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PACKAGING APPARATUS AND METHOD FOR PRODUCING PACKAGING UNITS

Abstract

The invention relates to a packaging apparatus (**1**) and a method used to produce packaging units (**35**). The packaging units (**35**) comprise at least one article (**30**), such as a beverage can (**31**), held in a packaging blank (**20**) having at least in some portions or areas that are flat. The packaging blank (**20**) has at least one passage opening (**23**) in the flat portion or area for article(s) (**30**). The packaging apparatus (**1**) comprises a feeder device (**2**); a pre-treatment module (**9**) to prepare the packaging blank (**20**) for the application to the article(s) (**30**); and a first packaging module (**7**) to apply and locate the packaging blank (**20**) to the article(s) (**30**). The pre-treatment module (**9**) comprises a device to reduce a resistance force in an edge area (**24**) of the passage openings (**23**) during the application of the packaging blank (**20**) to the article(s) (**30**).

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Background/Summary

CLAIM OF PRIORITY [0001] The present application is a continuation of U.S. application Ser. No. 17/610,751, filed Nov. 12, 2021, which application claims priority to International Application PCT/EP2020/061561, filed Apr. 24, 2020, which in turn claims priority to German Application DE 10 2019 113 176.6, filed May 17, 2019, German Application DE 10 2019 128 874.6, filed Oct. 25, 2019, and German Application DE 10 2019 135 254.1 filed Dec. 19, 2019, which are incorporated by reference.

FIELD OF THE INVENTION
[0002] The present invention relates to a packaging apparatus and a method used to produce packaging units according to the features of the independent claims.
BACKGROUND OF THE INVENTION
[0003] There is a variety of different packaging alternatives that are used to process, assemble, group, and package articles such as beverage containers. A frequently used variant, for example, consists in gathering together a plurality of articles or containers of the same type into portable, relatively handy pack units or packaging units. There are also various possibilities known to gather together individual articles or containers into larger packs. Beverage containers, for example, are mostly gathered together by shrink films and packaged into packs of four, six, or more containers. It is usually inevitable to produce packs, because packs are the most common type of packaging units for beverage containers or bottles made of PET plastic material. Some packs are further gathered together and/or assembled in layers and placed on pallets for transport purposes.
[0004] The production of the known pack types requires specific production steps in order to be able to process the shrink films commonly used for the packs. These production steps require a relatively high energy input, not least due to the shrinking process of the film taking place under heat exposure. The use of the film also entails costs for production, supply, handling, and subsequent waste disposal, because the film is no longer needed after the articles or packs have been sold and unwrapped. The machinery for supplying the so-called film wrapping modules and other handling stations also causes high investment costs. A relatively high input of capital is finally required for supplying the so-called shrink tunnel, where the film that the packs are wrapped into is shrunk around the containers by the application of hot air.
[0005] So-called strapped packs represent a packaging variant that generally makes it possible to dispense with the use of shrink films. For this variant, the containers are assembled to a pack and held together by so-called strapping tapes. Continuously or cyclically operated strapping machines are used to group containers, articles, or bottles into formations, which are then strapped together with a strapping tape or with a plurality of strapping tapes by employing strapping aggregates.

Typical formations include, for example, 1×2 arrangements (two containers in a row), 2×2 arrangements (four containers in a square or in a rhomboid formation), 3×2, 4×3, or generally any other variable N×M arrangement.

[0006] Another known variant involves the use of so-called top gripping type cartons to gather together a plurality of bottles via their neck areas, for example. The patent document EP 1 075 419 B1 describes a packaging machine used to set up such top gripping type cartons. In this context, the articles or containers are arranged in a crate, and the gripping type carton is lowered from above onto the at least one article arranged in the crate. In particular, there is a plurality of articles arranged in the crate, and subgroups are formed by positioning a smaller number of top gripping type cartons, with the subgroups each gathering together a part of the articles arranged in the crate.

[0007] The arrangement and number of passage openings of a gripping type carton corresponds to the arrangement and number of articles or containers to be gathered together. As a rule, the diameter of the passage openings is slightly smaller than a maximum diameter of an upper area of the articles. The gripping type carton is lowered and pressed onto the articles such that a defined upper area of the articles is pushed through the passage openings. In particular, an upper area with a maximum diameter is pushed through the passage openings, and the edge areas of the passage openings are brought into engagement with the articles below this maximum diameter such that the gripping type carton is safely and firmly located on the articles. Relatively high application forces are necessary to locate the gripping type carton on the articles in such a manner, in particular, to push the articles through the passage openings. The articles accordingly must be able to meet this application force with an appropriate resistance in order for the articles not to be damaged during the positioning of the gripping type carton.

[0008] The object of the invention lies in eliminating the disadvantages of the apparatuses known from the prior art.

SUMMARY OF THE INVENTION

[0009] The above object is solved by a packaging apparatus and a method used to produce packaging units, the packaging apparatus and the method comprising the features of the independent claims. Further advantageous embodiments of the invention are described in the subclaims.

[0010] The below-described method carried out by a packaging apparatus to produce packaging units is particularly directed to reducing the application force necessary to locate a gripping type carton to an article group. The packaging units produced in the process comprise at least one article or container that has at least one designed packaging blank arranged thereto, with the packaging blank having some portion or area that is flat and at least one passage opening in the flat portion or area for at least one article.

[0011] Normally, however, the packaging units produced in the process comprise two or more articles or containers gathered together and having at least one packaging blank arranged thereto, in each instance with the packaging blank having a passage opening in flat portion or area for each of the articles or containers, whereby the two or more articles or containers are mechanically held together.

[0012] The at least one article or container is preferably a beverage container, in particular a bottle made of PET or another suitable plastic material. Preferentially, the articles or containers can also be formed as cans made of plastic and/or aluminum or of another metal or the like. The packaging apparatus and the method are however also suitable to arrange and locate an appropriate packaging blank to other suitable articles or containers.

[0013] The flat packaging blank can in particular be made of recyclable cellulosic materials. For example, the flat packaging blank can be made of paperboard and/or cardboard, which can be recycled without problems after use. It is moreover conceivable that the flat packaging blank is made of plastic material, in particular using single-material thermoplastics, which are likewise good to recycle.

[0014] If required, it is possible for the flat packaging blank to have a number of cutouts that together form a carrying handle.
[0015] The flat packaging blank can be composed of a plurality of cellulosic layers, for example, or of a combination of different materials, and also of different recycled materials.
[0016] A packaging apparatus used to produce such packaging units comprises at least one feeder device for the at least one article or for assemblies of at least two articles, a pre-treatment module to prepare the packaging blank for the application to the at least one article, and a first packaging module to apply and locate the packaging blank to the at least one article. In this context it is provided that the pre-treatment module comprises at least one device designed to reduce a resistance force in an edge area of the at least one passage opening of the packaging blank during the subsequent application of the packaging blank to the at least one article.
[0017] The packaging units produced according to a particularly preferred embodiment consist of at least two articles or containers gathered together by at least one first secondary packaging device in the form of a flat packaging blank. All features described below in relation to such packaging units are also applicable in an analogous or appropriately adapted manner to packaging units comprising only one article and a thereto located packaging blank. A packaging blank formed with a carrying handle blank to provide a carrying handle is in particular referred to in this instance.
[0018] Furthermore, the articles or containers of the packaging units can be additionally gathered together by at least one other secondary packaging device. The additional second secondary packaging device is formed, for example, by at least one tape- or strip-like, full circle strapping tensely wrapped horizontally around an outer side of the articles or containers and optionally firmly secured at a contact point to at least one of the articles.
[0019] The strapping can in particular be secured at the contact point by a material-bonded connection in the form of at least one welded joint. Such a contact point of the strapping with one of the outer surfaces of the articles is however by no means mandatory, since the strapping can already adhere firmly to the outer surfaces of the strapped articles by the strapping tension applied thereto. Alternatively and additionally, the articles can be secured to each other by adhesive bonds.
[0020] The linear or point-shaped or flatly delimited adhesive bonds are expediently situated at contact surfaces or contact edges of the adjacently positioned articles such that all in all only relatively small glued surfaces can already provide for a firm connection between the articles. Another alternative embodiment can provide the articles gathered together with a packaging blank to be additionally arranged on a so-called tray and/or to be wrapped in shrink film. In the instance of at least one strapping with the articles arranged on a tray, the arrangement of the second secondary packaging device can be carried out prior to or simultaneously with or after the application of the packaging blank.
[0021] The application of an adhesive to form adhesive bonds is preferably carried out before or in a temporal connection with the assembling of the articles into an article group prior to the application of the packaging blank, whereas the application of a shrink film is preferably carried out after the application of the packaging blank, in particular, so that the shrink film is shrunk onto the articles gathered together with the packaging blank.
[0022] The packaging blank has at least two passage openings in the flat portion for the at least two articles. Furthermore, the flat portion of the packaging blank can have carrying handle openings for the user to pass the fingers through in order to be able to lift up and transport or the like the entire packaging unit using the carrying handle.
[0023] In particular, the packaging blank is a so-called top gripping type carton. The packaging blank is preferably made of a cardboard material, a plastic material, a cardboard-plastic composite material, or the like.
[0024] After locating the packaging blank, a defined upper area of the articles is preferably situated above the packaging blank, while a defined lower area of the articles is arranged below the packaging blank.

[0025] According to one embodiment, the passage openings of the packaging blank have suitable securing devices, which can be formed by securing tabs, for example. The securing tabs are formed, for example, by cuts or the like extending radially from the openings. After arrangement and fastening of the packaging blank to the articles, the packaging blank is in engagement with the articles in such a manner that it is substantially stationarily located to the articles and such that the articles can no longer make any significant relative movements or position changes relative to each other or relative to the packaging blank. The packaging blank can thus only be removed from the articles of the article group with an increased effort and with an upward directed force component, which normally leads to at least partially destroying the packaging blank.
[0026] The packaging apparatus comprises at least one feeder device via which the at least two articles are fed. Preferably, the articles are already previously assembled in a suitable number and arrangement to article groups, which are fed via the at least one feeder device to a packaging module. In the packaging module, a packaging blank is applied and located to the article group. To this end, a packaging blank is taken from a magazine and prepared in a pre-treatment module for the application to the at least two articles of the article group. For this purpose, the pre-treatment module comprises at least one device designed to reduce a resistance force in an edge area of the passage openings of the packaging blank during the subsequent application of the packaging blank to the at least two articles, a so-called resistance reducing device.
[0027] According to a first embodiment, the resistance reducing device of the pre-treatment module comprises at least one stretching die, preferably however a plurality of stretching dies, which is/are suitable to stretch and/or expand the edge areas of the at least one passage opening. In this instance, an average diameter of the at least one passage opening is at least slightly enlarged by the pre-treatment. An upper area of articles with a maximum diameter that is preferably at least slightly larger than an average diameter of the passage openings can thereby be more easily passed through the particular passage opening.
[0028] The application force used to press the packaging blank onto the articles such that the upper area of the articles with a maximum diameter is arranged above the packaging blank and the lower area of the articles is arranged below the packaging blank is in particular significantly reduced in relation to an application force that would be necessary to locate a packaging blank without pre-treatment to the articles. The risk of damaging the articles during the positioning of the packaging blank is thus also reduced in relation to customary packaging apparatuses and packaging methods. In this instance, it is even possible to use articles having less wall thickness without damaging the articles during the positioning of the packaging blank.
[0029] According to one embodiment, the at least one stretching die is arranged in the pre-treatment module in a detachable manner. The stretching dies are formed, for example, by differently designed molded parts. The molded parts can in this context substantially have the form of the articles to which the particular packaging blank is to be applied. The stretching dies are made of a rigid solid material, for example, or they at least have a greater stability than the particular articles. The in each instance suitable stretching dies are arranged in the pre-treatment module in the appropriate number and arrangement depending on the articles and the corresponding packaging blanks.
[0030] The packaging blank is positioned on the stretching dies and pressed down such that partial areas of the stretching dies in each instance pass through the passage openings and thereby in particular come into engagement with the edge areas of the passage openings. This causes stretching or another modification of the edge areas of the passage openings, and in particular, the material in the edge areas of the passage openings is weakened. Preferably, an average diameter of the passage openings is increased by the stretching dies.
[0031] According to one embodiment, the stretching dies have a conical or truncated cone form, with the apex or the end of the cone with the smaller cross-sectional area facing upward. In this instance, the stretching dies are suitable for different sizes of articles. Depending on the average

