



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
14.06.2023 Bulletin 2023/24

(51) International Patent Classification (IPC):
B65D 33/25 (2006.01) **B65D 33/24** (2006.01)
B31B 70/81 (2017.01)

(21) Application number: **21213604.8**

(52) Cooperative Patent Classification (CPC):
B65D 33/24; B31B 70/8132; B65D 33/2558

(22) Date of filing: **10.12.2021**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(54) **A ZIP STRIP FOR A FLEXIBLE POUCH AND METHOD AND APPARATUS FOR MANUFACTURING RECLOSABLE FLEXIBLE POUCHES**

(57) A reclosable zip strip (60) for a flexible pouch, comprising first and second interlockable closure formations (24, 26) each comprising a succession of projections (28) and recesses (30) extending along a longitudinal

dinal direction (X) and configured for interlocking with the recesses (30) and projections (28) of the other closure formation (24, 26).

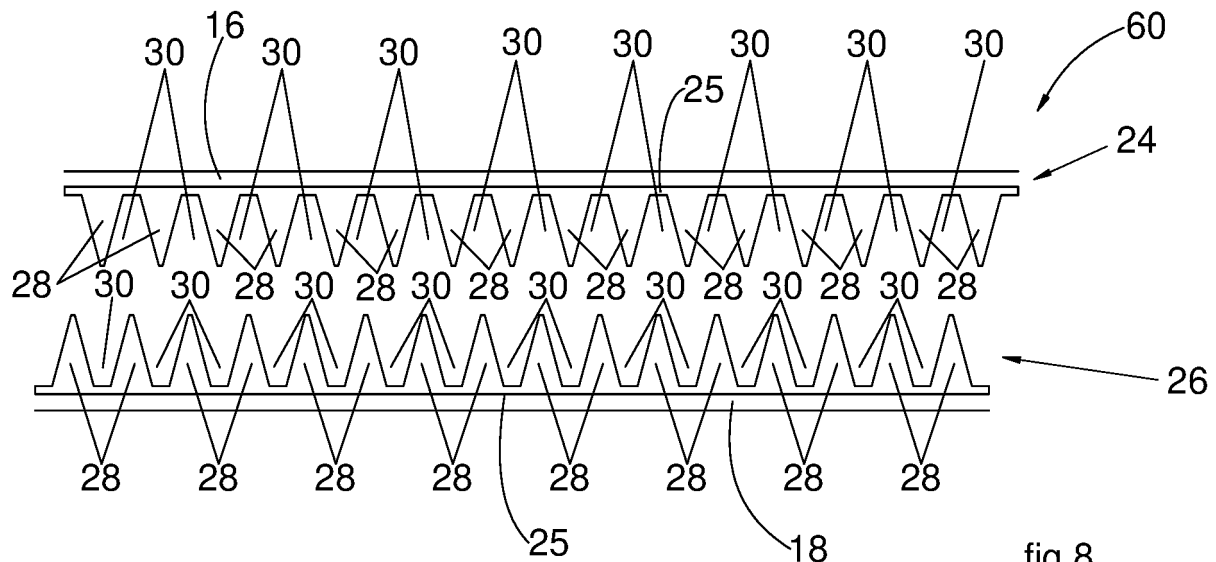


fig.8

Description

Field of the invention

[0001] The present invention relates to reclosable flexible pouches, also known as stand-up pouches or Doypacks (a trademark associated with the pouches).

[0002] More specifically, the invention relates to a zip strip for forming the reclosable closure of a flexible pouch

[0003] The present invention also relates to a method and apparatus for manufacturing reclosable flexible pouches.

Prior art

[0004] A stand-up pouch or Doypack is a type of flexible packaging which is able to stand erect on its bottom for display, storage, and use. It is a type of plastic bag commonly used for food products. The bottom part of a stand-up pouch is gusseted to provide support for display or use. The most common pouch has bottom gussets to form a "W" which opens to form a flat bottom.

[0005] The flexible pouches are usually constructed of multi-layer materials: various plastic films, paper, barrier layers, etc. Pouches are often printed with graphics or sometimes have attached labels. The materials must have specialized heat-seal properties to allow conversion into pouches.

[0006] The packaging machinery involved typically forms the pouches from pre-printed roll stock. The pre-formed pouches are shipped to a packager where they are filled, and the top is sealed.

[0007] Inclusion of reclosable zip strips in Doypack pouches is common. Typically, the pouch has two opposite flexible sheets having at their top portions internal interlockable plastic strips which are reclosable to keep the pouch airtight after its opening.

[0008] Zip strips feature flanged interlockable profiles that create a reliable seal when pressed together. Some types of zip strip employ a slider to open and close the pouch.

[0009] The zip component of the packaging is supplied on a continuous roll and is inserted between the upper and lower webs of the packaging film. The zip may be bonded to the packaging film by a heat activated adhesive that is pre-applied to the backing of the zip.

[0010] Zip strips are often formed by extrusion, which involves the following problems:

- low process speeds,
- extremely high temperatures and pressures,
- need for cooling processes using water,
- impossibility to make intermittent shapes in the direction of advancement of the raw material.

Object and summary of the invention

[0011] The object of the present invention is to provide

a zip strip for reclosable flexible pouches which overcomes the problems of the prior art, and which simplifies and reduces the costs involved in forming the interlockable zip strips.

[0012] According to the invention, this object is achieved by a zip strip for a reclosable flexible pouch having the features of claim 1.

[0013] According to another aspect, the present invention relates to provide a method and apparatus for manufacturing reclosable flexible pouches having the features of claims 10 and 15.

[0014] The claims form an integral part of the technical disclosure provided here in relation to the invention.

