

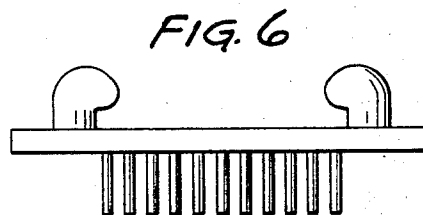
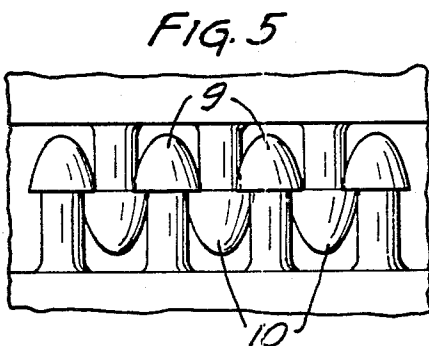
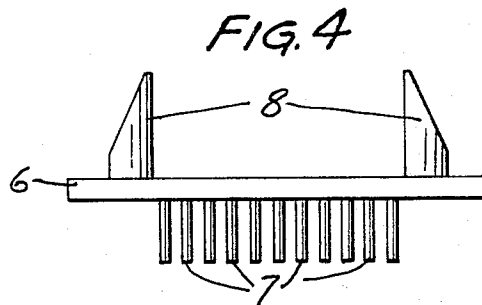
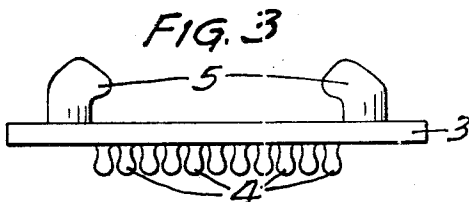
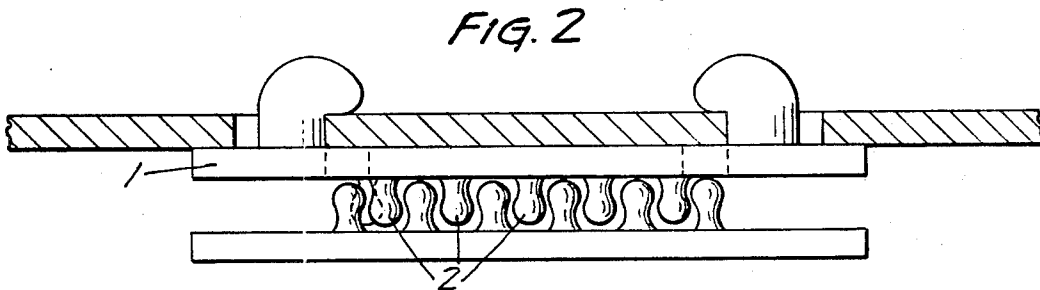
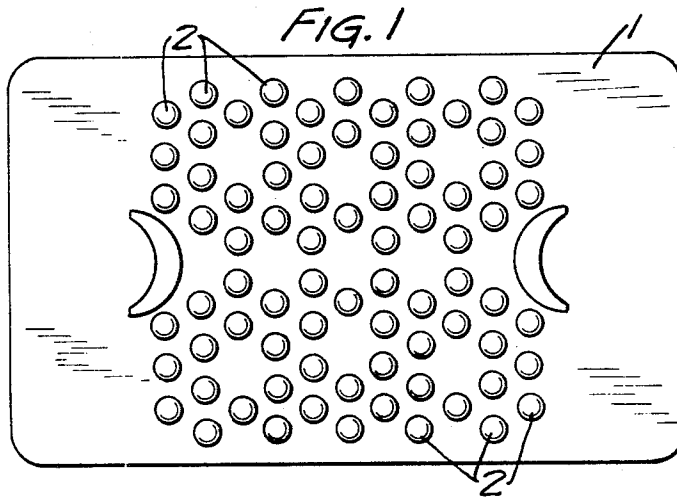
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3,471,903

STUD-BACKED FASTENERS

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STUD-BACKED FASTENERS

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1 Claim

ABSTRACT OF THE DISCLOSURE

A unitary fastener article having (1) a relatively stiff but resilient base, (2) a fastener surface on the front side of the base having a plurality of engaging elements distributed over its surface which can engage, hold and separate from another fastener surface and (3) a pair of spaced apart studs on the back side of the base which are undercut only on their inwardly disposed sides. The studs pass through spaced holes in a substrate and clamp the article thereon. Separation occurs between the fastener surfaces when a tensile force is applied, leaving the article locked on the substrate.