diameter of the passage openings, the packaging blank is pressed downward correspondingly far to expand the passage openings in the desired manner.
[0032] The arrangement and number of the stretching dies corresponds in particular to the number and arrangement of the passage openings of the packaging blank. In the instance of a change of product, a pre-treatment module with detachably arranged stretching dies thus makes it possible to convert to the new product in a simple, quick, and cost-efficient manner.
[0033] It should be pointed out explicitly here that this aspect of a simple and quick conversion of the stretching dies can be particularly advantageously realized with different exchangeable module parts, which can be placed into packaging machines and removed as well as exchanged for other module parts with a different division and/or with the stretching dies differently spaced apart.
[0034] It is accordingly possible that the working tool comprises at least one centering device in the form of the mentioned stretching dies, with the centering device pre-treating the openings of a flat packaging blank provided to receive the articles, containers, or beverage cans temporally before positioning the particular packaging blank, in particular by widening and/or stretching the edges of the openings far enough for the articles, containers, or beverage cans to be gathered together in order to more easily slide thereinto or be more easily received thereinto.
[0035] A preferably provided step of the method provides a pre-treatment of the flat packaging blank in order to reduce a resistance force occurring in an edge area of the openings of the particular flat packaging during a later positioning of the flat packaging blank.
[0036] It is possible in this context for an average diameter of the openings to be in each instance enlarged during the pre-treatment.
[0037] It is also possible that securing tabs formed in the particular edge areas of the openings are at least in some areas folded over such that the securing tabs subsequently protrude from a plane in which the openings are arranged.
[0038] In this context, it is provided that the flat packaging blank is pressed onto a device with at least one die or with at least one stretching die during the pre-treatment. It is possible in this context that the number and arrangement of the dies or of the stretching dies corresponds to the number and arrangement of the openings of the flat packaging blank, with the flat packaging blank being pressed onto the dies or onto the stretching dies in such a manner that the dies or the stretching dies at least in some areas pass through the openings.
[0039] If a plurality of dies or a plurality of stretching dies are provided, the plurality of dies or the plurality of stretching dies can be gathered together in one format part.
[0040] One aspect can therefore relate to a format part for the pre-treatment of flat packaging blanks each having a plurality of openings, which format part [0041] has a carrier preferably formed as a carrier plate and also [0042] comprises a plurality of stretching dies, with it being provided that [0043] the plurality of stretching dies are each arranged at the carrier that is preferably formed as a carrier plate, and the plurality of stretching dies each at least in some sections taper in the direction away from the carrier that is preferably formed as a carrier plate.
[0044] It is possible that cuts and/or perforations are in each instance introduced into the edge areas of the openings during the pre-treatment. It is in particular possible that radial cuts and/or radial perforations are introduced during the pre-treatment.
[0045] Embodiments with the edge area of the openings having moisture applied to or being moistened have also proved successful. It can be alternatively or additionally provided that the edge area of the openings is heated or that a temperature control device applies thermal energy specifically to edge areas of the openings.
[0046] It should be emphasized at this point that at least the aspect explained here relating to the exchangeability of the stretching die modules for such modules with other dimensions, spacing distances, and/or numbers of stretching dies within a module is regarded as an independent inventive idea.
[0047] According to one embodiment of the invention, a packaging blank is taken from a magazine

by a suitable gripping tool and is transferred into the pre-treatment module and there lowered onto the device with the stretching dies and is in particular pressed thereonto such that the stretching dies at least in some sections pass through the passage openings of the packaging blank. The packaging blanks are preferably stacked on top of each other in a lying position in the magazine.
[0048] An arrangement of the packaging blanks in a standing position can alternatively be provided. In this instance, the gripping tool is preferentially designed to transfer the packaging blank situated in a vertical and angled arrangement into a horizontal alignment before pressing it onto the stretching dies. The arrangement of the stretching dies can alternatively be designed such that it is possible to press a packaging blank aligned in a vertical or angled arrangement thereonto. The packaging blank pre-treated by the stretching tools is subsequently conveyed to the packaging module by the gripping tool and positioned on an assembly of articles inside the packaging module and applied and located to the articles by being pressed thereonto. In this instance, a gripping tool can perform both transport steps.
[0049] Alternatively, a first gripping tool can be provided to take a packaging blank from the magazine and a second gripping tool to take and transport the pre-treated packaging blank from the pre-treatment module.
[0050] According to one embodiment, an expanding of the passage openings is carried out due to the packaging blank being pressed onto stretching tools with a downwardly expanding diameter, whereby the material in the edge area of the passage openings is partially compressed and/or whereby material of the edge areas is partially pushed upward out of the plane of the passage openings.
[0051] It can be provided, for example, that radial cuts within the edge area extend from the passage openings. The areas between the radial cuts form the so-called securing devices or securing tabs. When the packaging blank is pressed onto the stretching tools, the securing tabs are pushed upward such that the average diameter of the passage openings is increased after the packaging blank is taken from the pre-treatment module.
[0052] According to a further embodiment, it can be provided that radial perforations within the edge areas extend from the passage openings. When the packaging blank is pressed onto the stretching tools, the packaging blank is torn open at the perforations, and securing tabs are formed in the edge areas delimiting the passage openings, the securing tabs being pushed upward analogous to the above-described manner.
[0053] The stretching tools with a downwardly expanding diameter in particular have the effect that the edge areas are bent within the packaging module opposite to the application direction. The application force to position the packaging blank on the articles is thereby reduced. The packaging blank is moreover centered and/or precisely positioned on the stretching tools and can thus be taken from the pre-treatment module and fed to the packaging module in a precisely positioned manner.
[0054] According to a further embodiment, the resistance reducing device of the pre-treatment module comprises at least one cutting device and/or perforating device. By introducing cuts or perforations into the edge area of the passage openings, the material in the edge areas of the packaging blank becomes more flexible, thereby reducing a resistance force when the packaging blank is pressed onto the articles.
[0055] In particular, it can be provided to combine the pre-treatment using a cutting device and/or perforating device with the pre-treatment using suitable stretching dies, in which instance cuts and/or micro-perforations and/or perforations are introduced by the cutting device and/or perforating device into the packaging blanks, in particular with the cuts and/or micro-perforations and/or perforations extending radially from the passage openings.
[0056] According to a further embodiment, the resistance reducing device of the pre-treatment module comprises at least one moistening device, in particular, a device with which edge areas delimiting the passage openings can be moistened. In the process, the edge areas of packaging blanks consisting of a cardboard material are preferentially treated with a fluid, while the fluid is

not applied onto the remaining areas of the packaging blank.
[0057] The moistening device is a vaporizing device, for example, whereby water vapor is applied onto the appropriate edge areas of the packaging blank. By the moistening, the cardboard material in these areas is slightly softened and thereby becomes easier to deform. This also facilitates the subsequent application of the in this manner pre-treated packaging blank to the articles of the article group. After the packaging blank has dried, its original rigid material properties in the appropriate areas are restored. One embodiment can provide an additional suitable drying device to support, for example, by the specific application of warm air, the drying of the packaging blank located to the articles.
[0058] According to a further embodiment, the resistance reducing device of the pre-treatment module comprises at least one heating device with which in particular edge areas delimiting the passage openings can be heated. In particular, the edge areas of the passage openings of packaging blanks consisting of a thermoplastic plastic material are heated, while the remaining areas of the packaging blank are not heated.
[0059] By the specific heating, the plastic material in the correspondingly treated areas becomes softer and thereby also becomes easier to deform. This also facilitates the subsequent application of the in this manner pre-treated packaging blank been to the articles of the article group. After the packaging blank has cooled, its original rigid material properties are restored. One embodiment can provide an additional suitable cooling device to support, for example, by the specific application of cold air, the cooling of the packaging blank located to the articles.
[0060] According to a further embodiment, it can be provided that the preparation of the packaging blanks can already be carried out before they are supplied in a magazine of the packaging apparatus, which magazine can be assigned, in particular, to the packaging module of the packaging apparatus. Appropriately prepared packaging blanks with the securing tabs already pre-creased or the like, can be procured from a supplier, for example. The packaging blanks prepared by the supplier are then supplied to the packaging module in a magazine of the packaging apparatus. The prepared packaging blanks are taken from the magazine and positioned on the articles of the article group in the manner described above. It can be alternatively provided that an appropriate pre-treatment module is assigned to the magazine and that the preparation of the packaging blanks to reduce the resistance force in an edge area of the passage openings of the packaging blanks takes place inside the packaging apparatus before the prepared packaging blanks are arranged in a magazine and supplied for the subsequent application to the articles.
[0061] It is possible to reduce the application force used to secure the packaging blanks to the article groups by the pre-treatment of the packaging blanks. The risk of damage to the articles, in particular to beverage cans, is thereby reduced. The packaging apparatus according to the invention and the method according to the invention thus also make it possible to gather together articles and a packaging blank in packaging units if the articles have less wall thickness and are therefore more sensitive to compressive forces. This allows to save material, thereby making it possible to produce articles more cost-efficiently. In addition, the articles that can be designed from primary packaging with thinner walls, for example bottles or cans, result in producing less packaging waste that would otherwise have to be disposed of.
[0062] It should be explicitly mentioned at this point that all aspects and embodiment variants explained in the context of the apparatus according to the invention can likewise pertain to or constitute partial aspects of the method according to the invention. If specific aspects and/or interrelations and/or effects relating to the apparatus according to the invention are referred to at some point in the present description or in the claims definitions, this therefore likewise pertains to the method according to the invention. The same applies conversely, so that all aspects and embodiment variants explained in the context of the method according to the invention can likewise pertain to or constitute partial aspects of the apparatus according to the invention. If specific aspects and/or interrelations and/or effects relating to the method according to the

invention are referred to at some point in the present description or in the claims definitions, this therefore likewise pertains to the apparatus according to the invention.

Description

BRIEF DESCRIPTION OF THE FIGURES

[0063] In the following passages, the attached figures further illustrate typical embodiments of the invention and their advantages. The size ratios of the individual elements in the figures do not necessarily reflect the real size ratios. It is to be understood that in some instances various aspects of the invention may be shown exaggerated or enlarged in relation to other elements in order to facilitate an understanding of the invention.

[0064] FIG. **1** shows a first embodiment of a packaging blank.

[0065] FIG. **2** shows an article.

[0066] FIG. **3**A and FIG. **3**B schematically show the application of a packaging blank to an assembly of articles according to FIG. **2**.

[0067] FIG. **4** shows a schematic procedure of a method used to produce packaging units according to the invention.

[0068] FIG. **5** shows a schematic illustration from above of a first embodiment of a packaging apparatus used to produce packaging units.

[0069] FIG. **6** shows a lateral view of a packaging apparatus according to FIG. **5**.

[0070] FIG. **7** shows a first embodiment of a pre-treatment module.

[0071] FIG. **8** shows a second embodiment of a pre-treatment module.

[0072] FIG. **9**A to FIG. **9**C show a first embodiment of a packaging blank and the corresponding pre-treatment and application of such a packaging blank to an article group.

[0073] FIG. **10**A and FIG. **10**B show a partial area of the packaging blank according to FIG. **9**A and FIG. **9**B in a cross-sectional illustration.

[0074] FIG. **11**A to FIG. **11**C show a second embodiment of a packaging blank and the corresponding pre-treatment and application of such a packaging blank to an article group.

[0075] FIG. **12**A to FIG. **12**D show a third embodiment of a packaging blank and the corresponding pre-treatment and application of such a packaging blank to an article group.

[0076] FIG. **13** shows a schematic procedure of another embodiment of a method used to produce packaging units according to the invention.

[0077] FIG. **14**A and FIG. **14**B show fourth embodiments of a packaging blank.

[0078] FIG. **15** shows a lateral view of a packaging unit with a packaging blank according to FIG. **14**A or FIG. **14**B.

[0079] FIG. **16** shows a lateral view of a packaging apparatus used to add a carrying handle blank according to FIG. **14**A or FIG. **14**B.

[0080] FIG. **17** shows a schematic view of a packaging line in which an embodiment of an industrial robot according to the invention as well as an embodiment of a working tool according to the invention are employed.

[0081] FIG. **18** and FIG. **19** show another embodiment of a packaging line in which an embodiment of an industrial robot according to the invention as well as an embodiment of a working tool according to the invention are employed.

[0082] FIG. **20** shows a third embodiment of a packaging line in which an embodiment of an industrial robot according to the invention as well as an embodiment of a working tool according to the invention are employed.

[0083] FIG. **21** to FIG. **23** each show a schematic view of an embodiment of a working tool according to the invention.

