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SLIDE FASTENER

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Fig. 1

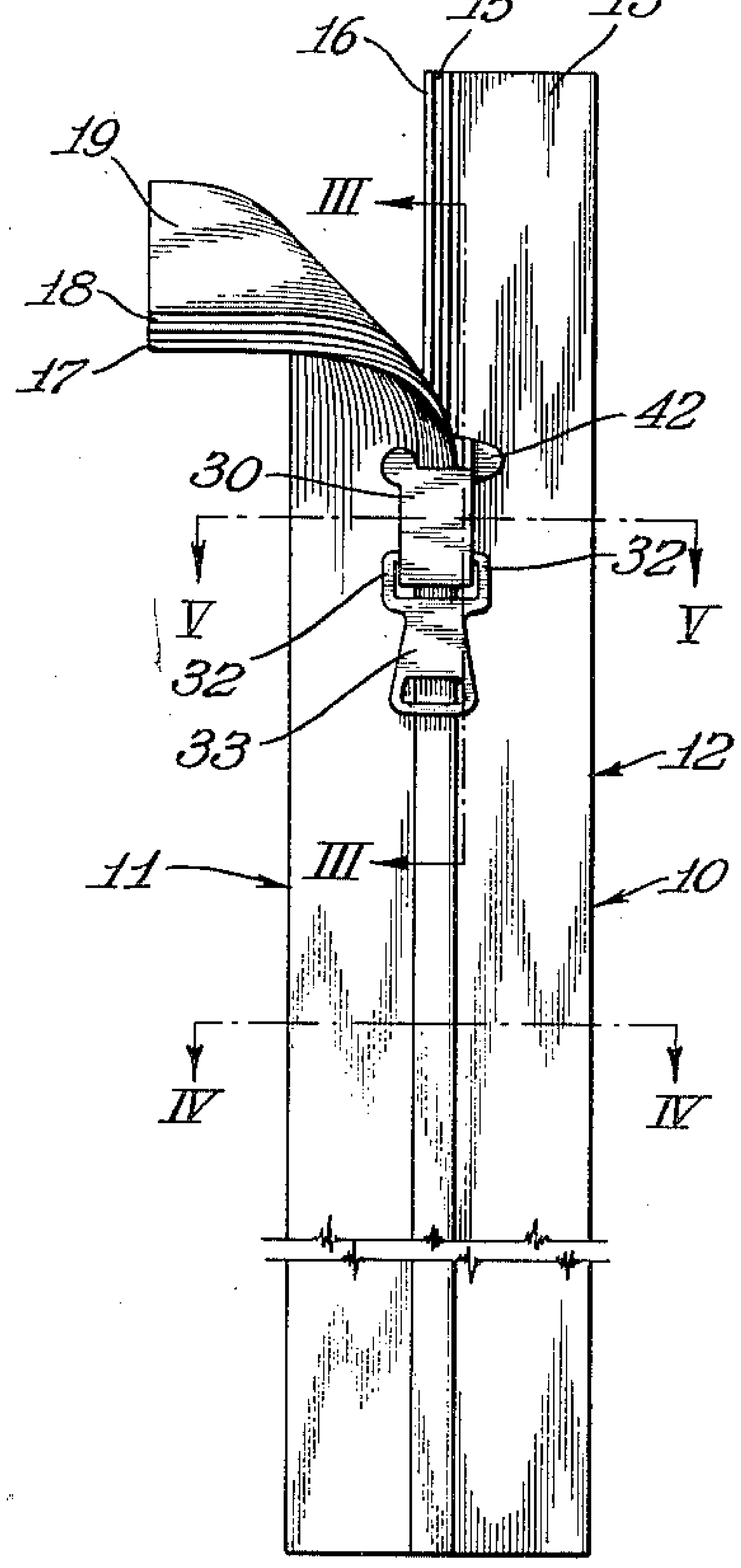


Fig. 2

