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Ehrmann et al.

(54) **PACKAGING MACHINE AND METHOD FOR CLOSING CONTAINERS WITH LIDS**

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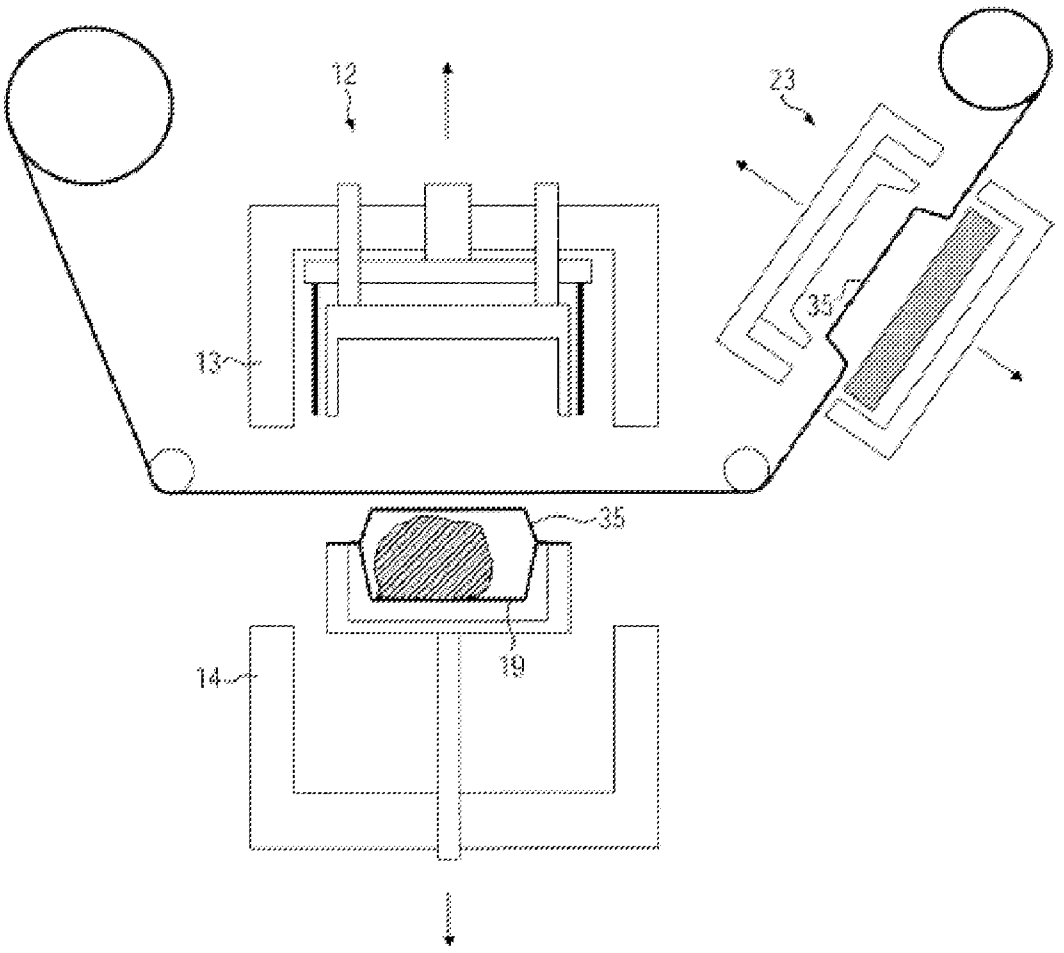
(57) **ABSTRACT**

The invention relates to a method for closing already preformed and separated containers (**19**), for example trays, with a lid foil (**24**) in a closing station (**3**). The invention is characterized in that a deep-drawable foil is used as lid foil (**24**), that the lid foil (**24**) is deep-drawn in a forming means (**23**) of the packaging machine (**1**), and that the deep-drawing of the lid foil (**24**) is accomplished before the containers (**19**) are closed with the lid foil (**24**). The invention also relates to a packaging machine (**1**) suited for carrying out such a method.



