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(51) Abstract: The present invention pertains to the handling of products, preferably electronic products, and relates to a method of handling products, a method of packaging products and a method of unpacking said products, apparatus for carrying out the packaging method, apparatus for carrying the unpacking method, and a package. According to the invention, layers (4, 4a, 4b, 50a, 50b, 400a, 400b, 500a, 500b) of strip-like flexible packaging material are joined together, and subsequently parted, respectively along part-seams (6a, 6b, 600a, 600b), to form a coherent packaging series (1, 10, 100) of sequentially disposed packaging volumes (2, 20, 200) which are delimited from one another. The packaging series also includes shock absorbing volumes which are delimited from the packaging volumes and also from each other, said shock absorbing volumes being delimited by the material layers and by part-seams (6a, 7a, 70a, 70b, 600a, 600b) and are filled with a shock absorbing material. The part-seams are broken successively when unpacking the packages.
HANDLING OF PRODUCTS

Field of invention
The present invention relates to the handling of products, preferably electronic products. The invention relates more particularly to a product handling method as defined in the preamble of claim 1.

The invention also relates to a method of packaging and unpacking such products, product packaging means, package unpacking means, and to a package.

The invention is particularly suited for use in handling sub-components between different working stations included in a manufacturing process. The invention, however, is also suited for handling manufactured end products, when said products shall be transferred from the manufacturing plant to a distributor, supplier, store, shop or like establishment.

Background of the invention
Many manufacturing industries have a need of handling sub-components and components effectively and safely between the various stages in the manufacturing chain of the end product.

For example, various sub-components are produced in the electronic industry, such as circuit cards, keypads, displays, and casings for a mobile telephone or cell phone, such components being produced in different manufacturing stations or in different manufacturing plants and assembled finally to provide a complete telephone. The different sub-components may also be produced in different places that are geographically remote from each other and also from their place of final assembly. Consequently, there is a need to transport the sub-components from their respective place of manufacture to their said final assembly plant. On certain occasions, it may also be necessary to place the sub-components in an intermediate
storage facility prior to their final assembly. It is important that the sub-components are protected from the surrounding environment and from impacts, blows and other mechanical forces during their intermediate transportation and storage, particularly when said components are sensitive electronic components or electronic products. The sub-components or sub-products therefore need to be packed in packages that will satisfy these safety requirements during their transportation and intermediate storage. Such packing of the components and also the unpacking of the components and the final assembly plant will, of course, increase manufacturing costs entailed by the work of packaging the components, the packaging material used and the packaging and unpacking equipment required in this regard.

There is thus a broad and significant need for an effective intermediate handling process with regard to sub-components within different manufacturing industries and then in particular in the electronic industry. It is particularly desirable that this intermediate handling process will protect sub-component products from mechanical forces, such as impacts, pressures and from the penetration of foreign particles and the influence of the ambient environment in a safe and space-lean fashion. The intermediate handling process will be preferably also be effective and incur low costs, meaning that the different process stages can be carried out quickly with only a few workers. Preferably, it will be possible to carry out the process with the effective use of additional material, such as the packaging material used, which will preferably be relatively inexpensive. Another important aspect resides in the handling of the packaging material, which will preferably be a simple procedure, both with regard to the actual packaging process and also with
regard to collecting the packaging material removed when unpacking the package and then either scrapping or recycling this material.

With regard to finished end products, there is a corresponding need for a handling process in which a finished product is packed for transportation to shops, stores for instance and there unpacked.

Prior art techniques

WO02/4791 describes a method and apparatus for packaging thin electronic cards, such as telephone cards and the like. The method involves feeding the electronic cards to a packaging station where the cards are enclosed sequentially between two layers of a first thermoplastic film, by sealing the two first films together. This results in a coherent web of individually packaged electronic cards which are folded in a second stage to form a stack of mutually overlying electronic cards, whereby the stack is enclosed in an outer sealed second film of packaging material. The method affords the electronic cards with a certain degree of protection against attack from the ambient environment and also against the penetration of foreign particles. However, a serious drawback with the method described in WO02/47981 is that it provides no protection to the packaged products against mechanical impacts, blows etc. Neither does the document refer to subsequent handling of the products, such as the unpacking of the packaged products for instance. EP044350B1 describes a method for protecting circuit boards with the aid of a given packaging process and a method for unpacking the circuit boards. The packaging process is similar to that achieved in the first packaging stage described in WO02/47981. Prior publication EP0443502B1, however, further specifies that the individual circuit board accommodating volumes will include a non-oxidizing atmosphere
so as to protect the circuit boards from oxidation. In the method described with regard to unpacking the circuit boards, a so-called belt of packaged circuit boards is delivered to an unpacking station where the mutually sequential packaging volumes or cavities are opened by rolling the two films onto an upper and a lower roller respectively, such as to break the seal or seam between said films and therewith expose the circuit boards.

