Oct. 31, 1950 V. F. ZAHODIAKIN 2,527,783

FASTENING DEVICE

Filed March 12, 1948

Fig. 1.

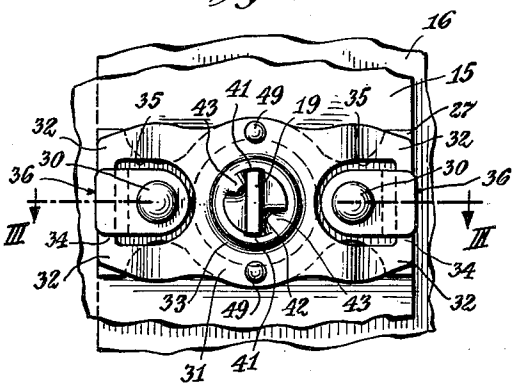


Fig. 2.

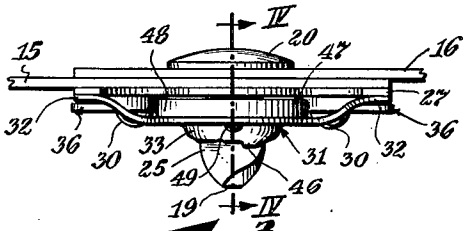


Fig. 3.

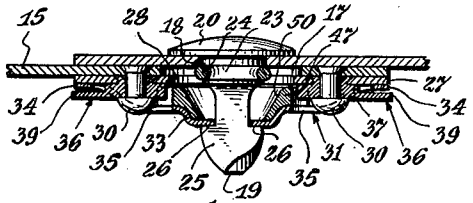


Fig. 4.

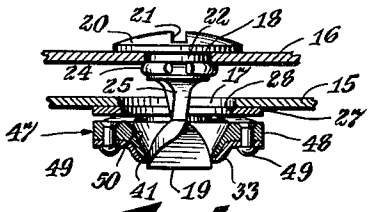


Fig. 5.

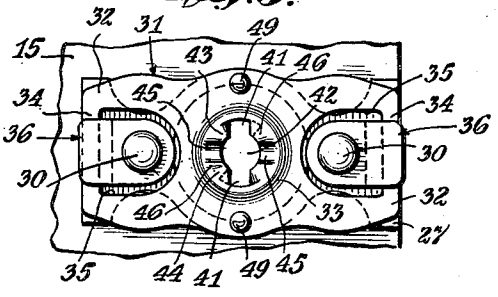


Fig. 6.

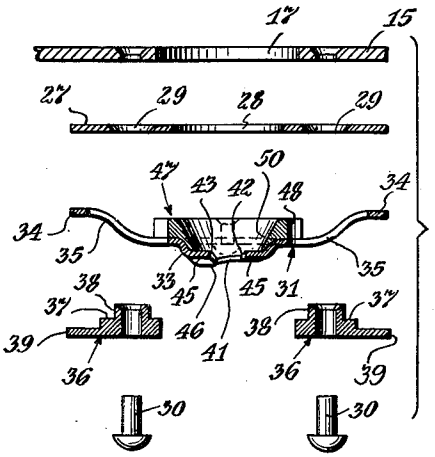


Fig. 7.

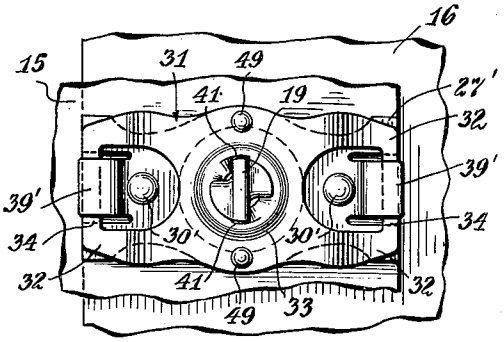
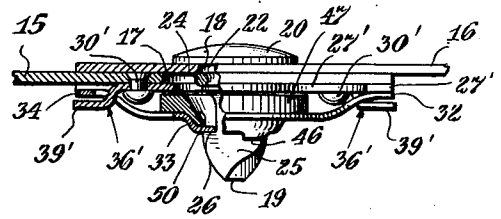


Fig. 8.



