

(19) **DANMARK**

(10) **DK/EP 1353578 T3**



(12) **Oversættelse af
europæisk patentskrift**

Patent- og
Varemærkestyrelsen

-
- (51) Int.Cl.: **A 44 B 19/16 (2006.01)** **B 31 B 23/60 (2006.01)** **B 65 D 33/24 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2015-07-27**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2015-05-20**
- (86) Europæisk ansøgning nr.: **01959332.6**
- (86) Europæisk indleveringsdag: **2001-07-30**
- (87) Den europæiske ansøgnings publiceringsdag: **2003-10-22**
- (86) International ansøgning nr.: **US2001023913**
- (87) Internationalt publikationsnr.: **WO2002013649**
- (30) Prioritet: **2000-08-10 US 636421**
- (84) Designerede stater: **AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR**
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- (54) Benævnelse: **Skyderbetjent fastgørelseselement med fordybninger anbragt med mellemrum og tilhørende præpakninger**
- (56) Fremdragne publikationer:
US-A- 5 067 208
US-A- 5 131 121
US-A- 5 161 286
US-A- 5 273 511
US-A- 5 405 478
US-A- 5 448 807
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DESCRIPTION

FIELD OF THE INVENTION

[0001] The present invention generally relates to reclosable plastic bags and, more particularly, to a slider-operated fastener with spaced notches and associated preseals.

BACKGROUND OF THE INVENTION

[0002] US 5,273,511 discloses a method for providing a welded side-seam area in a plastic bag or package having interlocking male and female profile sections on plies of plastic sheeting material which includes the provision of cutouts through one of the male and female profile sections and continuous plastic sheeting material at pre-selected intervals there along. The valves, which may be provided by a seal bar or jars are provided along lines including or passing through the cutouts. A thinner and more leak resistant system side-stream area between bags or packages is the result.

[0003] In one method of making reclosable plastic bags, a continuous fastener is sealed to a moving web of thermoplastic film. To form individual bags, the web is folded along a fold parallel to the direction of web movement, and the folded web is sealed at bag-width distances apart along side seals that are generally transverse to the direction of web movement. To facilitate opening and closing the fastener, sliders are preferably applied to the fastener at bag-width distances apart.

[0004] The fastener includes a pair of interlocking profiles and a pair of fins/flanges extending downward from the respective profiles. In one technique for installing sliders on the fastener, notches are formed in the fastener at bag-width distances apart. The side seals, which are formed later in the bag manufacturing process, are aligned with the respective notches. To install a slider on the fastener via a respective notch, the slider is first positioned within the notch while the web is temporarily stopped, and then the slider is threaded onto an end of the fastener in response to relative movement of the slider and fastener.

[0005] To form a notch, a short segment of the interlocked profiles and an upper portion of the fins extending from that segment are cut away from the fastener, leaving only a lower portion of the fins bridging opposite sides of the notch. Due to the removal of most of the fastener at the notches, the fastener can be difficult to control during such downstream operations as slider installation and when tensioned by various rollers in a bag making machine. The fastener tends to twist and distort and the fastener profiles tend to shift longitudinally relative to each other. In addition, the notches produce areas where air or liquid can potentially leak into or out of the bags eventually formed by the bag making machine.

SUMMARY OF THE INVENTION

[0006] To overcome the aforementioned shortcomings, the present invention provides a unique slider-operated fastener according to claim 1 and method of making the same according to claim 13. The slider-operated fastener comprises first and second opposing tracks including respective first and second interlocking profiles and respective first and second fins extending downward from the respective first and second profiles. The first and second fins are sealed to each other by a plurality of spaced preseals. After generating each pre seal, a notch is formed in the profiles and upper portions of the fins at the generated pre seal. To install a slider onto the fastener, the slider is initially positioned within the respective notch and then threaded onto the fastener in response to relative movement of the slider and the fastener. Either before or after the steps of forming each pre seal and respective notch and installing the respective slider, the fastener is attached to a moving web of plastic film. The fastener-carrying web is later folded and sealed to form individual plastic bags.