Neither does the package described in EP0443502B1 protect the products from mechanical impacts, pressures or other mechanical forces to which the products may be subjected during handling, transportation and storage of the products. The unpacking method described in this earlier document renders the total circuit-board handling chain or effective in total, since it enables automation of the unpacking stage.

However, this product unpacking method also has a number of drawbacks. Firstly, the packaging material is rolled-up on two separate rollers meaning that the rolls of used packaging material taken up by the rollers must be attended to and handled for transportation and destruction or recycling.

A more serious problem, however, is that the rollers that draw the two films apart are disposed parallel with some of the rectilinear welding seams that connect the films to respective individual packaging volumes. This means that the pulling force exerted by the rollers must overcome momentarily the combined sealing force along the full length of the weld seams that extend parallel with the roller axis. When breaking those seams or seals that are perpendicular to the roller axis, only a small pulling force is required since these seams are broken successively and because the combined sealing area to be broken at each moment in time is only very small.
The construction and the method thus require the unpacking apparatus to generate large pulling forces in order to break the seams that extend parallel with the roller axis. It is also mentioned in this earlier document that some seams can be difficult to break, depending on the material chosen for use. It is proposed in said earlier document that this problem can be solved by providing hole punches upstream of the rolls and by providing the rolls with teeth that engage in holes formed by the punches in the package belt so as to generate a greater pulling force, and also to provide the apparatus with heat applying means so as to heat the seams and therewith reduce the separating force required. Such solutions are both complicated and expensive and also incur an additional serious risk of the apparatus malfunctioning.

The fact that some seams are parallel with the rollers whereas other seams are perpendicular to said rollers incurs a further problem, to wit the separation force required varies during the breaking of the seams with each package. The apparatus will thus be loaded cyclically, which increases the power consumption of the apparatus in addition to increasing wear on the apparatus and also the noise generated thereby.

US patent specification 3,340,669 describes a packet and a packaging method in which a web of packaging material is folded and sealed to form a series of inner packaging pockets with outer air-filled pockets disposed around the inner pockets. As a result of these outer air-filled pockets, the packet described in US 3,340, 669 will provide some shock resistance with regard to components accommodate in the inner pockets. At the same time, this known packet and packaging method includes a number of drawbacks and causes certain problems.
One problem with this packet described above and the packaging method entailed resides in the relatively large consumption of material. Because the shock absorbing outer pockets extend fully along both outer sides of the inner product-accommodating pocket the amount of material required for the inner pocket will be greater than the packaging material required to produce the outer pockets.

The total consumption of packaging material for one packet series is thus more than double the amount of material consumed in respect of solely the product accommodating pockets.

Another drawback with the packet described in this prior publication is that it fails to provide complete shock protection when several packets are stacked one upon the other. Because the shock absorbing outer pockets are disposed on the upper side and the lower side of the inner product accommodating pockets and because all pockets have common seams that extend along the perimeter of the pockets, the packets are in danger of toppling when stacked together. Such stacking therefore means that the edges of the packaged products are in danger of striking against one another, therewith resulting in damage to the products.

Another problem caused by the packaging method described in US 3,340,669 is that the packet requires no less than four layers of packaging material and that these layers are welded together in a common seam or seal along the perimeter of each packet. Welding of these four layers requires a relatively large amount of energy and/or time.

**Summary of the invention**

One object of the present invention is, accordingly, to provide a method of handling electronic products for instance,
such that the products will be protected against shocks, impacts, pressures and other mechanical influences during the handling process, and also from the effect of the ambient atmosphere and from the penetration of foreign particles.

Another object of the invention is to provide such a method which enables the products to be effectively moved from one place to another, particularly from one working station to another working station, undamaged and in a cost and work saving fashion.

These and other objects are achieved with a handling method of the kind described in the first paragraph of this description, wherein said method is characterized by the features set forth in the characterizing clause of the accompanying claim 1.

The present invention enables the handling of products, for instance between different working stations, in a highly resource-lean fashion, since the packaging work and the unpacking work can both be carried out fully automatically without any appreciable involvement of manual workers. Because the products are packaged in a coherent package series of discrete packaging volumes, batches corresponding to the number of packaging volumes included in a series can be readily handled, transported, and - if desired - packed in secondary packages. Because the shock absorbing volumes are integrated in the package series, no additional shock absorbing material is required to protect the products from mechanical influences during transportation, storage and other handling of the products. Because the shock absorbing volumes are also integrated with the package series during the actual packaging process, no additional working stages are required to achieve the desired mechanical protection. For example, when practicing the inventive handling process only one
working operation is required at a working station in order to obtain a coherent packaging series that fully protects the products with regard to mechanical influences in the form, e.g., of shocks, impacts and pressures and also from the influence of the ambient atmosphere and the penetration of foreign particles. Because the shock absorbing material or substance can consist of air, the manufacture of the packaging series requires only two layers of flexible packaging material.