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FASTENING DEVICE

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3 Claims. (Cl. 24—221)

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This invention relates to fastening devices, and particularly to the stud and socket type of the general character shown in my prior application S. N. 790,863 filed December 10, 1947, now Patent No. 2,514,922 wherein by partial turn of the stud, an interlocking with the socket is obtained.

As in said prior application, it is here recognized that difficulty has been encountered in use of fastening devices of this general character, that the stud-receiving holes of the members being secured do not register always with requisite precision. Said prior application discloses the broad concept of floating socket structure for self-alignment upon insertion of the stud, and the present application proposes structural improvement in that concept.

An object of the present invention, therefore, is to provide an improved fastening device which is capable of positively clamping a plurality of members which happen to be misaligned at maximum tolerance discrepancy in location of the supposedly registering holes provided for receiving the clamping stud.

Another object of the invention is to adapt the device to provide greater shear resistance to transverse loads.

Closely related to the object just mentioned, is the further purpose of increasing the shear resistance without increasing the spring tension.

A further object of the invention is to provide an improved guide or centering member, and specifically to provide such a member which will seat solidly and accurately in place in the resilient bridge and which can be assembled and secured thereto prior to assembly of the bridge to the base plate.

Another object of the invention is to provide improved mounting of the movable parts or floating assembly on the base plate.

A further object is to utilize the rivets or other securing means by which the base plate is secured to the member to be clamped, to also take a part of the strain of retention of the floating assembly on the base plate.

Again, an object of the invention is to minimize disruptive leverage to the rivets or other securing means.

Yet another object is to minimize metal, bulkiness, weight and assembly difficulties, but maintain maximum required strength to resist applied strains and stresses.

Additional to the foregoing, an object of the invention is to provide a means to serve the double function of automatically centering with insertion of the stud and guiding the stud to its slot.

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The invention also contemplates provision of means for accepting and carrying the load when excessive for the resilient member or bridge.

The invention further contemplates a structure which is readily assembled at the factory as a unit and which is readily applied in its appointed place by the user.

Still further objects of the invention will appear to those skilled in the art to which it appertains as the description proceeds, both by direct recitation thereof and by implication from the context.

Referring to the accompanying drawing in which like numerals of reference indicate similar parts throughout the several views;

Figure 1 is a bottom plan of the assembled fastening device of the present invention;

Figure 2 is an edge view of the same;

Figure 3 is a sectional view on line III—III of Fig. 1, showing the device in its locked condition;

Figure 4 is a sectional view on line IV—IV of Fig. 2, and showing the device in its unlocked condition and the stud in partially withdrawn position;

Figure 5 is a plan of the socket-providing assembly similar to Fig. 1, but without the stud applied thereto;

Figure 6 is an exploded sectional view of the several parts present in the showing of Fig. 5;

Figure 7 is a bottom plan similar to Fig. 1, but showing a modified construction of retainer; and

Figure 8 is a view partially in edge elevation and partially in section of said modified construction of Fig. 7.

In the specific embodiment of the invention illustrated in said drawing, the reference numerals 15, 16 designate juxtaposed members adapted to be clamped together in an overlapped flatwise position. For convenience in making distinguishing reference thereto, the members will be arbitrarily referred to as inner member 15 and outer member 16. Particular attention has been given to aircraft construction and requirements in the development of the present invention, and it may therefore not be amiss to point out that various parts of airplanes, such as wing and fuselage plates, cowls, hoods and other parts or members are lapped and secured together. It has become quite common practice to now use some form of stud-and-socket securing means in place of rivets and bolts.