[0007] The preseals are advantageous in that they allow the fastener to be controlled during such downstream operations as notch formation and slider installation and when the fastener is tensioned by various rollers in the bag making machine. The preseals keep the interlocked profiles together and prevent them from moving longitudinally relative to each other. In addition, the preseals generally encompass the respective notches to assist in providing a leakproof barrier to entry into an interior of the fastener between the fins via the notches. This leakproof barrier is effective in the ultimately formed plastic bags.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings in which:

FIG. 1 depicts a method of making a slider-operated fastener;

FIG. 2 depicts a method of forming, filling, and sealing reclosable plastic bags employing the slider-operated fastener;

FIG. 3 depicts a finished bag produced by the form-fill-seal method after the bag's header has been partially removed by an end user;

FIG. 4 is an enlarged view of a U-shaped preseal according to a first embodiment;

FIG. 5 is an enlarged view of a solid preseal according to a second embodiment;

FIG. 6 is an enlarged view of a bracketed preseal according to a third embodiment;

FIG. 7 is an enlarged view of a notch in the U-shaped or solid preseals of FIGS. 4 and 5; and

FIG. 8 is an enlarged view of a notch in the bracketed preseal of FIG. 6.

[0009] While the invention is susceptible to various modifications and alternative forms, a specific embodiment thereof has been shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that it is not intended to limit the invention to the particular forms disclosed, but on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the scope of the invention as defined by the appended claims.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0010] Turning to the drawings, FIG. 1 depicts a method of making a slider-operated fastener for use in reclosable plastic bags. In the method, there is provided a continuous fastener 10 including first and second opposing tracks 12 and 14. The tracks 12 and 14 include respective first and second interlocking profiles 16 and 18 and respective first and second fins 20 and 22 extending downward from the respective profiles 16 and 18. The profile 16 preferably includes a rib, and the profile 18 preferably includes a groove for receiving the rib. Further details concerning the construction of the profiles 16 and 18 may be obtained from U.S. Patent No. 5,007,143 to Herrington. The fastener 10 may be unwound from a spool or the like.

[0011] The fastener 10 is conveyed by rollers and the like (not shown) to a preseal station. The preseal station includes a pair of reciprocating seal bars 24 and 26. Either both of the seal bars 24 and 26 move back and forth between open and closed positions, or one of the seal bars is stationary while the other seal bar moves back and forth. At least the seal bar 24 is heated. The other bar 26 may be heated as well, or may simply serve as a backing against which the heated seal bar 24 applies pressure when the seal bars 24 and 26 are brought together. The temperature, pressure, and dwell time of the seal bars 24 and 26 are properly adjusted to allow the seal bars 24 and 26 to impart a preseal 28. While the fastener 10 is temporarily stopped at the preseal station, the fins 20 and 22 are sealed to each other along the preseal 28. The preseal 28 preferably does not extend into the profiles 16 and 18 due to the technique for installing sliders on the fastener 10 later in the manufacturing process.

[0012] FIGS. 4-6 illustrate different configurations of the preseal. The preseal 28 in FIG. 4 is generally U-shaped and includes a pair of opposing sides 28a, 28b and a bottom 28c bridging the opposing sides. The opposing sides 28a, 28b are generally located along an upper portion of the fins 20 and 22 and extend downward from the interlocked profiles 16 and 18. The bottom 28c extends between the lower ends of the sides 28a, 28b. The seal bar 24 has a U-shaped projection 30 corresponding to the shape of the preseal 28. The preseal 28' in FIG. 5 is solid such that the rectangular area between the opposing vertical sides of the preseal is sealed. The bracketed preseal 28" in FIG. 6 is similar to the U-shaped preseal 28 in FIG. 4 except that the bottom of the bracketed preseal 28" is interrupted by a gap. The gap has a width W less than or equal to the width X of a side seal later formed in alignment with the preseal 28". An advantage of the bracketed preseal 28" is that it minimizes the heat imparted to the lower portions of the fins 20 and 22, thereby minimizing stretching and subsequent shrinkage and wrinkles in the lower fin portions.

