Sept. 8, 1953 J. F. LYNCH 2,651,093

SNAP FASTENER

Filed Feb. 3, 1950

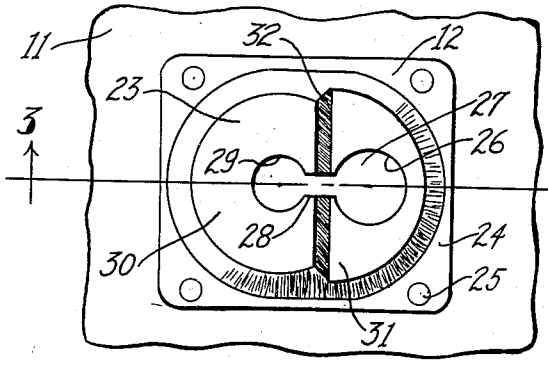


Fig. 1

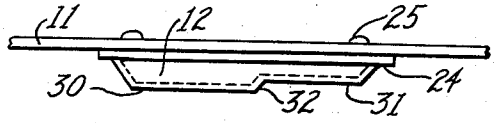


Fig. 2

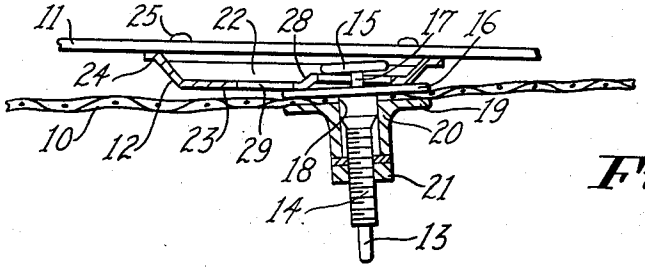


Fig. 3

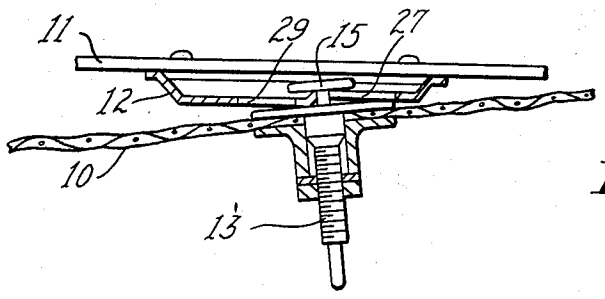


Fig. 4

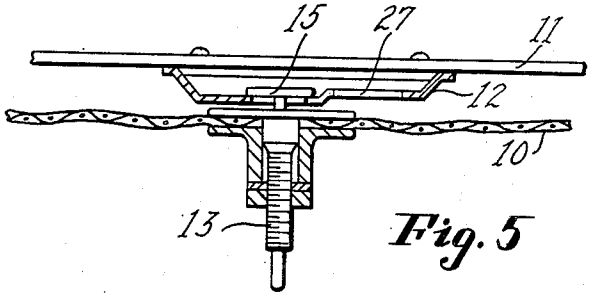


Fig. 5

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Patented Sept. 8, 1953

2,651,093

UNITED STATES PATENT OFFICE

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SNAP FASTENER

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Application February 3, 1950, Serial No. 142,220

2 Claims. (Cl. 24—224)

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This invention relates to an improved detachable snap fastener comprising a metal plate to which a stud is adapted to be attached and detached by deflecting portions of the plate along an elongated slot within which the stud may be secured.

The invention is particularly adapted for securing a flexible container, such as the bladder type of fuel cell, in the cavity provided therefor in the wings, or fuselage, of an aircraft. For that use the stud is attached to the cell wall and the stud is detachably secured to the plate which in turn is permanently attached to the wall of the cavity which supports the wall of the cell. A requirement of the fastener is that the stud may be readily attached to and detached from the plate to permit installing and replacing the fuel cell quickly. The fastener also should be capable of securely holding the cell to the walls of the cavity to prevent the collapse of the cell or excessive relative movement thereof with respect to the supporting wall under all conditions encountered in the operation of the aircraft.

Heretofore quickly detachable fasteners have been used for securing the walls of the fuel cell to the walls of its supporting cavity. Such prior fasteners sometimes became detached due to the shifting of the fuel load in the cell and also because of a sub-atmospheric pressure being produced in the cell by the discharge of fuel from an improperly vented cell, which caused the collapse of the cell and the disengagement of the fastener.