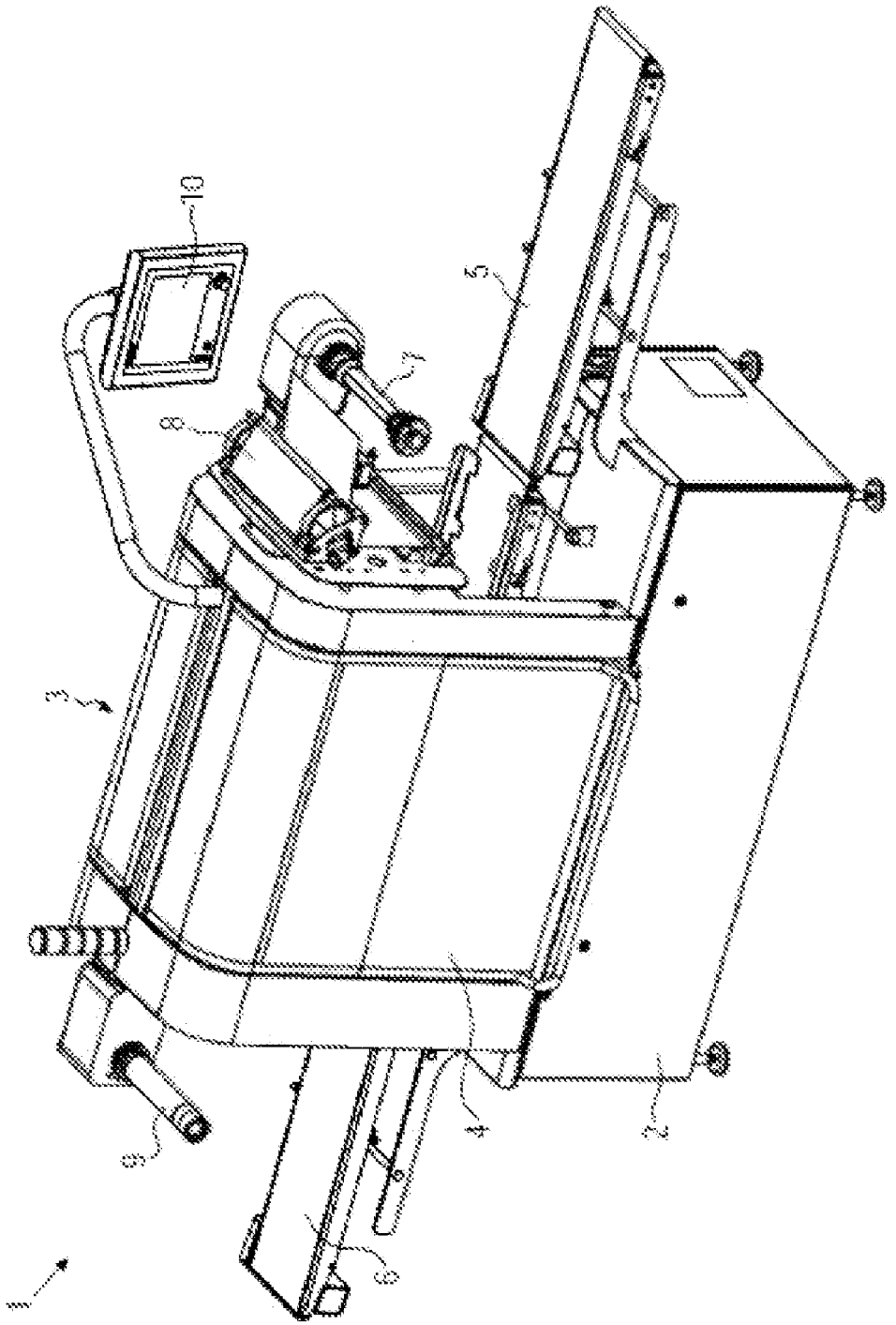


FIG. 1

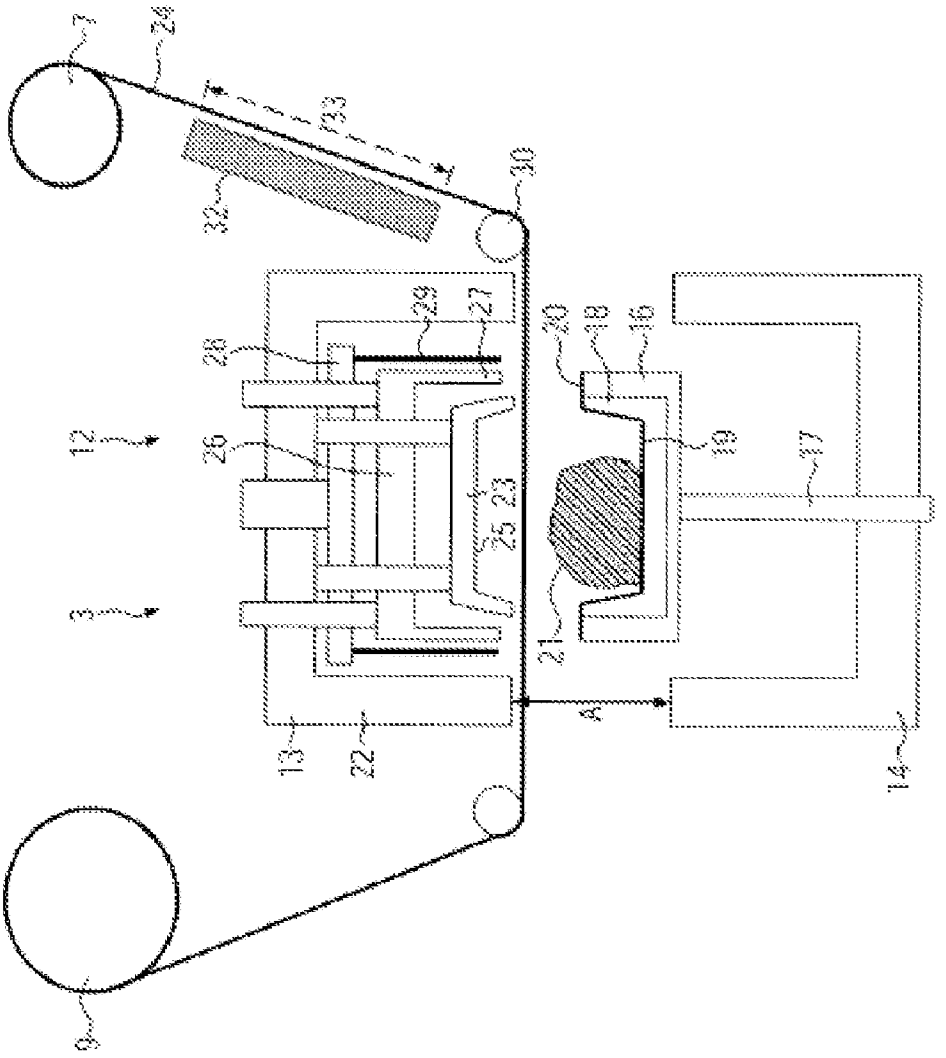


