

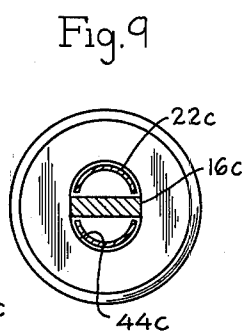
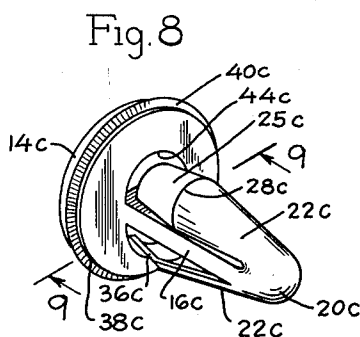
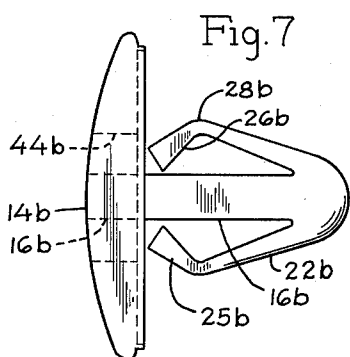
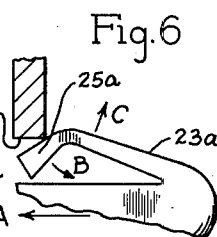
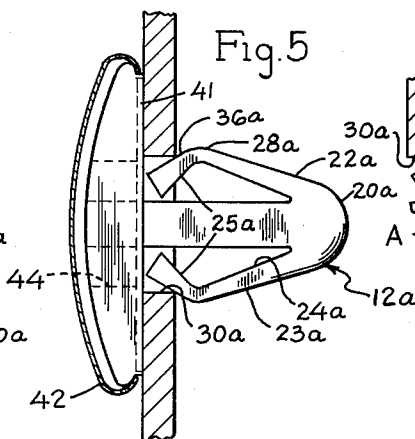
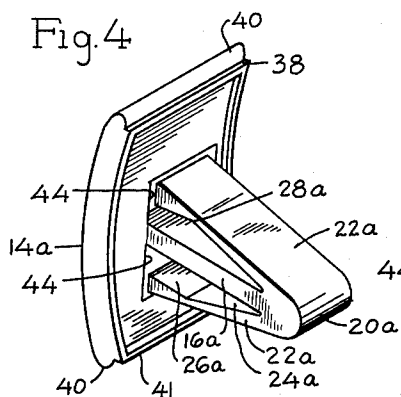
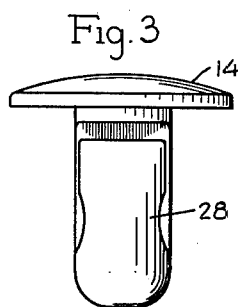
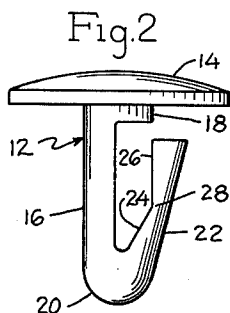
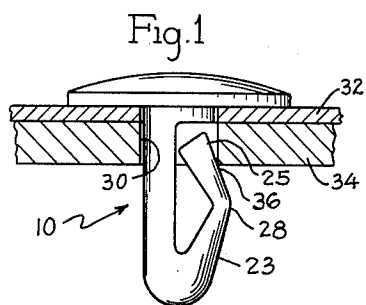
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FASTENER

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3,093,874
FASTENER

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This invention relates to an improved fastener. More specifically, it relates to a one piece plastic fastener of the drive type having an improved stud section.

An object of this invention is to provide an improved one piece plastic fastener.

Another object is to provide a plastic fastener having an improved stud section.

Still another object is to provide a one piece plastic fastener having a stud section of one or more portions which are deformable and will lock the fastener in applied position.

Other objects of the invention will become apparent when the specification is read in conjunction with the accompanying drawing wherein:

FIG. 1 is a front elevation in partial section of one embodiment of the invention shown in applied position joining two workpieces;

FIG. 2 is a front elevation of the same embodiment of the invention in its initial condition prior to its installation;

FIG. 3 is a side view of the device shown in FIG. 2 when viewed from its right side;

FIG. 4 is a perspective view of a second embodiment of the invention as shown in its initial condition before application to an apertured workpiece;

FIG. 5 is a frontal elevation in partial section of the embodiment shown in FIG. 4 when applied to a workpiece and supporting secondary means on its head;

FIG. 6 is a partial sectional view of one portion of the embodiment of the invention shown in FIGS. 4 and 5 showing the reaction of the various parts to an axial removal force;

FIG. 7 is a frontal elevation of a further embodiment of the invention;

FIG. 8 is a perspective view of still another embodiment of the invention; and

FIG. 9 is a partial sectional view taken along line 9-9 in FIG. 8.