Brief description of the drawings

[0015] The present invention will now be described with reference to the attached drawings, provided purely by way of non-limiting example, wherein:

- Figure 1 is a schematic side view of an apparatus for producing reclosable pouches according to the present invention,
- Figures 2-6 are schematic plan views showing different steps of a method for manufacturing reclosable pouches according to the present invention,
- Figure 7 is a schematic perspective view of the unit indicated by the arrow VII in figure 1,
- Figure 8 is a schematic enlarged detail of the zip strip indicated by the arrow VIII in figure 4,
- Figure 9 is a schematic view showing the zip strip of figure 8 in the interlocked position,
- Figures 10-12 are schematic enlarged views showing different possible shapes of mutually interlockable projections and recesses of the zip strip, and
- Figure 13 is a perspective view of a reclosable pouch according to the present invention.

[0016] It should be appreciated that the attached drawings are schematic and not to scale with respect to real products. Various figures may not be represented in the same scale. Also, in various figures some elements may not be shown to better show other elements.

Detailed description

[0017] With reference to figure 1 numeral reference 10 indicates an apparatus for producing reclosable flexible pouches.

[0018] With reference to figures 1 and 2, the apparatus 10 comprises a feeding device 12 configured for feeding in a machine direction MD a continuous flexible sheet 14 having a longitudinal axis X extending along the machine direction MD.

[0019] The continuous flexible sheet 14 may be unwound from a reel and may be printed with graphics. The continuous flexible sheet 14 may be made by a monolayer material or by a multilayer material comprising var-

ious plastic films, paper, air barrier layers, etc., as is common in packaging materials used for packaging food products.

[0020] With reference to figure 2, the continuous flexible sheet 14 has two longitudinal side portions 16, 18 opposite to each other with respect to the longitudinal axis X and two opposite longitudinal side edges 20, 22 parallel to the longitudinal axis X.

[0021] With reference to figures 1 and 7, the apparatus 10 comprises a zip strip forming unit 23 configured for forming a zip strip 60 comprising first and second interlockable closure formations 24, 26. Each of the first and second interlockable closure formations 24, 26 comprises a succession of projections 28 and recesses 30 extending along a longitudinal direction and configured for interlocking with the recesses 30 and projections 28 of the other closure formation 24, 26.

[0022] A continuous flexible band 25 is advanced longitudinally through the zip strip forming unit 23. The continuous flexible band 25 is made of a material having heat-forming properties. The continuous flexible band 25 may be made by a monolayer thermoformable material or by a multilayer material comprising at least one thermoformable outer layer.

[0023] With reference to figure 7, the zip strip forming unit 23 may be an ultrasonic forming unit comprising an anvil 34 and an ultrasonic horn 36. The anvil 34 may be formed by a wheel rotating about an axis transverse to the longitudinal axis of the continuous flexible band 25. The ultrasonic horn 36 may include a vibrating rod cooperating with the outer surface of the anvil 34. In a possible embodiment, the ultrasonic horn may be formed by a vibrating roller rotating about an axis transverse to the longitudinal axis of the continuous flexible band 25.

[0024] The first and second interlockable closure formations 24, 26 may be formed by a method similar to that disclosed in WO2010/085492. This document discloses an apparatus and process for forming micro-hooks on a substrate for use as hook-type fasteners in touch fastening systems, wherein vibration energy is used to soften a substrate which is positioned between a mould and a source of vibration. The mould includes a plurality of cavities into which the softened substrate is forced to form the projections. The substrate may comprise a film, sheet, web, composite, laminate, etc. The source of vibration may be an ultrasonic horn. The process to form such micro-hooks may be operated in a continuous, semi-continuous or intermittent manner.

[0025] With reference to figure 7, the anvil 34 has a plurality of cavities 38 open on its outer cylindrical surface. The ultrasonic horns 36 compress the continuous flexible band 25 against the outer cylindrical surfaces of the anvil 34 as the continuous flexible band 25 moves in the longitudinal direction.

[0026] The vibrating energy produced by the ultrasonic horn 36 liquifies or fluidifies locally the thermoformable material of the continuous flexible band 25, which penetrates in a fluid or liquid state in the cavities 38 of the anvil

34. The material of the continuous flexible band 25 which penetrates in the cavities of the anvil 34 cools in contact with the walls of the cavities 38 and forms projections 28 alternated to recesses 30 integral with the continuous flexible band 25.

[0027] As schematically shown in figure 7, at the exit of the forming unit 23 the continuous flexible band 25 has integrally formed first and second rows of projections 28 and recesses 30. The cavities 38 of the anvil 23 are offset to each other, such that the projections 30 of the first row are transversally aligned to corresponding recesses 30 of the second row and the recesses 30 of the first row are transversally aligned to corresponding projections 28 of the second row, and *vice versa*.

[0028] With reference to figures 1 and 7, the forming unit 23 may comprise a longitudinal cutting unit 27 configured for cutting longitudinally the continuous flexible band 25 to form first and second interlockable closure formations 24, 26. After the longitudinal cut the first and second interlockable closure formations 24, 26 may be transversally spaced from each other.

[0029] With reference to figures 8 and 9, the first and second interlockable closure formations 24, 26 form a zip strip 60. The first and second interlockable closure formations 24, 26 have respective successions of projections 28 and recesses 30 integrally formed on the surface of respective continuous flexible bands 25.

[0030] As shown in figure 9, the projections 28 of the first closure formation 24 are configured for interlocking with the recesses 30 of the second closure formation 26 and the projections 28 of the second closure formation 26 are configured for interlocking with the recesses 30 of the first closure formation 24.

