Dec. 16, 1952 A. F. GANDER 2,621,952

FLUSH TYPE TOGGLE LATCH

Filed March 31, 1950

Fig. 1

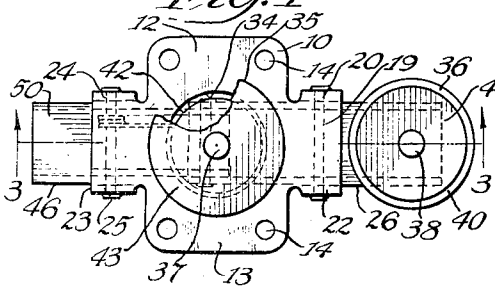


Fig. 2

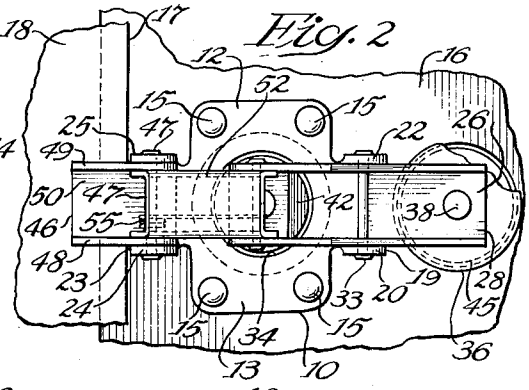


Fig. 3

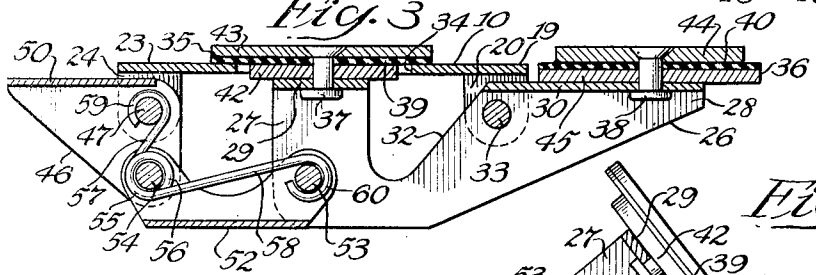


Fig. 4

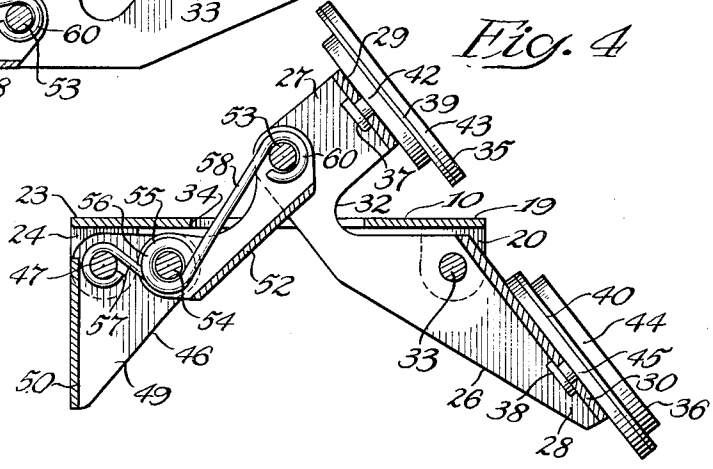


Fig. 6

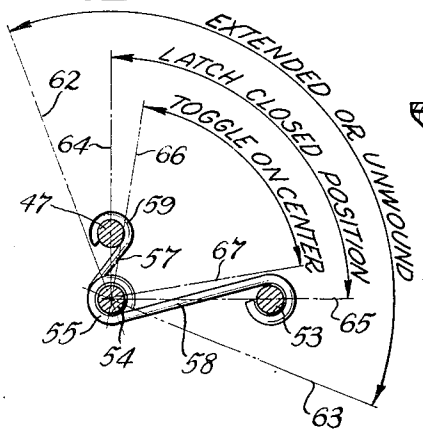
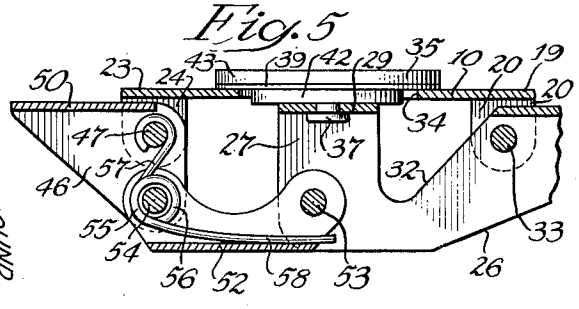