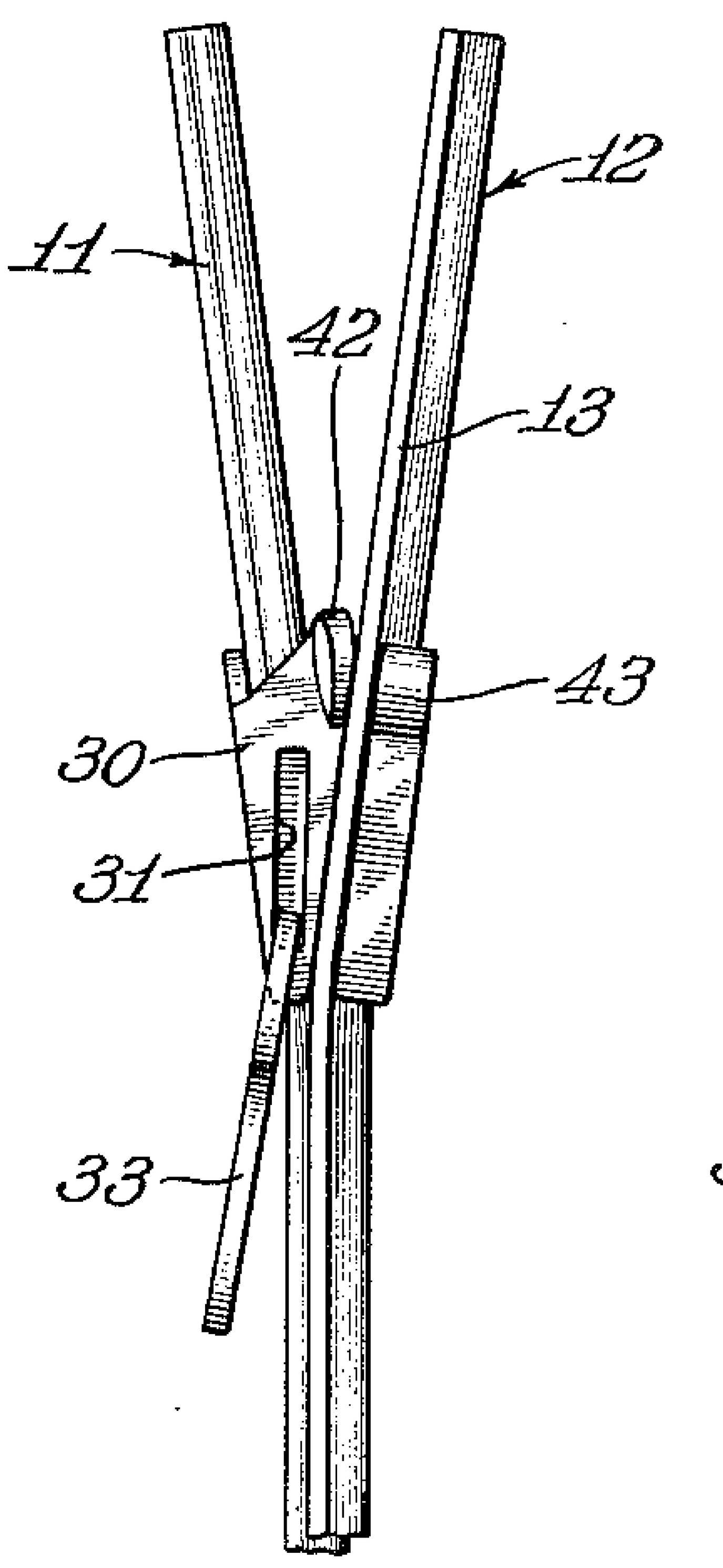


Fig. 3

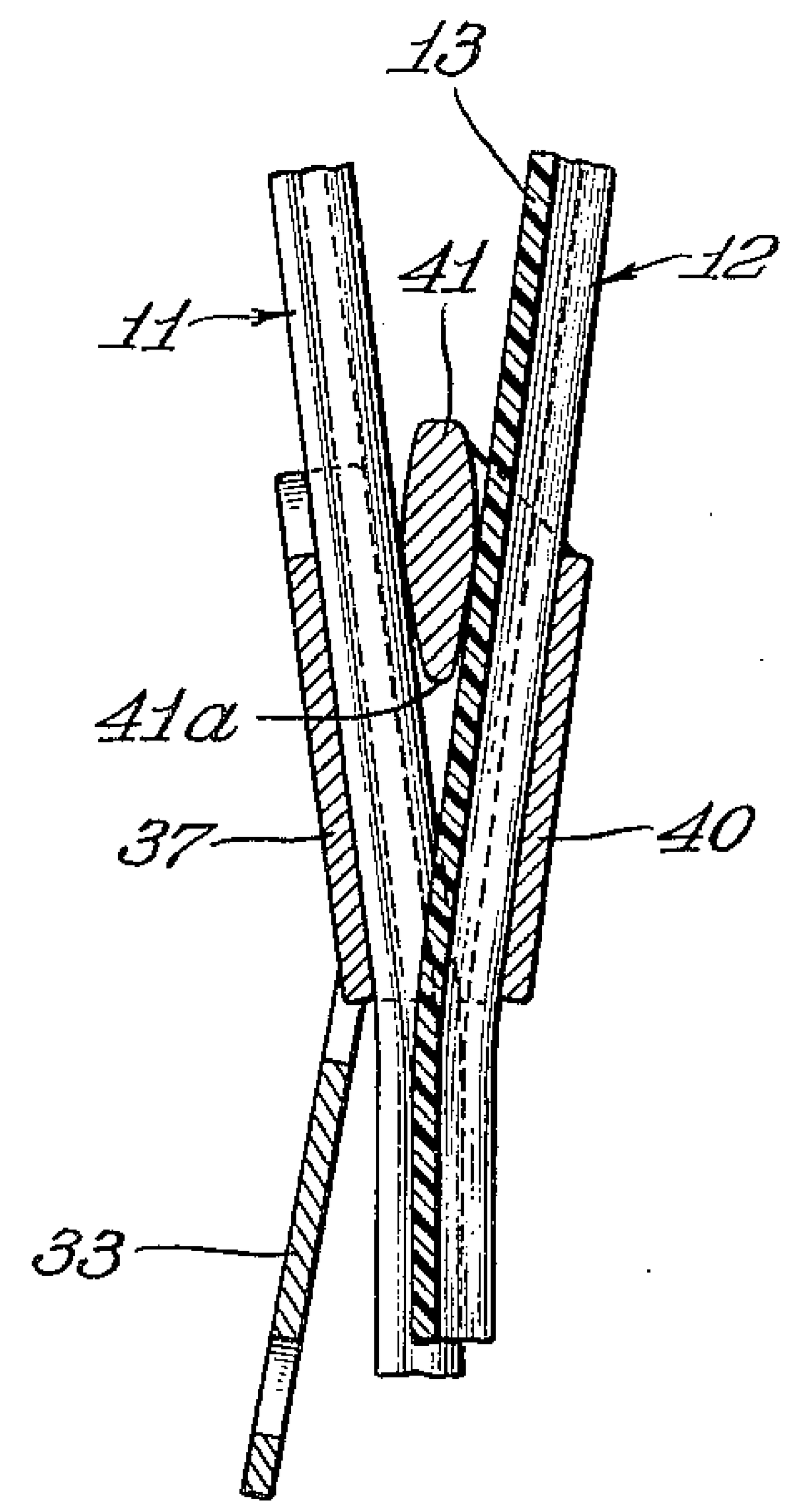