[0084] FIG. **24** to FIG. **26** show individual details of a manipulation element of the working tool

according to the embodiment of FIG. **18** to FIG. **20**.
[0085] FIG. **27** shows a schematic perspective view of a multipack such as can be produced with various embodiments of the working tool according to the invention.
[0086] FIG. **28** shows a schematic perspective view of a fourth embodiment of a packaging line in which an embodiment of an industrial robot according to the invention as well as an embodiment of a working tool according to the invention are employed.
[0087] FIG. **29** to FIG. **31** show individual details of an embodiment of a packaging line according to FIG. **28**.
[0088] FIG. **32** shows an alternative embodiment for the contact surface of a working tool.
[0089] FIG. **33** shows another alternative embodiment for the contact surface of the working tool.
[0090] The same or equivalent elements of the invention are designated using identical reference characters. Furthermore and for the sake of clarity, only the reference characters relevant for describing the individual figures are provided. It should be understood that the detailed description and specific examples of the embodiments of the apparatus or of the method according to the invention are intended for purposes of illustration only and are not intended to limit the scope of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0091] The schematic view in FIG. **1** shows a first embodiment of a packaging blank **20**. The schematic top view of FIG. **2** shows an article **30** from above, which article **30** can be gathered together with at least one further, in particular, identical article **30** into a packaging unit **35** or a pack **36** by a packaging blank **20**.
[0092] The side views of FIG. **3**A and FIG. **3**B schematically show the application of a packaging blank **20** to an assembly of articles **30** according to FIG. **2**.
[0093] The articles **30** are preferentially beverage containers in the form of bottles or cans **31** made of plastic material and/or aluminum or of another suitable metal or the like. The packaging apparatus and the method are however also suitable to arrange and locate an appropriate packaging blank **20** to other suitable articles **30**. Besides the cans **31** shown here, these could also be, for example, bottles made of mineral glass, PET beverage containers, or the like.
[0094] In some areas of the upper area, the articles **30** preferably have a widening to which the packaging blank **20** is located. In particular, the cans **31** have a lid edge **32**. Below this lid edge **32**, the cans **31** have at least a slight narrowing **33** or necking **33**. As is discernible in outlines from the schematic side view in FIG. **3**A, the necking **33** situated below the lid edge **32** has a smaller diameter than the outer surface of the particular can **31** situated below the necking **33** and also a smaller diameter than the lid edge **32** situated above the necking **33**.
[0095] The cans **31** are, in particular, beverage cans as customarily known from the prior art, which can likewise be referred to with the reference number **31** in the present context.
[0096] It is preferentially provided that the packaging blank **20** is located to the cans **31** in the area of the narrowing **33** or necking **33** below the lid edge **32** after the packaging blank **20** has been positioned on the assembly of at least two cans **31**. A partial area of the cans **31**, more specifically the can lid with the closure **34**, is thus situated above the packaging blank **20** after the positioning of the packaging blank **20** on the cans **31**, while the remaining area of the cans **31** together with the outer surfaces thereof extends below the packaging blank **20**. It is in particular provided that the packaging blank **20** is secured in this position by the cans **31** and vice versa.
[0097] If the articles **30** are, for example, bottles made of PET or of another suitable plastic material with a screw cap, the bottle has a widening in some areas in the form of a so-called neck ring below the screw cap. The diameter of the bottle below the neck ring is again designed to be smaller in some areas, and it widens downward from there. It is in particular provided that the packaging blank **20** is located below the so-called neck ring of the cap area to the bottles after the packaging blank **20** has been positioned on an assembly of bottles. The cap area and the neck ring of the bottles are thus situated above the packaging blank after the positioning of the packaging

blank, while the remaining area of the bottles extends below the packaging blank.
[0098] The packaging blank **20** is designed to be substantially flat, for example, and it has passage openings **23** for the articles **30**. The packaging blank **20** is designed in such a manner that it can be placed over the articles **30** from above, with the articles **30** at least partially passing through the passage openings **23** such that the articles **30** are situated with some areas above and with some areas below the packaging blank **20** after the fastening of the packaging blank **20** to an article group **41**.
[0099] After locating the packaging blank **20**, a defined upper area of the articles **30** is preferably situated above the packaging blank **20**, while a defined lower area of the articles **30** is arranged below the packaging blank **20**. In particular, an edge area **24** delimiting the passage openings **23** in this context abuts on the outer cover surface of the articles **30**.
[0100] According to a preferred embodiment, the passage openings **23** of the packaging blank **20** can have suitable securing devices, which can be formed by securing tabs, for example. Securing tabs are formed, for example, by cuts or the like (not illustrated in FIG. **1**, but cf. FIG. **9**A, FIG. **9**B in this context), which extend radially from the passage openings **23**.
[0101] After arrangement and fastening of the packaging blank **2** to the articles **30**, the packaging blank **20** is in engagement with the articles **30** in such a manner that the packaging blank **20** is substantially stationarily located to the articles **30** and such that the articles **30** can no longer make any significant relative movements or position changes relative to each other or relative to the packaging blank **20**.
[0102] The packaging blank **20** can thus only be removed from the articles **30** of the article group **41** with an increased effort and with an upward directed force component, which normally leads to at least partially destroying the packaging blank **20**. Such packaging blanks **20** are also referred to as top gripping type cartons. The packaging blank **20** is preferably made of a cardboard material, a plastic material, a cardboard-plastic composite material, or the like.
[0103] In order to produce a packaging unit **35**, a packaging blank **20** is pre-treated to reduce a resistance force of the packaging blank **20** in the edge areas **24** delimiting the passage openings **23** during the application of the packaging blank **20** to the at least two articles **30**. The pre-treated packaging blank **20** is in the following also referred to with the reference number **20***v*.
[0104] The pre-treated packaging blank **20***v* is placed onto a corresponding assembly **40** or article group **41** of at least two articles **30** and at least partially pressed onto and in the process secured to the articles **30** of the assembly **40** by an application force F, in particular, a downward directed pressure, that is at least partially directed downward or directed parallel to the longitudinal axes of the upright standing articles **30**.
[0105] Due to the pre-treatment and the thereby reduced resistance force mentioned above and explained in more detail below, the application force F can be reduced in relation to the known prior art. It is thereby possible to also arrange packaging blanks **20***v* to such articles **30** that have less wall thickness, for example, and that are thus less resistant to compressive forces. In this manner, it is possible to reduce the material usage for the articles **30**, because such a packaging blank **20** or **20***v* can also be used to gather together thinner walled and mechanically less stable articles **30**.
[0106] By the advantageous reduction of the resistance force and thus of the application force F as well, it is additionally possible to position a plurality of packaging blanks **20***v* simultaneously or approximately simultaneously on upright standing articles **30** or beverage cans **31** and to thereby increase machine performance.
[0107] FIG. **4** shows a schematic procedure of a method used to produce packaging units **35** or packs **36**. While at least two articles **30** are being assembled to an article group **41** (cf. FIG. **3**A) in, for example, a divider module or the like, a packaging blank **20** is taken from a magazine assigned to the packaging module preferably substantially at the same time or at least close to the same time.
[0108] The article group is fed to the packaging module, and the packaging blank is prepared for

the application to the article group by a suitable device of the packaging module or by a separate device assigned to the packaging module. A pre-treatment module for the packaging blanks, for example, is assigned to the packaging module, or such a pre-treatment module is integrated into the packaging module.

[0109] In the packaging module, the appropriately prepared packaging blank is positioned from above on the assembly of the at least two articles. The prepared packaging blank is in the process preferably brought into a form-locking and/or force-locking connection to the articles such that the articles are held inside the formed packaging unit at defined positions and, in particular, in a defined relative arrangement, by the packaging blank.

[0110] It can be furthermore provided that the articles are held together inside the packaging unit by at least one further secondary packaging device, for example by an additional strapping or the like encompassing all articles. This further secondary packaging device can be arranged and located to the articles before the application of the packaging blank, during the application of the packaging blank, or after the application of the packaging blank. This is in particular possible with the use of at least one strapping as a further secondary packaging device or with the additional arrangement of the articles on a tray or in a basket. If the further secondary packaging device is applied in the form of a shrink wrap, however, the application of the shrink wrap is carried out after the application of the packaging blank; in particular, a shrink film is wrapped around the articles and then shrunk onto the articles with the packaging blank holding the articles together.

[0111] FIG. **5** shows a schematic illustration from above of a first embodiment of a packaging apparatus **1** used to produce packaging units **35** (also cf. FIG. **3**B). The articles **30**, formed for example by beverage-filled cans **31** or beverage cans **31**, are fed via a feeding transport device **2**.

[0112] In the present exemplary embodiment, the articles **30** are fed in individual rows in lanes **3** separated from each other by lane guides **4**. The articles **30** are taken from the lanes **3** and each arranged on turntables **6** in a rotary module **5**. The articles **30** can be aligned by the turntables **6** on the basis of specific equipment characteristics.

[0113] For example, it can be desirable for the trade that at least one barcode and/or other information carriers marking the articles **30** inside a packaging unit **35** faces/face outwardly and therefore is/are clearly visible. The alignment of the articles **30** can be in particular sensor-monitored and appropriately controlled. However, the alignment of the articles **30** is not important for the present invention; this alignment therefore only represents an optional component of the packaging apparatus **1**.

[0114] The articles **30** are subsequently fed in the defined assembly **40** to a first packaging module **7** in order to apply and locate the secondary packaging device supplied in the form of packaging blank **20**, with some flat portion(s), to the at least two articles **30**.

[0115] The packaging module **7** can have at least one magazine **8** assigned to it in which flat packaging blanks **20** are provided. A first extraction tool (not illustrated here) takes at least one packaging blank **20** from the magazine **8** and transfers the packaging blank **20** to a pre-treatment module **9**. The extraction tool can be a vacuum cup, for example, which suctions the packaging blank **20**, in particular in the flat portions(s), in the magazine **8**, transports it to the pre-treatment module **9**, and deposits it there by the vacuum being dissipated. Alternatively, the packaging blank **20** can be held by a clamping or a suitable pneumatic force etc., which can be correspondingly disengaged.

[0116] The packaging blanks **20** undergo a pre-treatment in the pre-treatment module **9**, with the effect that a resistance force of the packaging blanks **20** is reduced during the subsequent application to the assembly of at least two articles **30**. In particular, a resistance force of the packaging blank **20** in an edge area **24** of the passage openings **23** of the packaging blank **20** is reduced in the process (cf. FIG. **1**).

[0117] It is in particular provided in the process that an average diameter of the passage openings **23** is in each instance at least slightly enlarged or the like. The pre-treatment module **9** comprises

suitable stretching tools **18**, for example, such as are described in more detail in connection with FIG. **7** and FIG. **8**.

[0118] The in this manner pre-treated packaging blank **20***v* is now taken from the pre-treatment module **9** by a second extraction tool, for example (not illustrated here), and the packaging blank **20***v* is pressed onto the assembly **40** of articles **30** (cf. FIG. **3**A) from above and thereby located thereto. The second extraction tool thus simultaneously assumes the function of an application device. The articles **30** are arranged within the assembly **40** corresponding to the arrangement of the passage openings **23** of the packaging blank **20**, **20***v*.

[0119] In the illustrated embodiment, it is provided that three packaging units **35** are in each instance produced in parallel with each other. In this respect, the packaging module **7** comprises three magazines **8** for packaging blanks **20**, and the pre-treatment module **9**, which can be integrated into the packaging module **7** or designed separately, has three devices for the pre-treatment of packaging blanks **20**.

[0120] The articles **30** gathered together with the pre-treated packaging blank **20***v* into a packaging unit **35** or a pack **36** can now be fed via a removal conveyor belt **10** to a further packaging module (not illustrated here), for example, where at least one second (optional) secondary packaging device is additionally applied and located to the articles **30** of the packaging units **35** or of the packs **36**.

[0121] Such a second packaging module, which is to be considered as optional, can be a strapping module, for example, in which at least one strapping is applied to the articles **30** of the packs **36**. In particular, at least one tape- or strip-like, full circle strapping is tensely wrapped horizontally around an outer side of the articles **30**. If required, an inner side of the strapping abutting on the outer sides of the articles **30** can be firmly secured at a contact point to at least one of the articles **30**. In this way, the strapping can in particular be secured at the contact point by a material-bonded connection in the form of at least one welded joint.

[0122] Alternatively, the further packaging module can also be a gluing module, for example, in which the articles **30** are secured to each other by adhesive bonds, for example by suitably placed adhesive points at contact points between two articles **30**.

[0123] A further alternative embodiment can provide that the articles **30** gathered together with a pre-treated packaging blank **20***v* are arranged on a so-called tray or are wrapped in a shrink film, in which instance the shrink film is shrunk onto the articles **30** with the packaging blank **20***v* holding the articles **30** together.

[0124] Alternatively, the articles **30** gathered together with a pre-treated packaging blank **20***v* can be fed to a palletizing module, for example, where a plurality of packaging units **35** are assembled in a palletizable layer, and a plurality of these palletizable layers are stacked on top of each other.

[0125] According to an alternative embodiment not illustrated here, it can be provided that an appropriately pre-treated packaging blank is applied as a second secondary packaging device to an article group **41**, in which the articles **30** are already being held together by a first secondary packaging device, in particular by a strapping and/or by adhesive bonds or the like.

[0126] FIG. **6** shows a schematic lateral view of a packaging apparatus **1** according to FIG. **5**. The description of the reference numbers already referred to in connection with FIG. **5** is largely dispensed with here; the additionally visible features, however, will be in particular described.