Fig. 5



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Patented Dec. 16, 1952

2,621,952

UNITED STATES PATENT OFFICE

2,621,952

FLUSH TYPE TOGGLE LATCH

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Application March 31, 1950, Serial No. 153,119

6 Claims. (Cl. 292—196)

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This invention relates to toggle type latch mechanisms of the type adapted to construction and mounting in a manner such that the actuating parts thereof are substantially flush with a surface of a door or the like in one operating position, and more particularly to such latch mechanisms in which the operating parts of the mechanism are positively biased to the operating position to which they were last operated.

In certain respects, this latch mechanism is an improvement of that shown in my United States Letters Patent No. 2,479,921, issued August 23, 1949, for Flush Type Toggle Latch.

It is a general object of my invention, as disclosed herein, to provide a flush type toggle latch which, in addition to being designed for light weight construction, is rugged by virtue of the structure and arrangement of its parts and positive in its operating characteristics.

In addition to having actuating elements which occupy positions in flush relationship to a closure surface in one operating position of the latch and providing a tight weather seal with that closure surface, my latch mechanism of this invention embodies a toggle mechanism having parts which definitely pass positions of alignment in moving from one operating position to another and are positively biased to each of the operating positions by a spring having stable operating characteristics.

As another object, my invention has within its purview the provision of a toggle type latch mechanism embodying a coil spring acting in torsion and having its parts supported so as to render consistent action within the required range of movement and with all operating positions coming well within the stress and fatigue limits thereof.

My toggle latch of this invention further comprehends the provision of structure in which the main operating parts are adapted to fabrication from sheet metal and utilize interfitting channel sections to provide ruggedness and rigidity, as well as to insure proper alignment of parts and smooth operation of the latch.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings in which similar characters of reference indicate similar parts throughout the several views.

Referring to the one sheet of drawings,

Fig. 1 is a front elevational view of a flush toggle latch embodying a preferred form of my invention;

Fig. 2 is a rear elevational view of the flush type toggle latch shown in Fig. 1 and depicts an adaptation of the latch to a door or the like and adjacent structure, which door and adjacent structure are fragmentarily illustrated;

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Figs. 3 and 4 are side sectional views, drawn to an enlarged scale, which respectively illustrate two operating positions of the latch, and wherein the sections are taken substantially on a line 3—3 of Fig. 1 and in the direction indicated by accompanying arrows;

Fig. 5 is a fragmentary side sectional view similar to Fig. 3 and showing the modification of a part of the structure; and

Fig. 6 is a diagrammatic view depicting certain operating characteristics and movements of a part of the latch shown in Figs. 3 and 4.

Although having other uses, the exemplary embodiment of my invention which is depicted herein for illustrative purposes is shown in a form adapted to use for retaining a door of an airplane structure in its closed position. The disclosed latch further provides for quick release of the door, the sealing of openings, so as to prevent trouble caused by moisture and ice, and the presenvation of a relatively smooth and streamlined surface devoid of projecting parts on the outer surface of the door with which the latch is used.

Having more detailed reference to the accompanying drawings, my disclosed toggle latch has a base plate 10 on the opposite sides of the mid-portion of which are substantially coplanar mounting flange portions 12 and 13. Mounting holes 14 are provided at spaced positions in the flanges 12 and 13 to accommodate fastening means, such as rivets 15 by which the latch is secured to a structure such as a door 16, and which door normally closes an opening 17 in a structure as a wall 18, as depicted in Fig. 2. At one end, the base plate 10 has a projecting tab 19 upon which a pair of flange elements 20 and 22 are integrally formed, so as to project rearwardly from the plane of the base plate in opposed and laterally spaced relationship. At the other end of the base plate, a similar tab 23 projects therefrom and has integrally formed thereon a pair of spaced and opposed flange elements 24 and 25 which, in the disclosed structure, are aligned longitudinally of the base plate with the flange elements 20 and 22.