Fig. 5

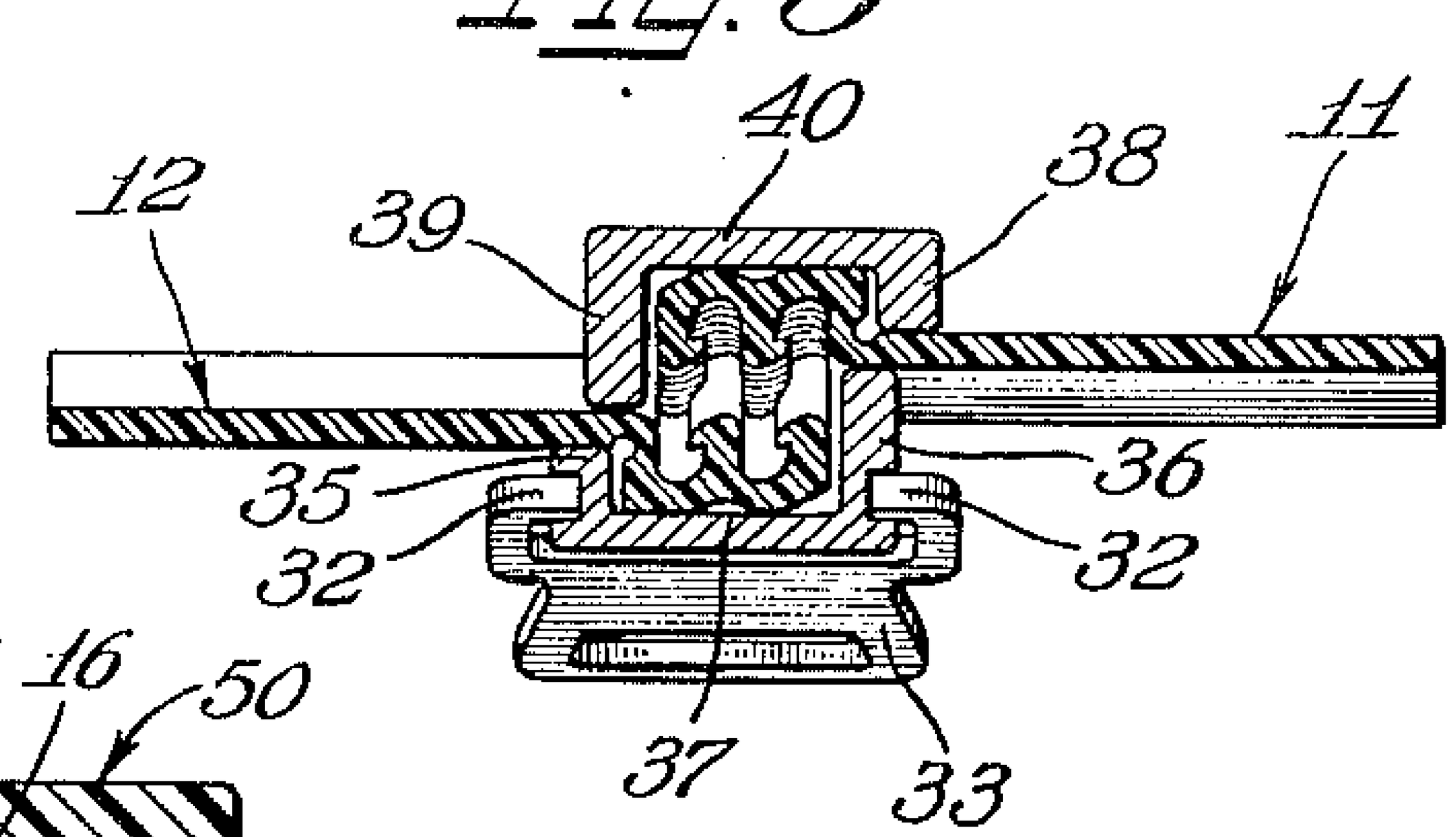
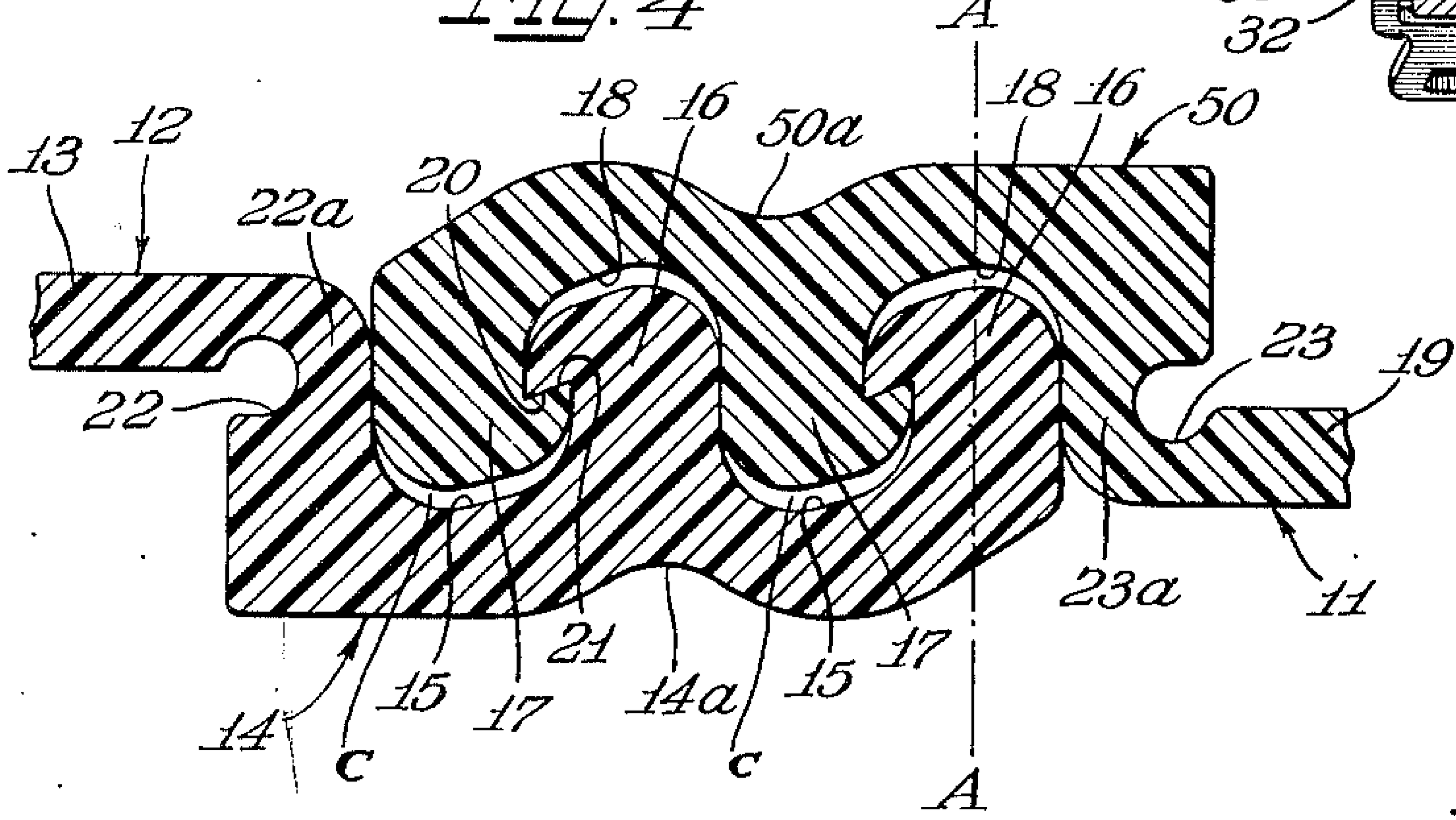