The improved fastener embodying this invention is more effective for securing the cell in place and is less costly than the prior fasteners heretofore used. The fastener comprises the combination of a stamped thin metal plate and a stud attached thereto. The fastener plate has a well stamped therein, which is provided with a bottom and a flange extending from the rim of the well for securing the plate to the supporting wall of the cavity for the cell. The stud is provided with a head which is connected by a smaller neck to a shoulder which is larger than the head. Such members cooperate with a keyhole slot in the bottom of the well. The stud is secured to the plate by extending the head through the larger end of a keyhole slot, which excludes the shoulder. The neck is then extended into the narrow branch of the slot which excludes the head and shoulder. The stud is thus held in its attached position by the projection of the edges of the slot between the head and shoulder of the stud. Relatively deflectable portions are formed in the bottom of the well at different levels on

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each side of the narrow branch of the slot. The distance between the levels in respect to the depth of the well is slightly greater than the distance between the head and shoulder of the stud. Such portions of the bottom are relatively deflected by the head and shoulder of the stud as the stud passes into or from its fully attached position. After the stud has passed into its attached position, the deflected portions spring back to their undeflected positions and restrain the stud from being disengaged from the plate. However the stud may be quickly detached from the plate by proper manipulation and upon applying properly directed force to deflect the portions of the well bottom at the different levels.

In the preferred form of the invention the bottom of the plate is provided with an incline which extends from one of the levels to the other, and in such embodiment the fastener stud is restrained from being detached from its attached position by three forces: (*a*) a force that is required to tilt the axis of the stud from its static loaded position, (*b*) a force that is required to overcome the force of gravity exerted on the stud to move its head up the incline between the portions of the bottom at the different levels, and (*c*) a force that is required to deflect the portions of the bottom of the well at the different levels relatively with respect to each other upon the application of the first two forces. Since such forces are required to be exerted on the stud to remove it from the attaching plate, it provides a greater security than the prior fasteners. Also, since the bottom of the well provides the snap acting deflecting member for retaining the stud in its attached position, no extra spring member is required, and by the elimination of such extra part the manufacture of the fastener is simplified and can be made at less cost.

The invention will be further described in reference to the accompanying drawings, in which:

Fig. 1 is a plan view of the fastener attaching plate embodying this invention, and it is shown as secured to the top of the supporting cavity for the fuel cell;

Fig. 2 is a side elevational view of the attaching plate shown in Fig. 1;

Fig. 3 is a cross sectional view on line 3—3 of Fig. 1, and showing in addition a cross sectional view of the fastener attaching stud as it begins to engage the attaching plate;

Fig. 4 is a view similar to Fig. 3, but showing the relationship between the fastener stud and the fastener plate when the portions of different levels are deflected;

Fig. 5 is a view similar to Figs. 3 and 4, but showing the position of the fastener stud when it is in its fully attached position and the different levels of the bottom of the well have sprung back to their undeflected positions.

As shown in Fig. 3 of the drawings, this invention is illustrated herein in connection with a fuel cell for the purpose of attaching its walls 10 to the supporting walls 11 of the cavity for the fuel cell, which may be formed in the wings or fuselage of an aircraft. The fastener comprises a stamped thin sheet metal plate 12 which is riveted, or otherwise secured to the cell supporting structure. The wall 10 of the fuel cell is secured to the fastener stud 13, which is provided with a stem 14 extending into the inside of the cell, and it is adapted to be attached and detached from the fastener plate 12 by a workman who operates from the inside of the cell. The stud stem 14 is provided with a head 15, which is attached to a flange or shoulder 16 by a neck 17. The stem 14 of the stud extends through an opening 18 in the wall of the cell, and the wall 10 is clamped with a fluid tight seal between the shoulder 16 and a flange 19 on a sleeve 20 by a nut 21, which is screwed down on the threaded stem 13 against the sleeve 20.

The fastener plate 12 for example may be made out of thin sheet aluminum metal having a thickness of .028 inch. It has a well 22 stamped therein, which is provided with a bottom 23, and an attaching flange 24, through which rivets 25 are passed to secure the plate to the cell supporting structure 11. The bottom 23 of the well has a key hole slot 26 formed therein, which has an enlarged circular opening 27 at one end and a narrow branch opening 28 extending therefrom, which terminates in a slightly enlarged opening 29. The bottom 23 is formed on two levels 30 and 31, which are connected by an inclined step 32, which extends transversely of the narrow branch 28 of the key hole slot. The difference in the elevations of the levels is slightly greater than the length of the stud neck 17. The larger opening 27 of the slot is formed in the upper level 31 of the bottom 23, and the narrow branch 28 terminates in the lower level 30 of the bottom 23.