[0013] After forming the preseal 28, the fastener 10 is conveyed to a notching station. The notching station includes a pair of reciprocating cutters 32 and 34. Either both of the cutters 32 and 34 move back and forth between open and closed positions, or

one of the cutters is stationary while the other cutter moves back and forth. The cutter 32 forms a rectangular projection, while the cutter 34 forms a rectangular hole for receiving the projection. The fastener 10 is temporarily stopped at the notching station with the preseal 28 aligned between the separated cutters 32 and 34. While the fastener 10 is stopped, the cutters 32 and 34 are brought together such that the rectangular projection of the cutter 32 punches a rectangular section 36 through the rectangular hole of the cutter 34, thereby leaving a U-shaped notch 38 in the fastener 10.

[0014] The preseal 28 generally encompasses the notch 38 and defines a periphery thereof such that the preseal provides a leakproof barrier to entry into an interior of the fastener 10 between the fins 20 and 22 via the notch 38. As discussed below, the leakproof barrier effectively prevents leaks in the reclosable plastic bags ultimately formed by the manufacturing process. FIG. 7 illustrates the notch 38 in either the U-shaped preseal 28 of FIG. 4 or the solid preseal 28' of FIG. 5. FIG. 8 illustrates the notch in the bracketed preseal 28" of FIG. 6. The bracketed preseal 28" is still effective to create the aforementioned leakproof barrier because the brackets are sized to overlap the side seal to be formed later in the manufacturing process.

[0015] After forming the notch 38, the fastener 10 is conveyed to a slider insertion station. While the fastener 10 is temporarily stopped at the slider insertion station, a slider 40 from a source of multiple sliders is positioned within the notch 38. The slider 40 is then threaded onto the fastener 10 in response to relative movement of the slider 40 and the fastener 10.

[0016] After installing the slider 40 onto the fastener 10, the fastener 10 is conveyed to an end stop applicator. The end stop applicator applies end stops 42 and 44 to the respective fastener ends 46 and 48 on opposite sides of the notch 38. In the plastic bags ultimately formed by the manufacturing process, the end stop 42 will be located at the fastener end 46 of one bag, while the end stop 44 will be located at the fastener end 48 of the adjacent bag. The end stops perform three primary functions: (1) preventing the slider 40 from going past the ends of the fastener, (2) holding the profiles together to resist stresses applied to the profiles during normal use of the plastic bag, and (3) minimizing leakage from inside the plastic bag out through the fastener ends.

[0017] In one embodiment, the end stop applicator includes a pair of chilled, reciprocating molds 50 and 52. Either both of the molds 50 and 52 move back and forth between open and closed positions, or one of the molds is stationary while the other mold moves back and forth. While the fastener 10 is temporarily stopped, the molds 50 and 52 close around the fastener ends 46 and 48. A predetermined amount of flowable plastic material is then forced around and between the profiles 16 and 18 at the fastener ends 46 and 48 by a conventional back pressure device (not shown) coupled to the supply tube. The molds 50 and 52 form channels for receiving the plastic material and guiding it to the fastener ends 46 and 48.

[0018] Instead of applying injection-molded end stops, other types of end stops may be applied to the fastener ends 46 and 48, including those disclosed in U.S. Patent Nos. 5,924,173, 5,833,791, 5,482,375, 5,448,807, 5,442,837, 5,405,478, 5,161,286, 5,131,121, 5,088,971, and 5,067,208. In U.S. Patent No. 5,067,208, for example, each end stop is in the form of a fairly rigid strap/clip that wraps over the top of the fastener. One end of the strap is provided with a rivet-like member that penetrates through the fastener fins and into a cooperating opening at the other end of the strap.

[0019] While the fastener 10 is temporarily stopped in the method depicted in FIG. 1, the various stations simultaneously perform their respective functions on different parts of the continuous fastener 10 spaced approximately at bag-width distances apart. Therefore, as the preseal station forms a new preseal 28, (1) the notching station forms a new notch 38 within a previously formed preseal, (2) the slider insertion station installs a slider 40 via a previously formed notch, and (3) the end stop applicator applies new end stops 42 and 44 proximate a previously installed slider. After each of the stations has completed its respective function on the stopped fastener 10, movement of the fastener 10 is resumed. The fastener 10 is moved for approximately a bag-width distance so that the next station can perform its respective function. The preseals 28 are advantageous in that they allow the fastener 10 to be controlled during such downstream operations as notch formation, slider installation, and end stop installation and when the fastener 10 is tensioned by various rollers in the bag making machine. The preseals 28 keep the interlocked profiles 16 and 18 together and prevent them from moving longitudinally relative to each other.