Fig. 4



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UNITED STATES PATENT OFFICE

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SLIDE FASTENER

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6 Claims. (Cl. 24—201)

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The present invention relates to a slide fastener of the type commonly used to join confronting edges, as for instance the edges of covering material generally and of fabric in garments and wearing apparel of any description.

An obvious disadvantage of using metallic slide fasteners arises from the common annoyance occasioned by folds of the fabric becoming engaged between the closely-spaced projections or teeth on the metallic slide fasteners. When portions of fabric are lodged between these projections, the movement of the slide is impaired, and fabrics are very often torn in attempting to remove the portion of the fabric engaged between the projections. Another disadvantage of slide fasteners having metallic runs arises from the fact that water may permeate the fastener and contact the fabric beneath the fastener.

The present invention overcomes all of the above noted disadvantages in both the metallic and the rubber-type slide fasteners. The slide fastener of the present invention consists of two interengaging strips composed of a resilient material, such as an organic plastic which can be conveniently fabricated in strip form through a process of extrusion. In a preferred embodiment of the present invention, the two coacting strips are made identical, each of the strips being provided with an alternate series of channels and projections so that the strips may be interlocked by inverting one of the strips with respect to the other, and engaging the projections of one strip in the corresponding channels of the other. This feature of using identical strips in the manufacture of the slide fastener is particularly important from the standpoint of ease of manufacture. The material for the strips may be extruded through a suitable die as a continuous strip, after which appropriate lengths may be cut from the strips and used in a pair of mating strips.

The strips making up the interlocking portions of the slide fastener assembly consist of a relatively flat web portion with an offset longitudinal marginal edge portion of greater thickness than the web portion and having an alternate series of longitudinally extending channels and rib-like projections therealong. Each of the projections is preferably formed with a reentrantly inclined edge portion which interengages a similarly inclined reentrant edge portion of a projection on the opposite strip.

One of the important features of the projections employed in the slide fastener of the present invention is that their major axes, i. e., the mid-

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lines of the heights of the projections, are substantially perpendicular to the plane of the web. This feature is particularly important in preventing accidental disengagement of the two strips by forces acting transversely of the line of fasteners and in opposite directions along the plane of the web. With this arrangement, there is no component of such forces tending to disengage the two strips from their interlocking engagement.

Another important advantage realized by the particular configuration of the interengaging projections of the slide fastener is the absence of any binding action between the projections in their engaged position that would prevent relative lengthwise movement between the strips. While the strips are held rigidly against accidental disengagement, as previously explained, the engagement is such that the strips are still free to slide relative to each other longitudinally.

It is, then, an object of the present invention to provide an improved slide fastener forming when closed a waterproof closure.

Another object of the present invention is to provide a slide fastener which can be conveniently and economically fabricated from an extruded strip of organic plastic material.

Still another object of the present invention is to provide improved slide fastener strips having interengaging projections that are relatively rigid yet sufficiently flexible to give slightly under the action of forces tending to disengage them, and having web portions that are locally rendered sufficiently flexible to give and aid in the disengagement of the projections by a force substantially perpendicular to the plane of the web of the fastener.

Another object of the present invention is to provide a slide fastener including two interengaging strips of identical configuration, each of the strips having specially designed projections therefrom which interengage tightly to resist displacement by forces acting in directions transversely of the line of the projections, while still permitting relative sliding movement between the strips.

