United States Patent [19]

Ausnit

[11] **3,918,131**

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[54] **FLUID-TIGHT FASTENER**

[76] Inventor: **Steven Ausnit,** 124 E. 61 St., New York, N.Y.

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[52] **U.S. Cl.** ..... **24/201 C**
[51] **Int. Cl.²** **A44B 19/10**
[58] **Field of Search** ..... 24/201 C

[56] **References Cited**

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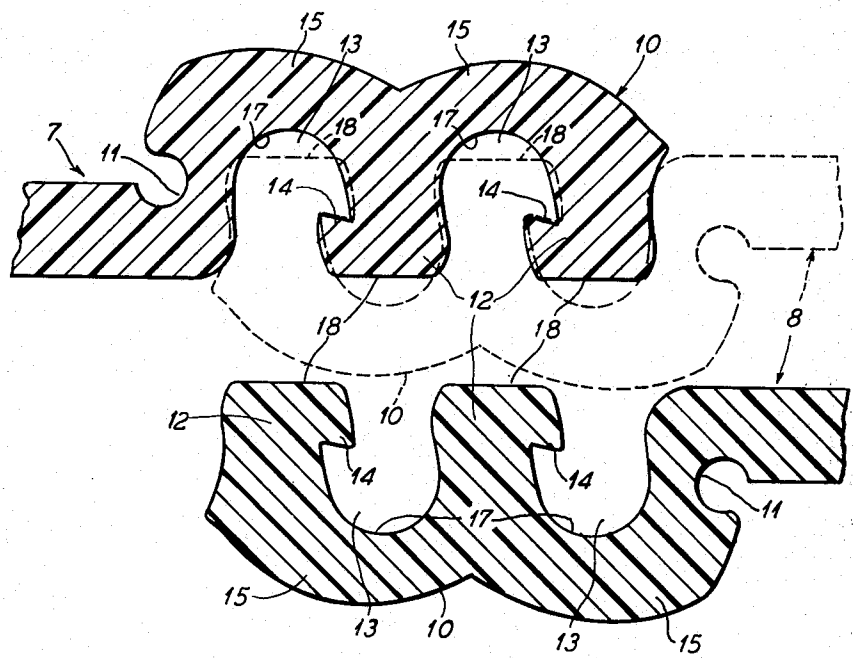
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Primary Examiner—Bernard A. Gelak
Attorney, Agent, or Firm—Hill, Gross, Simpson, Van Santen, Steadman, Chiara & Simpson

[57] **ABSTRACT**

A fluid-tight fastener comprising a pair of flexible closure strips each having a web portion and a marginal strip portion, at least the marginal strip portions being formed from strongly resilient material. The marginal strip portions have respective complementary longitudinal interlocking ribs and grooves, the ribs being wider than the grooves and the grooves deeper than the height of the ribs so that the ribs as received in the grooves cause the grooves to expand and bridges connecting the sides of the grooves to stretch and react under tension and to place the ribs under compression, whereby the ribs are sealingly gripped in fluid-tight relation within the grooves.