[0020] After applying the end stops 42 and 44, the fastener 10 is preferably applied to a moving web of plastic film that is then formed into individual plastic bags. Alternatively, the fastener 10 may be conveyed to a storage medium, such as a spool, and placed in an intermediate storage facility, and then applied to the moving web at a later time.

[0021] FIG. 2 depicts a method of forming, filling, and sealing reclosable plastic bags employing the slider-operated fastener 10. The fin 20 of the fastener 10 is "tacked" or lightly sealed to a moving web 50 of plastic film unwound from a film roll 52. To tack the fastener fin 20 to the moving web 50, there is provided a pair of reciprocating seal bars 54 and 56. Either both of the seal bars 54 and 56 move back and forth between open and closed positions, or one of the seal bars is stationary while the other seal bar moves back and forth. Both the fastener 10 and the web 50 are temporarily stopped while the seal bars are brought together to

tack the fastener 10 to the web 50. Of course, if the fastener 10 produced by the method in FIG. 1 is conveyed directly to the web 50, as opposed to an intermediate storage facility, the stoppage of the fastener 10 and web 50 for tacking can be made to coincide with the stoppage of the fastener 10 in FIG. 1 for forming the preseal and notch and installing the slider and end stops. In an alternative embodiment, the seal bars 54 and 56 are replaced with a static heat sealing mechanism such as a hot air blower that blows heated air onto the fastener 10. The tacked fastener 10 is carried with the moving web 50 without shifting relative thereto.

[0022] After tacking the fastener 10 to the web 50, the fastener-carrying web 50 is conveyed to a folding station. At the folding station, the web 50 is folded in half with the fastener 10 inside the web 50 and proximate the fold 51. To fold the web 50, the web 50 is conveyed over a horizontal roller 58, under a triangular folding board 60, and then between a pair of closely spaced vertical rollers 62. The folded web 50 includes a pair of overlapping panels 64 and 66 joined along the fold 51.

[0023] After folding the web 50, the fastener fins 20 and 22 are permanently sealed to the respective web panels 66 and 64 by respective seal bars 68 and 70. The seal bars 68 and 70 are sufficiently wide that they generate the fin seals across the entire width of a bag produced by the method in FIG. 2. Either both of the seal bars 68 and 70 move back and forth between open and closed positions, or one of the seal bars is stationary while the other seal bar moves back and forth. The fastener-carrying web 50 is temporarily stopped while the seal bars are brought together to seal the fastener 10 to the web 50. Both of the seal bars 68 and 70 are preferably heated. The temperature, pressure, and dwell time of the seal bars 68 and 70 are properly adjusted to allow the seal bars 68 and 70 to generate the permanent fin seals. In an alternative embodiment, the seal bars 68 and 70 are replaced with a static heat sealing mechanism such as a pair of hot air blowers that blow heated air onto the respective fastener fins.

[0024] After sealing the fins 20 and 22 to the respective web panels 66 and 64, the web panels 64 and 66 are sealed to each other along a side seal 72 by a pair of reciprocating seal bars 74 and 76. The side seal 72 is transverse to a direction of movement of the folded web 50 and is aligned with a center of the notch 38 (and preseal 28). Also, the side seal 72 extends from the folded bottom 51 to an open top 53 of the folded web 50. Either both of the seal bars 74 and 76 move back and forth between open and closed positions, or one of the seal bars is stationary while the other seal bar moves back and forth. The folded web 50 is temporarily stopped while the seal bars are brought together to seal the web panels 64 and 66 to each other. At least the seal bar 74 is heated. The other bar 76 may be heated as well, or may simply serve as a backing against which the heated seal bar 74 applies pressure when the seal bars 74 and 76 are brought together. The temperature, pressure, and dwell time of the seal bars 74 and 76 are properly adjusted to allow the seal bars 74 and 76 to generate the side seal 72.