Other objects and features of the present invention will be apparent to those skilled in the art from a consideration of the attached sheet of drawings, in which:

Figure 1 is a plan view of a slide fastener assembly embodying the present invention, with the runner closing the major length of the fastener strips but with portions of the strips separated

and one strip bent back to show the ridge and channel arrangement in that strip;

Figure 2 is an enlarged, fragmentary side view of the assembly shown in Figure 1;

Figure 3 is an enlarged, fragmentary cross-sectional view of the assembly taken along the line III—III of Figure 1;

Figure 4 is a greatly enlarged fragmentary cross-sectional view of the interengaging strips of the slide fastener taken along the line IV—IV of Figure 1; and

Figure 5 is an enlarged cross-sectional view taken through the slide fastener assembly, as indicated by the line V—V of Figure 1.

As shown on the drawing:

Reference numeral **10** denotes generally the slide fastener assembly of the present invention, including a pair of identical interengaging strips **11** and **12**. Each of the strips **11** and **12** can be conveniently fabricated by extrusion through a suitable die, followed by severing the extruded strip to appropriate lengths.

Suitable materials for manufacturing the strips **11** and **12** include the thermoplastic and thermosetting organic resins. Of particular importance for this use are the vinyl type resins such as polyvinyl chloride, polyvinyl acetate, polyvinyl chloride-polyvinyl acetate copolymers, and similar vinyl resins. Polymerized olefinic resins such as polyethylene are also useful starting materials. Rubber, either natural or synthetic, is not a preferred starting material, since, in the case of rubber, it is more difficult to control the degree of rigidity necessary to provide good interlocking engagement between the strips. However, by proper compounding and vulcanizing of rubber the degree of rigidity can be controlled to make rubber acceptable for the purposes of the invention.

The strip **12** includes a substantially flat, thin web portion **13** and an offset longitudinal marginal portion **14** substantially thicker than the thickness of the web **13**. Formed in the marginal portion **14** are an alternate series of pairs of channels **15** and solid rib-like projections **16**, both pairs of which extend in parallel relationship the full length of the strip. The corresponding marginal portion **50** on the strip **11** is provided with identical projections and channels **17** and **18**, respectively, and the strip **11** has a substantially flat web portion **19**. The projections and channels are of identical shape in cross-section, so that the projections of one strip are received in and nest with the channels of the other, and vice versa, when the strips are overlapped and a fastener closed.

The configuration of the projections and channels is best illustrated in the magnified view of Figure 4. As shown in that figure, the major height axis, indicated by the broken line A—A, of each of the projections **16**, and, of course, of the projections **17**, is substantially perpendicular to the planes of the webs **13** and **19**. This feature is important in that when forces are applied in opposite directions to the webs **13** and **19**, along the plane of the webs, there is no tendency for the projections to become disengaged.

The projections **16** and **17** include a substantially rigid smoothly contoured body portion and an overhanging portion that is tooth-like in cross-section and has a reentrantly inclined surface extending the length of the strip. These reentrantly inclined surfaces are indicated at **20** with respect to the pair of projections **16** and at **21** with respect to the pair of projections **17**.

The surfaces **20** and **21** are preferably plane and each reentrant surface slopes away from the height axis of its projection toward the bottom of the adjacent groove which said reentrant surface overhangs. The surfaces of the marginal portions **14** and **50** opposite the head end of the projections **16** and **17** are slightly recessed, as indicated at **14***a* and **50***a*, for increasing the flexibility of the marginal portions.

As will be obvious from an inspection of Figure 4, when the fastener strips are in mated engagement the projections **17** on one of the strips are nested within the corresponding channels **15** of the other strip, with the reentrantly inclined surfaces **20** and **21** in opposed relationship and in abutting contact with each other. It will be noted that when the strips are nested and the reentrant surfaces are in opposed abutting contact, there is clearance between the ends of the projections and the bottoms of the corresponding channels, as indicated at **C**. This clearance enables lengthwise flexing without separation of the strips. The resulting engagement is quite firm, while at the same time permitting relative sliding movement longitudinally between the strips **11** and **12**.

