APPARATUS AND METHOD FOR FASTENING BY CAPTURING PROTRUDING MEMBERS IN CORRESPONDING FLEXIBLE OPENINGS

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ABSTRACT

A fastener having protruding members on a first surface that are positioned for alignment with and capture by corresponding flexible openings in an elastic substrate of a second surface so that the first surface and the second surface may be detachably fastened together.
APPROPRIATE AND METHOD FOR FASTENING BY CAPTURING PROTRUDING MEMBERS IN CORRESPONDING FLEXIBLE OPENINGS

BACKGROUND OF THE INVENTION

[0001] The invention relates to a fastener having protruding members that are held by corresponding flexible openings that releasably capture said members by flexibly grasping a necking base portion of the protruding members, and products using such a fastener. The invention also relates to a method for removably fastening two surfaces together using the aforementioned fastener.

[0002] Many products are in use having inter-engaging protruding members, inter-engaging hooks and loops, and inter-engaging flexible troughs.

[0003] A problem with the mechanisms mentioned above is if any of them are exposed to sand, dirt, grit, and other particulate contaminants, they either perform less well or fail to perform altogether.

BRIEF SUMMARY OF THE INVENTION

[0004] It is therefore an object of the present invention, which has been devised to overcome this problem, to provide a versatile fastening mechanism that is effective even when exposed to particulate contaminants such as dirt, sand, and grit.

[0005] In accordance with the present invention, there is provided a plurality of protruding members, having basal necking portions, adapted to be removably engaged with a plurality of flexible openings that open from one side of the substrate through to an opposite side, the elastic material of the flexible openings configured so that the head portion of the protruding members may penetrate through to the opposite side, wherein elastic material forming the flexible openings grasp and hold the basal necking portions of the protruding members.

[0006] Accordingly, the invention has no place for contaminants like dirt or sand to collect and interfere with the mechanism of the fastener. The mechanism is an elastic material forming the flexible openings; thereby dirt and sand cannot prevent the openings from engaging with the protruding members. Instead, contaminants tend to fall through the flexible openings, or else be pushed out by the protruding members when the protruding members are operationally engaged with the flexible openings and brushed away from the basal necking portions of the protruding members by the flexible material upon engagement and disengagement.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a schematic diagram of a first embodiment of the invention in the plan view.

[0008] FIG. 2 is a schematic diagram of the first embodiment of the invention in cross-section.

[0009] FIG. 3 is an enlargement of the detailing a flexible opening of the second zone.

[0010] FIG. 4 is a schematic diagram of the first embodiment illustrating the protruding members of the first zone engaged with the flexible openings of the second zone.

[0011] FIG. 5 is a schematic diagram of a second embodiment of the invention in the plan view.

[0012] FIG. 6 is a schematic diagram of the second embodiment of the invention in cross-section.

[0013] FIG. 7 is a schematic diagram of the second embodiment illustrating the protruding members of the first zone engaged with the flexible openings of the second zone.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] FIG. 1 shows a schematic view of a first embodiment of the invention.

[0015] In this embodiment, the fastener 1 includes a sub- strate 5 that is spread across three zones: a first zone 10 at a first end 40, a second zone 20 at an opposite second end 50, and a third zone 30. The first and second zones 10, 20 are separated by the third zone 30 which is flexible in bending.

[0016] The first zone includes a plurality of protruding members 60 arranged across the surface of the first zone, 10.

[0017] Preferably, the head portion of the protruding mem- bers has a rounded end portion opposite the basal necking portion. Additionally, the head portion may have a spherical shape.

[0018] The second zone includes a plurality of flexible openings 70 arranged across the surface of the second zone 20 symmetrically to the arrangement of the protruding members 60.

[0019] FIG. 2 illustrates the embodiment of FIG. 1 in cross-section. Each protruding member 60 includes a basal necking portion 80 connecting a head portion 65 having maximum width d to the substrate 5 at a 90 degree angle from the surface of the substrate 5. Each protruding member has a maximum width indicated by d on FIG. 1. The necking portion of the protruding member 80 has a maximum width indicated by e on FIG. 2.

[0020] Width d is greater than width e.

[0021] FIG. 3 illustrates details of a flexible opening 70. The substrate of the second zone includes an outer layer 90 sandwiching an inner layer 100. This inner layer 100 is composed of a flexible elastic material capable of stretching in a resilient manner.