Several benefits are obtained by including in the handling method a packaging stage which comprises forming successively shock absorbing volumes that are delimited from each other and from the packaging volumes and filling the shock absorbing volumes with a shock absorbing material, by mutually bonding the layers of material forming the packaging volumes between said shock absorbing volumes. Because the shock absorbing volumes are disposed between the packaging volumes, the material consumed in obtaining shock absorbing volumes that are fully protective against shocks and completely relieve the products of load is very small. In fact, the amount of material required is only slightly greater than that which will ensure that the height or length of the shock absorbing volumes will be slightly greater than the height of the packaging volumes. The invention thus results in considerable saving of material in comparison with prior art technology.

Moreover, when stacking a package series constructed in accordance with the present invention, the shock absorbing volumes formed between the packaging volumes will function as double-jointed load and shock absorbing hinges for the package series. When the package series is stacked by folding the series at each shock absorbing volume, the shock absorbing volumes will be placed automatically above each other on
respective sides of the packaging volume. The shock absorbing volumes will also be orientated automatically so that their length directions (relative to their feed direction M in Manufacture) will be vertical i.e. parallel with the height direction of the stack. When the length of the shock absorbing volumes is only slightly greater than the height of packaging volumes, the packaging volumes will hang freely between the upright shock absorbing volumes on respective sides of the stack. The products will thus be free of load and there is no danger of the products coming into contact with one another along their respective edges. The stack remains stable at the same time.

Because the shock absorbing volumes are disposed between the packaging volumes in accordance with the invention, only two layers of packaging material need to be welded. This reduces both the energy consumed and the time involved in carrying out the welding operation while, at the same time, enabling better control of the welding operation to be achieved due to the fact that each of the welding jaws used in this regard is in direct contact with its respective layer of the two materials to be welded.

The inventive handling method can also include an unpacking stage in which the layers of packaging material bonded when forming the package series are separated by passing said layers in directions away from each other over layer deflecting elements which include long axes that are non-parallel with each part-seam formed around individual packaging volumes. This minimizes the force required to break the seams and therewith separate the layers of packaging material. The aforesaid problems that occur when part-seams are broken momentarily along their full lengths are therewith reduced or fully eliminated.
The present invention also relates to a method and to means for packaging products, a method and means for unpacking products, and to a packet. Further objects of the invention and benefits afforded thereby will be apparent from the following description and from the accompanying claims.

**Brief description of the drawings**

Exemplifying embodiments of the invention will now be described with reference to the accompanying drawings, in which

10 Fig. 1A is a schematic side view in plan of a first embodiment of an inventive packaging method;

Fig. 1B is a schematic illustration similar to the illustration in figure 1A and shows a second embodiment of the inventive packaging method;

15 Fig. 1C is a schematic illustration similar to that of figure 1A and shows a third embodiment of the inventive packaging method, figure 1C is an enlarged part of the embodiment shown in figure 1B;

Fig. 2 is a schematic perspective view of a package series produced with the method illustrated in figure 1A;

Fig. 3A is a schematic side view in plan of apparatus for carrying the method illustrated in figure 1A;

Fig. 3B is a schematic illustration from above of the apparatus shown in figure 3A;

25 Fig. 4 is a schematic view in perspective illustrating an unpacking method according to the present invention.
Detailed description of exemplifying embodiments

There is described initially with reference to figures 1A, 2 and 3 a packaging method and a packaging machine or apparatus for producing a package in accordance with a first embodiment of the invention. The packaging method illustrated in figure 1A may comprise a stage in a method of handling electronic products or the like in accordance of the invention.

The package illustrated in figure 2 is comprised of a package series 1 that includes a number of mutually sequential and mutually coherent packaging volumes 2. Each packaging volume 2 is sealed hermetically and accommodates an electronic product, such as a display screen, which is intended to form part of the assembled end product, for instance a hand terminal. A shock absorbing volume 3 is provided between each packaging volume 2. The package series 1 comprising the volumes 2 and the shock absorbing volumes 3 is formed by a respective top layer 4 and a bottom layer 5 of flexible packaging material. Each of the top and bottom layers of material for the entire package series 1 is formed by a respective coherent film of packaging material. The packaging material will suitably consist of a flexible thermoplastic material, such as polypropylene or polyethylene. The two films may consist of mutually the same material or mutually different materials. Each film may consist of a laminated material and/or a material that has been surface treated in different ways, for instance if the packaged products place particular requirements on low diffusion of different substances through the packaging materials. In the case of certain applications, the packaging material is preferably constructed or treated to protected the packaged products from static discharged, so-called ESD-protection (EDS=Electric Static Discharge).
Each package volume 2 is thus delimited by the top and bottom layers of packaging material 4 and 5 respectively, and by a seam 6A, 6B. The seams 6A and 6B hermetically join the two layers 4, 5 together and extend continuously around the packaging volume in a median plane. In the case of the illustrated embodiment, the seams are produced by means of a heat welding process, although they may alternatively be produced by other sealing methods, for instance by gluing or vulcanizing processes.