6 Claims, 4 Drawing Figures



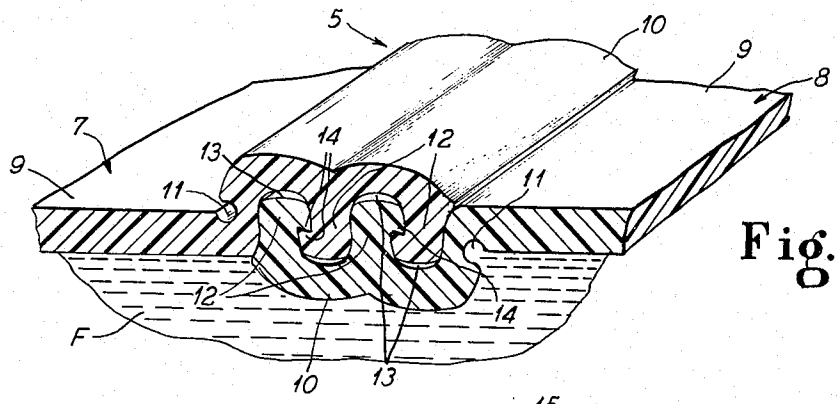


Fig. 1

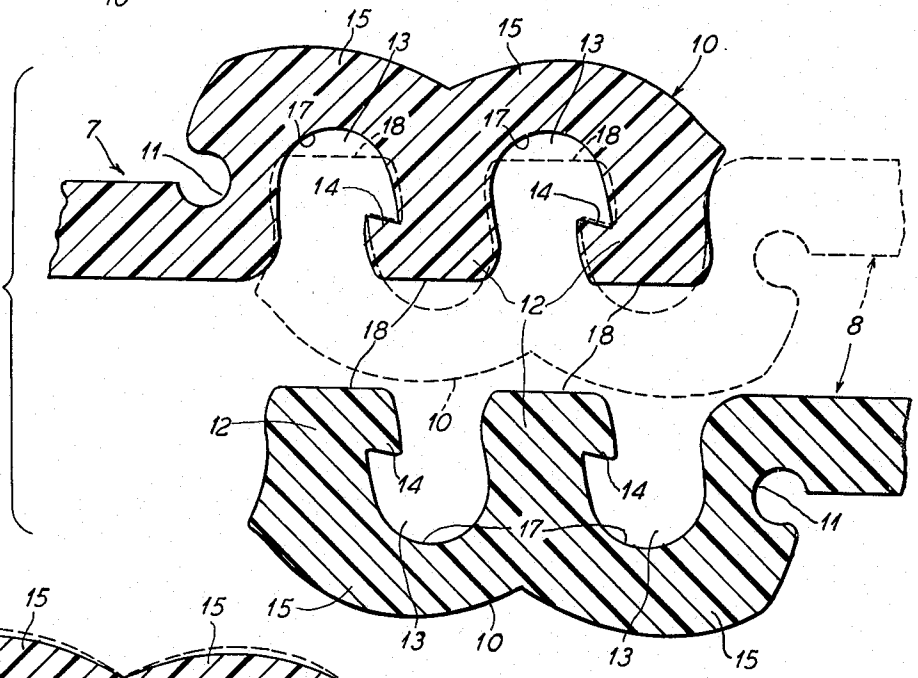


Fig 2

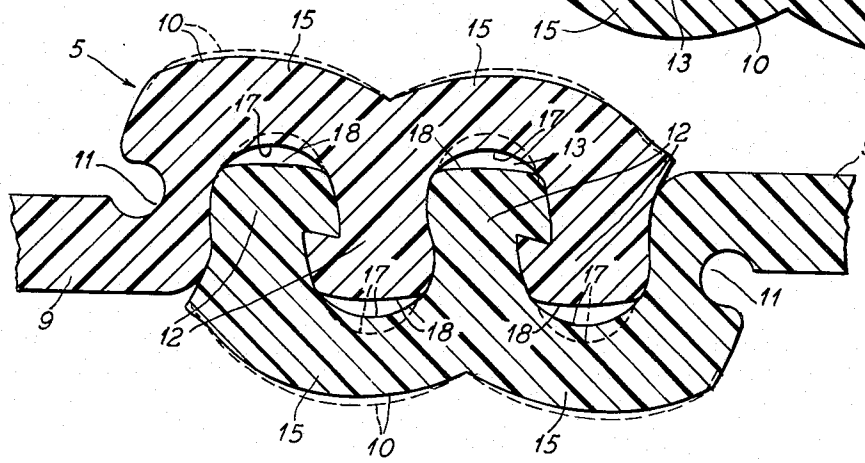


Fig. 3

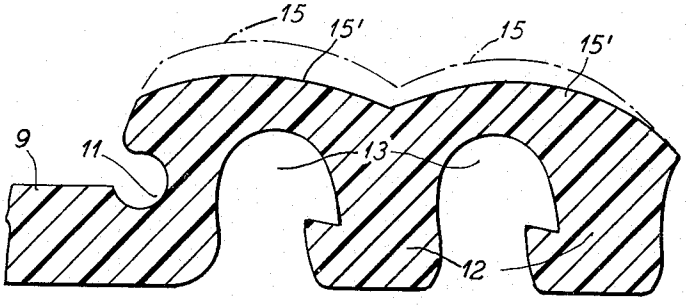


Fig. 4

FLUID-TIGHT FASTENER

This invention relates to improvements in resilient fasteners that provide flexible closures of a variety of different uses such as on brief cases, pouches, wrappers, and the like, and is specifically concerned with a new and improved fluid-tight fastener.

As heretofore constructed resilient fasteners of the type of the generally interlocking rib and groove structure, sometimes also referred to as slide fasteners, have generally been constructed with some looseness in the assembly. Representative of this type of fastener in the prior art is Madsen U.S. Pat. No. **2,713,421** wherein clearance is provided over the crowns of the ribs to enable the fastener strips to engage more readily as well as to permit relative sliding movement longitudinally between the strips.

Fasteners as just described are not leak proof so that where a fluid-tight (either vapor or liquid) closure is required some other type of closure would be required, although a resilient fastener might be more convenient and advantageous.