[0127] The articles being fed via the lanes **3** are removed from the lanes **3** by a suitable first gripper head **11**. The first gripper head **11** is equipped with an appropriate number and arrangement of packing bells **12**, for example, in which instance it is possible to change the arrangement of the packing bells **12** relative to each other. For the removal of the articles from the lanes **3**, the packing bells **12** can be situated, for example, in a first arrangement.

[0128] While the first gripper head **11** is conveying the articles toward the rotary module **5**, the relative arrangement of the packing bells **12** is adjusted to the arrangement of the turntables **6** such that each article is deposited in each instance centered on a turntable **6**. Each turntable **6** preferably has an own drive **17** assigned to it, for example a servomotor. In particular, the assembly of the

articles as an article group is in this context carried out in accordance with the arrangement of the articles on the turntables **6**.

[0129] The first gripper head **11** is vertically movable via a first vertical axis vA**1**, that is to say, the height of the first gripper head **11** can be appropriately adjusted, in particular, for the removal of the articles from the lanes **3** and for the placing of the articles on the turntables **6**. The first gripper head **11** can furthermore be moved laterally between the feeding transport device **2** and the rotary module **5** via a horizontal axis hA.

[0130] The packaging blanks **20** provisioned in the magazine **8** are in each instance taken from the magazine **8** and fed to the above described pre-treatment module **9** via a suitable second gripper head **13**, which is equipped with at least one vacuum cup **14**, for example.

[0131] The second gripper head **13** is vertically movable via a second vertical axis vA**2**, that is to say, the height of the second gripper head **13** can be appropriately adjusted, in particular, for taking the provisioned packaging blanks **20** from the magazine **8** and for the deposit of the packaging blanks **20** in the pre-treatment module **9**. The second gripper head **13** can furthermore be moved laterally between the magazine **8** and the pre-treatment module **9** via the horizontal axis hA.

[0132] The illustrations of FIG. **7** show a first embodiment of a pre-treatment module **9**. A packaging blank **20** is taken from a magazine **8** by a gripper head **13**, for example, a vacuum cup **14**, and transferred to the pre-treatment module **9**. This pre-treatment module **9** comprises so-called stretching tools or stretching dies **18**, which are designed in the form of the here so designated stretching cones **19**, for example.

[0133] These stretching cones **19** are situated in a relative arrangement corresponding to the arrangement of the articles **30** in the finished packaging unit **35**. In addition, the arrangement of the stretching cones **19** corresponds to the arrangement of the passage openings **23** of the packaging blanks **20**. The packaging blank **20** is placed over the stretching cones **19** by the gripper head **13** such that in each instance one stretching cone **19** projects through in each instance one passage opening of the packaging blank **20**.

[0134] The packaging blank **20** is pressed downward along the stretching cones **19** until the edge areas **24** of the passage openings **23** are stretched by the downwardly expanding cross section of the stretching cones **19**, whereby the diameter of the passage openings **23** is at least slightly increased. The in this manner pre-treated packaging blank **20***v* is subsequently conveyed to the packaging module **7** by the gripper head **13** and applied to an article group **41**.

[0135] The packaging blank **20** is centered and precisely positioned or aligned due to the slope of the stretching cones **19**. It is preferably provided that the packaging blank **20** is at least briefly released from the gripper head **13** for the purpose of the centering. The pre-treated packaging blank **20***v* can subsequently be taken up in a precise manner by the gripper head **13** and can be applied on a corresponding assembly **40** of articles **30** and secured thereto by being pressed down.

[0136] The illustrations of FIG. **8** show a second embodiment of a pre-treatment module **9**. In this context, the packaging blank **20** is completely released inside the pre-treatment module **9** by the gripper head **13** and pressed onto the stretching cones **19** with the aid of a suitable tool **50**, for example, a pressure punch **51**, in order to expand the edge areas **24** of the passage openings **23** and in this manner reduce the resistance force of the packaging blank **20** in the edge areas **24**.

[0137] The appropriately pre-treated packaging blank **20***v* is subsequently taken up by a third gripper head **15**, which is likewise designed as a vacuum cup **16**, for example, and conveyed from the pre-treatment module **9** to the packaging module **7**.

[0138] As will be explained in more detail below, a plurality of stretching cones **19** arranged regularly or in a die can be placed into the packaging machine as modules gathered together and can be taken from there as required, which can be expedient in the instance of a change of product, for example, and a processing of packaging blanks **20** with changed dimensions, spaces of the passage openings **23**, diameters of the passage openings **23**, number of the passage openings **23** per packaging blank **20**, etc.

[0139] The option of a modular exchange of a plurality of stretching cones **19** or of a die with a plurality of regularly arranged stretching cones **19**, is in this context optionally also to be regarded as an independent aspect of the present invention.
[0140] The schematic views of FIG. **9**A to FIG. **9**C show a first embodiment of a packaging blank **20** and the corresponding pre-treatment and application of such a packaging blank **20** to an article group **41** consisting of four articles **30**, in particular, consisting of four cans **31**.
[0141] FIG. **9**A thus shows a packaging blank **20** before an appropriate pre-treatment, while FIG. **9**B shows a packaging blank **20***v* after the appropriate pre-treatment. FIG. **9**C shows a packaging unit **35** made of four articles **30** gathered together by a pre-treated packaging blank **20***v*.
[0142] FIG. **10**A and FIG. **10**B show a partial area of the packaging blank **20**, in particular, a partial area in a cross-sectional illustration comprising a passage opening **23** according to FIG. **9**A and FIG. **9**B.
[0143] The packaging blank **20** has four passage openings **23** with a mean or average diameter d**23**. So-called securing tabs **25** are in each instance formed in the edge areas **24** delimiting the passage openings **23**. The securing tabs **25** are formed, in particular, by radial cuts **26** being provided which extend from the passage openings **23**.
[0144] When the packaging blank **20** is pressed onto the stretching cones **19** as described in connection with FIG. **7** and FIG. **8** or by other suitable deforming devices, the securing tabs **25** are at least partially pushed upward and/or bent. The securing tabs **25** now protrude upward from the plane in which the passage openings **23** are situated (cf. FIG. **10**B).
[0145] The average diameter of a passage opening **23** is increased by the upward push and/or by the upward bending of the securing tabs **25**, which is indicated by the use of the reference number d**23***v*. In particular, it applies that the average diameter d**23** of a passage opening **23** of a packaging blank **20** prior to pre-treatment is smaller than the average diameter d**23***v* of a passage opening **23***v* of a packaging blank **20** after the pre-treatment.
[0146] However, the enlarged average diameter d**23***v* of a passage opening **23***v* after the pre-treatment is preferably always still at least slightly smaller than a maximum average diameter of the articles **30** in an upper area, in particular, in an upper area formed above the packaging blank **20***v* that is located to the articles **30** in the completed packaging unit **35**.
[0147] The securing tabs **25** in the finished packaging unit **35** are preferably brought into engagement with the underside of the particular lid edge **32** of the cans **31** in such a manner that the packaging blank **20** is firmly secured to the cans **31** and cannot slip off upward (also cf. FIG. **3**B).
[0148] Alternatively, the packaging blank **20** can have perforations extending radially away from the passage openings **23**. When the packaging blank **20** is pressed onto the stretching cones **19**, the perforations break apart, whereby corresponding securing tabs **25** are formed, which are bent upward when the packaging blank **20** is pressed further onto the stretching cones **19**.
[0149] It is furthermore possible to expand a packaging blank **20** in the area of the passage openings **23** and correspondingly provide an at least slightly increased average diameter d**23***v* by pressing the packaging blank **20** onto the stretching cones **19** if the packaging blank **20** has no securing tabs **25** or if the packaging blank **20** has no appropriate perforations to form securing tabs. In this context, in particular, the material of which the packaging blank **20** consists is pressed together and/or compressed in the edge areas **24** delimiting the passage openings **23**.
[0150] FIG. **11**A to FIG. **11**C show a second embodiment of a packaging blank **20** and the corresponding pre-treatment and application of such a packaging blank **20** to an article group **41**.
[0151] In particular, FIG. **11**A shows an untreated packaging blank **20** and FIG. **11**B shows a pre-treated packaging blank **20***v*. In this context, it is provided that cuts **27** and/or micro-perforations are in each instance introduced into the edge area **24** of the passage openings **23** during the pre-treatment in order to reduce the resistance force in this area.
[0152] In particular, the cuts **27** introduced in such a manner extend radially from the passage openings **23**. When the pre-treated packaging blank **20** is pressed directly onto the articles **30**, the

partial areas **28** formed between the cuts **27** can be pushed upward with little effort. In particular, it is also provided in this embodiment that the partial areas **28** engage below an in some areas maximum article diameter, whereby the packaging blank **20***v* is firmly located to the articles **30**.
[0153] Furthermore, it can be provided that the pre-treatment is carried out in two stages, with cuts **27** and/or micro-perforations being introduced into the packaging blank **20** in a first pre-treatment step and the in this manner pre-treated packaging blank being pressed onto appropriate stretching dies, such as have already been described in detail in connection with FIG. **7** and FIG. **8**, in a second pre-treatment step.
[0154] The schematic views of FIG. **12**A to FIG. **12**D show a third embodiment of a packaging blank **20** and the corresponding pre-treatment and application of such a packaging blank **20** to an article group **41**.
[0155] In particular, FIG. **12**A shows an untreated packaging blank **20** and FIG. **12**B shows a pre-treated packaging blank **20***v*. In this context, it is provided that the packaging blank **20** is in each instance made more unstable in the edge area **24** of the passage openings **23** by moistening. This is suitable, in particular, for packaging blanks **20** made of a cardboard material.
[0156] By the moistening, in which water vapor, for example, or another suitable fluid is applied onto the appropriate areas of the packaging blank **20** by a vaporizing device, the material of which the packaging blank **20** consists can be softened at least in some areas. In particular, the edge areas **24** delimiting the passage openings **23** for the articles **30** are hereby specifically moistened.
[0157] The packaging blank **20***v* with the in this manner softened edge areas **24***v* can now be applied to the articles **30** with less effort (FIG. **12**C).
[0158] Furthermore, a subsequent drying step can be provided, in which the moistened edge areas **24***v* of the pre-treated packaging blank **20***v* applied to the articles **30** are dried by a suitable drying apparatus, for example, by drying air or the like. During drying, the stability appropriate to the material properties of the packaging blank **20** is restored to the edge areas **24** such that the packaging blank **20** abuts particularly firmly on the articles **30** (FIG. **12**D).
[0159] If the packaging blank **20** consists of a thermoelastic plastic material, for example, it is possible by heating in some areas, in particular, by heating the edge areas **24** delimiting the passage openings **23**, to increase the elastic properties in these heated areas. After the packaging blank **20***v* with correspondingly pre-treated, in particular heated edge areas **24***e* of the passage openings **23** has been applied to an article group **41**, the edge areas **24** of the passage openings **23** connect to the outer cover surfaces of the articles **30** in a particularly advantageous manner during cooling.
[0160] FIG. **13** schematically illustrates the procedure of another embodiment of a method used to produce packaging units according to the invention. In this context, it is provided that the preparation of the packaging blanks can already be carried out before they are supplied in a magazine of the packaging apparatus.
[0161] The preparation of the packaging blanks can already be carried out by the supplier of the packaging blanks. Alternatively, an appropriate pre-treatment module can be assigned to the magazine. This means that in such instances, already prepared packaging blanks are supplied in the magazine to the packaging module of the packaging apparatus. The prepared packaging blanks, in which the resistance force in an edge area of the passage openings of the packaging blanks is reduced, are taken from the magazine and positioned on the articles of the article group in the above described manner.
[0162] FIG. **14**A and FIG. **14**B show fourth embodiments of a packaging blank **20**. FIG. **15** shows a lateral view of a packaging unit **35** with a packaging blank **20** according to FIG. **14**A or FIG. **14**B. FIG. **1** to FIG. **3**, in particular, are referred to regarding the description of the articles **30**.
[0163] In particular, the packaging blank **20** is a so-called carrying handle blank **21**, which has at least some portions or areas that are flat and which has a passage opening **23** in this flat area for the application of the carrying handle blank **21** to the article **30**, in particular to the can **31**.
[0164] Furthermore, the carrying handle blank **21** comprises a so-called carrying handle opening **29**

for the user to pass at least one finger through, for example, in order to be able to hold and/or carry and/or transport the article more easily or better. Another suitable carrying element can also be provided instead of the carrying handle opening **29**. According to one embodiment of the invention, it can be provided that the carrying element extends beyond the plane of the flat area at least on one side.

[0165] As has already been described in connection with FIG. **1** to FIG. **3**, it is also provided in this exemplary embodiment that the carrying handle blank **21** is secured to the can **31** below the lid edge **32** in the finished packaging unit **35**. It is thereby ensured that the carrying handle blank **21** does not become disengaged from the article **30** or the can **31** when the user uses the carrying handle **29** or the carrying element (not illustrated here) to lift up the packaging unit **35**.