A fastener 10 of the type contemplated by this invention, and as best seen in FIGS. 1 through 3 may be a one piece injection molded plastic device having a shank 12 and a laterally extending head 14 located at one end of the shank. The shank 12 includes a rigid portion or leg 16 which emanates from the head in a cylindrical form as designated at 18 for a short distance and is then reduced or relieved to a semi-cylindrical form for the remainder of its extent. It is substantially rigid and at its lower extremity or free end opposite to the head 14 blends with a nose portion 20, which in the present instance is roughly hemispherical in shape. Also connected to nose portion 20 and extending upwardly towards head 14 and away from rigid leg 16 is distortable portion or leg 22. Distortable leg 22 is semi-cylindrical on its outer side and diminishes in thickness from its opposite ends in its lower and upper sections 23 and 25 respectively, to an intermediate point 28. This is accomplished in the present

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instance by having its inner side formed by a pair of planar surfaces 24 and 26 which diverge outwardly away from rigid leg 16 from their respective ends to their line of juncture so as to form a concavity facing leg 16 which radially relieves distortable leg 22. This relief provides a flexure line as indicated at intermediate point 28, for purposes best set forth hereinafter. The dimensions of distortable leg 22 at this flexure point 28 are controlled such that the width is substantially greater than the thickness of the leg, and the flexure point is thereby designed to have less flexing strength than the resilient juncture of leg 22 with the nose portion 20. The axial length of distortable leg 20 is controlled so that when the fastener is inserted through a complementary aperture 30 in workpieces 32 and 34, the distortable leg 22 will be accepted within the recess formed by the undercut in cylindrical portion 18.

The distortable leg 22, as indicated above, is resilient at its juncture with the nose portion 20 and will move as a straight unit into the aforementioned recess until such time as the shank 12 has moved axially a sufficient distance through the aperture 30 so as to expose flexure point 28. At this instant, the strength of the nose portion 20 being greater than flexure point 28 will force the lower section 23 of distortable leg 22 radially outwardly while flexing the upper section 25 inwardly towards the rigid leg 16 to assume the position best seen in FIG. 1. The flexing of distortable leg 22 about flexure point 28 provides shoulder means i.e. the outer surface of the upper section 25, as generally indicated at 36, which underlies the lower panel 34 and retains the fastener in assembled relation with the combined workpiece.

Referring now to FIGS. 4 through 6, there is disclosed a second embodiment of the present invention, wherein similar numerals are utilized to indicate similar parts with the addition of the suffix "a." This embodiment of the invention includes a rigid portion or leg 16a extending downwardly from head 14a and is joined at its nose portion to a pair of distortable legs both designated 22a. In this embodiment the rigid portion or leg 16a is substantially rectangular in configuration and the distortable legs 22a are similarly flat or substantially rectangular in section. The three legs are joined together by a semi-cylindrical nose 26a and legs 22a have inner obtusely related planar surfaces 24a and 26a respectively forming a relieved flexure point 28a intermediate the length of leg 22a.

The head 14a in this embodiment has substantial lateral extent. It is resilient and slightly arched in its initial condition so as to be concave in the direction towards the shank for purposes best set forth hereinafter. In addition, the ends of the head are undercut as at 38 to provide a shoulder 40 adapted to accept a secondary work means such as a trim molding 42 of the type generally shown in section in FIG. 5. A substantially continuous resiliently distortable lip 41 extends about the perimeter of the head 14a in the direction of the shank 12a, for purposes best set forth hereinafter.

The distortable legs 22a, in this embodiment, are of substantially greater length than the distance from their juncture with the nose portion 20a to the under surface of head 14a. To accommodate this initial excess length, the head 14a is provided with a pair of recesses 44 opening outwardly through the undersurface of head 14a

which are adapted to accept the free ends of legs 22a. In the present instance each recess 44 is a through bore passing through the entire axial extent of head 14a. The through bores forming recesses 44 have an added utility in that portions of the mold used to form the fastener stud may project through the head and be utilized in the formation of the rigid leg 16a and the inner planar surfaces 24a and 26a of the lower and upper sections 23a and 25a of leg 22a, respectively, during the molding operation. The action of the fastener is essentially the same as in the first embodiment in that the distortable legs 22a flex radially inwardly during passage of the stud 12a through the workpiece aperture 30a until the flexure point 28a is reached. At this point the lower section 23a carrying planar surface 24a moves laterally outwardly flexing the upper section 25a carrying planar surface 26a inwardly to form a shoulder means 36a.

As can be seen in FIG. 5, the head 14a in installed position may assume a substantially straight form from its initially arched concave form. Due to its resiliency the head acts as a "take-up" means on the stud to compensate for tolerance variations in work material thickness. The lip 41, due to its deformability, will assume the contour of the worksurface and acts as a seal around the periphery of head 14a whereby foreign material is prevented from entering aperture 30a.

In FIG. 6 a partial section has been illustrated along with lines of force to show the results of what occurs when an attempt is made to remove the fastener from a workpiece aperture 30a. When a removal force is exerted in the direction of the arrow "A," the upper section 25a of the distortable leg bends in the direction of the arrow designated "B." This movement tends to force the lower section 23a of the leg in the direction of the arrow designated "C" and thereby tends to create a triangular strut action. Thus, removal forces increase the retaining forces above what is normally available and in essence the fastener 10 is non-removable except from the back side of the sheet. Under extreme conditions, the free end of the distortable leg will contact the rigid leg on its facing surface and further increase the triangular strut action of the leg.