A latch actuator 26 has end portions 27 and 28 of channel section and repectively including integral webs 29 and 30; the mid-portion being cut away between the webs to provide a cross channel 32 facilitating movement of the actuator rela-

tive to the base plate 10. In the latch assembly, the actuator 26 is connected to the base plate 10 for limited swinging movement by a cross pin 33 which extends through the channel shaped end portion 28 of the actuator and through the flange elements 20 and 22 at one end of the base plate. The cross pin 33 being near the longitudinal mid-portion of the actuator, the end portions 27 and 28 thereof extend to opposite sides of the cross pin. The end portion 28 of the actuator extends beyond the end of the projecting tab 19 on the base plate and is straddled by the flange elements 20 and 22 thereof. Also, the base plate 10 has an opening 34 in the mid-portion thereof which is aligned with the end portion 27 of the actuator, the end portion 27 projects through the opening 34, as shown in Fig. 4.

Manually operable actuating elements 35 and 36 are respectively secured to the end portions 27 and 28 of the actuator by fastening means, such as rivets 37 and 38. In the disclosed forms of my latch, the actuating elements 35 and 36 are of laminated construction, including layers of compressible and moisture-proof sealing material 39 and 40, such as rubber interposed between metal discs. The actuating element 35 includes metal discs 42 and 43 of different diameters; the disc 42 being of a size to fit within the opening 34 in the base plate as shown in Fig. 3; while the disc 43 and the sealing material 39 are of a diameter larger than the opening 34, so that the marginal portion of the sealing material is adapted to engage the surface of the base plate adjacent the opening 34 and is supported and protected by the metal disc 43. On the other end of the actuator, a smaller metal disc 44 faces outwardly and has the marginal portion of the sealing material 40 exposed at its periphery and backed by a metal disc 45 to effect a seal against the inner surface of a door such as 16, with the smaller disc 44 exposed for actuation through an appropriate opening in the door.

In a position aligned with the actuator 26 and at the opposite end of the base plate 10, a latch bolt 46 is supported for limited rotational movement between the flange elements 24 and 25 by a cross pin 47. In the disclosed structure, the latch bolt 46 is of channel section having side portions 48 and 49 and an integral web portion 50, which web portion serves as a locking surface and is adapted to engage the inner surface of a wall or frame adjacent a door opening, to hold the door closed, as depicted in Fig. 2. The latch bolt 46 is shown in its holding position in Figs. 1, 2 and 3, while the released position thereof is indicated in Fig. 4. In the latter position, the latch bolt is folded back toward the base plate, so that it clears the holding structure and passes freely through the door opening.

It may be observed from the description thus far that the cross pins 33 and 47 which respectively support the actuator and latch bolt for rotational movements and relative to the base plate provide axes which remain in fixed positions relative to one another and to the base plate. For providing an operating connection between the actuator and latch bolt by which the latch bolt is moved in response to manual operation of the actuator, I have provided a link 52 which extends between the adjacent and aligned end portions of the actuator and latch bolt and is movably connected thereto by cross pins 53 and 54 respectively. In my preferred structure, the link 52 is of channel section with its side portions fitting between the side portions of the

actuator and latch bolt. As depicted in Figs. 3 and 4, the link 52 moves during the actuation of the latch bolt 46 by the actuator 26, with the axes of the cross pins 53 and 54 swinging around the axes of the cross pin 47 which supports the latch bolt.