[0031] At the exit of the forming unit 23 the projections 30 of each of the first and second closure formations 24, 26 are transversally aligned to corresponding recesses 30 of the other closure formation 24, 26 and the recesses 30 of each of the first and second closure formations 24, 26 are transversally aligned to corresponding projections 28 of the other closure formation 24, 26.

[0032] The first and second interlockable closure formations 24, 26 may be equal to each other and offset with respect to each other in the longitudinal direction X.

[0033] The continuous flexible band 25 forming the first and second interlockable closure formations 24, 26 may be made of a biodegradable and/or compostable material. The biodegradability of materials is defined according to the standard EN13432. In a possible embodiment the continuous flexible band 25 may be made of biodegradable and compostable bioplastic materials such as MATER-BI® or SPLASTICA.

[0034] In a possible embodiment the continuous flexible band 25 may be made of a material recyclable with paper. The characteristics of the materials that can be recycled with paper may be defined by the standard Aticelca® 501/2017. The wording and icon "RECYCLABLE WITH PAPER - Aticelca® 501" on packages inform consumers about the recyclability with paper. The Aticelca®

501/2017 standard defines a test for recyclability of products (e.g. packaging material, printed material, articles for domestic use, etc.) made of more than 50% by weight of cellulosic materials.

[0035] In order to form projections and cavities with dimensions sufficient for an effective interlocking, the continuous flexible band 25 may be a monolayer thermoformable material or a multilayer material having an outer layer of thermoformable material, having a weight comprised between 10-300 g/m².

[0036] In order to improve the recyclability of the reclosable pouches, the continuous flexible band 25 and the continuous flexible sheet 14 may be made of the same materials.

[0037] The first and second closure formations 24, 26 may be formed intermittently in the machine direction MD. The intermittent arrangement of the closure formations 24, 26 may be obtained by providing on the outer surface of the anvil 34 an intermittent pattern of cavities 38. Alternatively, the anvil 34 may have a continuous pattern of cavities 38 and the intermittent closure formations 24, 26 may be formed by intermittently turning off the ultrasonic horn 36. As a further alternative, the anvil 34 may have a continuous pattern of cavities 38 and the intermittent first and second closure formations 24, 26 may be formed by intermittently detaching the ultrasonic horn 36 from the outer cylindrical surface of the anvil 34.

[0038] In a possible embodiment, the forming unit 23 may be a thermomechanical forming unit, in which the material of the continuous flexible band 25 is locally liquified or fluidified by heating and compression.

[0039] The cavities 38 of the anvil 34 may be shaped to form projections 28 and recesses 30 with different shapes and dimensions. Figures 10-12 schematically show different possible shapes of the projections 28 and recesses 30 of the closure formations 24, 26.

[0040] In the embodiment of figure 10 each of the projections 28 has a rounded head portion 40 connected to a narrower shank portion 42, and each of the recesses 30 has a V-shape with curved sides.

[0041] In the embodiment of figure 11 each of the projections 28 has a rectangular shape and each of the recesses 30 has a U-shape.

[0042] In the embodiment of figure 12 the rectangular projections 28 and the U-shaped recesses 30 have respective rounded corners.

[0043] With reference to figures 1 and 3, the apparatus 10 comprises an attachment unit 29 configured for attaching the first and second interlockable closure formations 24, 26 to respective longitudinal side portions 16, 18 of the continuous flexible sheet 14, adjacent to respective longitudinal side edges 20, 22.

[0044] The first and second interlockable closure formations 24, 26 may be attached to the continuous flexible sheet 14 by welding, e.g. ultrasonic welding or thermomechanical welding, or by glue.

[0045] The first and second interlockable closure formations 24, 26 may be formed in-line in the apparatus

10 as schematically shown in figure 1.

[0046] In a possible embodiment, the first and second interlockable closure formations 24, 26 may be collected in reels at the exit of the forming unit 23. In this case the apparatus 10 may be provided with an unwinding unit configured for feeding the pre-formed first and second interlockable closure formations 24, 26 to the attachment unit 29.

[0047] With reference to figures 1 and 4, the apparatus 10 comprises a folding unit 44 configured for folding the continuous flexible sheet 14 about at least one folding line 46 parallel to the longitudinal axis X.

[0048] In a possible embodiment, the folding unit 44 may be configured for folding the continuous flexible sheet 14 about three folding lines 46 parallel to the longitudinal axis X in a W-shaped configuration which opens to form a flat bottom.

[0049] After the longitudinal folding, the two longitudinal side portions 16, 18 of the continuous flexible sheet 14 are overlapped to each other so that the first and second closure formations 24, 26 face each other.

[0050] The folded continuous flexible sheet 14 has a closed edge at the folding line(s) 46 and an open edge at the mutually facing side edges 20, 22.

[0051] With reference to figures 1 and 5, the apparatus 10 comprises a sealing unit 48 configured for joining to each other the two longitudinal side portions 16, 18 of the continuous folded flexible sheet 14 along sealing lines 50 extending between the closed edge 46 and the open edges 20, 22 of the continuous folded flexible sheet 14. The sealing unit 48 may be a welding unit, for example an ultrasonic or thermocompression welding unit.

[0052] With reference to figures 1 and 5, the apparatus 10 comprises a cutting unit 52 configured for cutting the continuous folded flexible sheet 14 along cutting lines extending over the welding lines 50, such that each cutting line is preceded and followed by a portion of a respective welding line 50. The cutting lines extend along the whole width of the said continuous folded flexible sheet 14 so that downstream of the cutting unit 52 a continuous array of individual reclosable pouches 52 is formed.

[0053] The individual reclosable pouches 52 are then filled. After filling, the mutually facing first and second closure formations 24, 26 are interlocked with each other and the reclosable pouches 52 are sealed between the edges 20, 22 and the mutually interlocked closure formations 24, 26, e.g. by welding.