[0166] FIG. **16** shows a schematic lateral view of a packaging apparatus **1** used to add a carrying handle blank **21** according to FIG. **14**A or FIG. **14**B. The description of the reference numbers already referred to in connection with FIG. **5** and FIG. **6** is largely dispensed with here; the additionally visible features or differences, however, will be in particular described.

[0167] The articles are fed in via a transport device **2**. The carrying handle blanks **21** are provisioned in a magazine **8**. One carrying handle blank **21** is in each instance taken from the magazine **8** and fed to a pre-treatment module **9** via a suitable gripper head **13** equipped, for example, with at least one vacuum cup **14**.

[0168] The gripper head **13** is vertically movable via a vertical axis vA**2**, that is to say, the height of the gripper head **13** can be appropriately adjusted, in particular for taking the provisioned carrying handle blanks **21** from the magazine **8** and for the deposit of the carrying handle blanks **21** in the pre-treatment module **9**. The gripper head **13** can furthermore be moved laterally between the magazine **8** and the pre-treatment module **9** via a horizontal axis hA.

[0169] The pre-treatment module **9** comprises a suitable stretching tool **18**. The pre-treatment of the carrying handle blank **21**, in particular in the area of the particular passage opening, is carried out analogous to the manner as already described in detail in connection with FIG. **1** to FIG. **13**.

[0170] The correspondingly pre-treated carrying handle blank **21***v* is positioned on the article **30** (also cf. FIG. **15**). This can be carried out, for example, while the article is being continuously moved along on the transport device **2**.

[0171] Alternatively, it can be provided that the particular article to which a carrying handle blank **21** is to be added is taken from a transport device **2** and transferred to a handling area (not illustrated here) of the packaging module **7** in which the addition of the carrying handle blank **21** is carried out. Subsequently, the article thus provided with a correspondingly prepared carrying handle blank **21***v* is arranged on a further transport device or arranged on the feeding transport device **2** again and fed to a further handling, for example.

[0172] The side views of FIG. **17** to FIG. **20** each schematically illustrate embodiment variants of a packaging line arranged inside a packaging apparatus **1**. The packaging apparatus **1** can be equipped with industrial robots, in particular, in which instance gripper heads **11** and/or **13** and/or **15** according to the above definition can continue to be used.

[0173] The packaging apparatus **1** can be used to produce packaging units **35** or packs **36**, such as are exemplarily illustrated in FIG. **27**, in each instance from assemblies **40** of articles **30** or of article groups **41**.

[0174] Such a packaging unit **35** or such a pack **36** comprises a plurality of articles **30** or beverage cans **31** and a flat packaging blank **20** via which the plurality of articles **30** or cans **31** are held to each other in a form-locking manner.

[0175] The flat packaging blank **20** has an opening **23** assigned to each of the beverage cans **31**, which opening **23** the particular beverage can **31** passes through with an upper section such that all beverage cans **31** of the particular pack **36** are held to each other in a form-locking and/or force-locking manner via the flat packaging blank **20**.

[0176] The embodiment of such a pack **36** as illustrated in FIG. **27** comprises exactly eight

beverage cans **31**. In other embodiments, it is possible for a pack **36** to comprise only two beverage cans **31**, four beverage cans **31**, or six beverage cans **31**, for example.

[0177] In order to assemble or to produce the particular pack **36**, the packaging line of the shown packaging apparatus **1** comprises a first module **60**, a second module **70**, and a transport device **2**, which can continue guiding articles **30** or beverage cans **31** from the first module **60** along to the second module **70**. In the exemplary embodiment according to FIG. **17**, FIG. **18**, FIG. **19**, and FIG. **20**, the second module **70** is downstream in a conveying direction FR provided for the beverage cans **31** from the first module **60**.

[0178] In order to be able to produce a pack **36** corresponding to the exemplary embodiment according to FIG. **27**, beverage cans **31** provided for the particular pack **36** have to be brought into an arrangement relative to each other in which the passage openings **23** of the packaging blank **20** are arranged to be aligned with the beverage cans **31** and the beverage cans **31** can then be pushed in an aligned orientation through the openings **23** of the flat packaging blank **20**.

[0179] If beverage cans **31** are not appropriately aligned with one another, the beverage cans **31** will not or only partially come in line with the passage openings **23** during a positioning of the packaging blank **20**, thereby potentially resulting in problems in a positioning of the particular flat packaging blank **20**.

[0180] In order to form a particular grouping **41** or assembly **40** from a plurality of beverage cans **31**, dividers can be provided, for example, which can comprise two horizontal conveying devices following one another in conveying direction FR and producing groupings **41** in each instance of a plurality of beverage cans **31** by an intermittent operation. Also known are dividers that are able to come into abutment on articles **30** or beverage cans **31** via a plurality of pushing bars, to then accelerate the particular beverage cans **31** in relation to beverage cans **31** succeeding in conveying direction FR, and to hereby form a particular grouping **41** from a plurality of beverage cans **31**.

[0181] In the packaging apparatus **1** from the exemplary embodiment according to FIG. **17** to FIG. **20**, the first module **60** comprises the first gripper head **11** (also cf. FIG. **5** and FIG. **6** in this context), which is schematically illustrated in FIG. **18**, in order to produce the groupings **41**. In such embodiments, beverage cans **31** are received from a supply unit **61** (cf. FIG. **28**) via the first gripper head **11**, then moved toward the transport device **2**, and deposited on the transport device **2** in a direction coming from above.

[0182] The depositing of the beverage cans **31** on the transport device **2** is in this context carried out via a handling device formed by the first gripper head **11** in the range of the first module **60** in such a manner that a grouping **41** of beverage cans **31** is formed on the transport device **2** immediately upon the depositing, with the particular number of beverage cans **31** in each grouping **41** corresponding to the appropriate number of beverage cans **31** in the pack **36** (cf. FIG. **27**) to be in each instance produced.

[0183] In addition, the depositing of the beverage cans **31** on the transport device **2** via the first gripper head **11** is carried out in such a manner that the beverage cans **31** of a particular grouping **41** formed on the transport device **2** already immediately upon the beverage cans **31** being deposited on the transport device **2** have an alignment relative to one another that is suitable for the positioning of the particular flat packaging blank **20**.

[0184] As already mentioned above, the first module **60** can also have a divider in order to produce or generate a particular grouping **41** on the transport device **2**, which divider is provided instead of the gripper head **11** and which forms the particular groupings **41**. In order to be able to receive the beverage cans **31** from the supply unit **61** (cf. FIG. **28**) and to deposit them on the transport device **2**, the mentioned handling device comprises at least one first gripper head **11**.

[0185] After the formation of the groupings **41** on the transport device **2**, with the groupings **41** each comprising a plurality of beverage cans **31** already aligned relative to one another for the positioning of the flat packaging blanks **20** thereonto, these groupings **41** are moved via the transport device **2** in conveying direction FR.

[0186] The transport device **2** is in contact with a control device and/or regulating device S only schematically indicated here, which controls the transport device **2** to provide the groupings **41** deposited thereonto with an interruption-free movement at a same conveying speed or at a conveying speed that is constant in time. The groupings **41** thereupon leave the first module **60** and reach the second module **70** arranged downstream in conveying direction FR from the first module **60**.

[0187] In order to minimize the risk of the beverage cans **31** inadvertently shifting relative to one another during a movement in conveying direction FR when the beverage cans **31** are already immediately upon being deposited on the transport device **2** suitably aligned relative to one another for the positioning of a flat packaging blank **20**, it can be provided that the transport device **2** has a circulating endless traction device or a circulating transport belt with a high static friction formed between the circulating endless traction device or the circulating transport belt and the beverage cans **31**. The endless traction device or the circulating transport belt can have a multitude of burls, for example, and/or it can consist of a material that can cause a high static friction to build between the beverage containers and the endless traction device or between the beverage containers and the circulating transport belt.

[0188] In order to position the flat packaging blank **20** on a particular grouping **41**, the second module **70** preferably comprises an industrial robot **71** carrying a working tool **72**, which is merely schematically illustrated in FIG. **17** to FIG. **20**. This working tool **72** explained in detail below has also been referred to above as second gripper head **13** and/or as third gripper head **15** (cf. FIG. **6** to FIG. **8** and FIG. **16** in this context).

[0189] The industrial robot **71** can be designed as or integrated into a gantry system, for example. It is conceivable for the industrial robot **71** to be designed as a multi-axis robot or as a delta kinematic robot.

[0190] The here so designated working tool **72** comprises a plurality of manipulation elements **73** (cf. FIG. **21**) designed in such a manner that the plurality of manipulation elements **73** can apply a particularly defined force along the particular circumferential course of the particular opening **23** onto the flat packaging blank **20** in a temporally offset manner in order to press a particular beverage can **31** into a particular passage opening **23** (cf. FIG. **25** and FIG. **26**). The working tool **72** provided in the exemplary embodiment according to FIG. **17** to FIG. **20** can in this instance be designed according to the exemplary embodiment of FIG. **21** to FIG. **26**.

[0191] The industrial robot **71** can receive a flat packaging blank **20** from a magazine **8** (cf. FIG. **28**; also cf. FIG. **5** to FIG. **8** in this context) for each grouping **41** via the working tool **72** according to FIG. **21** to FIG. **26** and also via the working tool **72** according to FIG. **17** to FIG. **20**, or, in other embodiments, use the working tool **72** to take off a flat packaging blank **20** from a plurality of dies **74** (cf. FIG. **28**) having a plurality of stretching cones **19** (cf. FIG. **7** and FIG. **8**) on which the flat packaging blank **20** had been positioned in a preceding process step. Magazine **8** can have a multitude of flat packaging blanks **20** stacked in it.

[0192] The industrial robot **71** then aligns the flat packaging blank **20** received by the working tool **72** above the particular beverage cans **31** on which the flat packaging blank **20** is to be positioned. After this, the industrial robot **71** lowers the working tool **72** vertically toward the particular beverage cans **31** or vertically toward the particular grouping **41** and presses the flat packaging blank **20** by force application against the particular beverage cans **31** that are to be gathered together to a pack **36** via the flat packaging blank **20**.

[0193] Beverage cans **31** hereby pass through openings **23** of the flat packaging blank **20**, whereupon the particular beverage cans **31** are held together in a form-locking manner via the flat packaging blank **20** and a pack **36** is formed.

[0194] In order to be able to move the working tool **72**, the industrial robot **71** preferably has a working arm **75** on which the working tool **72** is arranged. In other embodiments, the working tool **72** can also be designed as a component of or integrated into a gantry system. The working tool **72**

can be moved horizontally and vertically, as required, using the working arm **75**.
[0195] Since in practice a particular diameter of the openings **23** of the flat packaging blank **20** is reduced in relation to a diameter formed in each instance in the upper area by the beverage cans **31**, it is possible that the flat packaging blank **20** inadvertently tears in the area of an opening **23** or even in the area of a plurality of openings **23** during a positioning on beverage cans **31**. This causes a damage to the pack **36**, since it is not possible with a tear in the area of a particular opening **23** to ensure with certainty that a particular can **31** that has been inserted into this opening **23** will still be held securely to the flat packaging blank **20** und will be held together with the other cans **31** of the pack **36**. Such a tear also leads to an undesired optical impairment of the pack **36**, making it necessary to discharge such a pack **36**.
[0196] The embodiment of a working tool **72** as provided for the packaging line of the packaging apparatus **1** according to FIG. **17**, FIG. **18**, FIG. **19**, and FIG. **20**, as well as an embodiment of a working tool **72** as illustrated in FIG. **21** to FIG. **23** make it possible to reduce a risk of such a tear occurring during a positioning of a flat packaging blank **20** on beverage cans **31**.
[0197] Practice has even shown that the risk of such a tear occurring during a positioning of a flat packaging blank **20** on beverage cans **31** can be nearly completely excluded by a working tool **72** as provided with the packaging line of the packaging apparatus **1** according to FIG. **17** to FIG. **20** or as shown in the exemplary embodiment according to FIG. **21** to FIG. **23**.
[0198] The structure and operating mode of the working tool **72** are therefore described in detail below with FIG. **21** to FIG. **23**. The preparation of the packaging blanks **20** and **20***v* with the widened and post-treated passage openings **23** and **23***v* has already been described in detail above on the basis of FIG. **7** to FIG. **10**B.
[0199] FIG. **18** and FIG. **19** show another embodiment of a packaging line of a packaging apparatus **1** in which an embodiment of an industrial robot **71** according to the invention as well as an embodiment of a working tool **72** according to the invention are employed.
[0200] The packaging line of the packaging apparatus **1** from the exemplary embodiment according to FIG. **18** and FIG. **19** can likewise produce numerous packs **36** of the same type, as is exemplarily illustrated in FIG. **27**.
[0201] In order to assemble or produce the particular pack **27**, the packaging line of the shown packaging apparatus **1**, as well as the exemplary embodiment according to FIG. **17** comprises a first module **60**, a second module **70**, and a transport device **2**, which can continue guiding articles **30**, beverage containers or beverage cans **31** from the first module **60** along to the second module **70**. The second module **70** is arranged downstream in conveying direction FR of the horizontal conveying device **2** from the first module **60**.
[0202] In order to be able to ensure that a particular flat packaging blank **20** can be positioned without problems on beverage cans **31** or in order to be able to ensure that the beverage cans **31** of a particular grouping **41** have an alignment relative to one another that is suitable for the flat packaging blank **20** to be positioned thereonto, the first module **60** comprises a handling device **76** with the first gripper head **11** (cf. FIG. **18** and FIG. **28**).
[0203] Beverage cans **31** are received from a supply unit **61** illustrated in FIG. **28** via the handling device **76** with the first gripper head **11**, they are then moved toward the transport device **2**, and deposited on the horizontal conveying device **2** in a direction coming from above. The depositing of the beverage cans **31** on the transport device **2** is in this context carried out via the handling device **76** in such a manner that a grouping **41** of beverage cans **31** is formed on the transport device **2** immediately upon the depositing, with the number of beverage cans **31** in each grouping **41** corresponding to the number in the particular pack **36** to be produced (cf. FIG. **27**).
[0204] In addition, the depositing of the beverage cans **31** on the transport device **2** via the handling device **76** is carried out in such a manner that the beverage cans **31** of a particular grouping **41** formed on the transport device **2** already immediately upon the beverage cans **31** being deposited on the transport device **2** have an alignment relative to one another that is suitable for the