The parts or members to be secured are prepunched or drilled with holes 17, 18 which are intended to register when the members are assembled. Actually, however, because of tolerances allowed or inaccuracies of workmanship, the

holes may not register with absolute precision and where the holes are no larger than necessary for a particular stud, misalignment of even very small amounts will make insertion of the stud difficult or often impossible. The inner member 15 therefore may provide a hole larger than necessary with exact registration, so that the stud will pass even though registration is imperfect. Thus in the drawing, hole 17 of the inner member 15 is shown much larger than hole 18 of the outer member 16.

A stud 19 is provided having head 20 with kerf 21 in its outer end and a cylindrical neck 22 immediately under the head so proportioned that the neck will have rotatable fit in hole 18 and the head will have adequate bearing upon the face of outer member 16. Beyond neck 22, the stud has a peripheral groove 23 to receive a resilient split ring 24 next the opposite face of outer member 16 from that engaged by the head 20, thereby retaining the stud rotatably in and projecting from said member 16. This assembly of stud in said member may be accomplished in the field or place where the members are being assembled. The projecting part of the stud is constructed as a helical blade 25 providing undercut or transverse shoulders 26 at a common planar distance from the head and inwardly toward the head from the far end of the blade.

The socket-providing mechanism to co-operate with the stud is constructed as a unitary assembly to be later secured in place, in the field or elsewhere, upon inner member 15. Here again, inaccuracy of registration may transpire, and a feature of the invention is to accommodate misalignment either of hole 17 with hole 18 of the two members or of the socket assembly with respect to either of said holes.

The unitary socket-providing assembly comprises an attaching or base-plate 27, here shown as flat, of heavy sheet metal, of elongated shape, and with a stud hole 28 at its middle large enough to pass the stud therethrough even though said hole is not precisely aligned with the hole of either member when assembled in the field. Rivet holes 29 are provided in this base-plate to ultimately receive, when applying the assembly for use on member 15, rivets 30. A convenient location for said rivet holes 29 is upon the longitudinal center line of said plate near opposite ends thereof.

As in the aforementioned prior application, a resilient floating bridge, here identified by numeral 31, is provided, having feet 32 at each corner thereof which rest and are slidable flatwise upon base-plate 27. The bridge bulges from the outer ends of said feet toward a mid-part of the bridge so as to space said mid-part away from said base-plate, and at said mid-part said bridge provides a hollow annular embossment 33 projecting still further from the base-plate. When assembled with the base-plate, said bridge extends lengthwise in the same general direction of lengthwise direction of the base-plate so that said feet of the bridge are in the vicinity of the corners of the base-plate and project toward, but not beyond, the ends of said plate. The two feet constituting a pair at each end of the bridge are tied together by a tie-bar 34 transverse to the bridge and preferably an integral part therewith. These tie-bars, with the extremities of the feet, bear against marginal end surfaces of the base-plate and thereby not only increase the bearing surface but also re-enforce one foot of a pair by connection with the other foot of the same pair. The feet therefore cannot spread in use.

Improved means are shown herein for retaining the bridge in floating assembly with the base plate. The straddling separation of the feet of each pair and the tie-bar extending between the ends of the feet of each pair, result in the bridge having a sizable opening 35 in proximity to each end thereof. Retainers 36 fixed on the base-plate 27 project into said openings 35 and lap over the tie-bars 34 of said bridge 31. The tie-bars therefore serve an added purpose of holding the bridge slidably upon the base-plate.