[0054] Figure 13 schematically shows a reclosable pouch 52 according to the present invention.

[0055] The reclosable flexible pouch 52 comprises a flexible sheet 14 folded about at least one folding line 46 (preferably about three parallel folding lines 46).

[0056] The flexible sheet 14 has first and second mutually facing front portions 16, 18 having respective side edges joined to each other along two sealing lines 50. The first and second mutually facing front portions 16, 18 have respective top edges 20, 22 and a zip strip 60

formed by first and second interlockable closure formations 24, 26 attached to respective front portions 16, 18 adjacent to respective top edges 20, 22.

[0057] Each of the first and second interlockable closure formations 24, 26 has a succession of projections 28 and recesses 30 extending along a longitudinal direction X and configured for interlocking with the recesses 30 and projections 28 of the other closure formation 24, 26 to form a reclosable zip strip 60.

[0058] The projections 28 of each of the first and second interlockable closure formations 24, 26 are transversely aligned to corresponding recesses 30 of the other closure formation 24, 26 and the recesses 30 of each of the first and second interlockable closure formations 24, 26 are transversely aligned to corresponding projections 28 of the other closure formation 24, 26.

[0059] In a possible embodiment, the first and second interlockable closure formations 24, 26 are equal to each other and offset with respect to each other along the longitudinal direction X.

[0060] The main advantages of the method according to the present invention are the following:

- low process temperatures,
- low power and energy required,
- high dimensional stability and precision of the reclosable closure formations,
- high manufacturing speeds,
- possibility of forming the closure formations in line with the formation of the pouches,
- possibility of customizing the shapes of the closure formations by appropriately forming the anvils 34.

[0061] Of course, without prejudice to the principle of the invention, the details of construction and the embodiments can be varied, even significantly, with respect to those illustrated here without departing from the scope of the invention as defined by the following claims.

Claims

1. A zip strip (60) for a reclosable flexible pouch (52), comprising first and second interlockable closure formations (24, 26) each comprising a succession of projections (28) and recesses (30) extending along a longitudinal direction (X) and configured for interlocking with the recesses (30) and projections (28) of the other closure formation (24, 26) .
2. The zip strip (60) of claim 1, wherein the projections (28) of each of said first and second interlockable closure formations (24, 26) are transversely aligned to corresponding recesses (30) of the other closure formation (24, 26) and the recesses (30) of each of said first and second interlockable closure formations (24, 26) are transversely aligned to corresponding projections (28) of the other closure formation

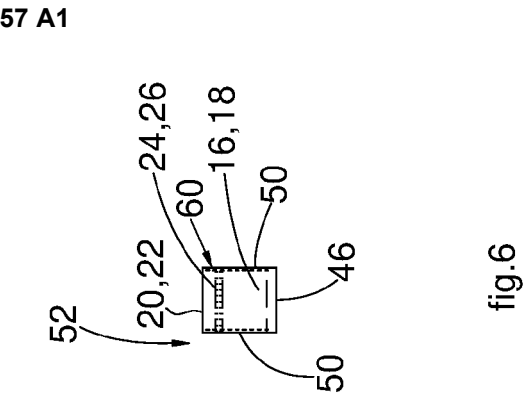
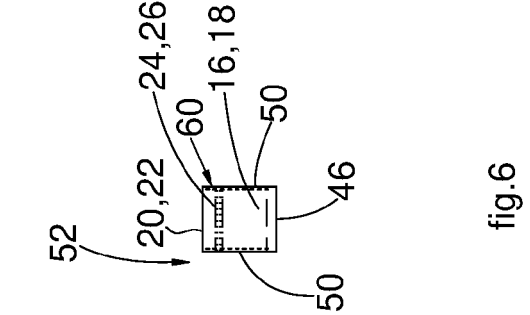
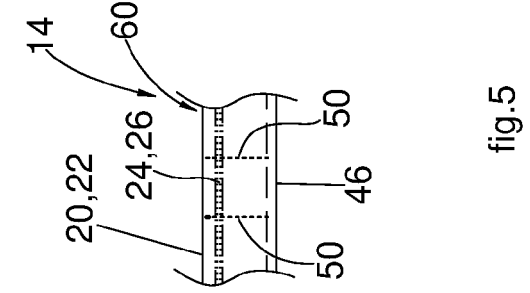
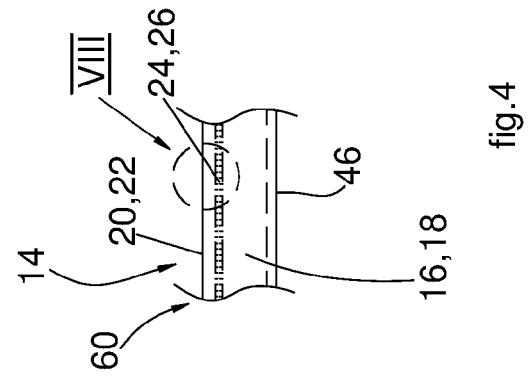
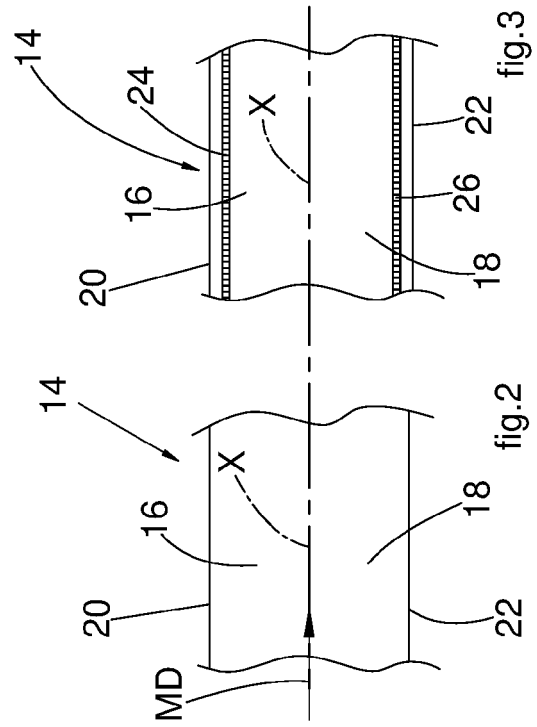
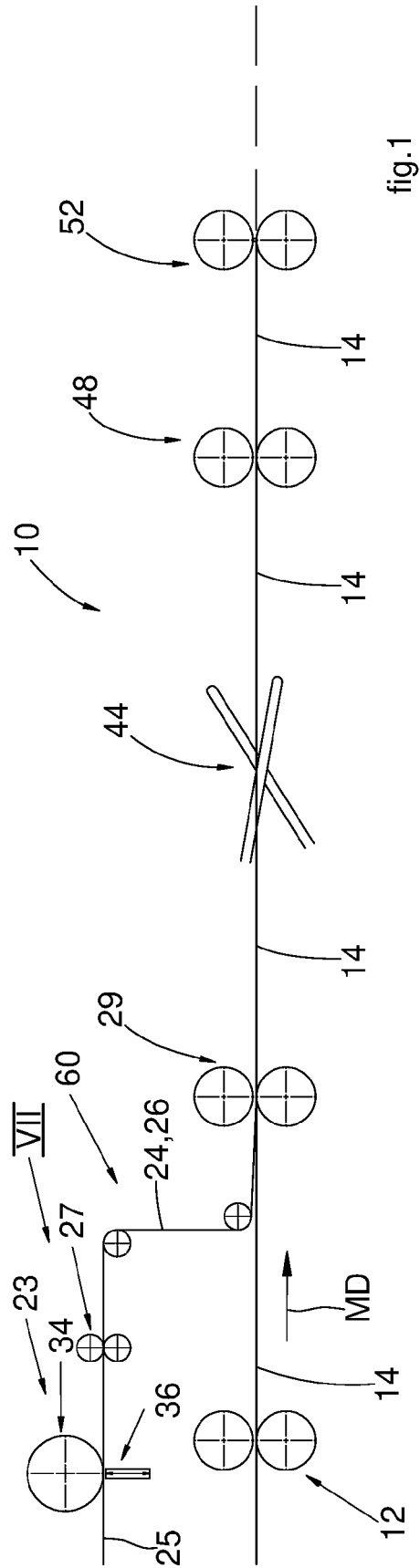
(24, 26).