The seams of each packaging volume comprise two first part-seams 6A and two second part-seams 6B, said part-seams being coherent and generally rectilinear with respect to each other. The first part-seams 6A (see also fig. 3) extend parallel with the longitudinal direction of the package series 1. The second part-seams 6B extend perpendicular to the first part-seams 6A.

Each shock absorbing volume 3 is also delimited by respective top and bottom layers 4, 5 of packaging material, and a seam 7A, 6B. The seams 7A, 6B join together the two material layers 4, 5 hermetically and extend continually around the shock absorbing volumes 3 along a median plane. The seams 7a, 6b of the shock absorbing volumes are obtained in the same way as the seams 6a, 6b of the packaging volumes. The seams provided around each shock absorbing volume are comprised of two first part-seams 7a and two second part-seams 6b. In reality, the second part-seams 6b of the shock absorbing volumes 3 are common with respective nearby second part-seams 6b of juxtaposed packaging volumes on each side of the shock absorbing volume. The first seams 7a of the shock absorbing volumes also comprise material joining extensions between the first part-seams 6a of adjacent packaging volumes 2.
The seam configuration described above enables the package series 1 to be produced readily and positively with the simple inexpensive and operationally reliable machine illustrated in figure 3. Figure 3 illustrates how two layers 4, 5 are joined together to form the package series shown in figure 2 when the packaging material is advanced through the machine or apparatus in the direction M. The machine includes four pairs of co-acting heat generating wheels 15a, 15b, 16a (the fourth wheel can not be seen in the figure). The machine also includes a pair of mutually co-acting rectilinear embossing jaws 17a, 17b that have heat generating tips 18a, 18b which are arranged to move towards and away from each other. The machine also includes two tubular air supply elements 19a, 19b which are orientated so that their respective ejection orifices will be situated relative to the feed direction M immediately downstream of the embossing jaws 17a, 17b.

As the packaging material is advanced through the machine or apparatus, the longitudinal seams that form the first part-seams 6a, 7a of the packaging volumes 2 and the shock absorbing volumes 3 are formed continually by the pair of mutually co-acting heat generating wheels 15a, 15b, and 16a. The products P to be packaged may be moved successively in between the heating wheels and placed on the bottom material layer 5. In the stage in figures 3a and 3b, the rear transverse part-seam 6b of a packaging volume 2 has just been formed as a result of pressing the heat generating tips 18a, 18b together and fusing the top and bottom layers 4 and 5 together along a transversely extending line. The two embossing jaws 17a, 17b are then parted and the two material layers 4, 5 are advanced in the feed direction M through a distance that corresponds to the distance between two transverse seams 6b, and a shock absorbing volume 3. As the thus
joined layers are advanced, air is blown through the tubular elements 19a, 19b such as to fill the rearward open space between the rearmost transverse seam 6b and the two longitudinal extending seams 7a⁻ (figure 3b) that have just been formed by the wheel pair 15, 16 with air. When this space has been filled with air, an overpressure is generated so as to cause the material layers 4, 5 between the longitudinally extending seams 7a⁻ to bulge outwards. Subsequent to advancing the packaging material through the aforesaid distance, which corresponds to the length of a shock absorbing volume 3, the embossing jaws 17a, 17b are again brought together so as to seal the inflated shock absorbing volume 3 with a further transverse seam 6b. The embossing jaws 17a, 17b are again parted and the packaging material is advanced through a distance that corresponds to the length of a packaging volume 2. As the material is advanced, a product that has been placed on the bottom material layer 5 is moved forwards and passes between the separated embossing jaws 17a, 17b. The jaws are then brought together so as to seal the packaging volume with yet another transverse seam 6b, therewith again reaching the state shown in figures 3a, 3b.

In the case of certain applications it may be desirable to deflate the packaging volumes 2 prior to them being closed. The tubular element 19a, 19b can then be used to suck air from each packaging volume 2 prior to the embossing jaws, 17a, and 17b forming the rear transverse seam of individual packaging volumes. According to one embodiment of the invention, air can be prevented from leaking into the packaging volume as the material is advanced and prior to the rear transverse seam being formed, the machine or apparatus may include a pair of sealing jaws 13a, 13b (shown in broken lines in the figure) disposed immediately downstream of the embossing jaws 17a, 17b.
and above and below respective tubular elements 19a, 19b. The sealing jaws 13a, 13b can be moved towards and away from each other and, although not shown, include on their mutually opposing borders or edges recesses for accommodating the tubular elements. As the sealing jaws 13a, 13b move towards each other, they press the top and bottom layers of material 4 and 5 towards each other and towards the tubular elements 19a, 19b such as to seal the space between the material layers from the ambient atmosphere, upstream of the sealing jaws.