FIG. 2

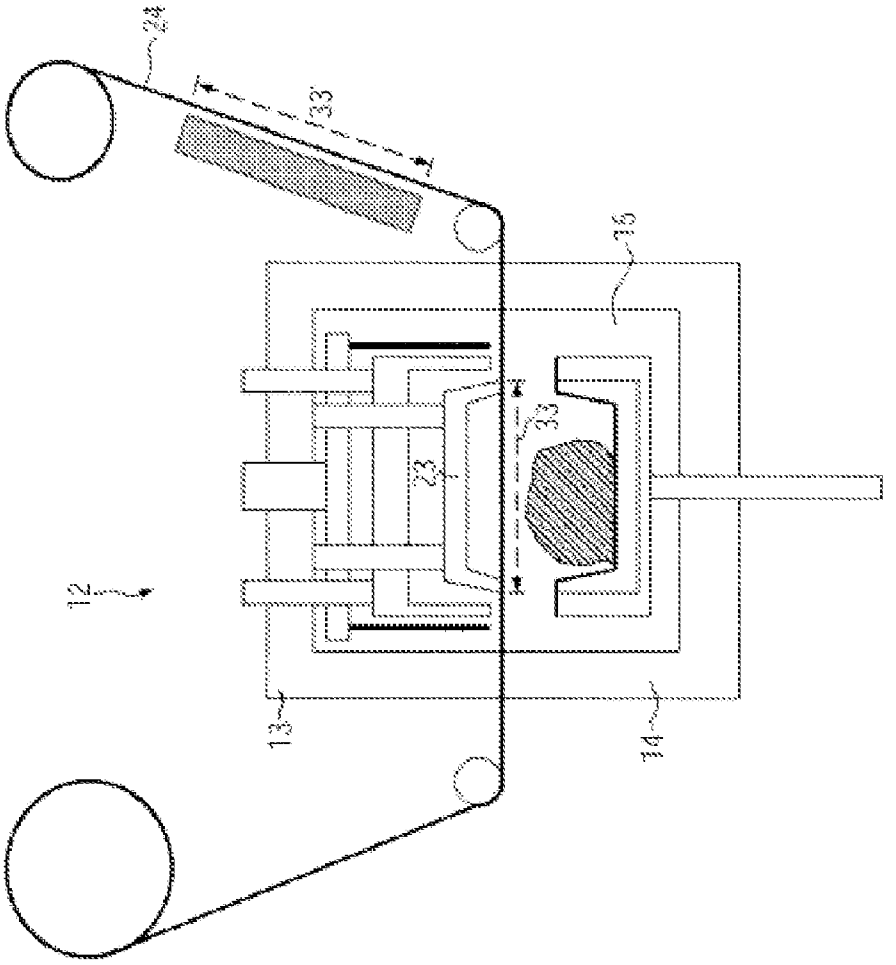


FIG. 3

