Assembling device to form a releasable bond between adjacent surface elements and method for manufacturing this assembling device.

An assembling device for forming a releasable bond between two adjacent surface elements (3, 4) comprises at least two connecting members (1, 2), respectively one male (1) and one female (2), placed in facing relation to each other for reciprocal engagement when said surface elements (3, 4) are assembled together. At least one of the surface elements (3, 4) is prepared from a sheet or film material, e.g. thermoformable material, a portion of which is embossed to provide at least said male connecting member (1), wherein said male connecting member (1) has a closed periphery. The female connecting member (2) may also be provided by an embossed portion of a sheet or film material or may, e.g., comprise a surface element having holes extending through the thickness thereof. Methods for manufacturing the connecting members are also disclosed.
ASSEMBLING DEVICE TO FORM A RELEASABLE BOND BETWEEN ADJACENT SURFACE ELEMENTS AND METHOD FOR MANUFACTURING THIS ASSEMBLING DEVICE

The present invention concerns an assembling device to form a releasable bond between two adjacent surface elements comprising at least two connecting members, respectively, one male and one female, placed in facing relation to each other for reciprocal engagement when said surface elements are assembled together; the invention also concerns a method for manufacturing the device.

There exists already a large number of devices of the aforementioned kind, namely in the field of packaging. All the closing devices of this kind to be used in packaging and which can be opened and closed again at will to protect the content of the package from the outside atmosphere comprise connecting members which are either extruded simultaneously with a wrapper film or sheet, or they are first injection molded and thereafter fixedly bonded to the wrapper sheet or film by glueing or welding.

When the connecting members are co-extruded with the sheet or film, these connecting members are formed of inter-joining ribs provided along the edges of the sheet which is thereafter folded to place the joining members in mutual registration. The folded sheet is then welded transversally to form bags which are then separated from each other by splitting along the transversal welding lines. This well known closure system can be formed only during extrusion of the sheet. Because of overthickness due to the ribs, it is difficult to store the material in the form of large rolls. This is because the volume of a roll with ribs, given a length of film or sheet, is substantially greater than the corresponding volume of a same length of film or sheet taken alone without ribs. Hence for packing, the packer has difficulty making the bags starting from the sheet material and thus has to use individual prefabricated bags. This is the reason why generally such bags are not used for conditioned packing, because they are not well suited to automation for which one preferably uses sheet wrapper material and directly form bags around the product to be packaged.

This is why the substances to be protected from air and moisture are packaged in sealed bags with welded joints. This type of closure enables to safely store the conditioned products until the bag is opened. From there on, since this type of bag cannot be closed tight again, many of the unconsumed products will no longer be protected and may rapidly degrade. It is a fact that, until now, a cheap and simple solution to this problem, to be implemented with light and efficient technical means, did not exist yet.

An object of the present invention is precisely to disclose a solution of this sort.

For doing this, the present invention has for an object an assembling device for forming a releasable bond between two adjacent surface elements according to claim 1. It has also for an object a method of manufacturing this device according to claims 16 to 20.

The main advantage of this assembling device resides in its manufacturing convenience, given that it can be brought about at any time from a simple film or sheet material without requiring additional material. For instance it can be formed simultaneously with the manufacture of the films or sheets or it can be formed at a later opportunity; this enables to make for instance a bag which can be opened and closed tight again during packaging of the product, this being without imposing production costs exceeding that of an ordinary bag with a welded joint of the type used until now. Since the sheet is not locally overthickened and the connecting members engage reciprocally with one another, the sheets in which the connecting members are formed can easily be stored into rolls. Naturally, as will be seen hereafter, the use of the assembling device is not limited to the sealing of bags.

The accompanying drawing illustrates schematically and by way of example several variants of the assembling device which is an object of the present invention.

Fig. 1 is a perspective view of an embodiment of this assembling device.

Fig. 2 is a perspective view of a variant of fig. 1.

Fig. 3 is a perspective view of another variant of fig. 1.

Fig. 4 is a cross-sectional side view of the profile of the sealing members of the assembling device.

Fig. 5a and 5b are cross-sectional side views of another variant of profile of the sealing members shown in disassembled and assembled condition, respectively.

Fig. 6a and 6b are cross-sectional side views of another variant of profile in the same position as in fig. 5a and 5b.

Fig. 7 is a view in perspective of still another variant of this profile.

Fig. 8 is a perspective view which illustrates an application of a closing device for a non-flexible container.

Fig. 9 is a cross-sectional view of a variant of the connecting members of the device.

Fig. 10 is a perspective view of still another variant of the device.

Fig. 11a and 11b are cross-sectional side views of a last variant of profile of the sealing members shown in disassembled and assembled condition, respectively.

Fig. 12 is a perspective view of one particular use of the device.