Evacuation of air by means of the tubular elements 19a, 19b when forming a packaging volume 2 enables a higher degree of vacuum to be achieved than would otherwise be the case. The sealing jaws 13a, 13b may also be used in a similar manner to seal a packaging volume or a shock absorbing volume when forming said volume if the volume shall be filled with air or with some other gas.

Instead of providing the mutually opposing edges of the sealing jaws with recesses for accommodating the tubular elements, these edges may be formed from a resilient material that allows the sealing jaws to be brought together around said tubular elements.

Figure 1B illustrates an alternative embodiment of the package and the packaging method according to the invention. According to this embodiment, the package series is formed by two top layers 14a, 14b and two bottom layers 15a and 15b of a flexible web-like packaging material. Similar to the manner described in respect of the earlier described example, the two inner layers 40b, 50b form a number of mutually sequential packaging volumes 20. The packaging volumes 20 are formed by said layers 40b, 50b and by seams consisting of longitudinal part-seams 60a and transversal part-seams 60b. Respective outer layers 40a and 50a of packaging material are applied to
the outer surface of said inner layers 40b, 50b. The outer layers 40a, 50a are welded to respective inner layers 40b, 50b by means of longitudinally extending part-seams 70a and transverse part-seams 70b (see also figure 1d). The longitudinal part-seams 70a may coincide with the part-seams 60a of the packaging volumes 20. This results in transverse shock absorbing channels 30 between the inner layers 40b, 50b and the outer layers 40a, 50b. As with the shock absorbing volumes 3 described above, these channels 30 are filled with air.

According to two alternative embodiments (not shown), the transverse seams 70b can be replaced by or supplemented with further intermediate longitudinal seams so as to form longitudinally extending shock absorbing channels and small bubble-like shock absorbing volumes respectively. The shock absorbing channels 30 and the bubble-like volumes are suitably formed and inflated prior to joining together the upper and lower inner layers 40b, 50b to form the packaging volumes 20.

Figure 1C illustrates a variant of the packaging method and package illustrated in figure 1B. In the case of the figure 1C-embodiment, the two top layers 400a and 400b and the two bottom layers 500a and 500b are joined together solely at the part-seams 600a and 600b to form the packaging volumes 200. This results in a top shock-absorbing volume 300a and a bottom shock-absorbing volume 300b above and below each packaging volume 200 respectively.

By joining the two outer layers 400a and 500a together along longitudinally extending seams (not shown) that are disposed outwardly of the longitudinally extending part-seams 600a that join the inner layers 400b and 500b instead, there is formed a single coherent shock-absorbing volume around each packaging volume.
In all of the embodiments described above, it is important that the shock absorbing volumes extend outwardly of the corresponding perimeter surfaces of the packaging volumes. This will ensure that it is the outer layers of packaging material of the shock absorbing volumes that will come into contact with surrounding objects or with adjacent shock absorbing volumes or packaging volumes when the package series is folded double or stacked on another package series. This will thus ensure that it is the shock absorbing volumes that take up impacts, blows, pressures or other mechanical forces.

Figure 4 illustrates the method and apparatus for unpacking packages in accordance with the invention. The unpacking method may be included as a sub-stage in the inventive handling method.

The figure illustrates advancement of a package series 1 towards an unpacking station in the direction of the arrow A. The package series 1 corresponds to the series illustrated in figures 1A and 2 and includes packaging volumes 2 and shock absorbing volumes 3 formed by longitudinally extending part-seams 6a and 7a respectively and transverse part-seams 6b. The feed direction A is parallel with the longitudinal direction of the package series 1, wherewith the longitudinal part-seams 6a, 7a are parallel with the feed direction A whereas the transverse part-seam 6b extends at right angles to the feed direction A.

The unpacking apparatus includes a top and a bottom deflecting element 8a and 8b in the form of an elongate rotatably mounted roll respectively. The longitudinal axis of respective deflecting elements 8a, 8b are disposed in mutually parallel and mutually spaced relationship so that the products to be unpacked are able pass between the deflecting elements. The
longitudinal axis of respective deflecting elements 8a, 8b also extends in a plane that is parallel with the feed direction A and defines in this plane an angle of 45 degrees to the feed direction. The unpacking apparatus also includes a pair of spacing rollers 9a, 9b that extend parallel with the feed direction on one side of the feed path, and a pair of material collecting rollers 11a, 11b that extend parallel with the spacing rollers 9a, 9b externally thereof as seen from the feed path.

The package series 1 is unpacked by feeding said series in the feed direction along the feed path. The series is moved in the feed direction by gathering the removed packaging material on a driven collecting roller 12 such as to draw said series towards the deflecting elements with the aid of the force generated by the removed packaging material. The top layer of packaging material 4 is deflected upwardly from the bottom layer 4 and the product P at the deflecting elements 8a, 8b. The top layer 4 is thus drawn away from the bottom layer and said product while in abutment with the top deflecting element 8a. The top packaging material 4 is lead from the deflecting element over the top spacing roller 9a and then under the top collecting roller 11a from which the layer of material 4 is lead to the collecting roller 12. The bottom layer 5 is deflected correspondingly away from the product P by virtue of the abutment of said layer 5 with the bottom deflecting element 8b, and is then passed under the bottom spacing roller 9b and over the bottom collecting roller 11b and then gathered together with the top layer 4 on the collecting roller 12.