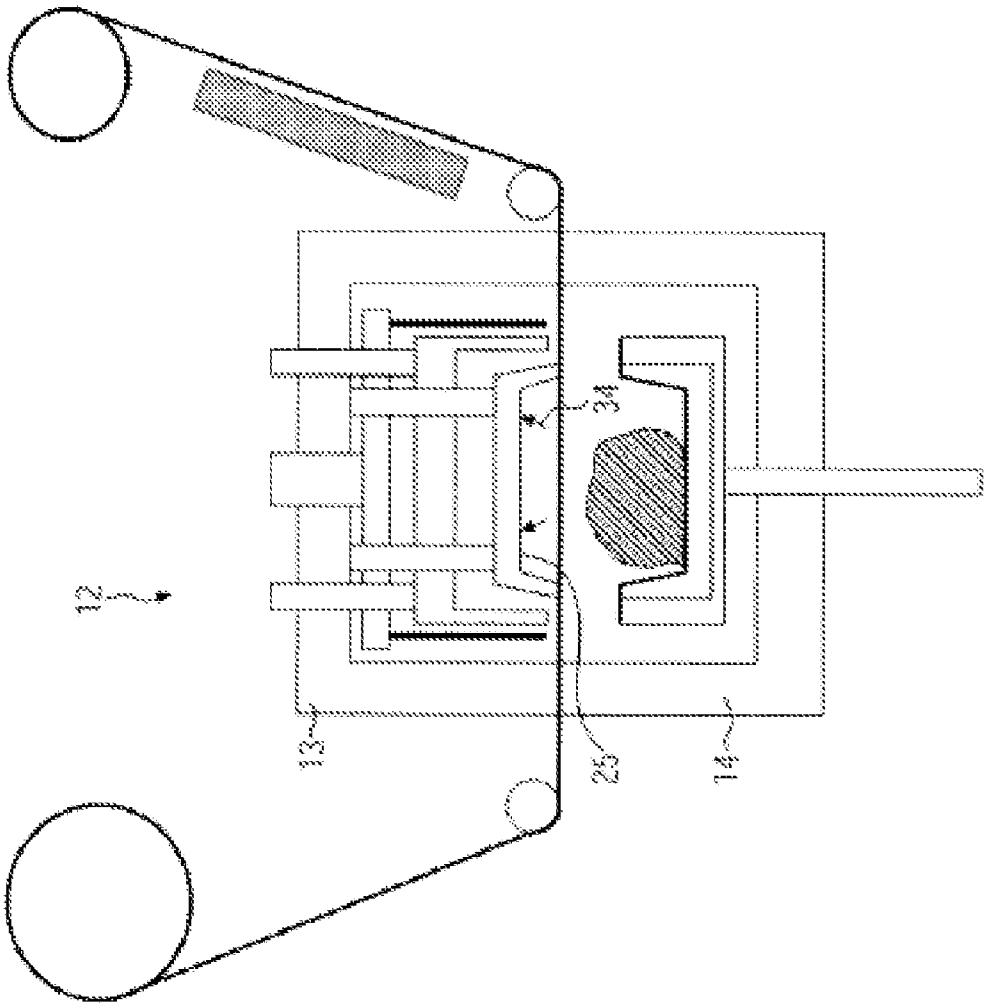


FIG. 4

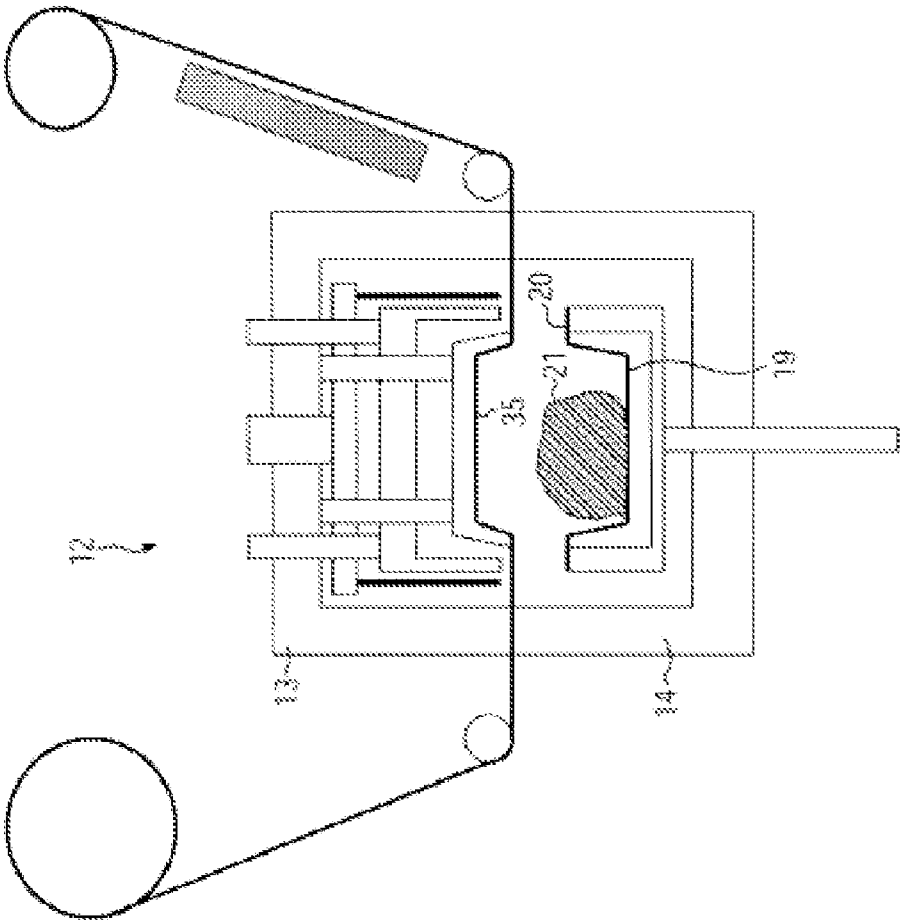


