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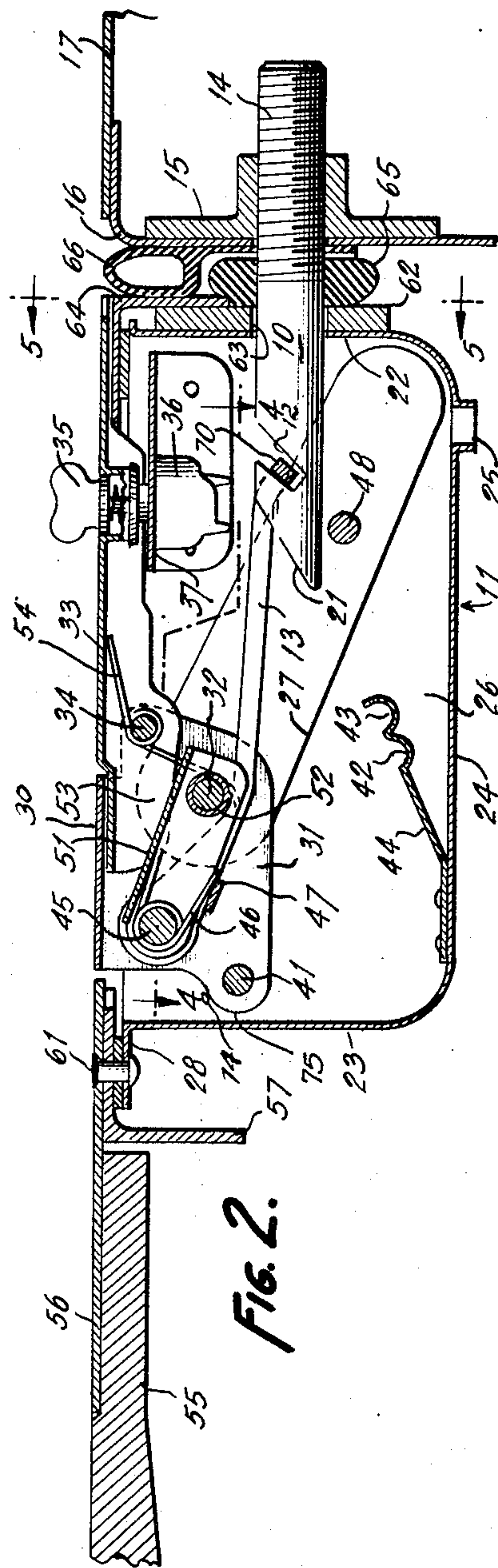
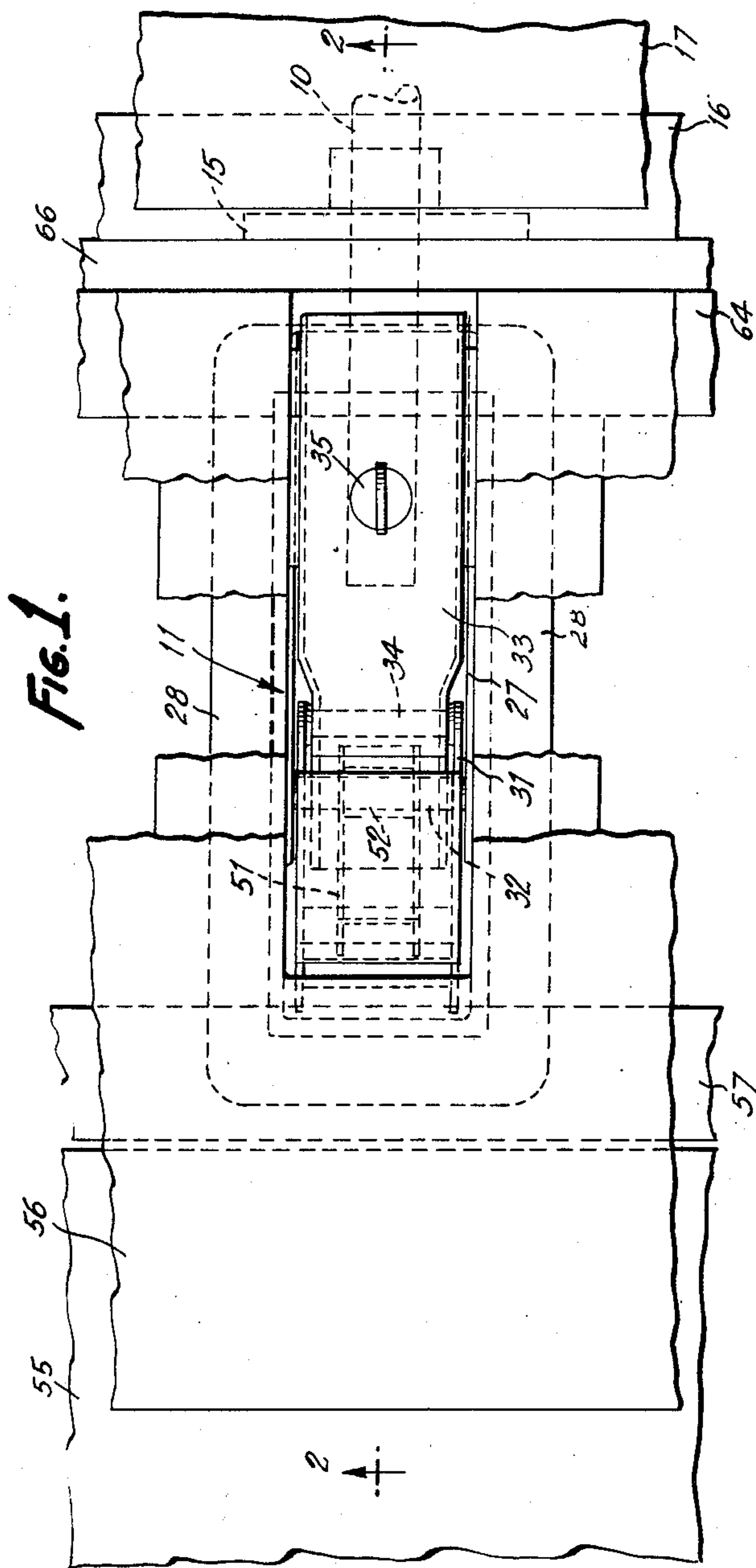
**J M. SUMMERS**