Because the deflecting elements 8a, 8b are out of parallel with each part-seam 6a, 6b, 7a, 7b of the package series 1, each part-seam will be broken successively during the entire unpacking process. This greatly reduces the force required to
break each part-seam. Moreover, the required breaking or separating force is continually of the same magnitude during breaking of all part-seams. This eliminates or reduces greatly the aforesaid problems that arise when large and cyclically varying breaking forces are required.

Because the deflecting elements 8a, 8b are disposed at an angle to the feed direction, it is also possible to gather the removed packaging material on one side of the feed path, for instance on the collecting roller 12 described above. This enables both layers of packaging material or, when applicable, all layers of packaging material to be collected on one and the same collecting roller, therewith significantly facilitating handling of the removed packaging material for destruction or recycling purposes. Instead of collecting the removed material of one roller it is also possible to use two mutually co-acting rollers that function to compact the removed layers therebetween and to feed the material to a collecting bin. In this regard, cutting or shredding rollers may be provided for finely dividing the material and therewith reduce its volume and thus greatly facilitate further handling of the removed material. According to another alternative of the unpacking method and unpacking apparatus, means may be provided for destroying the removed material directly in the collecting bin, for instance by combustion.

The embodiments described above are solely exemplifying embodiments and shall not be considered to limit the scope of the present invention. The invention can, instead, be varied freely within the scope of the accompanying claims.

For example, the shock absorbing volumes may be inflated with a gas other than air or with a shock absorbing liquid. The packaging volumes may also be filled with gas, for instance an
inert gas or an anti-septic gas. The packaging material may be chosen from many different types of material, for instance from different single layer or multilayer laminated barrier material or anti-septic material. Moreover, the heat generating wheels of the packaging apparatus described in the above examples may be replaced by or supplemented with other layer bonding devices, such as heat generating jaws or punches or technically corresponding devices. The described unpacking apparatus and unpacking method are fully automatic although it will be understood that they may alternatively be semi-automatic or manual.
CLAIMS

1. A method for handling products, preferably electronic products, comprising
   - joining together layers of flexible strip-like packaging material successively with the aid of seams to provide a packaging series of sequentially coherent packaging volumes that are closed and delimited from one another;
   - successively enclosing one or a number of products in each packaging volume;
   - transporting the packaging series;
   - feeding the packaging series to an unpacking station; and
   - breaking each seam successively in the unpacking station and freeing the products by removing the packaging the materials; wherein the method is characterized by
   - successively forming shock absorbing volumes (3) that are delimited from one another and from the packaging volumes (2) in conjunction with joining together said layers of packaging material, by joining together the material layers (4, 5) forming said packaging volumes between and/or adjacent to the packaging volumes (2),
   - filling the shock absorbing volumes with a shock absorbing material, and
   - sealing or closing the shock absorbing volumes.

2. A handling method according to claim 1, wherein the seams (6a, 6b, 7a) are broken by deflecting the layers of packaging material from each other over deflecting elements (8a, 8b) that have a deflecting axis that is out of parallel with each seam.

3. A method of packaging a number of products, preferably electronic products, comprising the steps of
   - successively placing the products (P) or batches of a smaller number of products one after the other between layers
of flexible strip-like packaging materials;
- successively enclosing each product or batch in mutually delimited and sealed packaging volumes by joining the material layers together around each product or each batch along a seam, characterized by the further steps of
  - successively forming shock absorbing volumes (3) which are delimited from each other and from the packaging volumes (2), by joining together the material layers (4,5) forming said packaging volumes between the packaging volumes (2);
  - filling the shock absorbing volumes with a shock absorbing material; and
  - closing or sealing the shock absorbing volumes.

4. A method according to claim 3, wherein the material layers forming the packaging volumes are two in number (4, 5).

5. A method according to any one of claims 3-4, wherein the shock absorbing material includes a fluid.

6. A method according to claim 5, wherein the shock absorbing material includes air.

7. A method according to any one of claims 3-6, wherein the material layers (4,5) are fed in a common feed direction and the seams enclosing the product volumes (2) include first part-seams (6a) which are formed generally parallel with the feed direction, and second part-seams (6b) which are formed generally at right angles to said feed direction.

8. A method according to any one of claims 3-7, characterized by the further step of forming two or more juxtaposed rows of mutually sequential packaging volumes.