FIG. 5

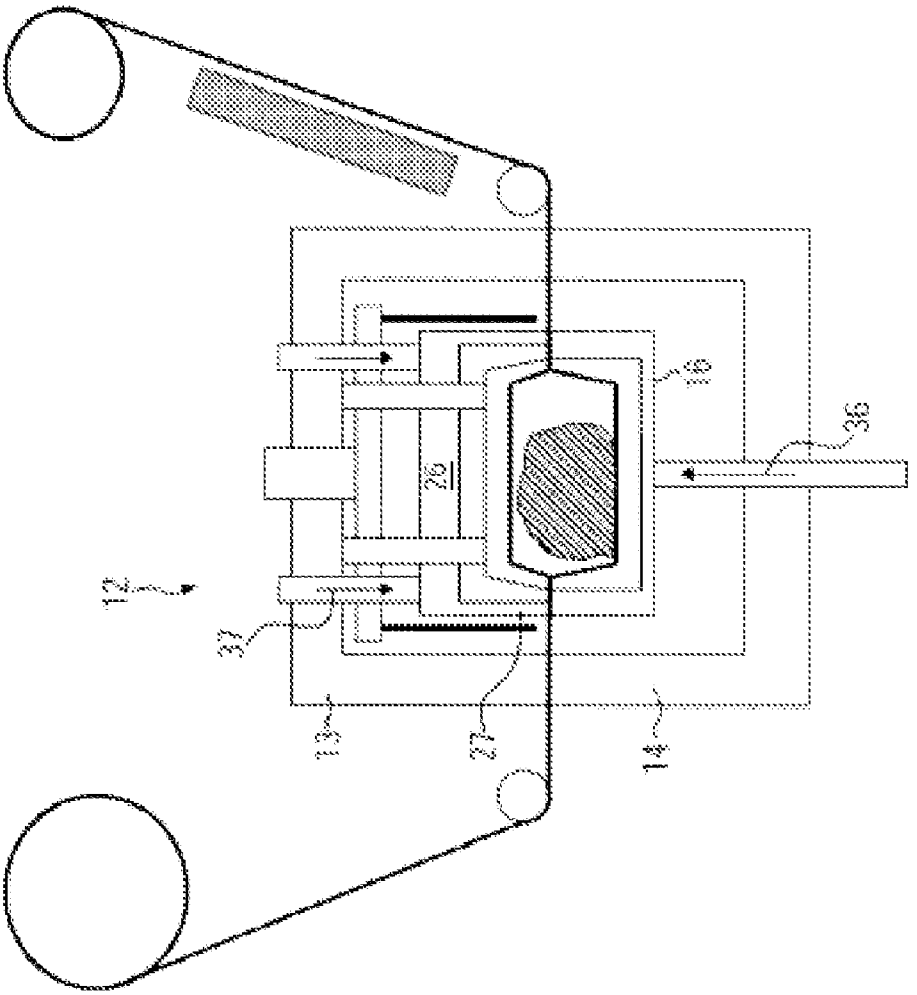


FIG. 6