[0025] After generating the side seal 72, the folded web 50 is conveyed to a cutter 78 for separating the folded web 50 into individual plastic bags. While the folded web 50 is temporarily stopped, the cutter 78 cuts the folded web 50 along a center of the side seal 72 to produce the individual plastic bag 80. The plastic bag 80 is opened with an opening device 79 and filled with a product through its open top 53 at a filling station 82. Finally, the open top 53 is sealed by a heat sealing mechanism 84. The end result is a filled and sealed bag 80 ready for shipment to a customer such as a grocery store or convenience store.

[0026] While the web 50 is temporarily stopped in the method depicted in FIG. 2, the various stations simultaneously perform their respective functions on different parts of the continuous web 50. For example, as the fastener 10 is tacked to the web 50 by the seal bars 54 and 56, (1) the fastener fins 20 and 22 of a previously tacked section of the fastener 10 can be permanently sealed to the respective web panels 64 and 66 by respective seal bars 68 and 70, (2) the web panels 64 and 66 carrying previously sealed fastener fin sections can be sealed to each other along a side seal 72 by the seal bars 74 and 76, (3) the folded web 50 can be cut along a previously generated side seal, (4) the cut bag is opened, (5) the opened bag is positioned under a filling device that fills the bag, and (6) the filled bag is sealed closed. After each of the stations has completed its respective function on the stopped web 50, movement of the web 50 is resumed.

[0027] The finished bag 80, with its header 82 partially removed by an end user, is illustrated in FIG. 3. After the header 82 is fully removed, it can be seen that each preseal 28 intersects both the adjacent side seal 72 and the fastener profiles 16 and 18. Therefore, the preseal 28 provides a leakproof barrier between an interior and an exterior of the bag 80. When the profiles 16 and 18 are interlocked but the header 82 has been removed, this leakproof barrier minimizes food spoilage and leakage of any food juices from inside the bag.

[0028] While the present invention has been described with reference to one or more particular embodiments, those skilled in the art will recognize that many changes may be made thereto. For example, the equipment used in the fastener and bag manufacturing processes may be modified so that the processes are entirely continuous with no temporary stoppages in the movement of the fastener or bag making web. Also, the fastener 10 may be attached to the web 50 prior to forming the preseal 28

and notch 38, installing the slider 40, and applying the end stops 42 and 44. To allow the fastener 10 to be accessed for such operations, however, the operations are preferably performed prior to folding the web 50 and enveloping the fastener 10 therein.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

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PATENTKRAV

1. Skyderbetjent fastgørelseselement, som omfatter:
 - et første spor (12), som omfatter en første profil (16) og en første finne (20), som
5 strækker sig nedad fra den første profil (16);
 - et andet spor (14), som omfatter en anden profil (18) og en anden finne (22), som
strækker sig nedad fra den anden profil (18), idet den anden profil (18) er tilpasset til at
blive sammenlåst med den første profil (16),
kendetegnet ved, at den første og den anden finne er forseglet til hinanden ved
10 hjælp af en flerhed af langsgående præpakninger (28) anbragt med mellemrum, som
støder op til profilerne (16, 18); og
 - en flerhed af langsgående fordybninger (38) anbragt med mellemrum, som re-
gelmæssigt afbryder profileme (16, 18)
og de nærmeste dele af finnerne (20, 22) ved de respektive præpakninger (28).
15
2. Fastgørelseselement ifølge krav 1, hvor hver af præpakningerne (28) generelt er U-
formede.
3. Fastgørelseselement ifølge krav 1, hvor hver af præpakningerne (28) generelt er
20 faste.
4. Fastgørelseselement ifølge krav 1, hvor hver af præpakningerne (28) omfatter et par
beslag adskilt af et mellemrum.
- 25 5. Fastgørelseselement ifølge krav 1, hvor finnerne (20, 22) er forseglet til hinanden
ved hjælp af præpakningerne (28) anbragt med mellemrum langs med det meste af en
periferi af hver af fordybningerne (38).
6. Fastgørelseselement ifølge krav 5, hvor periferien af hver af fordybningerne (38)
30 generelt er U-formet.
7. Fastgørelseselement ifølge krav 1, hvor hver af fordybningerne (38) er defineret af et
par sider og en bund, som forbinder siderne, idet finnerne (20, 22) er forseglet til hin-
anden ved hjælp af præpakningerne (28) anbragt med mellemrum langs med siderne
35 og i det mindste en del af bunden.