9. Apparatus for carrying out the handling method defined in any one of claims 3-8, comprising
- means for feeding layers (4, 5) of flexible packaging material in a feed direction (M)
- first means (15a, 15b, 16a) for joining together said layers of flexible packaging material along longitudinally extending part-seams (6a, 7a) that are generally parallel with said feed direction
- second means (17a, 17b, 18a, 18b) for joining together layers of flexible packaging material along transverse part-seams (6b) that extend generally at right angles to said feed direction, characterized by
- means for delivering shock absorbing material to shock absorbing volumes (3) formed between the layers of flexible packaging materials and by at least some of the part-seams (6b, 7a), said delivery means being intended to deliver the shock absorbing material behind said second means (17a, 17b, 18a, 18b) relative to the feed direction (M).

10. A product unpacking method, wherein the products (P) are enclosed in mutually delimited and closed packaging volumes (2) that are formed sequentially in a coherent packaging series (1) of mutually joined layers (4, 5) of flexible packaging material, wherein said layers are joined together along a seam around each packaging volume, wherein said seam includes at least one part-seam (6a, 6b, 7a) that has a generally linear length direction, wherein the method includes the step of
- feeding the packaging series to a separating station
- breaking each part-seam at the separation station by deflecting at least one layer away from remaining layers and removing each product, wherein the method is characterized by breaking each part-seam (6a, 6b, 7a) successively.

11. An unpacking method according to claim 10, comprising the steps of
- drawing at least one layer (4, 5) over a deflecting element that has a generally linear deflecting axis while being in abutment with said deflecting element, and
- feeding the packaging series (1) in a feed direction (A) relative to the deflecting element, said feed direction being orientated so that each part-seam (6a, 6b, 7a) with a generally linear length direction is non-parallel with the deflecting axis so as to obtain successive breaking of each part-seam.

12. A method according to claim 11, wherein the deflecting axis is non-parallel with the feed direction (A).

13. A method according to any one of claims 10-12, wherein the packaging series (1) includes a top layer (4) and a bottom layer (5) of packaging material that are joined together by part-seams (6a, 6b, 7a) that are generally perpendicular to and parallel with the feed direction (A) respectively, wherein the method further includes the step of separating the layers by deflecting said layers over a top deflecting roller (8a) and a bottom deflecting roller (8b), wherewith the longitudinal directions of said rollers define an angle of 45 degrees to the feed direction.

14. A method according to any one claims 10-13, comprising the step of collecting the separated layers (4, 5) of packaging material on a common roll (12) or in a common container.

15. Apparatus for carrying out the unpacking method according to any one of claims 10-14, wherein the apparatus includes means for feeding a coherent package series (1) of mutually delimited and closed packaging volumes (2) in a feed direction (A), said packaging volumes (2) being formed by layers (4, 5) of flexible packaging material joined together by part-seams (6a, 6b, 7a) and further comprising deflecting elements that
function to deflect the layers from one another as the seams are broken, wherein the apparatus is characterized by the deflecting means being arranged so that each part-seam (6a, 6b, 7a) will be broken successively.

16. Apparatus according to claim 15, wherein the deflecting elements comprise a top deflecting roller (8a) and a bottom deflecting roller (8b) which are non-parallel with the feed direction (A).

17. Apparatus according to claim 15 or 16, comprising a material collecting device (12) which is common to all layers (4, 5).

18. A package, preferably for electronic products, comprising a coherent packaging series (1) of mutually sequential and mutually delimited packaging volumes (2) formed by layers of strip-like flexible packaging material joined together along seams, characterized by shock absorbing volumes (3) which are delimited from each other and from the packaging volumes and which are disposed between two sequential packaging volumes (2) and formed by the layers of packaging material (4,5) and by part-seams (6b, 7a), said shock absorbing volumes being filled with a shock absorbing material or substance.

19. A package according to claim 18 in which the shock absorbing substance is air.

20. A package according to any one of claims 18–19 in which the seams enclosing the product volumes (2) include first part-seams (6a) and second part-seams (6b), wherein said second part-seams are generally at right angles to the first part-seams (7).
21. A package according to any one of claims 18-20, comprising two or more mutually adjacent rows of mutually sequential packaging volumes.

22. A method of packaging a number of products, preferably electronic products, comprising the steps of
- successively placing the products (P) or product batches of a small number of products one after the other between layers of strip-like flexible packaging material and
- successively enclosing each product or each batch in closed packaging volumes that are delimited from one another, by joining together the material layers around each product or each sub-component along a seam, characterized by the further steps of
- successively forming shock absorbing volumes (30, 300) which are delimited from each other and from the packaging volumes (20, 200), wherein the shock absorbing volumes are formed by joining together the material layers (40b, 50b, 400b) forming said packaging volumes outside said packaging volumes (20, 200) with further layers of strip-like flexible packaging material (40a, 400a, 50a, 500a), and the shock absorbing volumes are formed as a number of smaller longitudinal, transversal or bubble-shaped volumes (30) on the outside of each packaging volume (20);
- filling the shock absorbing volumes with a shock absorbing material or substance; and
- closing or sealing the shock absorbing volumes.