Fig. 13 is a cross-sectional side view of another variant of the profile.
The assembling device illustrated in fig. 1 comprises male and female connecting members, 1 and 2 respectively, of films or sheets, respectively 3 and 4, to be assembled together. The sheet 3 is provided with a row of male connecting members 1 and the sheet 4 is provided with a row of female connecting members 2. The distance that separates, in a row, the male connecting members corresponds to that distance which separates the female connecting members. As can be seen from this example, the male and female connecting members, 1 and 2 respectively, are formed by shaping or embossing the sheets 3 and 4, respectively. Preferably, the sheets are of thermoformable polymers and embossing is preferably achieved by hot-forming using methods to be disclosed hereafter in more detail. The sheets 3 and 4 can be thin, i.e. between 40 and 100 μm. It has been noted that it is preferable that the connecting members 1 and 2 have complementary cross-sectional dimensions which mate together and fit into each other. When the surfaces are separated, the sheets 3 and 4 are withdrawn from each other with sequential disengagement of male and female connectors. During disengagement, the male and female connecting members are subject to strain and deformation in the plane of the sheets which puts them out of alignment and results into a wedging effect between the respective side surfaces of said connecting members which resists to the disengagement. This effect reinforces the retaining back pressure effect which results from the disconnecting pull. The combined effects explain why the binding strength of the assembling device is so effective. This assembly of the two sheets along the row of connecting members is also sufficiently tight to provide, under ambient pressure, a barrier appropriate to protect the content of a bag for instance from the influence of the outside.

In this disclosure, the term of "sheet" should be understood as including all more or less flexible materials of any given thickness.

The resistance of the assembly to separation of the sheets and also the sealing capacity through the line of connecting means can be increased by placing, as illustrated for instance in fig. 2, two rows of connecting means 5 and 6 in parallel, the connecting members of a row being staggered relative to that of another row. The total rubbing surface is increased, hence the force for separating sheets 7 and 8 from each other is also increased. The connecting members of rows 5 and 6 are also given a rectangular form, so the tightness is improved due to the staggered configuration.

Obviously the assembling device does not provide full air-tightness and it can be desirable in some cases to achieve impervious seals, namely for vacuum packaging. For this, the two sheets 3 and 4 forming a bag can be sealed by a welding 5 externally to the line of connecting members; these members can be identical to that with reference numerals 1 and 2 in fig. 1 for example, and in parallel thereto. To open the bag, the sheets 3 and 4 are cut between the welding line 8 and the line of connecting members 1 and 2, which gives access to the inside of the bag; afterwards, the bag can be closed again using the connecting members, the content of the bag being thus preserved until entirely used up.

The variant illustrated in fig. 4 comprises male and female connecting members, 9 and 10 respectively, having a frustoconical or frustopyramidal shape. In this variant, the binding elements can preferably be used in combination with a pressure sensitive adhesive to be coated on the joining surfaces of the male and female sealing members 9 and 10. An adhesive of this kind can be, for instance, an ethylene/vinylacetate copolymer such as Elvax® sold by the Du Pont Company.

Fig. 5a and 5b illustrate a variant in which the female connecting member is formed by an opening 11 provided in a wall 12 whose thickness is greater than that of the embossed sheet 13 including the male connecting members 14. The front of each connecting member 14 is provided with a ring-like flange 14a whose transverse cross-section slightly exceeds the size of the opening corresponding to the female member 11. The distance between the flange 14a and the surface of the sheet 13 which carries the male members 14 corresponds substantially to the thickness of the wall 12, hence when the connecting members are in mesh after pressing sheet 13 against wall 12, the flange 14a which was temporarily deformed when passing through opening 11, rests against the surface of the wall 12 some distance away from the surface which is adjacent to that of sheet 13, as shown in fig. 5b. This mode of assembly evidently improves the resistance toward separation of walls 12 and 13 since the locking action is no longer the result of frictional resistance but is due to gripping of the male element 14 into the female element 13.

In the variant illustrated in fig. 6a, 6b, the assembling mode of sheets 15 and 16 is nearly identical with that of fig. 5a, 5b; the only difference concerns the thickness of sheets 15 and 16 which is the same for both, i.e. in the order of about 40-100 μm. In order that the axial length of the opening 17 forming the female securing member be greater than the sheet thickness, this sheet 16 is stamped to provide a wall 16a aligned with the opening 17 obtained by punching. Thereafter, when the male securing member 18, which is identical with that shown by reference numeral 14 in fig. 5a, 5b, is snapped into the opening 17, its annular flange 18a locks itself at the outlet of the channel formed by wall 18a.