This invention relates to fastener articles and more particularly to unitary fastener articles comprising a pair of spaced headed projections for mounting the article on a substrate and a fastener surface by which it is joined to a complementary fastener surface.

The articles of the invention each have (1) a relatively stiff but resilient base, (2) a fastener surface on the central portion of the front side thereof comprising a plurality of engaging elements distributed thereover, said fastener surface being capable of mechanical interengagement and holding with and separation from a complementary fastener surface and (3) a pair of spaced apart studs unitary with the base and extending from the back side thereof, the studs being undercut only on their inwardly disposed sides.

The ends of the studs are adapted to be sprung apart to enter spaced apertures in a substrate and to return to their normal relative positions when the undercut portions of the studs have passed through the substrate and the ends of the studs clamped onto it. When tensile loads are applied to the article through the mechanical functional surface, the central portion of the base is deformed away from the substrate and the ends of the studs are thereby urged toward one another and their effective holding or clamping action is increased. This design having undercuts only on the insides of the studs, permitting easy entry into any hole the size of the head or larger, therefore does not sacrifice holding strength (since the studs tend to move toward one another and tighten as the tensile load on the fastener increases).

Substrates suitable for use with the fasteners of the invention are those which are sufficiently thin or are otherwise shaped so that the undercut portions of the studs pass completely through holes therein to allow the studs to lock in place. Particular advantages of the fasteners of the present invention are that they can be mounted on substrates from the one side (i.e. requiring no access from the backside) and that no particular tools are required to mount them. If it is desired to prevent water or other liquids from leaking through the holes in the substrate used to mount the fasteners, foam rubber gaskets can be placed on the studs before mounting. Upon mounting they are compressed and permanently seal the holes.

The invention also includes single articles of the type described (in addition to complementary pairs thereof). Such single articles can be interengaged through their mechanical surfaces with other articles having complementary surfaces which have no studded back sides but which can be otherwise affixed to substrates (e.g. bolted, screwed, secured with permanently setting adhesives, molded to be unitary with the substrate, etc.).

The fasteners are useful as door latches, to hold access panels in place in appliances, machines and automobiles, to hold upholstery and trim members in place, etc. There are clearly also a wide variety of other situations in the home and industry in which these fasteners can be used.

The fasteners are frequently designed in such a way that the base surface is larger in area than the mechanical functional surface. The studs can be positioned on a section of the base near its periphery and so that they oppose a portion of the mechanical surface near its edge or even outside the mechanical surface altogether.

Among the mechanical surfaces suitable for use in the articles of the invention are those shown in U.S. Patents 2,499,898 and 3,266,113. The first of these patents relates to surfaces having interlocking mechanical prongs and the second relates to a preferred type of mechanical fastener portion of the articles of the present invention. These consist of a complementary pair of interengaging unitary functional surfaces each comprising multiple rows of flexible cam elements emanating from the backing member in which:

- (1) the elements comprise stems terminating in enlarged shaped heads which bear against the element heads of the other article during engagement and disengagement, said heads being substantially non-deformable,
- (2) the spaces between the heads of the individual elements of one of the pair of articles are smaller than the space occupied by the head of each element of the other article and
- (3) the rows of elements have vacant element positions to provide empty spaces at intervals over said functional surfaces so as to allow deflection of the elements during engagement and disengagement.

The complementary articles often (but not always) have identical fastener surface contours. Such fasteners which are of use in the present invention are capable of engagement from only one side of the functional surfaces and normally have solid bases. Usually, but not necessarily, they are capable of only a single depth of engagement. Such mechanical fastener surfaces are exemplified in the accompanying drawings.

Various embodiments of the invention are illustrated by the accompanying drawings wherein:

FIG. 1 is a top view of a single article of the invention viewed from the side of the mechanically interlocking fastener surface.

FIG. 2 is a side view of an article of the invention of the type shown in FIG. 1 which has been mounted on a substrate, the studs of the article having passed through holes in the substrate (which is shown in section) and locked thereon. Also the article of the invention has been interlocked through its fastener surface with an article having a complementary fastener surface.

The articles of FIGS. 1 and 2 have mechanical fastener surfaces of a preferred type (having a relatively stiff but resilient backing member and rows of headed elements with vacant element positions at intervals). In FIGS. 1 and 2, 1 denotes the rigid backings or bases of the mechanical fastener portions of the articles and 2 denotes the headed elements.

FIG. 3 is a side view of a somewhat different type of article of the invention mounted on a structural substrate

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wherein 3 is the base of the article carrying the elements of the mechanical functional surface 4 on one side and the undercut studs 5 on the other.