8. Fastgørelseselement ifølge krav 1, hvor præpakningerne tilvejebringer en tæt barriere mod indgang ind i det indvendige af fastgørelseselementet mellem finnerne (20, 22) via fordybningerne (38).
- 5
9. Fastgørelseselement ifølge krav 1, som desuden omfatter en flerhed af skydere, som er monteret til profilerne (16, 18) nær ved de respektive fordybninger (38).
10. Fastgørelseselement ifølge krav 1, som desuden omfatter en flerhed af endestop (42, 44), som er monteret til profilerne (16, 18) ved de respektive fordybninger (38).
- 10
11. Fastgørelseselement ifølge krav 1, hvor den første finne (20) og den anden finne (22) er forseglet til hinanden ved hjælp af præpakningerne (28) anbragt med mellemrum og har fordybninger inde i de respektive præpakninger (28), idet den første og den anden profil (16, 18) også har fordybninger nær ved de respektive præpakninger (28).
- 15
12. Fastgørelseselement ifølge krav 8, hvor nedre dele af finnerne (20, 22) forbliver intakte under det sted, hvor finnerne (20, 22) har fordybninger.
- 20
13. Fremgangsmåde til fremstilling af et fastgørelsesarrangement, hvilken fremgangsmåde omfatter:
- tilvejebringelse af et fastgørelseselement, som omfatter første modsatte spor (12) og andre modsatte spor (14), hvilke første spor (12) og andre spor (14) omfatter respektive første spor (16) og andre spor (18), som sammenlåser profiler, og respektive
- 25 første finner (20) og andre finner (22), som strækker sig nedad fra den respektive første profil (16) og anden profil (18);
- kendetegnet ved, at den første og den anden finne er forseglet til hinanden ved præpakninger (28) anbragt med mellemrum; og efter forsegling af den første finne (20) og den anden finne (22) til hinanden ved hver af præpakningerne (28) anbragt med
- 30 mellemrum dannes en fordybning (38) inde i den respektive præpakning (28) og den første profil (16) og den anden profil (18) nær ved den respektive præpakning (28).
14. Fremgangsmåde ifølge krav 13, som desuden omfatter:
- anbringelse af en skyder (40) inde i hver af fordybningerne (38); og

anbringelse af den anbragte skyder (40) på fastgørelseselementet (10) som svar på relativ bevægelse af skyderen (40) og fastgørelseselementet (10).

5 15. Fremgangsmåde ifølge krav 14, som desuden omfatter installering af endestop (42, 44) på profilerne (16, 18) på modsatte sider af hver af fordybningerne (38).

10 16. Fremgangsmåde ifølge krav 13, hvor præpakningerne (28) i det mindste delvist omfatter de respektive fordybninger (38) for at hjælpe med til at tilvejebringe en tæt barriere mod indgang ind i det indvendige af fastgørelseselementet (10) mellem finnerne via fordybningerne (38).

15 17. Fremgangsmåde ifølge krav 13, hvor trinnet med forsegling af den første finne (20) og den anden finne (22) til hinanden ved præpakningerne (28) anbragt med mellemrum omfatter forsegling af finnerne (20, 22) til hinanden på modsatte sider af hver af de fordybninger (38), som skal dannes derefter.

20 18. Fremgangsmåde ifølge krav 13, hvor trinnet med forsegling af den første finne (20) og den anden finne (22) til hinanden ved præpakningerne (28) anbragt med mellemrum omfatter i det mindste delvis forsegling af finnerne (20, 22) til hinanden nedenunder hver af de fordybninger (38), som skal dannes derefter.

25 19. Fremgangsmåde ifølge krav 13, hvor trinnet med forsegling af den første finne (20) og den anden finne (22) til hinanden ved præpakningen (28) anbragt med mellemrum omfatter forsegling af finnerne (20, 22) langs med det meste af en periferi af hver af de fordybninger (38), som skal dannes derefter.