Variants of fig. 5a, 5b, 6a, 6b can be of particular interest for packaging products in powder form. This is so because when a powder is taken from a bag, some can penetrate into the hollow female connecting
members of the kind illustrated in fig. 1 and 3 and hinder subsequent closing of the bag; in the case of openings shown in fig. 4a and 5a, the powder can no longer fill the female imprints. Having an opening 11 with no substrate deformation can also be of interest when the sheet or wall 12 is of a non-thermofromable material, i.e. a relatively rigid material.

The variant of fig. 7 illustrates the fitting of a cylinder-shaped male element 19 into a polygonal-shaped cross-sectional print 20, a square in this example, forming the female member. Using connecting elements in which the shape of the male members is different from that of the female members can facilitate the evacuation of the air upon pressing the members together. Naturally for this, the female member could also be shaped cylindrically and the male member have a polygonal cross-section fitting into the female circle. In the two modifications of this variant, the respective size of the transverse cross-section of both male and female connecting means will be selected to ensure that some deformation thereof be achieved upon fitting the two together.

Naturally, the use of the foregoing assembling device is not limited to closing bags but can be adapted to other kinds of containers as illustrated for instance in fig. 8 in which there is shown a tray 21 with a rim 22 in which there are formed a plurality of openings 23 which function as the female connecting members of the assembling device. There is also provided a sheet 24 for closing the tray 21 whose edge is embossed to form male connecting members 25.

Since the mating of the male and female connecting members requires some force, the thickness of the sheet used for forming the male embossments must be sufficient to resist the effort. If the material of the sheet is too thin, its resistance can be enhanced by folding the sheet 26 on itself in the area where the connecting members are formed as shown in fig. 9.

As indicated previously, at least the male connecting members are formed by embossing the sheet material which is essentially of thermofromable polymer. The simplest method to achieve embossing includes heating the area to be raised to forming temperature, placing this area in registration with a stamping matrix having in negative the shape of the desired relief, subjecting the sheet to depression on the matrix side of the sheet, this depression being sufficient to drive the softened sheet material into the hollow print in the matrix, cooling the area of the formed sheet and removing it from the matrix. This method is simple and fast. In some cases, the suction which drives the softened thermofromable material into the matrix prints can be replaced by using a punch which deforms the material and drives it into the matrix.

The female connecting means can be made similarly in the cases of the variants of fig. 1 to 4 and 7; in the case of the variant of fig. 5a, the opening is punched; in the case of fig. 6a, the opening can be stamped, i.e. deformation and punching can be carried out simultaneously.

It is also possible to combine different forming methods to make the present connecting members, for instance combining vacuum forming and die stamping.

Also, according to another variant, the embossed connecting elements can be made by cold forming of a deformable sheet material.

Naturally, the assembling device disclosed here need not be limited to using sheet materials for forming bags or tray lids for instance as illustrated in fig. 12. The elements of the device to be assembled can be in the form of a strip 31 whose width only slightly exceeds that of the embossed area, the strip being thereafter welded or glued to a surface 32 to be joined to another one. For instance a paper bag can be provided with a system of this kind.

The strip element carrying the female connecting members can be akin to the strip 31 the surface on which it is to be glued being first punched with holes. This strip element carrying the female members can also be molded from a strip with thickness greater than that of strip 31. Finally, a system is also possible in which the male members in a strip match with simple openings in a sheet, like the openings 11 in fig. 5a which are directly cut into the surface to be reciprocatingly assembled to the male membered strip.

The sheet material to be used for making at least the male connecting members is either in single film form or in multilayer form, i.e. comprising several polyolefin layers in combination with another or more different polymers. Up to now, the embodiments of the assembling device have been represented as comprising a plurality of binding members aligned in the form of at least one row. In other cases one may have only one continuous long male member 27 which fits into a complementary female member 28 as illustrated in fig. 10. The catching action of said elements 27 and 28 toward one another results from the shape of their cross-sectional profile which is provided with a narrowing. The presence of a narrowing requires that the profile be temporarily strained upon reciprocal engagement or disengagement.

In the variant of fig. 11a and 11b, the male and female elements, respectively 29 and 30, are complementarily shaped and formed of circular cross-sectional elements with a frustoconical section 29a, 30a. When the mushroom shaped stud 29b of the male member 29 is applied against the socket 30a of the female element 30 in order to make it snap into it, the pressure makes the tip 20b to shrink and pass through the bottleneck 30c of the female element in order to come into its meshed state as illustrated in fig. 11b.

It is possible to combine any of the foregoing variants with a heat-reactive adhesive which enables to eventually separate the assembled surface elements by peeling off at least the surface element in form of
a sheet or film. This type of closure is generally known as a "peel-seal" and can be achieved with a blend of two components sold by the Du Pont Company under Trade names Surlyn® and Bynel®; the proportions of components in the blend depend on the properties sought after.