positioning of the particular flat packaging blank **20**. As it is hereby possible to dispense with a division via holding elements and with a guiding via tracks, there is no risk of the beverage cans **31** being scratched or damaged due to a surface contact with guide rails and/or holding elements.
[0205] Temporally after the groupings **41**, each comprising a plurality of beverage cans **31** already aligned relative to one another for the positioning of the flat packaging blanks **20** thereonto, have been formed on the transport device **2**, the groupings **41** are moved via the transport device **2** in conveying direction FR. The transport device **2** is in contact with a control device and/or regulating device S, which controls the transport device **2** to provide the groupings **41** deposited thereonto with an interruption-free movement at a same conveying speed or at a conveying speed that is constant in time. The groupings **41** thereupon leave the first module **60** and reach the second module **70** downstream in conveying direction FR from the first module **60**.
[0206] The schematic views of FIG. **18** and FIG. **19** moreover illustrate that an industrial robot **71** carrying a working tool **72** via a working arm **75** in a hanging position is assigned to the second module **70**. Via the working tool **72**, the industrial robot **71** can be enabled to receive a plurality of flat packaging blanks **20** simultaneously from a stack, which is not illustrated in the figures (for example, from a magazine **8**, cf. FIG. **5** to FIG. **8**), or from dies **74** (cf. FIG. **28**).
[0207] After the receiving, the working tool **72** is moved toward the transport device **2** such that the working tool **72** is situated together with the plurality of flat packaging blanks **20**, which are up to then still being held by the working tool **72**, above the plurality of groupings **41** onto which the flat packaging blanks **20** are to be positioned. The working tool **72** is subsequently lowered toward the groupings **41** and then positions the flat packaging blanks **20** on the groupings **41**.
[0208] Since the groupings **41** are moved along interruption-free in conveying direction FR by the transport device **2** temporally during the positioning of the packaging blank **20**, the working tool **72** is moved along in conveying direction FR together with the groupings **41** temporally after the lowering and up to the complete positioning of flat packaging blanks **20** onto the groupings **41**. As soon as all packaging blanks **20** have been positioned on the groupings **41**, the beverage cans **31**, which each form a component of a particular grouping **41**, form a packaging unit **35** or a pack **36** together with the particular flat packaging blank **20**, as is exemplarily illustrated in FIG. **27**.
[0209] In order to position the flat packaging blanks **20** on the groups of articles or groups of cans or on the groupings **41** the flat packaging blanks **20** have to be pressed in the direction toward the particular beverage cans **31** onto the particular beverage cans **31**. In order to position each flat packaging blank **20**, the working tool **72** accordingly has to apply a defined force onto the particular flat packaging blank **20**, which force acts in a downward direction or toward the particular beverage containers **31**.
[0210] In order to prevent the working tool **72** from having to apply a relatively high total force at a specific point in time, such embodiments have proved successful in which the working tool **72** is designed in terms of function according to the embodiment described in FIG. **21** to FIG. **23**.
[0211] If required, it can be additionally provided that the working tool **72** positions the flat packaging blanks **20** on the groupings **41** according to FIG. **19** in a temporally offset manner. In the exemplary embodiment of FIG. **19**, a flat packaging blank **20** is in this instance first positioned on an article grouping **41** arranged foremost in conveying direction FR of the transport device **2**. Temporally thereafter, flat packaging blanks **20** are consecutively positioned on groupings **41**, which succeed the grouping **41** arranged foremost in conveying direction FR of the transport device **2**.
[0212] It is moreover clear from FIG. **19** that there are also no guide rails or holding elements provided or required in the range of the second module **70**, which would otherwise extend in conveying direction FR and which would be moved along together with the groupings **41** or have the groupings **41** slide along them. Groupings **41** or beverage cans **31** are thus preferably also not in surface contact with guide rails and/or holding elements at any point or at any time in the range of the second module **70**.

[0213] The schematic view of FIG. **20** shows a further embodiment of the packaging line of the packaging apparatus **1**, in which an embodiment of an industrial robot **71** according to the invention as well as an embodiment of a working tool **72** according to the invention are employed.
[0214] The transport device **2** and the first module **60** here are designed corresponding to the exemplary embodiment according to FIG. **18** and FIG. **19**, the passages of the description of which are therefore referred to in this context. The embodiment according to FIG. **20** differs from the exemplary embodiment according to FIG. **18** and FIG. **19** in the manner of positioning the flat packaging blanks **20** via the working tool **72**.
[0215] As has already been mentioned with reference to FIG. **19** and to the corresponding passages of the description for FIG. **19**, the flat packaging blanks **20** have to be pressed onto the particular beverage cans **31** in the direction toward the particular beverage cans **31** via the working tool **72**.
[0216] In order to position each flat packaging blank **20**, the working tool **72** thus has to apply a specific force onto the particular flat packaging blank **20**, which force acts in a downward direction or toward the particular beverage containers **31**. In order to prevent the working tool **72** from having to apply a relatively high force at a specific point in time, the flat packaging blanks **20** are also positioned on the groupings **41** in a temporally offset manner via the working tool **72** in the exemplary embodiment according to FIG. **20**. In addition, the working tool **72** is designed in terms of function according to the exemplary embodiment of the following FIG. **21** to FIG. **23**.
[0217] From FIG. **19** seen in conjunction with FIG. **20**, it is clear that the sequence of positioning flat packaging blanks **20** on the groupings **41** differs in the variant according to FIG. **20** from the variant according to FIG. **19**. Whereas in the variant shown in FIG. **19**, a flat packaging blank **20** is first positioned on a grouping **41** arranged foremost in conveying direction FR of the transport device **2** and the other groupings then follow, in the variant shown in FIG. **20**, a particular flat packaging blank **20** is positioned on a grouping **41** arranged foremost in conveying direction FR and at least approximately simultaneously on a grouping **41** arranged hindmost. Only afterward is a particular flat packaging blank **20** positioned on the other groupings **41** situated between the grouping **41** arranged foremost in conveying direction FR and the grouping **41** arranged hindmost in conveying direction FR, as is shown in the variant of FIG. **20**.
[0218] The positioning of flat packaging blanks **20** is also carried out pairwise for groupings **41** situated between the groupings **41** arranged foremost and hindmost in conveying direction FR such that in each instance two flat packaging blanks **20** are at least approximately simultaneously positioned on in each instance two groupings **41**.
[0219] In the exemplary embodiment according to FIG. **20**, there are also no guide bars or guide rails and/or no holding elements provided in the range of the second module **70**, which could otherwise come into abutment on lateral outer surfaces of beverage cans **31**. The movement of the beverage cans **31** in the range of the second module **70** is carried out via the transport device **2** without abutment of lateral outer surfaces of the beverage cans **31** on guide rails and/or holding elements.
[0220] FIG. **21** to FIG. **23** each show a schematic view of an embodiment of a working tool **72** according to the invention as has been repeatedly explained above.
[0221] The perspective view of FIG. **21** in this context illustrates that the working tool **72** has a carrier **77**, which is designed as carrier plate **78** and to which a plurality of manipulation elements **73** are fastened in a hanging position. In the instance of the working tool **72** being moved by an industrial robot **71**, the carrier **77** or the carrier plate **78** continuously remains in a horizontal orientation.
[0222] The working tool **72** has an own manipulation element **73** for all articles **30** formed by beverage cans **31** of a particular pack **36** to be produced, which manipulation element **73** is in each instance shown in detail in terms of its constructional design in FIG. **24** to FIG. **26**, and which manipulation element **73** comes into surface contact by force application with the flat packaging blank **20** upon a positioning of the flat packaging blank **20** on beverage cans **31**.

[0223] As is illustrated in FIG. **21** to FIG. **23**, it is possible to position three flat packaging blanks **20** at least approximately simultaneously on beverage cans **31** via the working tool **72** such that a plurality of beverage cans **31** are at least approximately simultaneously gathered together in three packs **36** by three flat packaging blanks **20** via the working tool **72**.
[0224] An alternative arrangement of manipulation elements **73** on different height levels moreover provides the possibility of positioning flat packaging blanks **20** on different groupings **41** according to FIG. **19** and FIG. **20** in a temporally offset manner. In such embodiments, manipulation elements **73** assigned to a first flat packaging blank **20** can thus be arranged on different height levels or can have a different relative spacing from the carrier **77** in comparison to manipulation elements **73** assigned to a second flat packaging blank **20**.
[0225] It is moreover discernible from the perspective view according to FIG. **21** that the working tool **72** comprises a plurality of side partitions **79** as well as a rear wall **80**. The side partitions **79** and the rear wall **80** are oriented perpendicular to each other. The side partitions **79** and the rear wall **80** are also each arranged in a hanging position to the carrier **77** or to the carrier plate **78**, with the manipulation elements **73** also each being carried in a hanging position by the carrier **77** or by the carrier plate **78**.
[0226] In this context, the spacing between two adjacent side partitions **79** is selected in such a manner that a particular flat packaging blank **20** can be arranged in a form-locking manner or with slight clearance between two adjacent partitions **79**. The rear wall **80** determines a position in a further spatial direction for a flat packaging blank **20** arranged between adjacent partitions **79**. A flat packaging blank **20** can therefore in each instance be in abutment on the rear wall **80** as well as on two adjacent side partitions **79**, or it can be merely slightly spaced apart from the side partitions **79** or slightly spaced apart from the rear wall **80**.
[0227] Since the side partitions **79** and the rear wall **80** disable a relative movement of a received flat packaging blank **20** in relation to the manipulation elements **73** in a plurality of spatial directions, it can be ensured with a high degree of certainty that the manipulation elements **73** come in line precisely with a specified position of the flat packaging blank **20** on the particular grouping **41** during a positioning of the flat packaging blank **20**.
[0228] The side partitions **79** moreover have a further function, as becomes clear from FIG. **17** and FIG. **21** seen in conjunction. As mentioned above, groupings **41** are formed from beverage cans **31** in the range of the first module **60**, with these formed groupings **41** being moved spaced apart from one another in conveying direction FR via the transport device **2** and in the process reaching the range of the second module **70**.
[0229] In order to be able to position flat packaging blanks **20** precisely on the groupings **41** such that the beverage cans **31** each come in line with the openings **23** provided for them, it is necessary for a relative spacing formed between consecutive groupings **41** to correspond very precisely to a specified target spacing. In the instance of a beverage can **31** inadvertently shifting out of place during the movement via the transport device **2** or during the dividing of the beverage cans **31** into groupings **41**, it is possible that this beverage can **31** comes to be situated too close to a preceding grouping **41** or too close to a succeeding grouping **41**.
[0230] In order to correct such errors or in order to then shift the beverage can **31** into a position in which the beverage can **31** comes in line precisely with a particular opening **21** during a positioning of the flat packaging blank **20**, the particular beverage can **31** is shifted via the side partitions **79**, as required.
[0231] As is discernible from FIG. **21**, FIG. **22**, and FIG. **23**, the side partitions **79** each taper in the direction away from the carrier **77**. To position the flat packaging blank **20**, the working tool **72** is moved toward the beverage cans **31** or toward the particular groupings **41**, with the side partitions **79** in this context dipping into a free space formed between consecutive groupings **41**. If an inadvertently shifted beverage can **31** or a beverage can **31** the position of which does not correspond to a target position is situated in this free space, a side partition **79** pushes this beverage