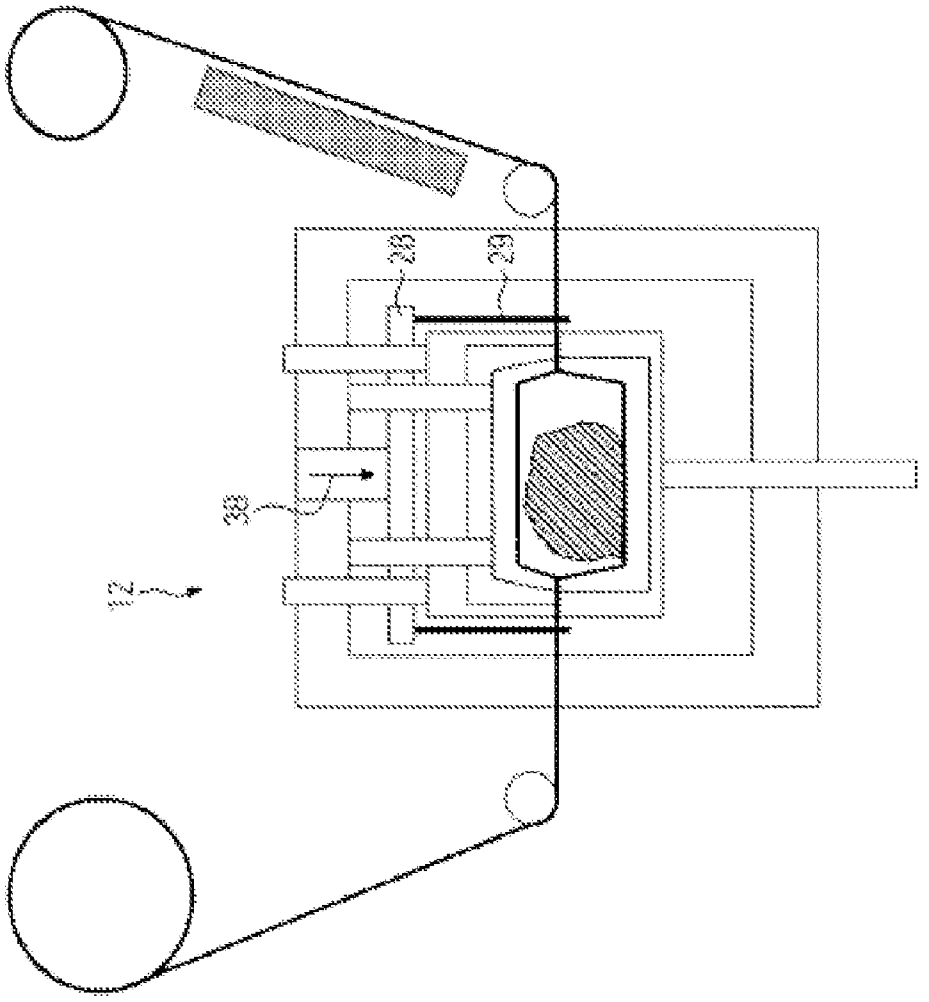


FIG. 7

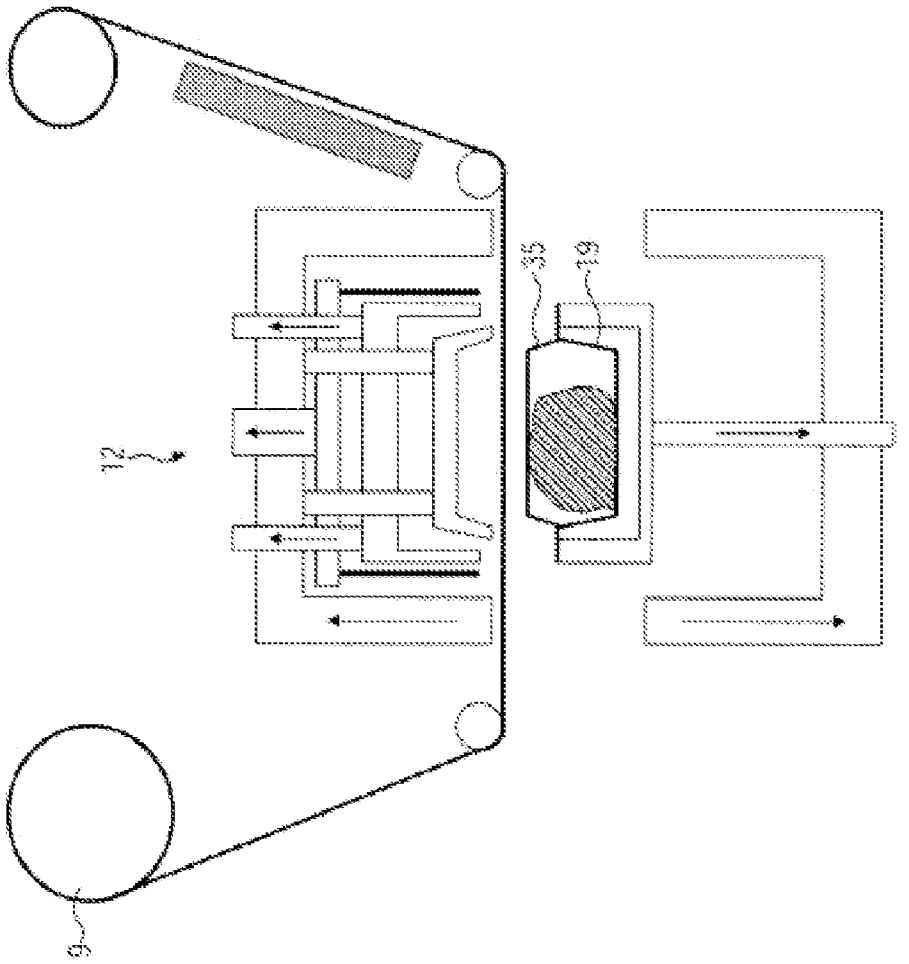


