilts the dog 50 at the initial pulling action by reason of a clearance between the nose 54 and the shoulder 55, to shift the dog 50 out of the path of the shoulder 55. The limiting position of movement of the slide 36 is achieved when the camming face 33 is co-terminous with the edge 16 of the door, as shown in Figures 12 and 17.

It is an object of another phase of this invention to dog the slide 36 in the retracted position of the latch bolt 19 when the door is open and for this purpose, a trigger pawl 67 is pivoted between the slide walls 30 and 30a on the pin 68. The trigger pawl 67 is swingable in the casing 29 and has its lower branch 69 so that in one position it may lie parallel to the cover 48, as shown in Figure 10, and in another position this end may swing inwardly in the path of the cam block lug 63 carried by the slide 36. When the slide 36 has been moved to the fully retracted position of the latch bolt 19, the trigger pawl 67 holds the latch bolt in the retracted position by the pivotal movement exerted on the tripping arm 71 in the opposite direction. For this purpose the tripping arm 71 has an offset branch 72 extending to the exterior

of the casing 29 through a cutout 73 in the side wall 30. The casing wall 30 has an extension flange 74 supporting the same in socket 25 at the door edge. The extension has a socket 75 in which a spring 76 is positioned, normally projecting the lower branch 69 of the trigger pawl 67 into dogging position shown in Figure 12.

The spring 76 is centered on the pin 77 extending from the screw 78, whose head 79 projects through the slot 25 in the door casing to encounter the stop bead 15. A coil spring 80 is positioned between the head 79 and the branch portion 72 adjustably to retain the screw 78 under constant tension in any set position, thus holding the same against loosening due to vibration. Pressure against the head 79 will tilt the trigger pawl 67 from the position shown in Figure 12 to release the slide against the spring action of the spring 41. Likewise, the cam block lug 63, when the slide 36 is spring projected, will lie in the path of the lower branch 69, as shown in Figures 10 and 11, to restrain the biasing influence of the spring 76 to a predetermined position, as shown in Figure 8.

The bottom of the doors may include identical latch construction except that the trigger pawl construction 67 and the cooperating bead 15 need not be included.

The upper and lower draw rods 43 are each screw-threaded at 81 and engage the pull rods 82. The lower ends of the pull rods are screw-threaded at 83 into a block 84, providing a turnbuckle adjustment between the rod 82 and the block 84.

The upper and lower blocks 84 terminate and are accessible adjacent the actuator well 85. In this well there is positioned a frame 86 having a flange 87 abutting the inner face 26 of the stile 21 into which the actuator is mounted. The side walls of the frame 86 pivotally support the link extending into the side walls on the pin 89. The rock link 88 has an upper knuckle joint connection 90 on which the connecting member 91 is mounted. The lower end of the rock link 88 has a knuckle joint connection 92 to the upper end 93 of the retractor 94. The retractor 94 has a cam block 95 against which the finger 96 bears. The finger extends into a slot 97 for tolerance in movement of the retractor independently of the finger 96. The finger 96 extends from a shallow bell crank lever 98 pivoted on the pin 99 on the escutcheon 100 and extends through the opening 101 for connection to the press bar 24. The escutcheon 100 has an offset 102 through which a stop screw 103 extends, to project a dogging head 104 against the shoulder 105 of the lever 98.

Relative adjustment of each of the locks 84 to the actuator movement of the connecting member 91 and the retractor is effected by the lap joint connection comprising the extensions 106, 106a from the connecting member 91 and the retractor 94, respectively. In Figures 5 and 6 this lap joint connection is shown in greater detail, it being understood that the upper block 84 and the lower block 84a have extensions 107 and 107a, respectively.

Referring now to Figures 5 and 6, the extensions 106 and 106a have their contacting faces formed with serrations or teeth 108. The extension 107a is formed with an elongated slot 109 through which the locking screw 110 extends, to have its shank 111 screw-threaded for fine adjustment in a tapped hole 112 formed in the extension 106a. The head of the screw 110 has its shoulder bearing against the lock washer 113 and upon a spring coupling 114 comprising a resilient metal stamping formed of light gauge steel terminating at its end 115 into spaced branches 116, 116, entering the milled slots 117 in the extension 107a, the extension 106a being provided with a plurality of milled side edge slots 118. The slots 117 are spaced apart by the lead of three teeth. The slots 118 on the extension 106a are spaced apart by the lead of two teeth.