Due to the relative thickness of the body portions of projections **16** and **17**, the flexibility of the projection body portions is not particularly great. To facilitate disengagement of the projections upon opening of the fastener requires the tooth-like portions to have some degree of resiliency and flexibility, however, and this is accomplished by proper dimensioning and shaping of the tooth-like portions. Preferably, the included angle of the points of the tooth-like portions is less than 90°, thereby making the points themselves relatively flexible and capable of giving slightly during the act of disengagement. In addition, each of the strips **11** and **12** is provided with localized areas of increased flexibility to facilitate disengagement of the projections. In the form of the invention shown in the drawings, the increased resiliency in the strips is attained by providing a longitudinally extending groove **22** at the side of the web portion **13** along the area in which the web **13** is joined to the offset thickened marginal portion **14**. A similar groove **23** is formed in the strip **11**. The reduction in thickness occasioned by providing the grooves **22** and **23** results in increased flexibility at the juncture between the respective web portions and the offset marginal portions, so that disengagement of the projections is facilitated by a lateral shifting of the strips **11** and **12** in a separating direction, thereby permitting the abutting reentrantly inclined surfaces **20** and **21** to slide along each other until they are in contact with each other only at their points, which then flex under forces tending to pull the strips apart in a direction perpendicular to the plane of the webs. During such disengagement, the walls **22***a* and **23***a* of the webs **13** and **19** are flexed in a direction away from each other and toward the grooves **22** and **23** to afford room for the lateral shifting of the inclined surfaces **20** and **21** that has been referred to.

The structure of the runner which functions to engage and disengage the interlocking strips is illustrated in Figures 1, 2, 3 and 5. As shown in these figures, the runner structure includes a traveling slide member **30** having therein a pair of elongated slots **31** (Figure 2) for receiving the bifurcated arms **32** of a finger grip member **33**.

The slide member 30 includes a pair of opposed lateral guide walls 35 and 36 joined by an inclined inner guide wall 37. The opposed guide walls 35 and 36 and the inclined inner wall 37 define an enclosure which is adapted to enclose the marginal portion 14 of the strip 12, as shown in Figure 5.

On the opposite face of the slide fastener assembly the slide member 30 includes a pair of opposed lateral guide walls 38 and 39 joined by an inclined outer wall 40. Extending between the two enclosures formed by the various wall portions is a transverse member 41 (Figure 3). The leading edge 41*a* of the transverse member 41 is shaped to provide a wedge which functions to disengage initially the interlocking strips. As best seen in Figure 5, the width of the space enclosed by the various wall portions is slightly greater than the width of the offset marginal portions 14 and 50 of the two strips 12 and 11. This leaves the portions 14 and 50 free to expand slightly laterally upon interengagement or disengagement of the two strips, without causing the slide to bind against the edges of the engaged marginal portions.

As illustrated in Figure 2, the slide body also includes a pair of offset opposed tabs 42 and 43 which engage the web portions 13 of the strip 12 to guide the strip through the slide after the wedge-shaped member 41 disengages the interlocked strips. It will be appreciated that similar tabs are provided to bear against the opposite web 19.

The operation of the slide fastener should be apparent from an inspection of Figure 5. As the slide member 30 is moved along the engaged strips 11 and 12, the transverse wedge member 41 forces the strips 11 and 12 apart, and the strips are guided in angular directions due to the angular arrangement of the tabs 42 and 43. Similarly, in closing the slide fastener, the divergent strips 11 and 12 are guided into alignment between the angularly disposed inner and outer walls 37 and 40, where they are forced into engagement.

The slide fastener of the present invention will find use in various coverings such as garments, brief cases, waterproof covers, and numerous other articles which now employ conventional metallic slide fasteners. Where it is desired to provide bottom stops to limit the run of the slide member, if the strips are of thermoplastic material, the two interlocking strips can be spot-welded together at one end of the run merely by localized application of heat. Alternatively, the two strips can be sewed together at the bottom of the run while they are meshed together by ordinary stitching. Similarly, top stops can be provided by cutting a small portion off the plastic strip and training the same about edge portions of the strips at the top of the run, and thereafter heat-welding the strips about the edges.

From the foregoing, it will be appreciated that I have herein provided a novel type of slide fastener which has many inherent advantages over the slide fasteners conventionally used. While the engaging portions of the slide fastener are made of resilient material, the construction is such that the engagement between the strips is quite firm and sufficient to resist effectively disengagement of the strip by lateral forces. The types of resins which may be employed in making the slide fastener of the present invention can be extruded to give very smooth surfaces and can be colored by the use of compatible pigments to make the slide fastener a neat, attractive accessory.

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

I claim as my invention:

1. A fastener comprising a pair of flexible strip portions, each strip portion having a web portion and a thickened marginal portion, said marginal portions being of substantially identical cross-section but reversed when in overlapping relation, each marginal portion having parallel channels and projections alternating with each other, the median planes of said web portions passing through said projections when said fastener is closed, each of said projections having a reentrant surface sloping away from the height axis of such projection toward the bottom of the adjacent groove which said reentrant surface overhangs, said reentrant surfaces of the projections on one marginal portion being in opposed abutting relationship with matching reentrant surfaces on the other marginal portion when said fastener is closed and resisting oppositely applied forces tending to effect the opening of said fastener.