FIG. 8

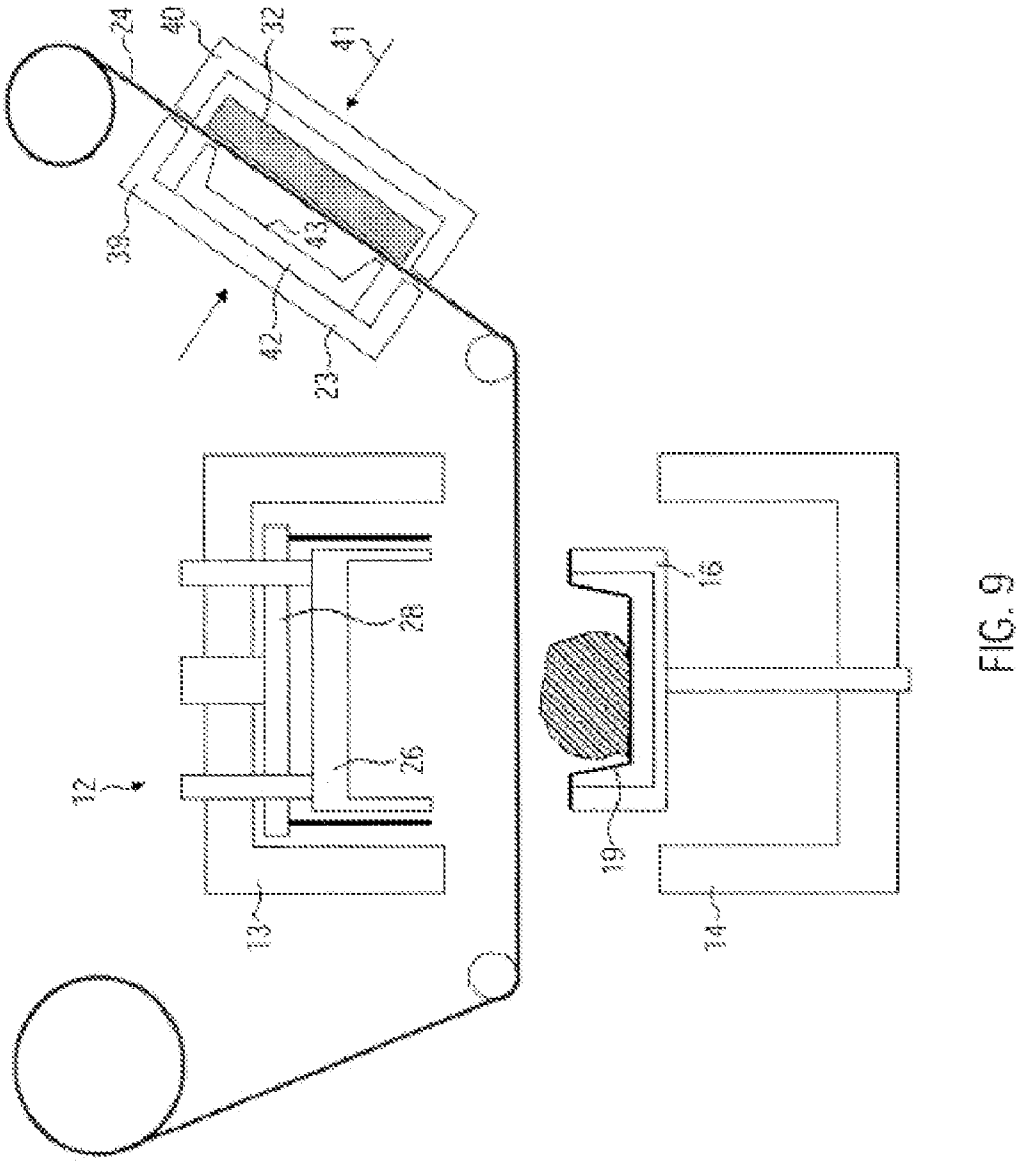


FIG. 9

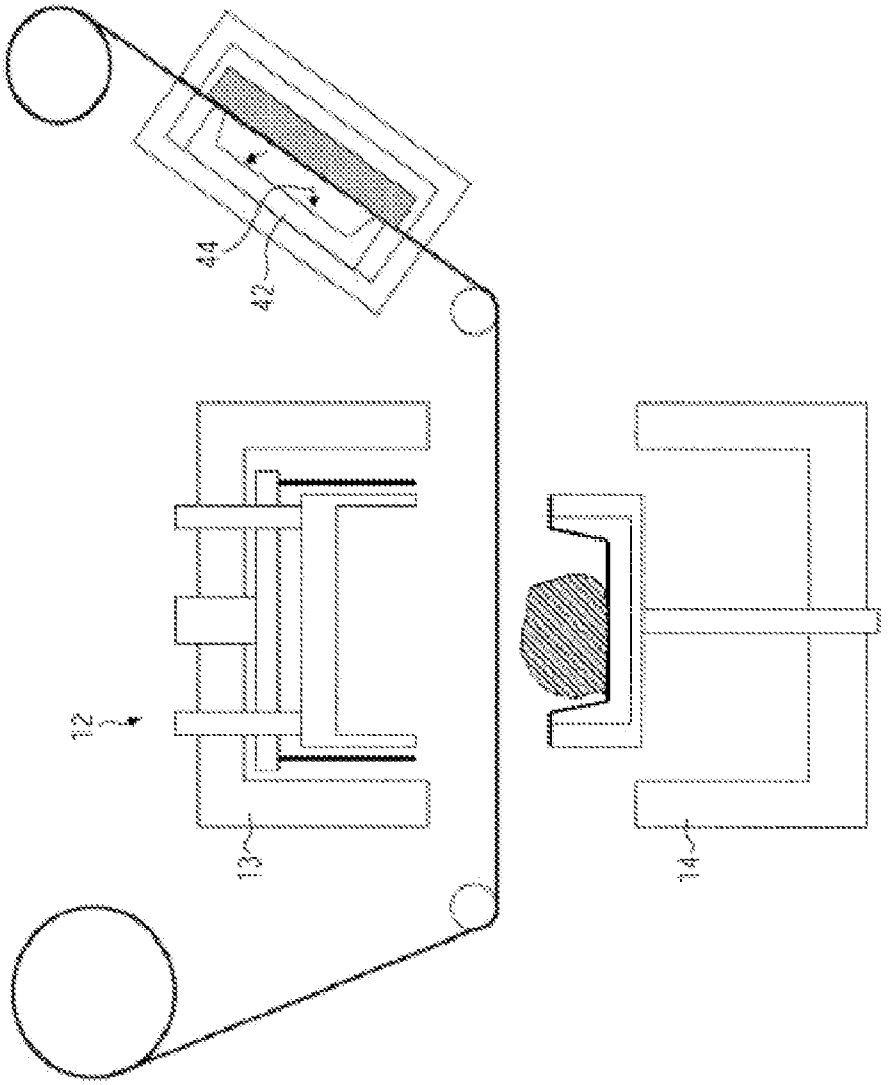