A further embodiment of the invention is shown in FIG. 7, similar parts being designated by similar numerals with the addition of the suffix "b." This embodiment is substantially the equivalent of the embodiment shown in FIGS. 4 through 6 except that the upper section, 25b, of the distortable leg carrying planar surface 26b is in its initial condition flexed toward the rigid portion 16b. This embodiment again has the recess 44b passing through the head 14b for acceptance of the free end of the legs 22b when they are moved inwardly during insertion in an apertured workpiece.

Still another embodiment of the invention is shown in FIGS. 8 and 9 wherein similar parts are designated by the same numerals with the addition of the suffix "c." In this embodiment the fastener includes a substantially rigid leg portion 16c connected to a head 14c. In this embodiment the head is substantially cylindrical and is provided with an undercut 38c and a shoulder 40c adapted to accept a secondary element, not shown, of the type designated as molding 42 in FIG. 5. The head is provided with one or more recesses 44c for purposes best set forth hereinafter.

In this embodiment the distortable legs 22c are each substantially semi-circular in section and have an increasing radius of curvature in transverse sections commencing with the nose portion 20c to a point intermediate their extremity, generally designated as 28c, and thence have a decreasing radius of curvature in successive transverse sections to the free end. Similarly, the wall thickness of the parts diminishes from the nose portion towards the intermediate point 28c and thence increases towards the free end. This results in each leg having a pair of adjoining semi-frustoconical sections which are

concave in the direction of the rigid leg 16c and have a varying wall thickness. The action of this fastener when associated with an apertured workpiece is similar to the previous embodiments in that the distortable legs 22c tend to flex inwardly toward the rigid leg until the intermediate or flexure point 28c is passed a plane passing through the undersurface of the workpiece whence the distortable legs 22c spring outwardly, flexing the upper section 25c inwardly forming shoulder means 36c for underlying the workpiece.

In this embodiment the recesses 44c in the head 14c must be through bores traversing the axial extent of the head. Besides accommodating the free ends of legs 22c while flexed inwardly, the recesses 44c are necessary to accept those portions of the die needed to form the concave surfaces of legs 22c and the opposing surfaces of leg 16c.

The embodiments disclosed hereinabove may be injection molded of plastic materials having the characteristics of flexibility, resiliency and rigidity when properly dimensioned. While the embodiments disclosed have been shown as being utilized for fastening two sheet material workpieces together as well as for molding clip purposes, the invention contemplates the use of the stud portion with other functional head elements such as cable clamps, door strikes, weather strip retainers, snap-in shelf supports, etc. Other embodiments of the invention will, of course, be apparent to those skilled in the art and it is my intent that I be limited only by the appended claims.

I claim:

1. A one-piece plastic fastener for use in an apertured panel having a head and an integral shank, said shank including a substantially rigid first leg extending downwardly away from said head, at least one second leg resiliently connected to said first leg at its extremity opposite the head and extending upwardly towards said head in diverging relation to said first leg, said first leg being substantially uniform in section throughout its length, said second leg having substantially the same width as said first leg through its length, a first section of said second leg extending from the attachment to said first leg to a point intermediate the length of said second leg and decreasing in radial thickness as it diverges from said first leg, a second section of said second leg progressively increasing in radial thickness from its juncture with said first section to its free end, the juncture of said two sections being the thinnest radial measurement of said second leg and forming a concavity facing said first leg, said juncture constituting a flexible resilient hinge line which is weaker than the resilient connection between the two legs, the transverse measurement between the outer extremities of said two legs measured on a plane perpendicular to the axis of the fastener and passing through said resilient hinge line of said second leg normally being substantially greater than the diameter of the aperture in the complementary panel with which the fastener is to be associated, whereby telescopic insertion of the shank in a complementary panel aperture causes the second leg to flex inwardly toward the first leg until the resilient hinge line of said second leg passes the vicinity of the undersurface of the panel whereupon the second section is automatically deflected inwardly to form a shoulder to underlie the workpiece and the first section of said second leg springs outwardly under the panel due to the relative resilient strengths of the junctures between the two sections of said second leg and the first section of said second leg with the said first leg respectively.

2. A device of the type claimed in claim 1 wherein said shank adjacent said head is cylindrical and said first leg portion is semi-cylindrical with the free end of the shank being hemispherical, said distortable second leg portion being joined to the hemispherical section which has a substantially greater cross-sectional area than the cross-section through said resilient hinge line.

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3. A device of the type claimed in claim 1 wherein said first leg portion is substantially polygonal in cross-section and is provided with two second leg portions located on opposite sides thereof, said second leg portions being of generally flat configuration and having a greater transverse measurement than the thinnest radial measurement of the second leg forming the flexible resilient hinge line.

4. A device of the type claimed in claim 1 wherein said head portion is provided with a bore which transverses the top and bottom surface portions of the head and overlies a substantial portion of the shank.

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