2. A fastener comprising a pair of flexible strip portions, each strip portion having a web portion and a thickened marginal portion, said marginal portions being of substantially identical cross-section but reversed when in overlapping relation, each marginal portion having parallel longitudinally extending projections and channels with a projection intermediate two channels and a second projection at the free edge of each marginal portion, said marginal portions having longitudinally extending recesses on the side thereof opposite said intermediate projections to increase the flexibility of said marginal portions, the median planes of said web portions passing through said projections when said fastener is closed, each of said projections having a reentrant surface sloping away from the height axis of such projection toward the bottom of the adjacent groove which said reentrant surface overhangs, said reentrant surfaces of the projections on one marginal portion being in opposed abutting relationship with matching reentrant surfaces on the other marginal portion when said fastener is closed and resisting oppositely applied forces tending to effect the opening of said fastener.

3. A fastener comprising a pair of flexible strip portions, each strip portion having an integral web portion and an integral thickened marginal portion, said marginal portions being of substantially identical cross-section but reversed when in overlapping relation, each marginal portion having parallel channels and projections alternating with each other, the median planes of said web portions passing through said projections when said fastener is closed, each of said projections having a reentrant surface sloping away from the height axis of such projection toward the bottom of the adjacent groove which said reentrant surface overhangs, said reentrant surfaces of the projections on one marginal portion being in opposed abutting relationship with matching reentrant surfaces on the other marginal portion when said fastener is closed and resisting oppositely applied forces tending to effect the opening of said fastener, all of said channels being of the same depth and all of said projec-

tions being of the same height but there being clearances between the head ends of said projections and the bottoms of said channels when the projections are interengaged with their reentrant surfaces in contact with each other.

4. A fastener comprising a pair of flexible strip portions, each strip portion having a plane web portion and a thickened marginal portion, said marginal portions being of substantially identical cross-section but reversed when in overlapping relation, each marginal portion having parallel channels and projections alternating with each other, the median planes of said web portions passing through said projections when said fastener is closed, the depth and height axes of said channels and projections respectively being generally perpendicular to the plane of their respective web portions, each of said projections having a reentrant surface sloping away from the height axis of such projection toward the bottom of the adjacent groove which said reentrant surface overhangs, said reentrant surfaces of the projections on one marginal portion being in opposed abutting relationship with matching reentrant surfaces on the other marginal portion when said fastener is closed and resisting oppositely applied forces tending to effect the opening of said fastener.

5. A fastener comprising a pair of flexible strip portions formed of resilient heat weldable plastic material, each strip portion having a plane thin web portion and an integral thickened marginal portion, said marginal portions being of identical shape in cross-section but reversed when in overlapping relation for interengagement, each marginal portion having longitudinally extending parallel channels and solid rib-like projections alternating with each other, the median planes of said web portions passing through the projections when said fastener is closed, each of said projections having an enlarged head portion and a restricted neck portion forming an adjacent complementary channel with a restricted opening and an enlarged bottom, each projection having a plane reentrant surface sloping away from the height axis of such projection toward the bottom of such adjacent channel to provide the head of such projection with a tooth-like portion overhanging such adjacent channel, said reentrant surfaces on the projections of one marginal portion being in opposed abutting contact relationship with matching reentrant surfaces on the other marginal portion when said fastener is closed and resisting oppositely applied forces tending to effect the opening of said fastener.

6. A fastener comprising a pair of flexible strip portions formed of resilient material, each strip portion having a plane thin web portion and an integral thickened marginal portion, said marginal portions being substantially identical in size and shape but reversed when in overlapping interengagement, each marginal portion having longitudinally extending parallel channels and solid rib-like projections alternating with each other with a projection intermediate two channels and a second projection at the free edge of each marginal portion, there being a longitudinally extending recess on the side of said marginal portion opposite said intermediate projection to increase the flexibility of said marginal portions, the median planes of said web portions passing through the projections when said fastener is closed, each of said projections having an enlarged head portion and a restricted neck portion forming an adjacent complementary channel with a restricted opening and enlarged bottom, each projection having a reentrant surface sloping away from the height axis of said projection toward the bottom of said adjacent channel to provide the head of said projection with a pointed tooth-like portion of less than 90° included angle overhanging said adjacent channel, said reentrant surfaces on the projections of one marginal portion being in opposed abutting contact relationship with matching reentrant surfaces on the other marginal portion when said fastener is closed and resisting oppositely applied forces tending to effect the opening of said fastener.

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