can **31** back into an intended target position.
[0232] Hereby, the beverage cans **31** come in line precisely with the openings **23** of the flat packaging blank **20**, whereby the risk of a tear occurring in the flat packaging blank **20** while the beverage cans **31** are being pressed into the openings **23** can be additionally reduced.
[0233] The design of the side partitions **79** tapering in the direction away from the carrier **77** has moreover proved successful in preventing damage to the beverage cans **31** during a contact with the side partitions **79** as well as in preventing an overturning of the beverage cans **31** while they are being pushed.
[0234] In order to be able to take a flat packaging blank **20** from a magazine **8** (cf. FIG. **28**) and to then move the extracted flat packaging blank **20** toward the groupings **41**, and in order to be able to firmly hold the particular flat packaging blank to the working tool **72** while the packaging blank **20** is being moved toward the groupings **41** and until it is positioned on a particular grouping **41**, the working tool **72** comprises a plurality of suction instruments **14**, which have already been referred to as vacuum cups **14** and explained above (cf. FIG. **6** to FIG. **8** in this context).
[0235] The suction instruments **14** or vacuum cups are each impingeable with negative pressure or they can secure flat packaging blanks **20** to the working tool **72** using negative pressure. For this purpose, the working tool **72** comprises a plurality of such suction instruments **14** for each flat packaging blank **20** to be received such that the particular flat packaging blank **20** can be securely held to the working tool **72** via the particular plurality of suction instruments **14**.
[0236] The suction instruments **14** are illustrated in enlargement in FIG. **22**. FIG. **22** also shows an enlarged illustration of the carrier **77** or of the carrier plate **78** with the manipulation elements **73**, the side partitions **79**, and the rear wall **80** each fastened thereto in a hanging position. As already explained above, the manipulation elements **73** assigned to a first flat packaging blank **20** can be arranged on different height levels or can be situated at a different relative spacing from the carrier **77** or from the carrier plate **78** in comparison to further manipulation elements **73** assigned to a second flat packaging blank **20**.
[0237] From the perspective view onto the working tool **72** from below according to FIG. **23**, it is discernible that the side partitions **79** are oriented parallel to one another. A flat packaging blank **20** held by the working tool **72** between two side partitions **79** is illustrated on the right side in FIG. **23**. The flat packaging blank **20** already forms a particular opening **23** for each beverage can **31**, into which opening **23** the particular beverage can **31** can be inserted or pressed. A beverage can **31**, which is already pressed into an opening **23** of the flat packaging blank **20** via the working tool **72** and which is now located to the flat packaging blank **20**, is illustrated for clarification in FIG. **23**.
[0238] In the embodiments illustrated here, the flat packaging blank **20** forms an opening **23** assigned to each beverage can **31** of a particular grouping **41** already during the positioning of the packaging blank **20** on the particular grouping **41**. In other embodiments, however, it is also possible that an area in each instance provided in the flat packaging blanks **20** to form the openings **23** is pre-punched and that the openings **23** are not formed before the flat packaging blank **20** is positioned on the beverage cans **31**. In this instance, the beverage cans **31** can be guided against the pre-punched area by force application, in which context the pre-punched area is at least partially separated out of the flat packaging blank **20**, and openings **23** are hereby created in the flat packaging blank **20**. Such embodiments of a flat packaging blank **20** can also be positioned on a plurality of beverage cans **31** by the embodiment of a working tool **72** according to FIG. **21** to FIG. **23**.
[0239] The perspective view of FIG. **24** illustrates an embodiment of a manipulation element **73**. The manipulation element **73** is a component of the embodiment of the working tool **72** according to FIG. **21** to FIG. **23**, but it can also be used in a general context independently of this embodiment or it can be a component of other embodiments.
[0240] The manipulation element **73** shown in FIG. **24** comprises a contact surface **81**, which is

brought into surface contact with the flat packaging blank **20** by force application in order to press a beverage can **31** into an assigned opening **23**. The contact surface **81** has a curved design.
[0241] From FIG. **24** seen in conjunction with FIG. **25**, it is moreover clear that the contact surface **81** of the manipulation element **73** does not entirely abut on the flat packaging blank **20** or only abuts on the flat packaging blank **20** in some areas immediately upon coming into contact with the flat packaging blank **20**. When the manipulation element **73** is moved starting from its position in FIG. **25** closer toward the beverage can **31**, the contact surface **81** of the manipulation element **73** comes into contact with the flat packaging blank **20** along the entire circumferential course of the opening **23** formed in the particular flat packaging blank **20** at a specific point in time due to an elastic deformation of the flat packaging blank **20** in the area immediately around a particular passage opening **23** and then presses the beverage can **31** through the opening **23** up to the point where the beverage can **31** is held firmly to the flat packaging blank **20**.
[0242] Due to the curved design of the contact surface **81**, a force necessary to press a particular beverage can **31** into a particular opening **23** is applied to the flat packaging blank **20** along the circumferential course of the opening **23** in a temporally offset manner. In the beginning of a beverage can **31** being pressed into a particular opening **23**, the manipulation element **73** thus first comes into surface contact with the flat packaging blank **20** at a plurality of areas offset along the circumferential course of the particular opening **23**.
[0243] Only during the further pressing of the particular beverage can **31** into the particular opening **23** is an area with which the manipulation element **73** comes into abutment on the flat packaging blank **20** via the contact surface **81** areally enlarged, whereby the risk of an inadvertent tearing of the flat packaging blank **20** in the area of the particular opening **23** can be kept very low.
[0244] Apart from the curved profile of the contact surface **81** exemplarily shown here, there are further embodiments for the forming of the contact surface **81** of the manipulation element **73**, in which the force necessary to press a particular beverage can **31** into a particular opening **23** can be applied to the flat packaging blank **20** along the circumferential course of the opening **23** in a temporally offset manner. For example, the contact surface **81** can be formed in a rectilinear manner in this context, and it can be in a slanted position in relation to the flat packaging blank **20**.
[0245] Such embodiments have also proved successful in which the manipulation elements **73** designed as a component of a working tool **72** are rotated in order to apply a force, which is provided for pressing a particular beverage can **31** into a particular opening **23**, in a temporally offset manner. In this instance, an axis of rotation can extend along a longitudinal axis of the particular beverage can **31**. The design of the contact surface **81** of the particular manipulation element **73** in this context can still be formed in a curved manner or can be in a slanted position in relation to the flat packaging blank **20**.
[0246] The enlarged view of FIG. **26** once more shows individual aspects of the illustration of FIG. **25** in detail or in enlargement. The curved profile of the contact surface **81** of the manipulation element **73** is again discernible. FIG. **26** also shows that the flat packaging blank **20** has a plurality of securing tabs or retaining tabs **25** (for the securing tabs or retaining tabs also cf. FIG. **25**) in the area of a particular opening **23**. A particular beverage can **31** moreover forms an upper edge **24** or a seam (cf. FIG. **27**) extending around a closure (not illustrated in the figures) of a particular beverage can **31**.
[0247] Temporally after a particular beverage can **31** has been pressed into a particular opening **23**, the retaining tabs or securing tabs **25** are in each instance arranged below the particular upper edge **24**, and they secure the flat packaging blank **20** to the particular beverage can **31** so as to be immovable in axial direction. In order to keep a force necessary to press the beverage cans **31** into the openings **23** at a low level, embodiments have proved successful in which the retaining tabs **25** are pre-bent temporally before the beverage cans **31** are pressed into the openings **31** or transferred to an upright orientation according to FIG. **25**.
[0248] FIG. **27** shows a schematic perspective view of a packaging unit **35** or a pack **36** as can be

produced with various embodiments of the working tool **72** according to the invention. The pack **36** in the present context comprises precisely eight beverage cans **31**, which are held to each other via a flat packaging blank **20**. For this purpose, the beverage cans **31** have been pressed into the openings **23** of the flat packaging blank **20** by a working tool **72** (cf. FIG. **21** to FIG. **23**), whereby the retaining tabs or securing tabs **25** are arranged below the upper edges **24**, which retaining tabs **25** secure the flat packaging blank **20** to the beverage cans **31** so as to be immovable in axial direction.

[0249] FIG. **28** shows a schematic perspective view of a further embodiment of a packaging apparatus **1** according to the invention, in which an embodiment of an industrial robot **71** according to the invention as well as an embodiment of a working tool **72** according to the invention are employed. The industrial robot **71** can be designed as a gantry system or as a multi-axis robot, for example, and, for the purpose of clarity, it is not illustrated in FIG. **28**.

[0250] The packaging line of the packaging apparatus **1** comprises a supply unit **61** which transports beverage cans **31** in a plurality of parallel rows. For the transport in a plurality of parallel rows, the supply unit **61** has a plurality of guide rails or lane guides **4**, with a single-row stream of beverage cans **31** being moved between immediately adjacent guide rails or lane guides **4**.

[0251] The embodiment of FIG. **28** moreover comprises a transport device **2** which moves beverage cans **31** deposited thereon in conveying direction FR. The conveying direction FR and the movement direction in which the supply unit **61** transports beverage containers **31** in a plurality of parallel rows or lanes **3** are oriented parallel to one another.

[0252] The packaging apparatus **1** furthermore comprises a handling device **76** with a plurality of gripper heads **11** via which the handling device **76** can receive beverage cans **31** being moved in parallel rows or lanes **3** via the supply unit **61** and can deposit the beverage cans **31** as a grouping **41** on the transport device **2**. In the packaging line of the packaging apparatus **1** of FIG. **28**, it is also provided that the beverage cans **31** of a particular grouping **41** already immediately upon being deposited on the transport device **2** have an alignment relative to one another that is intended or suitable for the positioning of the particular flat packaging blank **20**.

[0253] In order to be able to position flat packaging blanks **20** on the groupings **41** each comprising a plurality of beverage cans **31**, the packaging apparatus **1** has six working tools **72** in the present instance. The working tools **72** in this context can have a structure corresponding to the embodiment previously described with FIG. **21** to FIG. **23**, and they can position flat packaging blanks **20** on groupings **41**, as has already been explained above in the description for FIG. **21** to FIG. **23**.

[0254] The packaging apparatus **1** furthermore comprises a magazine, **8** which picks up and keeps ready the packaging blanks **20** that have not yet been positioned on groupings **41**. For this purpose, the magazine **8** comprises a plurality of vertically aligned tines **82**, for example, with a particular tine **82** gripping through the particular opening **23** of a particular flat packaging blank **20** picked up in the magazine **8**. The flat packaging blanks **20** are thus held in the magazine **8** by the tines **82**.

[0255] In practice, it is possible that the working tools **72** have to apply a relatively high force in order to position a particular flat packaging blank **20** on a particular grouping **41**. In consideration of the pack **36** according to FIG. **27**, it is discernible here that an upper edge **32** of a particular beverage can **31** has to be inserted through a particular opening **23** if a particular flat packaging blank **20** is to be positioned on a particular grouping **41**. Since the flat packaging blank **20** has to be elastically deformed in this process, it is possible that individual or several beverage cans **31** will be inadvertently overturned when the packaging blank **20** is positioned on a particular grouping **41**. This force can already be reduced in terms of amount by the manipulation elements **73**, which are in each instance a component of the working tools **72**.

[0256] In order to further reduce a resistance force of the flat packaging blanks **20** in the area of the openings **23**, the flat packaging blanks **20** are first placed on dies **74** in the packaging apparatus **1** according to FIG. **28**, with a particular die **74** dipping into a particular opening **23** of a particular

flat packaging blank **20**. In their function, the here so designated dies **74** thus correspond to the stretching cones **19** already explained above with reference to FIG. **6** to FIG. **8** and the dies **74** can also resemble the stretching cones **19** or correspond to them in design.

[0257] It is possible in this context that the working tools **72** take a particular flat packaging blank **20** from the magazine **8**, dip the dies **74** or stretching cones **19** temporally hereafter into the openings **23** of the particular packaging blank **20**, and then elastically deform or stretch a particular edge area **24** of a particular opening **23** by the dies **74** (in this context cf. FIG. **7** to FIG. **10**B and the corresponding passages of the description) such that the resistance force to be overcome in order to position the flat packaging blank **20** on a particular grouping **41** is hereby reduced.

[0258] In the embodiment according to FIG. **28** it is provided, however, that a transfer tool **83** illustrated in detail in FIG. **29** takes a particular flat packaging blank **20** from the magazine **8** and then places it on the dies **74** such that a particular die **74** is dipped into a particular opening **23** of a particular flat packaging blank **20**. The transfer tool **83** then leaves the close vicinity of the dies **74** and is returned toward the magazine **8**.

[0259] In temporal overlap with the movement of the transfer tool **83** toward the magazine **8**, the working tools **72** are moved toward the flat packaging blanks **20** having been placed onto the dies **74** and then come into contact with the dies **74** still positioned on the flat packaging blanks **20**. The flat packaging blanks **20** are hereupon pressed downward onto the dies **74** via the working tools **72**, whereby edge areas **24** of the openings **23** are stretched.