3. The zip strip (60) of claim 1 or claim 2, wherein said first and second interlockable closure formations (24, 26) are equal to each other and offset with respect to each other along said longitudinal direction (X).
4. The zip strip (60) of any of the preceding claims, wherein each of said first and second interlockable closure formations (24, 26) comprises a respective flexible band (25) having integrally formed therein said succession of projections (28) and recesses (30).
5. The zip strip (60) of any of the preceding claims, wherein said first and second interlockable closure formations (24, 26) are made of a biodegradable and/or compostable material according to the standard EN13432.
6. The zip strip (60) of any of the preceding claims, wherein said first and second interlockable closure formations (24, 26) are recyclable with paper according to the standard Aticelca® 501/2017.
7. The zip strip (60) of any of the preceding claims, wherein said first and second interlockable closure formations (24, 26) are made of a monolayer thermoformable material or a multilayer material comprising at least one outer layer of thermoformable material.
8. The zip strip (60) of claim 7, wherein said first and second interlockable closure formations (24, 26) are made of a material having a weight comprised between 10-300 g/m².
9. The zip strip (60) of claim 6 or claim 7, wherein said succession of projections (28) and recesses (30) are formed by locally liquifying or fluidifying thermoformable material on the surface of said material.
10. A method for manufacturing reclosable flexible pouches (52), comprising:
 - feeding in a machine direction (MD) a continuous flexible sheet (14) having a longitudinal axis (X) extending along said machine direction (MD), two longitudinal side portions (16, 18) opposite to each other with respect to the longitudinal axis (X) and two opposite longitudinal side edges (20, 22),
 - providing continuous first and second interlockable closure formations (24, 26) each comprising a succession of projections (28) and recesses (30) configured for interlocking with the recesses (30) and projections (28) of the other clo-

- sure formation (24, 26),
- attaching said first and second interlockable closure formations (24, 26) to respective longitudinal side portions (16, 18) of said continuous flexible sheet (14) adjacent to respective longitudinal side edges (20, 22), 5
 - folding said continuous flexible sheet (14) about at least one folding line (46) parallel to said longitudinal axis (X), and overlapping to each other said longitudinal side portions (16, 18) to form a continuous folded flexible sheet (14) having a closed edge (46) and an open edge (20, 22), 10
 - joining to each other the two overlapped longitudinal side portions (16, 18) along sealing lines (50), and 15
 - cutting said continuous folded flexible sheet (50) along cutting lines extending over said sealing lines (50) such that each cutting line is preceded and followed by a portion of a respective sealing line (50). 20
11. The method of claim 10, wherein the projections (28) of each of said first and second interlockable closure formations (24, 26) are transversely aligned to corresponding recesses (30) of the other closure formation (24, 26) and the recesses (30) of each of said first and second interlockable closure formations (24, 26) are transversely aligned to corresponding projections (28) of the other closure formation (24, 26). 25 30
12. The method of claim 10 or claim 11, comprising forming first and second rows of projections (28) and recesses (30) in a single continuous flexible band (25) and cutting longitudinally said continuous flexible band (25) to form said first and second interlockable closure formations (24, 26). 35
13. The method of any of claims 10 to 12, wherein said first and second interlockable closure formations (24, 26) are formed by locally liquifying or fluidifying thermoformable material and inserting the liquified or fluidified thermoformable material into cavities (38) of an anvil (34). 40 45
14. The method of claim 13, wherein locally liquifying or fluidifying the thermoformable material is obtained by subjecting said thermoformable material to ultrasonic compression or to thermomechanical compression. 50
15. An apparatus for manufacturing reclosable flexible pouches, comprising: 55
- a feeding device (12) configured for feeding in a machine direction (MD) a continuous flexible sheet (14) having a longitudinal axis (X) extend-