One manner of solving the problem is represented in prior patent to Staller U.S. Pat. No. **3,440,696.** Therein is disclosed the provision of a relatively soft sealing thermoplastic substance placed under compression during engagement of the rib and groove elements. However, that solution complicates manufacture of the fastener, requiring bringing together of materials of different durometer characteristics, rather than making the fastener from a single material as is conventional practice.

Accordingly, there has been a long felt need for a fluid-tight fastener which will provide a vapor lock or hermetic seal, but which can be manufactured according to conventional practices comprising extruding the parts from a suitable plastic material of uniform characteristics suitable for the intended purpose.

An important object of the present invention is to provide a new and improved resilient fluid-tight fastener which may be used as a closure for pouches, containers, wrappers, and the like, for enclosing articles and substances that must be protected against atmospheric, water or other deteriorating conditions or, on the other hand, must retain within the enclosure a fluid substance without any leakage hazard.

Another object of the invention is to provide a new and improved fluid-tight fastener which automatically provides a fluid barrier between sheeting sections upon securing interlocking groove and fastener elements secured thereto.

A further object of the invention is to provide a new and improved resilient fastener wherein a novel tensioning and compression relationship is provided in the closed fastener such that the elements thereof provide with the other portions of the fastener a fluid-tight barrier.

Still another object of the invention is to provide a new and improved fluid-tight fastener which can be manufactured according to conventional techniques from preferred conventional materials and to be manipulated into closed and open conditions by conventional means, but which automatically seals against fluid leakage therethrough in the assembled condition of the fastener.

Other objects, features and advantages of the invention will be readily apparent from the following description of certain preferred embodiments thereof, taken in conjunction with the accompanying drawing although variations and modifications may be effected without departing from the spirit and scope of the novel concepts embodied in the disclosure, and in which:

FIG. **1** is a fragmentary sectional isometric view illustrating a fluid-tight fastener embodying features of the invention;

FIG. **2** is an exploded assembly view of the fastener showing the same with the complementary portions thereof separated and schematically illustrating certain features contributing to the new and improved results attained with this fastener;

FIG. **3** is an enlarged sectional view through the fastener assembled together and schematically illustrating how the parts of the fastener stretch in the assembly to attain the desirable compressive sealing reaction therein; and

FIG. **4** is a transverse sectional view showing a modification.

On reference to FIG. **1** a fluid-tight fastener **5** embodying features of the invention is depicted comprising a pair of complementary flexible closure strips **7** and **8** each of which has a web portion **9** provided with a marginal strip portion **10.** Although the web portion **9** and the marginal strip portions **10** may be constructed from different materials, but with at least the marginal strip portions **10** formed from strongly resilient material, in the construction shown both the web portions **9** and the marginal strip portions **10** are formed integrally in one piece as an extrusion made from a suitable durometer thermoplastic material. Relative flexing movement between the portions **9** and **10** of each of the strips is facilitated by the provision of a longitudinal groove **11** between the web portion **9** and the marginal strip portion **10** in each instance.

For separable interlocking of the marginal strip portions **10** they are provided with respective, complementary longitudinal interlocking ribs **12** and grooves **13.** Each of the marginal strip portions **10** is provided with at least one rib **12** and one groove **13,** but in a preferred arrangement as shown, each of the marginal strip portions has two ribs and corresponding grooves. Each of the ribs **12** has arcuate sides generally complementary to arcuate sides of the groove **13** in which received, and an undercut tooth formation **14** along one side thereby forming an enlarged head and which is complementary to and releasably interlockingly interengagable with the like tooth along one side of the groove **13,** provided by the head of the counterpart rib **12** in the fastener assembly.

According to the present invention, the construction and relationship of the interlocking ribs **12** and grooves **13** is such that in the assembled relationship the ribs **12** are sealingly gripped in fluid-tight relation within grooves **13.** For this purpose, the ribs **12** are of solid form-retaining, construction (although resiliently flexible) and are wider than the normal width of the grooves **13** so that the ribs as received in the grooves cause the grooves to expand and areas of the marginal strip portions **10** at the grooves to stretch and react under tension to place the ribs **12** under compression. On reference to FIG. **2,** for example, it will be observed by comparing the full line and the dash line representations of the strips **7** and **8** that the sides of the grooves in the unassembled normal condition of the marignal strip portions **10** are significantly narrower than the width of the

ribs **12.** Therefore, when the ribs **12** are forced into the grooves **13** until the teeth **14** interlock, the sides of the grooves **13** must move apart to accommodate the mass of the inserted ribs **12.** This causes areas of the marginal strip portions **10** at the grooves, and more particularly bridge portions **15** of the marginal strip portions **10** connecting the ribs **12** with one another and with the web portions **9** to stretch and elongate transversely, as indicated by the full line showing in FIG. **3** as compared to the dot-dash illustration therein. By reason of the resilient characteristics of the material of the fastener, such stretching causes a corresponding reaction due to the tension generated tending to pull the sides defining the grooves **13** back toward their normal position, resulting in placing the sides of the ribs **12** under compression between the sides defining the grooves. As a result, the side surfaces of the ribs **12** and of the grooves **13** are in tight gripping relation and effectively hermetically seal the fastener **5.**