[0260] In the following, the working tools **72** take the flat packaging blanks **20** off the dies **74**, move the flat packaging blanks **20** taken off of the dies **74** toward the groupings **41** arranged in the transport device **2**, and then position the flat packaging blanks **20** on the groupings **41**. Since edge areas **24** of the openings **23** were previously stretched by the dies **74**, a resistance force that has to be overcome in order to position the flat packaging blanks **20** on groupings **41** is significantly reduced in comparison to embodiments without such a previous stretching of the edge areas **24**.

[0261] As already mentioned above, the flat packaging blanks **20** are placed on the dies **74** by a transfer tool **83**, with a particular die **74** dipping into a particular opening **23** of a particular flat packaging blank **20**. The number of dies **74** thus has to correspond at least to the number of openings **23** formed by the flat packaging blanks **20**. In order for the dies **74** to be able to dip into the openings **23**, the arrangement or the position of the dies **74** has to be adjusted to the particular arrangement or to the position of the openings **23** formed by the flat packaging blanks **20**.

[0262] In order to produce different packs **36** (in terms of size, arrangement, etc.), it is possible that flat packaging blanks **20** are required for this purpose that are different with regard to the particular number of the openings **23** and/or with regard to their particular position or to their arrangement in the flat packaging blank **20**. It can thus be necessary to exchange the dies **74** if different packs **36** are intended to be produced by the packaging apparatus **1** in temporally consecutive packaging processes.

[0263] In order to be able to accomplish such an exchange of dies **74** in a quick and uncomplicated manner, a plurality of dies **74** are gathered together to a particular format part **84** (cf. FIG. **31**) in the embodiment according to FIG. **28**. If flat packaging blanks **20** are replaced in the packaging apparatus **1** for flat packaging blanks **20** which differ with regard to number and/or arrangement of the openings **23**, format parts **84** are exchanged, which format parts **84** in each instance comprise a plurality of dies **74**. The exchange of format parts **84** comprising a plurality of dies **74** can be carried out by a user, for example, or in an automated manner by a correspondingly equipped and correspondingly controllable industrial robot.

[0264] There are also embodiments in which format parts **84** comprising a plurality of dies **74** can be exchanged by a driverless transport system, if required.

[0265] FIG. **29** and FIG. **30** show individual details of an embodiment of a packaging apparatus **1** according to FIG. **28**. FIG. **29** here shows the previously mentioned transfer tool **83**, which can take flat packaging blanks **20** from a magazine **8** and position them on the dies **74**. The transfer tool

83 has four supporting tappets **85** assigned to each flat packaging blank **20**, which supporting tappets **85** are each spring-mounted and can suction and seize a particular flat packaging blank **20** in a pneumatic manner, that is, by vacuum-controlled seizing and receiving.

[0266] FIG. **30**, in particular, once more shows the gripper heads **11** already illustrated in FIG. **28**, which gripper heads **11** receive beverage cans **31** from a supply unit **61** (cf. FIG. **28**) and deposit them as a grouping **41** on the transport device **2**. Immediately upon being deposited on the transport device **2**, the beverage cans **31** of a particular grouping **41** already have an alignment relative to one another that is intended for the positioning of the particular flat packaging blank **20**.

[0267] FIG. **31** once more shows in detail the magazine **8** described with FIG. **28**, in which flat packaging blanks **20** are arranged in a stacked manner. Furthermore, the format parts **84** are discernible, which each comprise a plurality of dies **74** and which can be exchanged if required.

[0268] The schematic side view of FIG. **32** shows an alternative embodiment of the contact surface **81** of the manipulation element **73**.

[0269] The schematic side view of FIG. **33** shows a further alternative embodiment of the contact surface **81** of the manipulation element **73**. At least one controllable contact surface **86** is in addition provided. When the flat packaging blank **20** is pressed onto the contact surface **81**, the controllable contact surface **86** is extended out of the plane of the contact surface **81** such that a temporally offset pressing of the flat packaging blank **20** takes place.

[0270] During the pressing or temporally before finalizing the pressing procedure, the controllable contact surfaces **86** are actively or passively retracted into the contact surface **81**.

[0271] The embodiments, examples and alternatives of the preceding paragraphs, the claims, or the following figures and description, including any of their various aspects or respective individual features, may be taken independently or in any combination. Features described in connection with one embodiment are applicable to all embodiments, unless such features are incompatible.

[0272] If illustrations and aspects are generally referred to as being “schematic” in the context of the figures, this is by no means intended to imply that the illustrations of the figures and their description are of inferior significance with regard to the disclosure of the invention. The person skilled in the art is fully capable of gathering sufficient information from the schematically and abstractly drawn illustrations for facilitating the understanding of the invention without the understanding being in any way impaired by, for example, the size ratios of the articles and/or of parts of the apparatus or of other of the illustrated elements being drawn and potentially not being precisely true to scale. On the basis of the more concretely explained realizations of the method according to the invention and on the basis of the more concretely explained functionality of the apparatus according to the invention in the figures, the reader as a person skilled in the art is thus enabled to derive a better understanding of the inventive idea, which is formulated in a more general and/or more abstract manner in the claims and in the general part of the description.

[0273] The invention has been described with reference to a preferred embodiment. Those skilled in the art will appreciate that numerous changes and modifications can be made to the preferred embodiments of the invention and that such changes and modifications can be made without departing from the spirit of the invention. It is therefore intended that the appended claims cover all such equivalent variations as fall within the true spirit and scope of the invention.

LIST OF REFERENCE NUMBERS

[0274] **1** Packaging apparatus [0275] **2** Transport device [0276] **3** Lane [0277] **4** Lane guide [0278] **5** Rotary module [0279] **6** Turntable [0280] **7** Packaging module [0281] **8** Magazine [0282] **9** Pre-treatment module [0283] **10** Removal conveyor belt [0284] **11** First gripper head [0285] **12** Packing bell, packing bells [0286] **13** Second gripper head [0287] **14** Vacuum cup, suction instrument [0288] **15** Third gripper head [0289] **16** Vacuum cup [0290] **17** Drive [0291] **18** Stretching tool, stretching die [0292] **19** Stretching cone [0293] **20** Packaging blank [0294] **20***v* Pre-treated packaging blank [0295] **21** Carrying handle blank [0296] **21***v* Pre-treated carrying handle blank [0297] **23** Passage opening, passage openings, opening [0298] **23***v* Passage openings after pre-

treatment [0299] **24** Edge area, top seam [0300] **24***v* Pre-treated edge area [0301] **24***e* Heated edge area [0302] **25** Securing tab, retaining tab [0303] **25***v* Securing tab after pre-treatment [0304] **26** Radial cut [0305] **27** Cut [0306] **28** Partial area [0307] **29** Carrying handle opening [0308] **30** Article [0309] **31** Can, beverage can [0310] **32** Lid edge [0311] **33** Narrowing, necking [0312] **34** Closure [0313] **35** Packaging unit [0314] **36** Pack [0315] **40** Assembly [0316] **41** Article group, grouping [0317] **50** Tool [0318] **51** Pressure punch [0319] **60** First module [0320] **61** Supply unit [0321] **70** Second module [0322] **71** Industrial robot [0323] **72** Working tool [0324] **73** Manipulation element [0325] **74** Die [0326] **75** Working arm [0327] **76** Handling device [0328] **77** Carrier [0329] **78** Carrier plate [0330] **79** Partition, side partition [0331] **80** Rear wall [0332] **81** Contact surface [0333] **82** Tine [0334] **83** Transfer tool [0335] **84** Format part [0336] **85** Supporting tappet [0337] **86** Controllable contact surface [0338] d**23** Average diameter of a passage opening [0339] d**23***v* Average diameter of a passage opening after appropriate pre-treatment [0340] F Application force [0341] FR Conveying direction, transport direction [0342] hA Horizontal axis [0343] S Control device and/or regulating device [0344] vA**1** First vertical axis [0345] vA**2** Second vertical axis

Claims

1. A method of producing packaging units (**35**), comprising: gripping at least one packaging blank (**20**) wherein the packaging blank (**20**) comprises at least some portion that is flat and at least one passage opening (**23**) in the flat portion; pre-treating the at least one packaging blank (**20**) by cutting or perforating the packaging blank (**20**); and applying the pre-treated packaging blank (**20**) to at least one article (**30**) or an assembly (**40**) of at least one article (**30**), wherein the gripping, pre-treating, and applying steps are carried out by at least one robot capable of handling at least two packaging blanks (**20**).
2. The method of claim 1, wherein the packaging blank (**20**) is cut or perforated by pressing the packaging blank (**20**) onto at least one stretching die (**18**).
3. The method of claim 2, wherein the packaging blanks are carton packaging blanks.
4. The method of claim 3, wherein the gripping, pre-treating, and applying steps are carried out by at least two robots.
5. A method of producing packaging units (**35**), comprising: gripping at least one packaging blank (**20**) wherein the packaging blank (**20**) comprises at least some portion that is flat and at least one passage opening (**23**) in the flat portion; pre-treating the at least one packaging blank (**20**) by reducing a resistance force in an edge area (**24**) of the at least one passage opening (**23**) of the packaging blank (**20**); and applying the reduced packaging blank (**20**) to at least one article (**30**) or an assembly (**40**) of at least one article (**30**).
6. The method of claim 5, wherein the gripping step comprises gripping the at least one packaging blank (**20**) from at least one magazine (**8**) holding a stack of packaging blanks (**20**).
7. The method of claim 6, wherein the gripping and pre-treating steps are carried out by a first robot and wherein the applying step is carried out by a second robot.
8. The method of claim 7, wherein the pre-treating step comprises enlarging an average diameter (d**23**) of the at least one passage opening (**23**).
9. The method of claim 8, wherein the pre-treating step further comprises pressing the packaging blank (**20**) onto at least one stretching die (**18**).
10. The method of claim 9, wherein the number and arrangement of the at least one stretching die (**18**) correspond to the number and arrangement of the passage openings (**23**) of the packaging blank (**20**), and wherein the pre-treating step comprises pressing the packaging blank (**20**) onto the at least one stretching die (**18**) such that each stretching die (**18**) passes through a passage opening (**23**) of the packaging blank (**20**).
11. A method of producing packaging units (**35**), comprising: gripping at least one packaging blank

(**20**) wherein the packaging blank (**20**) comprises at least some portion that is flat and at least one passage opening (**23**) in the flat portion; pre-treating the at least one packaging blank (**20**) by reducing a resistance force in an edge area (**24**) of the at least one passage opening (**23**) of the packaging blank (**20**) with at least one stretching die (**18**) for each passage opening (**23**) in the packaging blank (**20**), wherein the at least one stretching die (**18**) has a conical or truncated cone form; and applying the pre-treated packaging blank (**20**) to at least one article (**30**) or an assembly (**40**) of at least one article (**30**), wherein the gripping, pre-treating, and applying steps are carried out by at least one robot.

12. The method of claim 11, wherein the gripping step comprises gripping the at least one packaging blank (**20**) from at least one magazine (**8**) holding a stack of packaging blanks (**20**).

13. The method of claim 12, wherein the packaging blank (**23**) is a carton packaging blank.

14. The method of claim 13, wherein the pre-treating step comprises at least partially pushing upward or bending upward a plurality of securing tabs (**25**) located in the edge area (**24**) of each of the at least one passage opening (**23**) of the packaging blank (**20**).

15. A method of producing packaging units (**35**), comprising: gripping at least one packaging blank (**20**) wherein the packaging blank (**20**) comprises at least some portion that is flat and at least one passage opening (**23**) in the flat portion; pre-treating the at least one packaging blank (**20**) by reducing a resistance force in an edge area (**24**) of the at least one passage opening (**23**) of the packaging blank (**20**); applying the pre-treated packaging blank (**20**) to at least one article (**30**) or an assembly (**40**) of at least one article (**30**) to form a pack (**36**); and changing a format of the pack (**36**) to be formed by varying the number, size, or arrangement of the at least one article (**30**) or the assembly (**40**) of the at least one article (**30**) that make up the pack (**36**).

16. The method of claim 15, wherein the changing step comprises exchanging a first format part (**84**) with a second format part (**84**), each format part comprising a plurality of dies (**74**), wherein such dies (**74**) are used to reduce the resistance force in an edge area (**24**) of the at least one passage opening (**23**) of the packaging blank (**20**).

17. The method of claim 16, wherein the exchanging step comprises exchanging the first and second format parts (**84**) with a driverless transport system.

18. The method of claim 17, wherein the gripping step comprises gripping the at least one packaging blank (**20**) from at least one magazine (**8**) holding a stack of packaging blanks (**20**).

19. The method of claim 18, wherein the at least one stretching die (**18**) used to reduce the resistance force in an edge area (**24**) of the at least one passage opening (**23**) has a conical or truncated cone form.

20. The method of claim 19, wherein the packaging blank (**23**) is a carton packaging blank.