[0022] A first opening in the outer layer 90 has a maximum width f both above and below the flexible inner layer 100. Inner layer 100 has a second opening of width g centered within the first opening of width f.

[0023] The minimum width of g is less than that of f and d, while the maximum width of g is less or equal to the maximum width of f.

[0024] FIG. 4 illustrates an example of the first embodiment where the protruding members 60 of the first zone 10 are in engagement with the flexible openings 70 of the second zone 20. The substrate 5 of the third zone 30 bends so that all the protruding members 60 may fit through the flexible elastic material of the inner layer 100 through top side of the second zone 20 through to the bottom side of second zone 20, held snugly in place by the flexible elastic material of inner layer 100.

[0025] The protruding members 60 of the first zone 10 are engaged with the flexible openings 70 of the second zone 20 by bending the fastener at the third zone 30, aligning the protruding members 60 with the top side of corresponding flexible openings 70, and applying a force directed from the top side to the opposite bottom side so that the flexible openings 70 expand from width f to width g to allow passage of the protruding members 60 through to the bottom side of the second zone.

[0026] Disengagement of the first zone 10 and the second zone 20 is accomplished by applying force directed to pull the
zones apart sufficient to cause the flexible openings 70 expand from width f to width d to allow passage of the protruding members 60 through to the top side of the second zone.

[0027] Another embodiment of the invention is illustrated in FIGS. 5-7. In this embodiment, the first zone 10 and the second zone 20 are not connected with each other by a third zone. FIG. 5 illustrates the two zones in the plan view. FIG. 6 illustrates the two zones in a cross-section.

[0028] FIG. 7 illustrates the two zones in engagement with each other. As with the first embodiment described above, the protruding members 60 align with corresponding flexible openings 70 at a top side of the second zone to be forced through the flexible inner layer 100 so that the substrate side of the head portions rest against the flexible elastic material on the bottom side of the second zone.

[0029] Disengagement of the fastener in the second embodiment is accomplished in the identical manner as with the first embodiment.

[0030] In one embodiment, the first zone is part of one surface of an opening portion of a flexible container (e.g., a plastic bag) and removably engages with the second zone attached to a second surface of the opening portion so that when engaged, the opening of the flexible container is closed. The protruding members in this embodiment range from 1/8 inch to 1/2 inch. The container can be sealed when the protruding members of and the flexible openings are fully engaged. The protruding members and the substrate of the first zone, for example, may be formed from a common, thermoformable material. Further, the container itself may be formed from this same thermoformable material.

[0031] In one embodiment, the protruding members of the first zone are placed along the circumferential surface of a wheel, such that protruding members are arranged in a circumferential surface. This "protrusion gear" such that each protruding member is points perpendicularly to the circumferential surface of the wheel. This protrusion gear is attached to a drive shaft and is configured to couple with a second zone on a continuous belt or strap, so that the belt may be driven by the shaft and protrusion gear. The material for the belt is a flexible composite or rubber, while the wheel and the protruding members of the protrusion gear, is composed of a hard material such as rigid plastic, brass or steel.

[0032] In one embodiment, the protruding members may be anchored to a surface of a pouch-like container, and the flexible openings fashioned within a closing flap, so that the flap closes the container when the flexible openings engage the flexible openings. So that the protruding members and the flexible openings may be easily manipulated by hand, the head portions of the flexible openings may have maximum widths of 1/8 inch to 1/4 inch. A non-exclusive list of applications of this embodiment include a purse, a pack, or a handbag. The protrusions in such an embodiment may be composed of, for example, metal such as brass or a molded polymer that may be colored appropriately.

[0033] In one embodiment, the first zone is anchored to a first section of a garment, and the second zone is constructed in a second section of a garment that is removable attached to the first section. In this embodiment the dimensions of the invention would be similar to that of the pouch-like container, above, e.g., 1/4 inch to 1/4 inch so as to be easily manipulated by hand. In addition, the protruding members and or the flexible openings may have colored surfaces appropriate to the garment. A non-exclusive list of applications of this embodiment include a shoe buckle, skirt, trousers or slacks closure, and hat or helmet closure. As with the pouch, above, the protrusions may be composed of a metal such as brass or a molded polymer.