23. A method according to claim 22 in which each of the shock absorbing volumes is formed as one volume that encloses one or more packaging volumes.
24. A method according to any one of claims 22-23, wherein the layers of material forming said packaging volumes are two in number (4, 5, 40b, 50b, 400b, 500b).

25. A method according to any one of claims 22-24, wherein the further layers comprise two layers (40a, 50a, 400a, 500a).

26. A method according to any one of claims 22-25, wherein the shock absorbing substance or material includes air.

27. A method according to any one of claims 22-26 comprising the step of forming two or more mutually adjacent rows of mutually sequential packaging volumes.

28. A package, preferably for electronic products, comprising a coherent packaging series (10, 100) of mutually sequential and mutually delimited and closed packaging volumes (20, 200) formed by layers of strip-like flexible packaging material joined together along seams, characterized by shock absorbing volumes (30, 300a, 300b) which are delimited from each other and from the packaging volumes and which are formed by layers of packaging material (40a, 40b, 50a, 50b, 400a, 400b, 500a, 500b) and by part-seams (70a, 70b, 600a, 600b) wherein said shock absorbing volume is filled with a shock absorbing material, wherein the shock absorbing volumes (30) included in said package are formed as longitudinal or transversal or bubble-shaped outwardly projecting volumes externally of the packaging volume.

29. A package according to claim 28, wherein the packaging volumes are accommodated in the shock absorbing volume.

30. A package according to any one of claims 28-29, wherein the shock absorbing material is air.
A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B65B, B65D, H05K, B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>US 3768724 A (HILL), 30 October 1973 (30.10.1973), figures 4-6</td>
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<td>A</td>
<td>File EPODOC/EPO, SAKAI CHEMICAL INDUSTRY CO: &quot;Method for Packaging with Cushioning Synthetic Resin Sheet and Apparatus Used Therefor&quot; JP 11171107 A, 19990629</td>
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<td>US 4087002 A (BAMBARA ET AL), 2 May 1978 (02.05.1978)</td>
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search: 9 January 2006

Date of mailing of the international search report: 3-03-2006

Name and mailing address of the ISA/Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. +46 8 666 02 86

Authorized officer

William Helin / JA A
Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (April 2005)
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Form PCT/ISA/210 (continuation of second sheet) (April 2005)
INTERNATIONAL PATENT CLASSIFICATION (IPC):

B65D 81/03 (2006.01)
B65B 9/02 (2006.01)
B65H 41/00 (2006.01)
H05K 13/02 (2006.01)

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Cited literature, if any, will be enclosed in paper form.
INTERNATIONAL SEARCH REPORT

Box No. II  Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III  Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The following separate inventions were identified:

1: Claims 1-9 and 18-30 directed to a method for packaging products in stripe-shaped flexible packaging material comprising shock absorbing volumes. The claims are also

.../...

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest ☐ The additional search fees were accompanied by the applicant’s protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant’s protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (April 2005)
directed to a method for handling products, an apparatus and a package.

2: Claims 10-17 directed to a product unpacking method and an apparatus, wherein seams between layers of packaging material are broken successively in a non parallel manner.

The present application has been considered to contain 2 inventions which are not linked such that they form a single general inventive concept, as required by Rule 13 PCT for the following reasons:

The closest prior art to the first mentioned invention has been identified as D1: US3340669 A1.

Document D1 describes air cushioned packets. Two layers of heat sealed plastic film form inner volumes for the products. Two further film layers form outer air filled protecting pockets, which surround said inner volumes.

Invention 1:

From a comparison of the disclosure of D1 and the technical features of claims 1-9 and 18-30, the features concerning the design of the shock absorbing volumes can be seen to make a contribution over this prior art.

These features are hence considered as special technical features in the sense of Rule 13.2 PCT.

The effects of these features are inter alia improved shock absorption and stability when the products are stacked.

From these special technical features, the objective problem to be solved by the first invention can be construed as: to improve the shock absorption and stability for the products when stacked.

Invention 2:

From a comparison of the disclosure of D1 and the technical features of claims 10-13, 15 and 16, the features concerning the breaking of the seams between the layers of packaging

.../...
Box III
material successively in a non parallel manner, can be seen to make a contribution over this prior art.

These features are hence considered as special technical features in the sense of Rule 13.2 PCT.

The effects of these features are reduced and more constant separating forces at opening of the packages.

From these special technical features, the objective problem to be solved by the second invention can be construed as: to eliminate or reduce large and cyclically varying breaking forces when separating the package material layers.

The above analysis shows that the special technical features of invention 1 are neither the same as, nor corresponding to, those of invention 2.

In conclusion, therefore, the 2 groups of claims are not linked by same or corresponding special technical features and define different inventions not linked by a single general inventive concept.

The application, hence does not meet the requirements of unity of invention as defined in Rule 13.1 and 13.2 PCT.
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