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LATCH FASTENER

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2 Sheets-Sheet 1



INVENTOR.  
J MILLS SUMMERS  
BY *John P. Chandler*  
his ATTORNEY





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## LATCH FASTENER

J Mills Summers, Englewood, N. J., assignor to Camloc Fastener Corporation, Paramus, N. J., a corporation of New York

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7 Claims. (Cl. 292—247)

This invention relates to latch fasteners and relates more particularly to a novel latch having both an intermediate locking position and a fully locked position.

The latch fastener of the present invention is particularly useful where a unit is applied to a structure by employing a number of the detachable latches and wherein it is desirable to effect a preliminary locking action immediately upon application of the unit, thus leaving the hands of the operator free to effect full locking position without the necessity of manually holding the unit in place. The two-part latch fastener of the present invention is highly effective for securing plastic radar domes to aircraft. The male element, comprising a combined hook-shaped latching member and shear pin member, is carried by the primary structure and a plurality of these elements are arranged in spaced relation. The female elements carried by the dome are aligned with the shear pins and to apply the dome it is simply necessary to line up the shear pins with the respective holes and move the dome axially along the pins into approximate position. This automatically effects the preliminary locking action and the operator now has both hands free to manually move each of the latches to completely locked position while eliminating the possibility of the dome falling during the process.

An important object of the invention is to provide a positively acting, heavy duty latch fastener wherein primary locking elements have a toggle action and are in a below or past-center position when the parts are fully locked and there is further provided a secondary locking element which definitely assures the continuance of this below-center position at all times.

Another object of the invention is to provide an improved draw hook or bail arrangement for initially grasping and then securing the male latching element without requiring the attention of the operator.

A still further object of the invention is to provide an improved latching member having a high measure of resistance to tension loads and which also serves as an effective shear pin element capable of absorbing shear stresses in all directions.

Another object of the invention is to provide a latch with a two-step locking action wherein the second locking step cannot be effected unless and until the primary locking action has been fully and completely effected. A handle pivoted on a primary lever, and having limited rotation relative thereto, is manipulated to move the primary locking elements to below-center position. The handle cannot be moved to and be retained in this position unless the first locking step has been achieved. Having achieved this primary locking action the handle has a second function, namely as a safety factor to act as a "flag" to visually indicate the fact that the latch is only half locked and to this end a spring urges the handle outwardly some 15° from the surface of the structures. When the lock associated with this handle is then capable of being moved to fully locked position, wherein it is flush with the structure to be secured, and

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is so moved and locked, there is full assurance that complete locking has been effected.