As shown in Fig. 3, in the latching or holding position of the latch, the latching surface of the web 50 of the latch bolt projects outwardly from the end of the tab 23 of the base plate, and the actuator is in a position such that the sealing material 39 on the actuating element 35 is in sealing engagement with the outer surface of the base plate. In the latter described positions of the actuator and latch bolt, the axes of the cross pins 53 and 54 which connect the link to the actuator and latch bolt are nearly aligned laterally of those axes with the fixed axis of the cross pin 33 about which the actuator moves. Also, the axes of the cross pins 53 and 54 by which the link is connected to the actuator and latch bolt lie in a plane which is displaced from the fixed axis 47 of the cross pin, upon which the latch bolt is supported, in a direction which is substantially normal to and away from the latching surface of the web 50 of the latch bolt. With this arrangement, of the axis of the moving parts, it may be readily appreciated that in the latching position, the latch is braced longitudinally of the actuator, so that force applied to the latching surface of the latch bolt urges the actuator toward its holding position, thereby tending to insure the secure holding of a closure with which it is used. On the other hand, a relatively small force applied to the actuating element 36 on the actuator effects swinging movement of the link and resultant swinging movement of the latch bolt to its released position, as shown in Fig. 4.

To further insure the desired operation and secure holding action of the disclosed latch, as well as to positively bias the movable parts toward the operating position to which they are last operated, a spring 55 is utilized. This spring, in my disclosed structure, is a torsion spring with a coiled portion 56 encompassing the cross pin 54 between the sides of the link 52. End portions 57 and 58 project outwardly in angularly disposed relationship relative to one another from the coiled portion 56 of the spring. The end portion 57 of the spring has a formed loop 59 thereon through which the cross pin 47 extends to anchor that end of the spring. In the form of my invention which is depicted in Figs. 3 and 4, the end portion 58 of the spring has a formed loop portion 60 thereon through which the cross pin 53 extends. In the modified form of my invention which is depicted in Fig. 5, the loop 60 is omitted from the end of the arm 58 of the spring and that arm engages the inner surface of the channel shaped link 52.

With either form of the spring, and as depicted in Fig. 6, the end portions 57 and 58 thereof are normally biased to positions such that they tend toward obtuse angular relationship, as depicted by lines 62 and 63. When the latch is in its holding position, as shown in Figs. 3 and 5, the end portions 57 and 58 of the spring are restrained to an angle materially less than that between the lines 62 and 63 as indicated by lines 64 and 65 in Fig. 6. Furthermore, at a position intermediate the holding and released positions of the latch bolt, the spring arm portion 57 and 58 are forced through a minimum acute angular relationship as indicated by lines 66 and 67 in Fig. 6. Being thus forced through a minimum angle at a position

intermediate the holding and released positions, it may be understood that the spring **55** positively biases the actuator and latch bolt to the operating positions to which they are last operated.

In comparing the angles depicted in Fig. 6 with the positions of the axes of the cross pins, as illustrated in Figs. 3 and 4, it may be observed that when the latch is in the holding position depicted in Fig. 3, a plane passing through the axes of the cross pins **53** and **54** of the link approaches right angular relationship to a plane passing through the axes of the cross pins **47** and **54**. Minimum acute angular relationship of the defined planes is reached at substantially the positions of the cross pins in which the cross pins **53** and **54** lie in a common plane with the axes of the cross pin **33**; this condition occurring at a position of the latch parts intermediate the extreme latch operating positions. When the latch is in the released position, as shown in Fig. 4, a plane passing through the axis of the cross pins **47** and **54** is in obtuse angular relationship to a plane passing through the axes of the cross pins **53** and **54**.