Retainers 36 as shown in Figs. 1, 2, 3, 5 and 6, are constructed as tubular body portions shouldered at 37 toward one end to seat on the base-plate and provided each with a tubular shank 38 beyond the said shoulder to function as hollow rivets. At the opposite end of each said tubular body portion is a radially projecting lug 39 which has an under surface paralleling the plane of said shoulder 37 at a distance therefrom substantially equal to or slightly more than the thickness of the tie-bar 34 of the bridge. Shank 38 of the retainer is inserted in the previously described rivet hole 29 of the base-plate 27 and flared at its end to thereby rivet or mount the retainer 36 in fixed position on said base-plate 27. As the retainer 36 is tubular coaxially with the shank 38 thereof, rivet 30, heretofore mentioned, may be inserted therethrough and through the member 15 to secure the assembly of base-plate, retainer and bridge in ultimate position of use. However, it will be observed that the retainer 36, with its lug 39 projecting across tie-bar 34, maintains floating assembly of the base-plate and bridge prior to inclusion of said rivet 30 or before the assembled mechanism is applied in ultimate place of use on member 15. It is also appropriate to note that spacing of the tie-bars from each other exceeds spacing of the body portions of the retainers so as to permit restricted slidable movement of the bridge longitudinally as well as laterally, and each lug has a length exceeding the slidable play of the bridge in its lengthwise direction so the tie-bar cannot escape from retention thereunder.

The embossment 33 of bridge 31 provides diametrically opposed key-hole notches 41 radiating from a central hole 42 through the embossment, which together provide a double key-hole slot for reception and passage of the helical blade 25 of the stud 19. Rotation of the stud in said slot draws the resilient bridge inward at its middle until the shoulders of the blade come out of the slot and then ride upon the inwardly directed overhang or ledge 43 of the embossment. Said ledge, in the same direction from each notch, for instance anti-clockwise with respect thereto as viewed in Fig. 1, provides outwardly or forwardly sloping cams 44 requiring further deflection of the resilient bridge as the shoulders of the stud blade ride thereover, said cams terminating in radially disposed depressions 45 into which said shoulders 26 will seat in finally passing over the cams. Raised stops 46 at the far sides of the depressions 45 are provided in the embossment 33 to prevent rotation of the stud 19 past the seated position of the stud shoulders in said depressions.

It will be recognized from the above description and showing in the drawing, that partial flattening and retractive bowing of the resilient bridge is permitted by slidable engagement of the bridge feet on the surface of the base-plate against which they are resiliently pressed. It also will be recognized that the base-plate, re-

tainers and bridge are fabricated as a unitary assembly constituting a socket-providing assembly or member which may be readily and conveniently attached as an entity to one of a plurality of members where intended to be used, and that the floating mounting of the movable part of that socket-providing assembly will accommodate a very considerable latitude of misalignment of the stud holes of the fixed part with respect to the stud hole of the member to which said fixed part is attached by the person applying the socket-providing member in place. Choice of length of stud can be made to accommodate existing thickness of the members 15, 16 being secured by my improved fastening device.

By virtue of embossment 33 being formed with sheet steel, the underside thereof constitutes a hollow or pocket, and in said pocket I secure an eyelet 47 having a peripheral flange 48 underlying the bridge adjacent said embossment. Said eyelet is secured to the bridge to be a permanent part thereof, as by small rivets 49. The riser portion of the eyelet has adequate fitting engagement with the pocket wall so as to be immovable laterally in the pocket in consequence of which the small rivets 49 will not be subjected to shearing stresses. The inside of the eyelet constitutes a stud-passing and aligning hole 50 which slopes toward the eyelet axis from said flanged end toward its end seated in the pocket. At said seated end of the eyelet stud hole 50 therethrough is of a diameter substantially equal to the blade diameter of the stud, whereas at its other end toward the flange said hole 50 is of considerably greater diameter by virtue of the slope. Preferably the excess of the greater diameter over the smaller diameter is substantially equal to the latitude of movement in any one direction of the bridge upon the base-plate. This is to assure that the stud end will always be fully opposite some part of the large end of the opening so as to be readily introduced thereinto. Upon insertion of the stud end at the large end of the stud hole 50 of the eyelet and by sliding the stud toward and through the smaller end of that hole, any misalignment of stud and eyelet is corrected by the engagement of the stud against the sloping wall of the hole and as the stud advances automatically shifting the eyelet, and with it the attached bridge, transversely of the stud until the stud and eyelet align and the stud passes through the smaller end of the eyelet hole and into and through the double key-hole slot of the embossment. In locked condition of the stud, the bridge is depressed in opposition to its inherent resiliency and is limited as to depression, so as not to exceed its elastic limit, by engagement of the eyelet flange with the base-plate. Spacing clearance between the said eyelet flange and base-plate is made just sufficient to permit the stud blade to ride over its cams on the embossment, but limited so as to prevent any material or objectionable separation of members 15, 16 in use due to extraneous opposite pressures. The eyelet is of a solid character, as distinguished from sheet metal, and as it is in contact with the under side of the cam-seating depressions 45, adequate resistance to deformation of the embossment is provided thereby against pressures to be encountered in use.