In order to provide adhesion, one of the surfaces to be joined is coated with an appropriated blend of Surlyn® and Bynel® and applied to the other surface; the assembly is thereafter heated. In the present invention, the heating step can advantageously be combined with the thermoforming of the embossed connecting elements. A fixture of this kind can replace the welding line S of fig. 3. For removing the two assembled surface elements, the adhesive force between them must be overcome. Afterwards, the two surface elements can be reclosed due to the male and female connecting elements which will match together.

As mentioned already in the foregoing disclosure, the present assembling device is usable to close pouches, bags and to ensure the fastening of flexible lids over container of more or less rigid texture; hence it is useful as fastening means in all appliances where a releasable bond is necessary.

Claims

1. An assembling device for forming a releasable bond between two adjacent surface elements, comprising at least two connecting members, respectively one male and one female, placed in facing relation to each other for reciprocal engagement when said surface elements are assembled together, wherein at least one of the surface elements is prepared from a sheet or film material, a portion of which is embossed to provide at least said male connecting member, wherein said male connecting member has a closed periphery.

2. A device according to claim 1 wherein the female connecting member is also provided by an embossed portion of a sheet or film material.

3. A device according to claim 1 or 2 wherein each adjacent surface element comprises a plurality of connecting members.

4. A device according to claim 3 when dependent on claim 1 wherein the female connecting members comprise a surface element having holes extending through the thickness thereof.

5. A device according to claim 1, 2 or 3 wherein the transverse cross-section of the male and female connecting members have mating forms of substantially complementary size.

6. A device according to claim 1, 2 or 3 wherein the external profile of the transverse cross-section of the male and female types of connecting member is circular for one type and polygonal for the other type, the size of such profiles being such that the reciprocal engagement of male and female connecting members develops frictional forces.

7. A device according to any one of claims 1 to 6 wherein the embossed portion has a side face, at least a part of which is perpendicular to the surface of the surface element from which it is formed.

8. A device according to claim 2 wherein the embossed portion has a side face, at least a part of which is perpendicular to the surface of the surface element from which it is formed.

9. A device according to any one of claims 1 to 8 wherein the cross-sectional size of said male connecting member is larger distal from the surface element than at the base.

10. A device according to any one of claims 1 to 9 wherein the connecting members form an array of a plurality of parallel rows in each of said surface elements.

11. A device according to claim 10 wherein the connecting members of a row are in staggered configuration in respect to an adjacent row.

12. A device according to any one of claims 1 to 11 wherein at least that surface element bearing at least a male connecting member is of thermoformable material.

13. A device according to claim 12 wherein the surface element of thermoformable material in at least the embossed part comprises a plurality of layers.

14. A device according to claim 12 wherein the surface element of thermoformable material in at least the embossed part comprises a plurality of layers of at least two different polymers.

15. A device according to any one of claims 1 to 14 wherein at least the surface element provided with the male connecting members is in the form of a strip added to another surface.

16. A method for manufacturing the connecting members of the device according to claim 1, comprising the steps of
heating at least one surface area of a thermoformable polymer sheet to its softening temperature;
placing the heated area in registration with a matrix in which a profile to be imparted to said surface is provided in negative replication;
applying the sheet against the matrix and subjecting it to reduced pressure from the matrix side, this reduced pressure being sufficient to cause the sheet material to be mated with the matrix profile;
cooling thereafter at least the embossed part of said sheet to below its thermoforming temperature; and
removing the sheet from the matrix.

17. A method for manufacturing the connecting members of the device according to claim 1, comprising the steps of
heating at least one surface area of a thermoformable polymer sheet to the softening temperature;
placing the heated area between a die matrix in which a profile to be imparted to said surface is provided in negative replication and a stamp having a raised profile corresponding to the negative profile of the die matrix;
driving the stamp into the die to deform the heated material;
cooling said sheet to below its thermoforming temperature;
removing the stamp from the die; and
removing the embossed area of the sheet from the matrix.

18. The method of claim 17, further comprising subjecting the heated sheet, when between the die matrix and the stamp, to reduced pressure from the matrix side.

19. A method for manufacturing the connecting elements of a device according to claim 4, comprising punching holes through the thickness of said female connecting member.

20. A method for manufacturing the connecting members of a device according to claim 1, comprising cold forming the connecting elements from a deformable sheet material.
**EUROPEAN SEARCH REPORT**

**DOCUMENTS CONSIDERED TO BE RELEVANT**

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<td>WO-A-8 802 311 (SORENSEN) * Page 7, line 20 - page 8, line 3; page 8, lines 17-19; page 9, lines 9-13; page 9, line 22 - page 10, line 21; page 14, lines 3-7; page 18, line 25 - page 19, line 16; figures 1,6,8,10,12,45</td>
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The present search report has been drawn up for all claims

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**TECHNICAL FIELDS SEARCHED (Int. Cls)**

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