By utilizing the disclosed and discussed relationships of the positions of the respective axes in combination with the general relationships of parts and the application of the spring forces to those parts, I have not only provided a latch mechanism which affords secure locking action of the latch bolt, but I also have provided a latch in which the operating parts, including the actuator, are biased positively to both the holding and released positions when operated thereto. By utilizing the type of spring disclosed in both modifications in its prescribed relationship to the parts, I have provided an arrangement in which the spring is held in a position to provide consistent operation, and I have provided a spring structure affording a desired biasing force in each of its positions of operation while operating well within the stress or fatigue limits of the spring, thereby to accomplish long and consistent operation. By utilizing the disclosed channel type parts in the structure, which parts are adapted to fabrication from sheet metal, the disclosed latch mechanism is not only adapted to consistent and economical production, but also has strength and ruggedness without excessive weight.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A flush type toggle latch mechanism comprising, in combination, a base plate including integrally formed pairs of spaced and opposed flange elements in aligned relationship at opposite ends thereof, said base plate having an opening in the mid-portion thereof, a latch actuator movably secured to the base plate between one pair of said flange elements by means providing a fixed axis of swinging movement therefor, said actuator having end portions on opposite sides of said fixed axis, one of said end portions being aligned with the opening in the base plate and having an actuating element thereon, a latch bolt movably secured to the base plate between the other pair of flange elements by means providing a second fixed axis about which the latch bolt is swingable between holding and retracted positions, a link having opposite end portions rotatably connected to the actuator and the latch bolt by cross pins providing axes which move during operation of the latch mechanism, the fixed axes and the axes of the cross pins being disposed relative to one another at positions in which the second fixed axis and the axes of the cross pins define the vertices of a triangle of variable shape spaced to one side of the first fixed axis, which triangle is swingable relative to said first fixed axis during operation of the latch mechanism to positions such that the axis of one of the cross pins crosses a plane extending through the fixed axes, and so that a plane passing through the axes of the cross pins and a plane passing through the second fixed axis and the axis of the cross pin which connects the link to the latch bolt move through varying relative angles as the actuator effects movement of the latch bolt, the angle between the planes passing through a minimum angle of displacement at a position of the latch bolt intermediate the holding and retracted positions thereof, and a torsion spring having a coil portion and end portions projecting from the coil portion and normally biased to obtuse angular relationship to one another, said coil portion having an axis substantially coincident with the axis of the cross pin connecting the link to the latch bolt, and the ends of the spring exerting biasing force against the latch bolt and link tending to increase said angle of displacement, whereby the actuator is biased to the limit of swinging movement to which it is last operated by the actuator.

2. A flush type toggle latch mechanism as defined in claim 1, and wherein one of said end portions of the spring is movably connected to the means providing said second fixed axis.

3. A flush type toggle latch mechanism as defined in claim 1, and wherein one of said end portions of the spring is movably connected to the means providing said second fixed axis, and the other end portion of said spring is movably connected to the cross pin by which the link is connected to the actuator.

4. A flush type toggle latch mechanism as defined in claim 1, and wherein an extension of a plane passing through the axes of the cross pins passes across the first mentioned fixed axis during movements of the latch bolt between the holding and retracted positions thereof and at a position in which the latch bolt is close to said holding position.

5. A flush type toggle latch mechanism as defined in claim 1, and wherein said actuator and the latch bolt have adjacent end portions of channel section, and said link has a channel section and interfits in overlapping relationship with the channel end portions of the latch bolt and actuator.

6. In a flush type toggle latch mechanism, the combination comprising a base member, a latch actuator and a latch bolt each movably secured to the base member by separated means providing fixed axes of swinging movement therefor, said latch bolt being swingable between holding and retracted positions, a link having opposite end portions rotatably connected to the actuator and the latch bolt by cross pins providing axes which swing around the fixed axis of the latch bolt during operation of the latch mechanism, the fixed axes and the axes of the cross pins being disposed relative to one another at posi-

tions in which one of said fixed axes and the axes of the cross pins define the vertices of a triangle of variable shape spaced from the other of said fixed axes, which triangle is swingable relative to said one of the fixed axes during operations of the latch mechanism to positions such that the axis of one of the cross pins crosses a plane extending through the fixed axes and so that planes passing through the axes of the cross pins and through the fixed axis of the latch bolt and the axis of the cross pin by which the link is connected to the latch bolt move through varying relative angles as the actuator effects movement of the latch bolt, the planes passing through a minimum acute angle of displacement at a position of the latch bolt intermediate the holding and retracted positions thereof, and a spring having end portions projecting from a coiled connecting portion and normally biased to positions extending away from one another at an angle greater than said minimum acute angle, said

coiled connecting portion encompassing the axis of the cross pin connecting the link to the latch bolt, and the ends of the spring exerting biasing force against the latch bolt and link tending to increase said angle of displacement therebetween, whereby the latch bolt and actuator are biased to the position to which they are last operated by the actuator.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,479,921	Gander	Aug. 23, 1949

FOREIGN PATENTS

Number	Country	Date
15,763	Norway	Nov. 19, 1906