The stud 13 is manipulated by the hand of an operator from the inside of the cell 10, which may be provided with a hand hole, through which the workman's hand may be extended, or which may be provided with an opening large enough for the workman to crawl through to the inside of the cell. In order to attach the stud 13 to the plate 12, the workman grasps the stem 14 of the stud with his hand, and inserts its head 15 through the enlarged opening 27 in the key hole slot, and brings the stud into position as shown in Fig. 3. In such position, the head 15 is extended into the well 22, and the shoulder 16, which is larger than the opening 27 abuts against the outside of the bottom 23 on an incline between the upper level 31 and the lower level 30. The neck 17 of the stud 13 is then pushed in the direction of the step 32 and into the narrow branch 28 to the position shown in Fig. 4. The length of the neck 17 is less than the height of the step 32, and as the rounded edge of the head 15 makes contact with the top of the step 32, it rides over the upper edge of the step and deflects the incline step 32 between the head 15 and the shoulder 16 of the stud. The operator must exert pressure on the stud in the lengthwise direction of the narrow slot 28 in order to deflect the edges of the step to force the overlapping area of the head 15 and the shoulder 16 over the step 32. After the overlapping areas of the head and shoulder have cleared the step 32, the edges of the step 32 spring back to their undeflected positions and thereby restrain the stud from returning towards the opposite end of the slot 26. When the stud has been moved to its fully attached position, it occupies the position shown in Fig. 5. In such position, the neck 17 of the stud 13 may wander around in the closed end 29 of the branch opening 28 (which is slightly larger than the neck 17) to permit the cell wall 10 to adjust itself and relieve stresses thereon.

Where the attaching plate 12 is secured to the top wall of the supporting cavity 11, the force of gravity acting upon the wall 10 of the cell normally acts to prevent the disengagement of the stud from the plate. The same is also true when the plate is attached to the side walls of the cell cavity where the narrow branch 28 of the slot extends downwardly. In order to disengage the stud, it must be turned through an angle as shown in Fig. 4, and the force of gravity acting on the wall 10 must be overcome to force the head 15 of the stud up the inclination of the step 32, and at the same time additional force must be applied to deflect the upper and lower levels of the bottom to cause the stem 17 to pass through the narrow passage 28 into the enlarged opening 27 in the slot, through which the stud head 15 may be removed. It will thus be understood that several forces are required to be applied in given directions in order to remove or disengage the stud 13 from the attaching plate 12.

While the details of this invention have been described herein, it will be understood changes may be made therein without departing from the spirit of the invention or the scope of the appended claims.

Having thus described my invention what I claim and desire to protect by Letters Patent is:

1. A snap fastener comprising in combination a thin sheet metal plate and a stud adapted to be detachably connected to said plate, said stud having a head connected to a shoulder by a neck, said plate having a well stamped therein, an attaching flange extending from the perimeter of said well, a bottom in said well having upper and lower levels connected by an inclined step, said bottom having a slot therein provided with a narrow portion extending transversely through the length of said step, said slot having an enlarged end located within said upper level of said bottom and the opposite end of said slot terminating in said lower level of said bottom at a distance from said step greater than one half of the sum of the dimensions of said neck and head extending perpendicular to the length of said neck, said shoulder of said stud being larger than said head, said enlarged end of said slot being adapted to receive said head and exclude said shoulder, said narrow portion of said slot being adapted to receive said neck and exclude said head and shoulder, the height of said step being greater than the length of said neck, said step being adapted to be deflected by the pressure exerted thereon between said head and shoulder when said head is above said step, and said step being adapted to spring back to its undeflected position after the passage of said head over said step, and thereby restrain the return of said neck of said stud to the opposite end of said slot.

2. A snap fastener comprising in combination a thin sheet metal plate and a stud adapted to

be detachably connected to said plate, said stud having a head connected to a shoulder by a neck, said plate having a well stamped therein, an attaching flange extending from the perimeter of said well, a bottom in said well having upper and lower levels connected by an inclined step, said bottom having a slot therein comprising relatively small and large enlargements at each end thereof connected by a narrow portion extending transversely through the length of said step, said small and large enlargements being located respectively within said lower and upper levels of said bottom and the end of said slot at the smaller of said enlargements terminating in said lower level of said bottom at a distance from said step greater than one half of the sum of the dimensions of said neck and head extending perpendicular to the length of said neck, said shoulder of said stud being larger than said head, the larger of said enlargements being adapted to receive said head and exclude said shoulder, said narrow portion of said slot and the smaller of said enlargements being adapted to receive said

neck and exclude said head and shoulder, the height of said step being greater than the length of said neck, said step being adapted to be deflected by the pressure exerted thereon between said head and shoulder when said head is above said step, and said step being adapted to spring back to its undeflected position after the passage of said head over said step, and thereby restrain the return of said neck of said stud to the opposite end of said slot.

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