The relative position of the screws 110 and 110a is such as to be exposed in the well 85 when the escutcheon

100 is removed. The length of the screw shank 111 and the head 110 is calculated to be so positioned that loosening by a full turn will cause interference between it and the inside face of the case, immediately to indicate a loosening condition. However, the continued coupling between the spring 114 and the corresponding extension 106a as described will assure linkage of these parts to each other until the screw 110 can be reset.

With the adjustment construction as shown in Figures 5 and 6, the relative adjustment of locks 84 and 84a to the pull rods 82 is determined by the turnbuckle arrangement of the threaded engagement of the threads 81 to the pull rods 82, the threaded engagement of the rods 82 to the blocks 84 and 84a and, finally, by the lap joint of the extensions 106, 107, and 106a and 107a, and the length of the slot 109 in the extensions 107 and 107a.

By snapping the teeth 116 from one set of aligned slots 117 and 118, a fine adjustment of the serrations with respect to each other may be effected without complete disengagement of the overlapping portions to each other, as determined by the screw 110 and thereby secure adjustments equivalent to the spacing of one tooth of the serrated surfaces.

By the construction described with respect to the adjustment between the pull rods 82 and the blocks 84 and 84a, rough adjustment may be made before mounting the door on the frame. Final adjustment to take care of inequality in centering of the door in the frame, while still maintaining the maximum throw of the latch bolt, is made after the door is hung by the overlap connection of the extensions 106 and 107, and 106a and 107a with each other, as described.

Actuation of the latch bolts by the pull rods 82 is effected by movement of the press bar 24 against the levers 98 to each end thereof. Movement from the position shown in full line in Figure 2 to the dotted line will throw the retractor up or down and reverse the connecting member 91 by reason of the rocking movement of the intermediate link, which is pivoted on the pin 89.

For actuating the latches from the exterior, a pin 119 on the connecting member 91 extends through the slot 120, formed in the outer face of the door stile, and extends into the cylinder case 121. In the case, the pin 119 is depressed by the follower 122 slidably mounted in the case 121. A cam 123 is coupled to a square spindle 124, running through the hub 125 and engaged with the lever 126 for clockwise or counter-clockwise movement, thereby camming the follower 122 bearing against the pin 119. Actuation from the exterior face of the door may be effected by the manual pivotal movement or swinging action of the lever 126.

The cam 123 has a notch 127 to receive the locking bolt 128 projected into and out of engagement slidably through the key actuating cylinder assembly 129.

By the construction described, an exit door construction, particularly that made of narrow-frame stiles as obtainable for example by the use of extruded aluminum channelling to present the greatest glass exposure, may have incorporated a large or magnified throw latch bolt to assure requisite protection against unlawful entry and admitting of high degree of tolerance in fitting the doors within the door frame, without sacrificing the desired security.

Also by the construction described a novel long throw latch bolt is combined with an exit or panic type lock operator which will restrain and hold the bolt in the retracted position when the door is once opened, which will be released into locking position with a long throw of the bolt when the door is in the closed position, and to combine with these features positive dogging or deadbolting of the latch bolt to prevent unwarranted entry by jimmying of the bolt when projected into the locked position.

Further security features of the construction described will be evident from the independence of the lock mecha-

nism affixed to the upper and lower portions of the door when set or released to the projecting position in that the failure of one, such as the lower lock assembly, will not affect the other or transmit movement to the upper other lock member. Thus, though the two latches may be manually operated together through the cross bar mechanism, unlawful tampering or prying action and failure of one, will not affect the operation or security furnished by the other latch.

Still further features reside in novel tripping mechanism for the retracted latch which will meet a wide range of operation conditions or workmanship, to compensate for misalignment or warping of door or frames or these parts to each other.

Still further features reside in the wide range of adjustability affected by the installation which may be made first when assembling the mechanism, before the door is hung on the hinges, and then, after the door has been mounted in position, through the medium of the latches themselves and the connecting members comprising 43, pull rods 82, in their threaded and adjustable relation to the blocks and the adjustable lap joint of the blocks and extensions from the crank lever connecting member.

By the provision of spring projected tripping means for the retracted latches, a substantially rattle-free assembly is assured as the door is spring-biased by said tripping mechanism, and the tripping means and block therefor take up the stresses of such rattling action without contact between the inner door surfaces and the door frame.

Other features will become apparent in the ease with which installation and adjustment may be made, without special tools, thereby to effect substantial economies.