In the drawings:

Fig. 1 is a broken plan view of the latch fastener of the present invention;

Fig. 2 is a vertical section taken on line 2—2 of Fig. 1 and showing the parts in fully locked position;

Fig. 3 is a similar section but showing the parts in unlocked position and the two units to be joined in spaced relation, said view omitting the sealing gaskets;

Fig. 4 is a broken section taken on line 4—4 of Fig. 2; Fig. 5 is a section taken on line 5—5 of Fig. 2.

The latch fastener of the present invention includes a combined shear pin and latching member 10 carried by one part of the structure which is received in a cage 11 where its hook-shaped notch 12 is grasped by a draw hook or bail 13.

If a removable member is to be secured in latched relation to a fixed structure the cage 11 housing the female element will be carried by the former and the shear pin is mounted in the fixed structure, for instance an aircraft fuselage.

The pin is threaded at 14 and is secured within a threaded bushing 15 mounted on the inner surface of an angular frame member 16 secured to a structure 17. The shear pin is beveled at 21 at its forward end for a purpose to be shown.

When the latch is locked, cage 11 is a substantially closed unit in order to keep out foreign bodies and presents a clean aerodynamic surface. It includes front and rear walls 22 and 23, a bottom wall 24 having a drain hole 25 for any water which may enter, and side walls 26 having elongated struck-in portions 27 to reinforce the same. A mounting flange 28 extends around the upper edge.

A primary lever 31 of channel shape is freely mounted on a spacing bushing 52 carried on pivot pin 32 secured in the opposed side walls of the cage. The bushing is of a length equal to the distance between the struck-in portion 27 of side walls 26 of the cage and effectively retains said side walls in their spaced relation and prevents them from interfering with the free rotation of the primary lever. A handle 33 also of channel shape is freely mounted on pivot pin 34 carried by the primary lever. The handle carries the rotatable stud portion 35 of a quick-acting fastener and the receptacle portion 36 which receives the stud is secured to a channel 37 bridging the opposed side walls and secured thereto.

A handle positioning pin 41 extends between the walls of the primary lever and such pin is received in one or the other of two recesses 42 and 43 of a handle positioning spring 44 secured to the bottom wall. The draw-hook 13 is pivotally mounted at its rear end on pin 45 and a spring 46 which engages a cross bar 47 at the inner end of the draw-hook urges it in a clockwise direction and this travel is limited by a fixed stop pin 48 which also acts as a guide for the outer end of the draw hook as will become apparent.

Since the primary lever takes the major stresses it is reinforced by a channel 51 of lesser width than the primary lever and which extends between pin 32 and pin 45.

When the fastener is in fully closed position (Fig. 2) it will be noted that handle 33 is flush with all of the upper parts. When, however, quick acting fastener 35 is unlocked, which is the first step in releasing the latch, it is desirable that the handle be raised automatically so as to enable it to be grasped. About 15° of rotation is sufficient for this purpose and its upward travel is limited by its tailpiece 53 contacting bushing 52 on pin 32 as shown at 53a in Fig. 3. A spring 54 urges the handle in a counter-clockwise direction.

If the fastener is used to mount a radar dome on an



aircraft fuselage, as was earlier suggested, the mounting means for the female section is shown in Figs. 1, 2 and 3. A portion of the plastic dome is shown at 55 which is secured to a metallic skin 56. 57 is an angular reinforcement which stiffens the skin. The cage is secured to this part of the structure by rivets 61 which are shown as being flush with the upper surface. At the other end of the cage a shear plate is shown at 62 having an opening 63, to receive the combined latching member and shear pin.

A reinforcing angle bracket is shown at 64 and to seal the locked parts against the entry of water, which would cause damage if it were to freeze, a rubber sealing washer 65 and a rubber sealing gasket 66 are provided.

The operation of the latch is as follows: when the parts are in fully unlocked position as in Fig. 3 handle positioning pin 41 is in recess 43 of spring 44. The primary lever is in its outermost position and handle 33 has revolved about 15° beyond the plane of the primary lever.