ing along said machine direction (MD), two longitudinal side portions (16, 18) opposite to each other with respect to the longitudinal axis (X) and two opposite longitudinal side edges (20, 22),

- a zip strip forming unit (23) configured for forming first and second interlockable closure formations (24, 26) each comprising a succession of projections (28) and recesses (30) configured for interlocking with the recesses (30) and projections (28) of the other closure formation (24, 26),
- an attachment unit configured for attaching said first and second interlockable closure formations (24, 26) to respective longitudinal side portions (16, 18) of said continuous flexible sheet (14) adjacent to respective longitudinal side edges (20, 22),
- a folding unit (44) configured for folding said continuous flexible sheet (14) about at least one folding line (46) parallel to said longitudinal axis (X), and for overlapping to each other said longitudinal side portions (16, 18) to form a continuous folded flexible sheet (14) having a closed edge (46) and an open edge (20, 22),
- a sealing unit (48) configured for joining to each other the two overlapped longitudinal side portions (16, 18) along sealing lines (50), and
- a cutting unit (52) configured for cutting said continuous folded flexible sheet (50) along cutting lines extending over said sealing lines (50) such that each cutting line is preceded and followed by a portion of a respective sealing line (50).



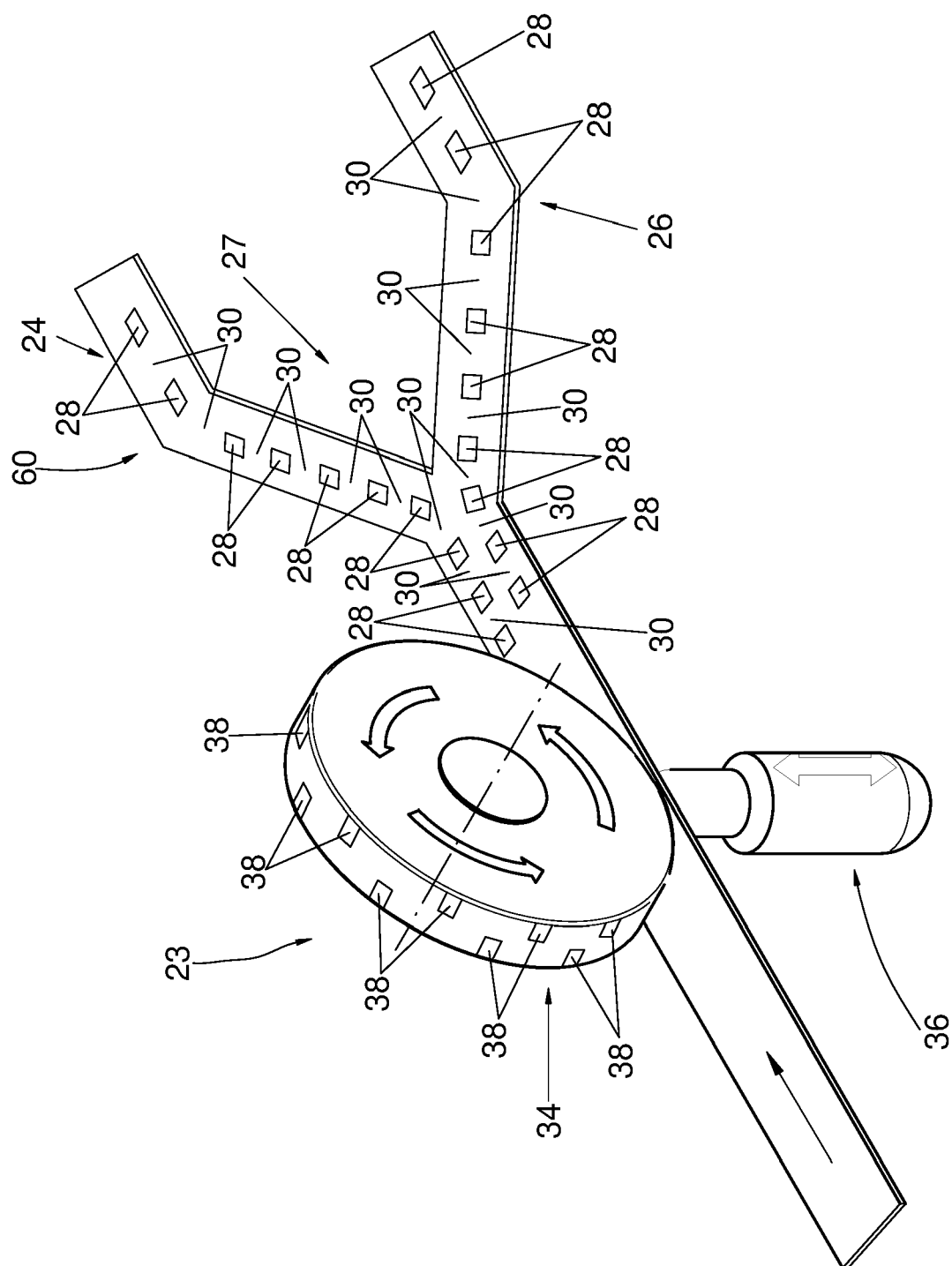
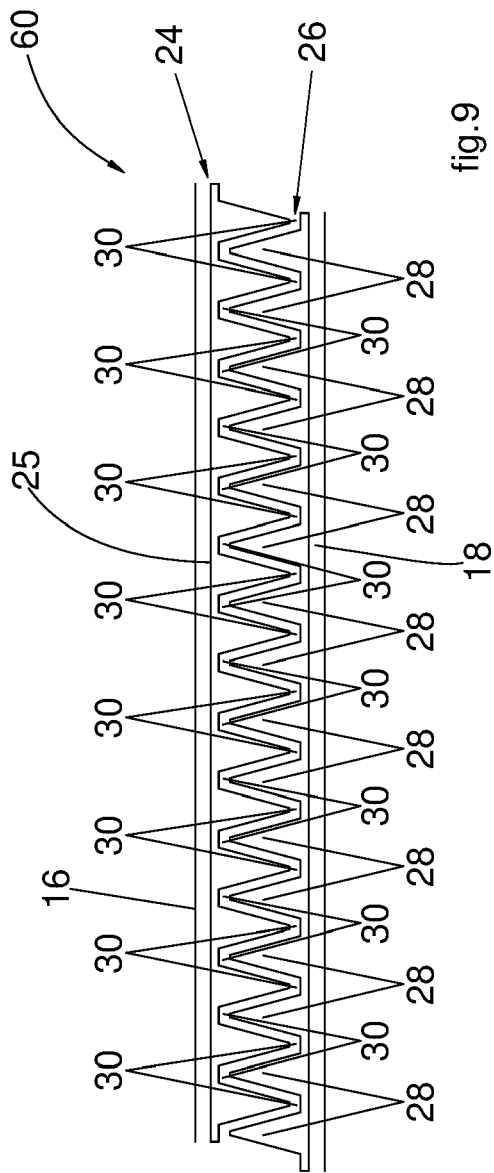
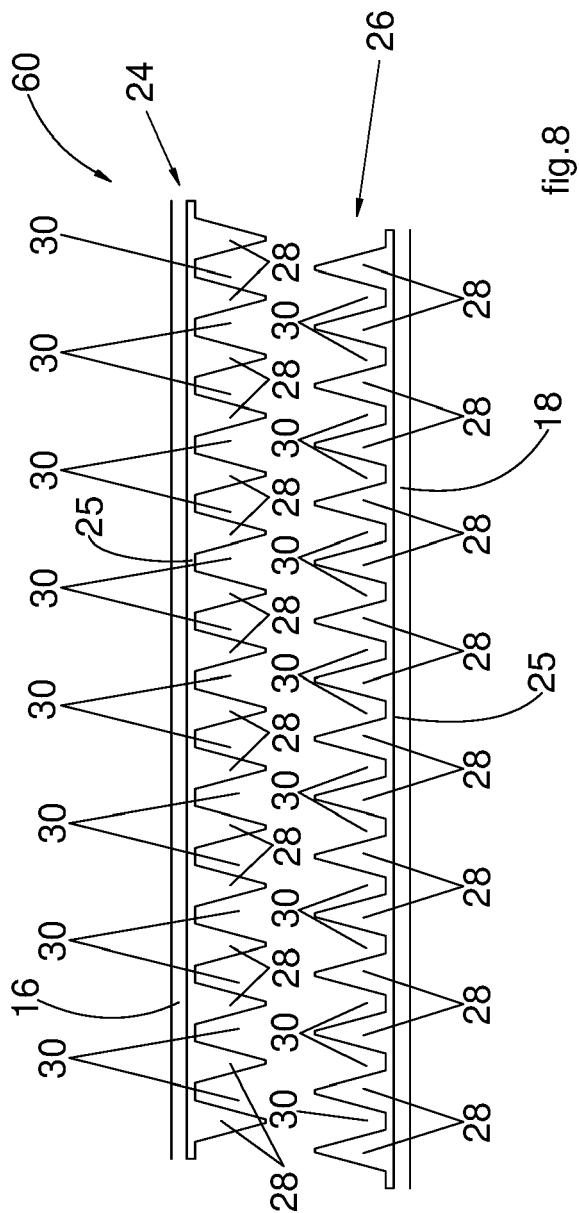