Especial attention is directed to the fact that in use, the bridge is frequently subjected to severe twisting moments so that the edges of the legs toward the retainers apply considerable lateral or shearing pressure against said retainers. The retainers, however, where engaged laterally by the bridge legs, are cylindrical and the applied force is accordingly received in a radial direction, and consequently exerts no force tending to twist the retainer on its axis; wherefore, the lugs 39 on the retainers will always remain in fixed position to project over the tie-bar 34 of the bridge. Furthermore, the riveting of the retainer shank to the base-plate adds its strength to that of rivet 30 and together they provide adequate shear resistance.

In consequence of the floating characteristic of the bridge, by which it can twist as well as slide, within limits, a twisting moment will cause one leg at one end of the bridge and a diagonally opposite leg at the other end of the bridge to both engage the retainers thereat, thus dividing the shear load between the legs at opposite ends of the bridge. The tie-bars 34 at the opposite ends of the bridge connecting pairs of feet further divide the shear load so that all of the legs function at once to resist the shear load, which means that it is practical to make the legs relatively narrow for any probable shear load.

Many of the advantages above related are present in the modified construction shown in Figures 7 and 8 wherein description will not be here repeated for parts common with the previously described construction, but the similar parts will be identified by use of the same reference numerals appearing in the foregoing description which likewise applies. The essential difference in structural showing of Figs. 7 and 8 over the first-described construction is that retainers 36' are formed as tabs struck up from the metal of base-plate 27' there shown. The rivets 30' are located at the base of the tabs so that shear load applied to the edges of the tabs transmits only a modest twisting momement well within the material strength to resist. As shown, said tabs project upward from the base plate and then are bent parallel to the plate, extending in directions toward the respective ends of the plate to provide lugs 39' to overlie the tie-bars 34 for maintaining assembly of the bridge on the base-plate. The final bending of one or more of the said lugs to parallelism with the plate may be made after applying the bridge in place on the plate.

I claim:

1. A socket-providing assembly for a stud and socket type of fastening device, comprising a floating resilient bridge and means for mounting the same, said bridge having a part thereof bulging away from the surface on which the bridge is mounted, and said bridge providing stud-receiving and locking means at said bulging part, and an eyelet in part within said bulging part of the bridge and between the bridge and said surface for both guiding the stud to the stud-receiving means and to limit flexing of the bridge in one direction.

2. A socket-providing assembly for a stud and socket type of fastening device, comprising a floating resilient bridge and means for mounting the same, said bridge having a mid-part thereof bulging away from the surface on which the bridge is mounted and having an embossment at said mid-part, said embossment having stud-receiving and locking means, and an eyelet interposed between said embossment and said surface and seated in said embossment and secured to said bridge, said eyelet having a tapered hole therethrough converging toward said stud-

receiving means of the embossment for guiding a stud to said means.

3. A socket-providing assembly for a stud and socket type of fastening device, comprising a floating resilient bridge and means for mounting the same, said bridge having a mid-part thereof bulging away from the surface on which the bridge is mounted and having an embossment at said mid-part more remote from said surface, said embossment having a stud-receiving hole therethrough and having stud-locking means on the convex face of said embossment, and an eyelet seated in the concavity of said embossment and projecting therefrom and having a flange marginally around the concavity and between the bulging part of the bridge and the surface on which the bridge is mounted for limiting flexure of the bridge and for carrying over-load applied to the bridge.

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