The cross-piece or hooking element 70 of draw hook 13 is positioned above shear pin opening 63 in shear plate 62 so the hook-shaped shear pin has been free to withdraw from the cage when the latch was last unlocked. The first step in locking the latch when the removable unit is to be affixed to the structure is to rotate handle 33 to the right. During the first 15° or thereabouts of this rotation the only restraining force is caused by spring 54. When the tail piece of the handle contacts the upper wall 30 of the primary lever the handle starts to rotate the primary lever and the next thing to occur is for locating pin 41 to be dislodged from spring recess 43 and move into recess 42.

This causes the primary lever to move draw hook 13 from its full line position of Fig. 3 down to its broken line position at 13a where it is stopped by pin 48. Cross piece 70 of the draw hook 13 is now in the line of travel of the shear pin and when the removable unit is moved inwardly to the right as in Fig. 3 the tapered surface 21 of the shear pin raises the draw hook until cross piece 70 snaps into recess 12 under the influence of spring 46. This action prevents the shear pin from being withdrawn and the operator has both hands free to lock the several latches. He grasps the handle and moves the primary lever to closed position which pulls the draw hook and the shear pin inwardly. It will be apparent from the foregoing that the spring loaded detents have two important functions, one of which is to retain the primary lever system in one of its two unlocked positions, and the other of which is to retain the handle against flapping motion.

It will be noted in Fig. 2 that pivot pins 45 and 32, and cross piece 70 of the draw hook are so related when the parts are in locked position that the axis of pin 32 is below the center line defined by elements 45 and 70. Element 32 passes below center just before the end of the closing stroke so the parts are in fully locked position even without moving the handle to closed position by manipulating locking stud 35. When the latter is accomplished, however, all the parts are in the position of Fig. 2 and no unlocking can occur except in case of destruction of one of the parts.

During the closing operation it will be appreciated that the applied force is clockwise and the reaction force is counterclockwise until element 32 is in dead center relative to elements 45 and 70. The moment this position of dead center is passed the reaction force is in a clockwise direction. This force would tend to continue the rotation of the primary lever past the position of Fig. 2. Actually bail 13 acts as a stop for this further rotation but a positive stop may also be employed. This may comprise a fixed pin 74 which contacts a portion of the extension 75 of the primary lever to the rear of pivot pin 32. This stop will definitely align the upper wall 30 of the primary lever with the surface of the structure. If desired the upstanding thumb wing for the fastener 35

may be replaced with a flush mounted stud which is manipulated with a screw driver or other tool. Also a finger operated spring urged latch or other readily releasable locking means may be employed.

The method of mounting the component parts of the fastener may vary in differing installations. For example cage 11, whose side walls 26 are essentially spaced frame members could be eliminated completely and any conventional frame structure could be used and in certain instances the latch may be mounted directly into the permanent integral structure which would form bearings for shaft 32, fixed pin 48 and a fixed support for handle positioning spring 44.

While one form or embodiment of the invention has been shown and described herein for illustrative purposes, and the construction and arrangement incidental to one specific application thereof has been disclosed and discussed in detail, it is to be understood that the invention is limited neither to the mere details or relative arrangement of parts, nor to its specific embodiments shown herein, but that extensive deviations from the illustrated forms or embodiments of the invention may be made without departing from the principles thereof.

What I claim is:

1. A fastener for latching two members together comprising a frame and an apertured shear plate carried by the first member and a cooperating, hook-shaped shear pin extending forwardly from the second member and through the shear plate when the fastener is in locked position, a primary lever pivoted in the frame and provided with an extension to the rear of its pivot, a bail pivoted at its rear end to said extension which engages at its opposite end the hook of the shear pin, the pivot of the primary lever being in a below-center position relative to opposite ends of the bail when the latch is locked and in an above-center position when unlocked, a handle pivotally carried by the primary lever to rotate the same, a lock for securing the handle in closed position, means for limiting rotation between the handle and the primary lever, a spring for lowering the bail to shear-pin engaging position, after which the shear pin is moved into locking position.

2. A fastener for latching two members together comprising a frame and an apertured shear plate carried by the first member and a cooperating, hook-shaped shear pin extending forwardly through the shear plate from the second member when the fastener is in locked position, a primary lever pivoted in the frame and provided with an extension to the rear of its pivot, a bail pivoted at its rear end to said extension which engages at its opposite end the hook of the shear pin, the pivot of the primary lever being in a below-center position relative to opposite ends of the bail when the latch is locked and in an above-center position when unlocked, a handle pivotally carried by the primary lever to rotate the same and to move same into and out of locked position, means for limiting rotation between the handle and the primary lever, a lock for securing the handle in closed position, and a spring urging the handle outwardly when unlocked.