[0034] In one embodiment, the first zone and second zone are attached with the third zone as in the first embodiment, and the protruding members are constructed of sturdy, rigid plastic formed by injection-molding or else welded to the substrate of like material, the protruding members having a maximum width having a range e.g., 1/4 inch to 1/2 inch. This embodiment would serve as a dirt and sand resistant clamp to bind one object to another. This clamp may have either a continuous section of flexible openings in the second zone, or multiple fields of flexible openings (e.g., zone 2.1, zone 2.2, zone 2.3, etc.) spaced intermittently on the substrate. In this configuration, the clamp can be re-usably employed as a binder for multiple items (e.g. planks, pipes, paper, etc.).

[0035] In one embodiment, the substrate comprises a material with conductive properties for use with electronic circuits. The protruding members are constructed with maximum widths ranging from several millimeters to a few micrometers in order to make flexible connections of electronic circuits. These circuits can be used in applications where electronic modules are required to be mounted and dismounted from platforms, such as unmanned vehicles.

[0036] The invention would also include a method for detachable fastening a first surface to a second surface, including the steps of aligning protruding members with flexible openings in an elastic material, and the step of forcing the protruding members, the flexible openings permitting the head portions to pass through from a first side of the second surface to an opposite second side, and the elastic material contracting around the basal necking portions of the protruding members to detachably fasten the first surface to the second surface.

[0037] While the present invention has been described with reference to the particular illustrative embodiments, it is not to be restricted by those embodiments but only by the appended claims. It is to be appreciated that those skilled in the art can change or modify the embodiments without departing from the scope and spirit of the present invention.

1. A fastener, comprising:
   a first zone (10), having a first substrate (5) and protruding members (60) extending upward from the first substrate, the protruding members each having a head portion (65) with a maximum first width (d) and a basal necking portion (50) with a maximum second width (e) and connecting said head portion to said first substrate; and
   a second zone (20), having a second substrate with an elastic layer (100) having flexible openings (70) adapted to flex between a flexing width (f) and a resting width (g) wherein,
   the maximum first width (d) is greater than the resting width (g) and at most equal to the flexing width (f) and the protruding members are arranged to align with the openings so that, in an engaged configuration, each of the protruding members penetrates through one of the flexible openings to be engaged by the elastic layer of the flexible openings at the basal necking portion of the protruding members thereby to detachably fasten the first zone to the second zone.
2. The fastener according to claim 1, further comprising: a third zone (30) between the first zone (10) and the second zone (20), and connecting an end of the first substrate with an end of the second substrate; wherein, the third zone is free of flexible openings and protruding members, and the third zone comprises a flexible material to permit the protruding members of the first zone to engage with the flexible openings of the second zone.

3. The fastener according to claim 1, wherein the head portion (65) of the protruding members (60) is spherical with a diameter equal to the maximum first width.

4. The fastener according to claim 1, wherein the head portion (65) of the protruding members (60) has a rounded end portion opposite the necking portion (80).

5. The fastener according to claim 1, wherein the head portion (65) of the protruding members (60) has a pointed end portion opposite the necking portion (80).

6. The fastener according to claim 1, wherein the substrate and the protruding members of the first zone are formed from a common, thermofromable material.

7. A product, comprising:
   - a first surface area;
   - a second surface area; and
   - a fastener having a first zone (10) comprising a substrate (5) and a protruding member (60) extending upward from the substrate, the protruding member having a head portion (65) with a maximum first width (d) and a basal necking portion (80) connecting said head portion to said substrate with a maximum second width (e), and a second zone (20), comprising an elastic layer (100) having a flexible opening (70) adapted to flex between a flexing width (f) and a resting width (g), the first zone located within the first surface area, the second zone located within the second surface area, the fastener operable to fasten the first area to the second area by detachably coupling the protruding member with the flexible opening wherein the elastic layer of the flexible opening disengagably closes around the basal necking portion of the protruding member.

8. A container, comprising:
   - an opening; and
   - a closure affixed to the container and configured to close the opening of the container.

   the closure having a first zone (10) comprising a substrate (5) and protruding members (60) extending upward from the substrate, the protruding members each having a head portion (65) with a maximum first width (d) and a basal necking portion (80) connecting said head portion to said substrate with a maximum second width (e), and a second zone (20), comprising an elastic layer (100) having flexible openings (70) adapted to flex between a flexing width (f) and a resting width (g), the closure operable to fasten the first area to the second area by detachably coupling the protruding members with the flexible openings wherein the elastic layer of the flexible openings disengagably closes around the basal necking portion of the protruding members.

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