To facilitate the stretching and tensioning of the bridges **15,** the relative shape and relationship of root surfaces **17** in the grooves **13** and confronting crown surfaces **18** on the heads of the interlocking ribs **12** are so relatively shaped as to leave freedom of relative movement therebetween during the assembly of the ribs into the grooves. To this end, the root surfaces **17,** in the grooves **13,** are arched away from the ultimate position of the crown surfaces **18** and further, the crown surfaces **18** are relatively flattened so that a spaced relationship between the root surfaces and the crown surfaces persists after assembly has been completed, as is seen in FIGS. **1** and **3.** It will be observed that while the crown surfaces **18** remain substantially in their original shape, the root surfaces **17** tend to flatten somewhat and pull in toward the crown surfaces **18** as the bridge areas **15** pull in toward said crown surfaces **18** by reason of the stretching of the bridge areas.

A reasonable degree of control upon the stretching characteristics of the bridge material of the interlocking marginal portions of the fastener may be effected by the thickness of the bridge in any instance. For example, in FIG. **4** the bridges **15'** are shown in full line as substantially thinner than the bridges **15** indicated in dot dash line and corresponding to the bridges in the form of FIGS. **1–3.** In other respects the fastener remains the same and therefore identical reference numerals indicate identical parts according to foregoing description. Thus by having the bridges **15'** thinner, a softer easier stretch is attained. Of course, by the same token, by increasing the thickness of the bridge in any instance increased resistance to stretching and a tighter leak-proof grip on the interlocking ribs can be attained, though if the bridge is too thick, no stretching will be possible and the fastener will not close.

In any form of the invention, the fastener is adapted to be opened and closed by means of any preferred form of slider. When closed, a thorough hermetic seal is provided against internal or external leakage of fluid F, shown for illustrative purposes in FIG. **1** as a liquid on one side only of the fastener. The fluid F may, of course, be on both sides of the fastener where mixing or contamination of one fluid by another must be avoided as, for example, where a sealed package containing fluid must be stored or transported in another fluid. Also, the fluid may be in a vapor or a gaseous phase or liquid phase.

It will be understood that variations and modifications may be effected without departing from the spirit and scope of the novel concepts of this invention.

I claim as my invention:

1. A fluid-tight fastener, comprising:

a pair of flexible closure strips each having a web portion and provided with a marginal strip portion;

at least said marginal strip portions being formed from strongly resilient materials;

one of said marginal strip portions having at least one solid form-retaining longitudinal rib provided with an undercut interlacking tooth along one side thereof thereby forming an enlarged head, said head having a relatively flattened crown surface and arcuate sides;

the other of said marginal strip portions having a longitudinal groove with an undercut longitudinal tooth along one side thereof, said groove having an arcuate root surface, said groove also having arcuate sides generally complementary to said arcuate sides of said head;

said rib being releasably engaged in said groove with said teeth in interlocked engagement and with said arcuate root surface and said crown surface forming a space therebetween;

said rib being wider than the normal width of the groove and causing the groove to expand laterally; and

a bridge of said other marginal strip portion joining the opposite sides of the groove and including said arcuate root surface overlying said crown surface of said rib, said bridge being stretched by the lateral expansion of the groove and thereby reacting under tension to draw said groove sides tightly against the rib;

whereby the rib is sealingly gripped in fluid-tight relation by and between said groove sides.

2. A fastener according to claim **1,** wherein said bridge is deflected toward the crown surface of the rib in the stretched tensioned condition of the bridge.

3. A fastener according to claim **1,** wherein the stretching tension of said bridge is controlled by the thickness of the bridge.

4. A fastener according to claim **3,** wherein said bridge is relatively thin so that the bridge is stretched with only moderate tension.

5. A fastener according to claim **3,** wherein said bridge is relatively thick and the stretching thereof effects a strong tensioned reaction for gripping of the rib.

6. A fastener according to claim **1,** wherein each of said marginal strip portions has a plurality of said longitudinal ribs and a corresponding plurality of said longitudinal grooves and bridges, with the ribs of each of said marginal strip portions received in and expanding the grooves in the opposite marginal strip portion, and thereby providing multiple rib and groove gripping fluid-tight sealing of the fastener.

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