3. A fastener for latching two members together comprising a frame and an apertured shear plate carried by the first member and a cooperating, hook-shaped shear pin formed with a bevelled forward end and extending forwardly from the second member and through the shear plate when the fastener is in locked position, a primary lever pivoted in the frame and provided with an extension to the rear of its pivot, a bail pivoted at its rear end to said extension which engages at its opposite end the hook of the shear pin, the pivot of the primary lever being in a below-center position relative to opposite ends of the bail when the latch is locked and in an above-center position when unlocked, a handle pivotally carried by the primary lever to rotate the same and for securing the same in locked position, means for limiting rotation between the handle and the primary lever, a



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spring for lowering the bail to shear-pin engaging position, after which the shear pin is moved into locking position.

4. A fastener for latching two members together comprising a frame and an apertured shear plate carried by the first member and a cooperating, hook-shaped shear pin provided with a bevelled forward end and extending forwardly through the shear plate from the second member when the fastener is in locked position, a primary lever pivoted in the frame and provided with an extension to the rear of its pivot, a bail pivoted at its rear end to said extension and which engages at its opposite end the hook of the shear pin, a handle pivoted on the primary lever to move the same into and out of locked position, stop means limiting rotation between the latter and the handle, a spring urging the handle outwardly to indicate unlocked position thereof, a lock for securing the handle in flush relation with the first member, a spring urging the bail inwardly, a detent for locating the bail above the hook element to permit withdrawal of the shear pin and a second detent for positioning it in the inward line of travel thereof to be contacted by its bevelled end.

5. A fastener for latching two members together comprising a frame and an apertured shear plate carried by the first member and a cooperating, hook-shaped shear pin provided with a bevelled forward end and extending forwardly from the second member and through the shear plate when the fastener is in locked position, a primary lever pivoted in the frame and provided with an extension to the rear of its pivot, a bail pivoted at its rear end to said extension and which engages at its opposite end the hook of the shear pin, the pivot of the primary lever being in a below-center position relative to opposite ends of the bail when the latch is locked and in an above-center position when unlocked, a handle pivoted on the primary lever to rotate the same, stop means limiting rotation between the latter and the handle, a spring urging the handle outwardly, a lock for securing the handle in flush relation with the first member, a spring urging the bail inwardly, plural detent means for locating the bail above the hook element to permit withdrawal of the shear pin and for positioning it in the inward line of travel of the shear pin to be contacted by its bevelled end to afford preliminary locking means as the parts are moved to locked position.

6. A fastener for latching two members together comprising a frame and an apertured shear plate carried by the first member and a cooperating, hook-shaped, bevel-ended shear pin extending forwardly from the second

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member and through the shear plate when the fastener is in locked position, a primary lever pivoted in the frame and provided with an extension to the rear of its pivot, a bail pivoted at its rear end to said extension and which engages at its opposite end the hook of the shear pin, the pivot of the primary lever being in a below-center position relative to opposite ends of the bail when the latch is locked and in an above-center position when unlocked, a handle pivoted on the primary lever to rotate the same and to secure the same in locked position, stop means limiting rotation between the latter and the handle, a spring urging the handle outwardly, a fastener for securing the handle in flush relation with the frame, a spring urging the bail inwardly, a detent for retaining the bail above the hook element to permit withdrawal of the shear pin and a second detent for retaining the bail in shear pin engaging position.

7. A fastener for latching two members together comprising a primary lever pivoted in the first member and provided with an extension to the rear of its pivot, a hook-shaped shear pin provided with a bevelled forward end projecting forwardly from the second member and into the first member when the fastener is in locked position, a bail pivoted at its rear end on the extension of the primary lever and which engages at its opposite end the hook of the shear pin, the pivot of the primary lever being in a below-center position relative to opposite ends of the bail when the latch is locked and in an above-center position when unlocked, a handle pivoted on the primary lever to rotate the same, stop means limiting rotation between the latter and the handle, a lock for securing the handle in closed position when the fastener is locked, a spring urging the handle outwardly, a detent for locating the bail above the hook element to permit withdrawal of the shear pin and a second detent for positioning it in the inward line of travel of the shear pin to be contacted by its bevelled end to afford preliminary locking means as the parts are moved to locked position.

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