30 20. Fremgangsmåde ifølge krav 13, hvor hver af præpakningerne (28) generelt er U-formede.

30 21. Fremgangsmåde ifølge krav 13, hvor hver af præpakningerne (28) generelt er faste.

35 22. Fremgangsmåde ifølge krav 13, hvor hver af præpakningerne (28) omfatter et par beslag adskilt af et mellemrum.

23. Fremgangsmåde ifølge krav 13, hvor hver af fordybningerne (38) er defineret af et par sider og en bund, som forbinder siderne, idet trinnet med forsegling af den første finne (20) og den anden finne (22) til hinanden ved præpakninger (28) anbragt med mellemrum omfatter forsegling af finnerne (20, 22) til hinanden langs med siderne og i
5 det mindste en del af bunden.

24. Fremgangsmåde ifølge krav 13, som desuden omfatter fastgørelse af fastgørelses-elementet (10) til et bevægeligt væv af plastfilm.

10 25. Fremgangsmåde ifølge krav 24, som desuden omfatter:

foldning af vævet langs med en fold parallelt med retningen for bevægelse af vævet; og

forsegling af det foldede væv i posebreddeafstande fra hinanden langs med pakninger, som generelt går på tværs af retningen for bevægelse af vævet, idet sidepakningerne er anbragt på linje med de respektive fordybninger.
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DRAWINGS

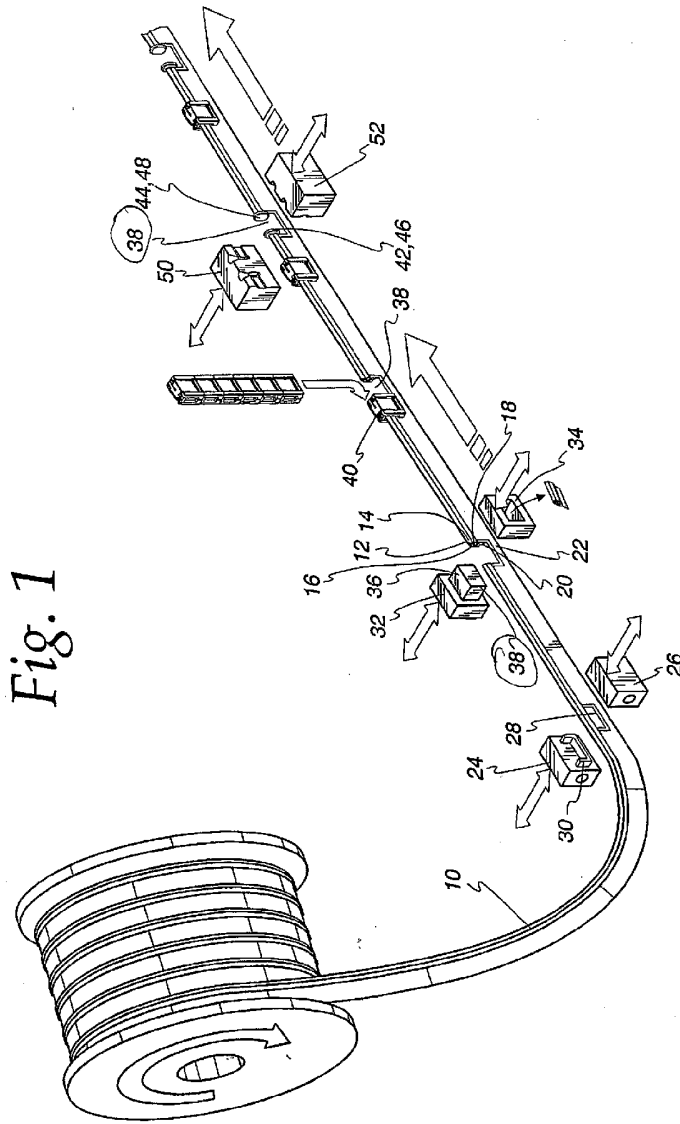


Fig. 1

Fig. 3