fig. 7



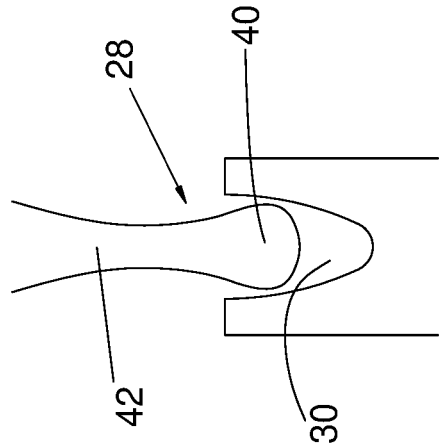


fig.10

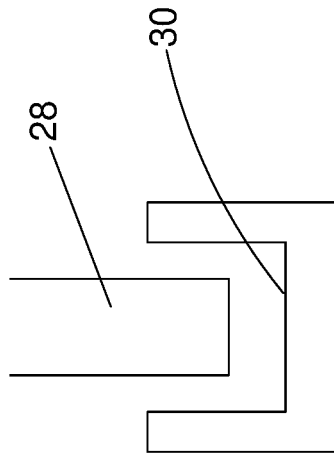


fig.11

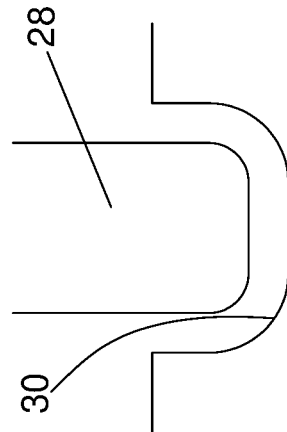


fig.12

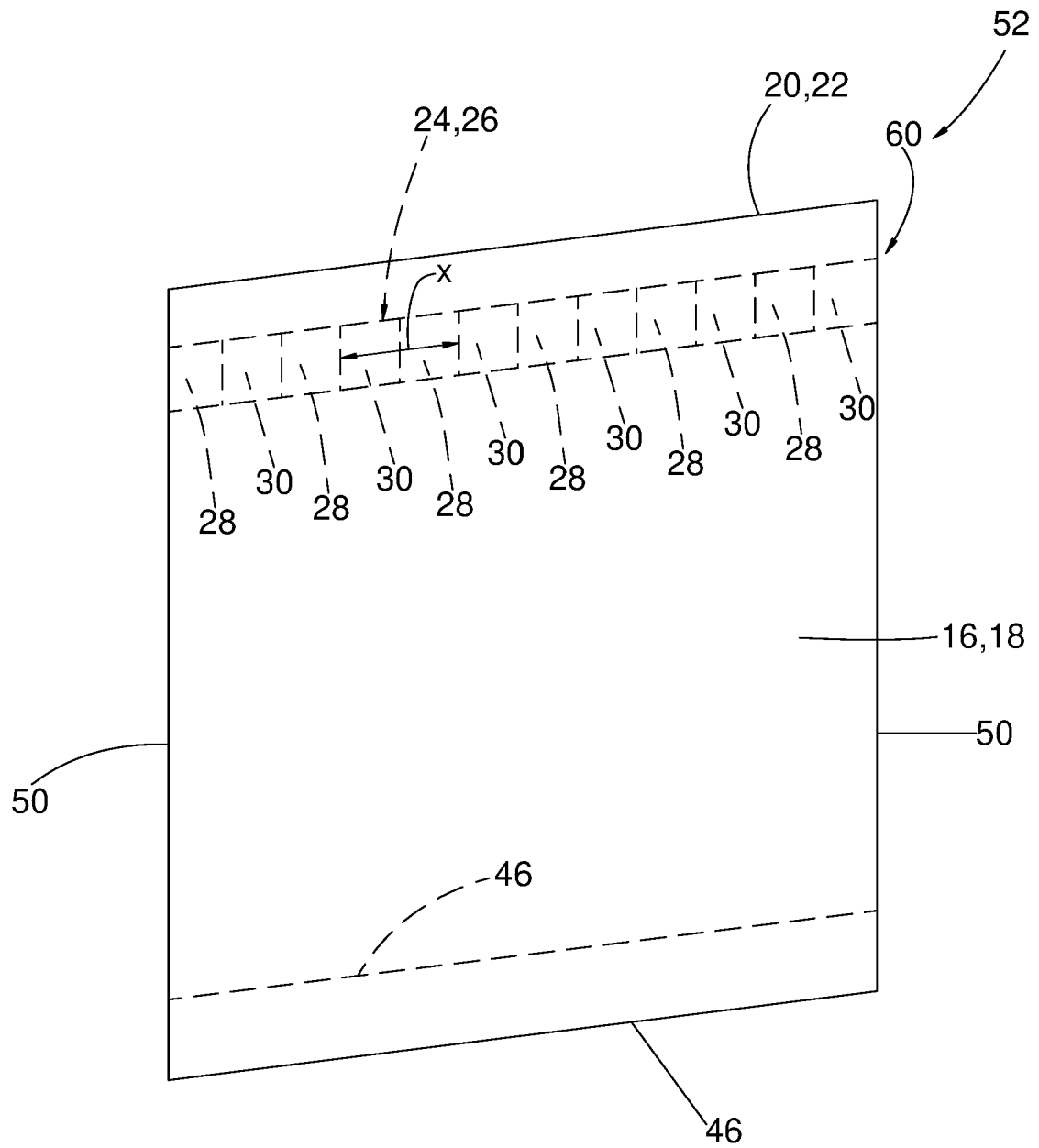


fig.13



EUROPEAN SEARCH REPORT

Application Number

EP 21 21 3604

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 603 434 A (HERRINGTON FOX J [US]) 29 July 1986 (1986-07-29)	1-8	INV. B65D33/25
Y	* figures 9-15, 17 * -----	10-12, 15	B65D33/24 B31B70/81
X	EP 0 434 447 A1 (DU PONT [US]) 26 June 1991 (1991-06-26)	1, 2, 4, 9	
Y	* figure 4 * -----	13, 14	
A	US 2021/214129 A1 (WOO GEOFF [US] ET AL) 15 July 2021 (2021-07-15) * the whole document *	1	
Y	US 2004/066984 A1 (YI LI JENNY JIE [US]) 8 April 2004 (2004-04-08) * figure 5 *	10-15	
A	EP 0 023 817 A1 (ROEDER IND HOLDINGS [GB]) 11 February 1981 (1981-02-11) * figure 1 *	10, 15	
A	EP 0 273 327 A2 (DOW CONSUMER PRODUCTS [US]) 6 July 1988 (1988-07-06) * figure 4 *	10, 15	TECHNICAL FIELDS SEARCHED (IPC) B65D B31F B31B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 1 June 2022	Examiner Balz, Oliver
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

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