FIG. 4 is a side view of a unitary article of the invention at an intermediate stage of fabrication which, when completed, will be an article of the type shown in FIG. 3. The part of FIG. 4 is prepared by injection molding; the cylindrical blanks 7 are headed to form the elements 4. The blanks 8, which are cylinders of which the ends are defined by planes at acute angles to the cylinder axes as shown. The elements can be headed and the studs formed into the undercut shape by heating them from the ends, e.g. by passing them by a heated bar or under a bank of infrared lamps at a controlled rate (causing partial melting and resolidification of the polymeric material used in preparing the original molds).

FIG. 5 shows a fragmentary detail of an interlocked pair of mechanical functional surfaces having somewhat differently shaped elements which are also suitable for use on the fasteners of the invention. The mushroom shaped elements, 9 and 10, can be formed from blanks of the type 7 shown in FIG. 4 by pressing the ends thereof into properly shaped swaging dies.

Articles of the type shown in FIGS. 1 and 2 can be formed from an injection molded part of the type shown in FIG. 6. The studs are molded in their final undercut shape utilizing two movable mold cores which extend through the base of the fastener to form the undercut surface. This results in two holes shaped somewhat like a new moon in the fastener base (as shown in FIG. 1). These mold cores are withdrawn before the piece is removed from the mold. The blanks of the mechanical functional surface elements can be headed by heating from the ends or can be given mushroom shaped heads through the use of swaging dies.

EXAMPLE

This example provides further details on the manufacture of presently preferred products.

A unitary article such as is shown in FIGS. 1 and 2 hereof is prepared. It has a relatively stiff but resilient base and a fastener surface on the central portion of the front side thereof of the type described in U.S. Patent 3,266,113. On the back side of the base are two studs about $\frac{3}{16}$ inch in diameter which are undercut about $\frac{1}{16}$ inch on their inner sides. The article is composed of a copolymer of trioxane (a cyclic trimer of formaldehyde) which is available under the trade designation "Celcon" from the Celanese Corporation of America. The base is about 0.95 square inch in area and the mechanical surface has 78 headed elements arranged in the pattern shown in FIG. 1 hereof. Two interengaged mechanical surfaces of this type require a short term separating force normal to the surfaces of 30 pounds or somewhat more to disengage them. The area of each mechanical surface is about 0.45 square inch.

The article of this example is mounted on a sheet metal

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substrate by pressing the studs through properly spaced holes therein until the head portions of the studs have passed completely through the holes and snapped into position. Thereafter when a fastener surface of the article is engaged with a complementary fastener surface and the article is subjected to a separating force, the center part of the base is arched away from the substrate slightly thus causing the studs to grip the substrate more firmly. When the separating force reaches a sufficient magnitude, separation occurs between the fastener surfaces, leaving the article in place on the substrate.

What is claimed is:

1. In a unitary fastener article of the type having a relatively stiff but resilient base and a fastener surface on the central portion of the front face thereof made up of multiple rows of flexible elements emanating from the base comprising stems terminating in enlarged shaped heads which bear against the element heads of a complementary fastener surface during engagement and disengagement, the spaces between the element heads being smaller than the space occupied by the head of each element of the complementary fastener surface and the rows of elements have vacant element positions to allow deflection of the elements during engagement and disengagement, the improvement in combination therewith for easily and firmly affixing it to a substrate comprising a pair of substantially springable studs extending from opposite marginal portions of the back face of the base which are undercut only on their inwardly disposed sides, said back face being substantially planar, said studs being adapted to pass through holes in the substrate and snap onto the inwardly disposed sides of the holes so that a tensile force on the fastener surface will cause a slight bowing of the central portion of the base away from the substrate thereby converting the tensile force into shear forces causing the engaged studs to more firmly grasp the inner edges of the substrate holes and consequently increasing the resistance to removal of the article from the substrate.

References Cited

UNITED STATES PATENTS

| | | | |
|-------------|--------|-----------|--------|
| Re. 19, 238 | 7/1934 | Burke. | |
| 1,972,155 | 9/1934 | McMaster. | |
| 3,031,730 | 5/1962 | Morin | 24—204 |
| 3,049,781 | 8/1962 | Cochran | 24—213 |
| 3,135,820 | 6/1964 | Hallett. | |
| 3,266,113 | 8/1966 | Flanagan | 24—204 |

FOREIGN PATENTS

1,216,512 4/1960 France.

BERNARD A. GELAK, Primary Examiner

U.S. Cl. X.R.

24—204, 213