While I have shown my invention as having greatest utility when all the elements are assembled in a unitary combination, it will be observed that it is intended to cover independent features which may be embodied in other combinations as outlined in the appended claims.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is:

1. In an exit door having locking elements at its upper and lower edges, a cross bar actuator, connecting rods from said locking elements and intermediate primary and secondary adjustment for said connecting rods, the combination which includes primary adjusting means comprising screw-threaded pull rod and block connections and the secondary adjustment comprising a lap joint coupling formed by separable segments, slotted portions in the overlapping segments of said joint connection being held by separable fastening means, said contacting faces of said lap joint connection comprising serrations formed on the respective surfaces, a spring coupling mounted on one of said segments by said fastening means and resiliently engaging slotted means on said second segment separable fastening means comprising screw-threaded means adjustably to hold said overlapping portions in engagement, the resilient coupling holding said overlapping segment portions against relative movement in moving said contacting surfaces relatively to each other.

2. In an exit door having locking elements at its upper and lower edges joined by connecting rods slidable in opposed relation to said upper and lower locking elements, respectively, a common actuator comprising a cross bar, levers extended from said cross bar coupled to said connecting rods by a rock link for simultaneous operation, one of said locking elements having a spring-projected latch bolt including a latch dogging element holding said latch in retracted position and a dog tripping means on the door frame to release said dog upon closing of said door to the frame engaging position, and dead bolting means comprising a shoulder on said locking element, a dogging pawl spring biased into shoulder engagement when said locking element is in the projected

position, independent camming means affixed to said actuator and operated thereby and an auxiliary latch adjacent said locking element, said auxiliary latch extendably engaging said dogging pawl, said camming means urging said auxiliary latch and dogging pawl into shoulder disengaging position upon depression of said actuator.

3. In an exit door having hollow stiles, lock casings each including a sliding locking element at its upper and lower edges seated within said stiles and including a cross bar operator and connecting rods to which one of each of said locking elements is joined, one of said locking elements including a latch bolt swingable to and within a strike on the frame of the door by a spring projected retractor coupled to said connecting rod for magnified movement of the latch bolt in relation to the movement of said connecting rod, a dogging member for holding said retractor in the retracted position, said dogging member having a tripping extension cooperating with means on the door frame for tripping said latch bolt to the extended position when the door is closed, said tripping finger including yieldable adjustable means cooperating with means on the door frame, resiliently to abut the door frame in moving the door to the closing position.

4. In an assembly in accordance with claim 3 wherein a dogging pawl includes oppositely positioned arms spring biased to project against the slidable retractor to dead-bolt the latch in the extended position thereof and a plunger slidably mounted in said lock casing for undogging said pawl in the retracted position of said latch bolt and releasing said pawl to move to the dogging position in the projected position of said latch bolt in the door frame aperture.

5. In an exit door, a casing having locking element including a swingable latch bolt, a spring projected retractor for providing a magnified retraction movement of the latch bolt in respect of the movement of the retractor, a trigger pawl having an offset extending outside the casing, said pawl having a branch for holding said retractor in the retracted position, including a tripping arm arranged to engage a fixed stop bead on the door frame to release said latch bolt, said offset branch including an adjustable spring supported head resiliently to hold said door in engagement with said stop bead and a dogging pawl carried by said retractor having a branch spring biased for engagement with said latch bolt, said dogging pawl having another branch cooperating with a cam lug in said casing to tilt the

dogging pawl in latch bolt releasing position and an auxiliary plunger cooperating with means on said door frame when the door is moved to the closed position to release said dogging pawl into dogging position, to dead bolt said latch bolt, when said auxiliary plunger is depressed by the door frame.

6. In an exit panic door having a keeper in the upper frame, a locking element including a swingable latch bolt mounted on said door to engage said keeper, coupling means for actuating said latch bolt, a spring projected slide for imparting retraction movement of said latch bolt in respect of the movement of said slide, including slidable coupling means transmitting swinging movement to said latch bolt, trigger pawl means for said latch bolt actuatable upon retracting movement of said slide to retain said latch bolt in retracted position when said door is opened by actuating said slide, lug means providing a shoulder for said trigger pawl means on said slide, a branch on said trigger pawl means adjacent said lug, spring biased means for directing said branch into shoulder engagement, operatively effective upon moving said door to the open position upon conjoint actuating of said slide, and means to release said latch bolt comprising a tripping arm for said trigger pawl means, a head on said arm, resilient means for adjustably holding said head on said arm, a stop bead on said frame in opposed position to said head, said bead cooperating with said head on said tripping arm to disengage said trigger pawl means from said shoulder in the closed position of the door, dogging pawl means for said latch bolt to dog the same in the projected position of said latch bolt, a spring biasing said dogging pawl means, and an auxiliary latch bolt plunger means, effective upon closing the door, to engage the door frame to permit said dogging pawl means to move into dogging position of said latch bolt.

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