FIG. 10

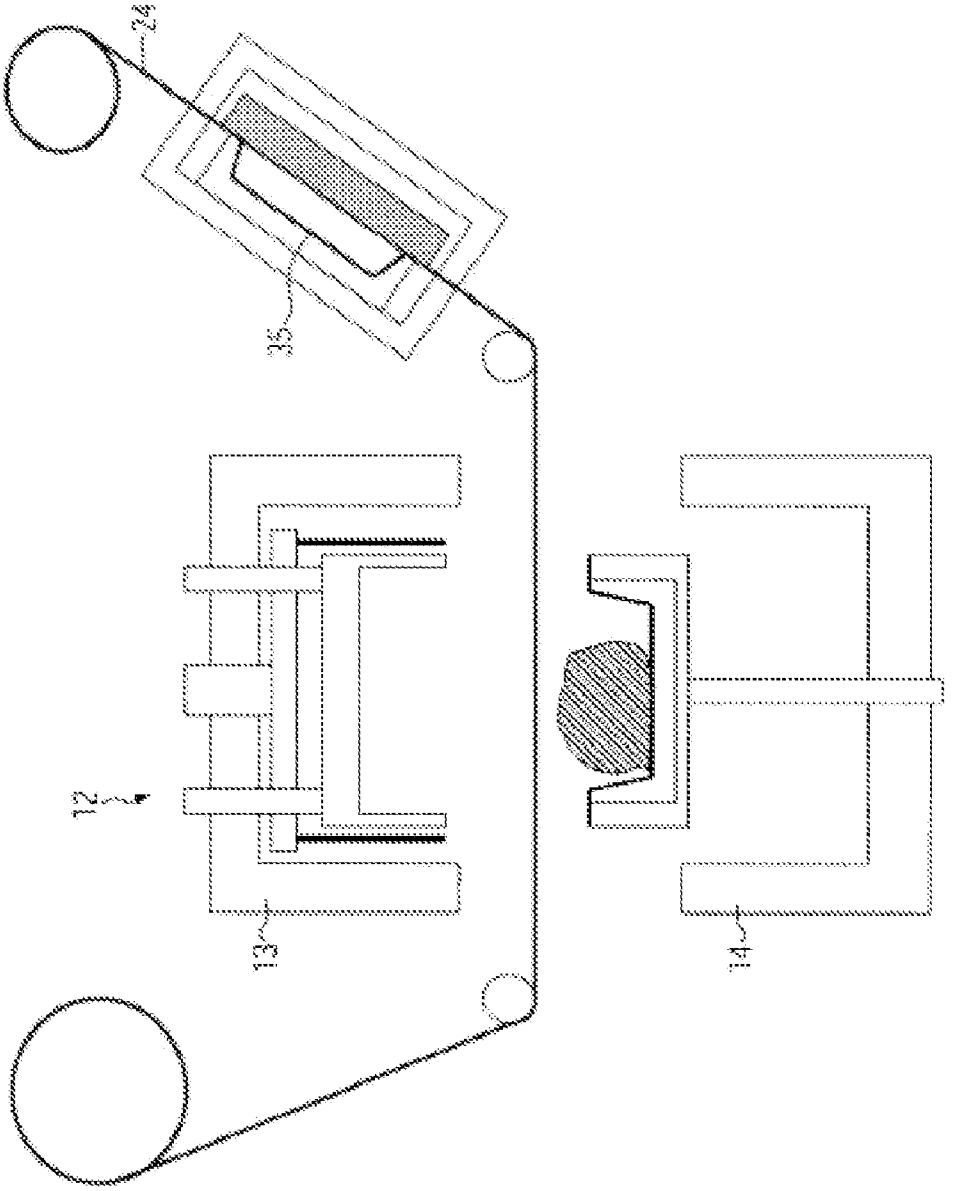


FIG. 11

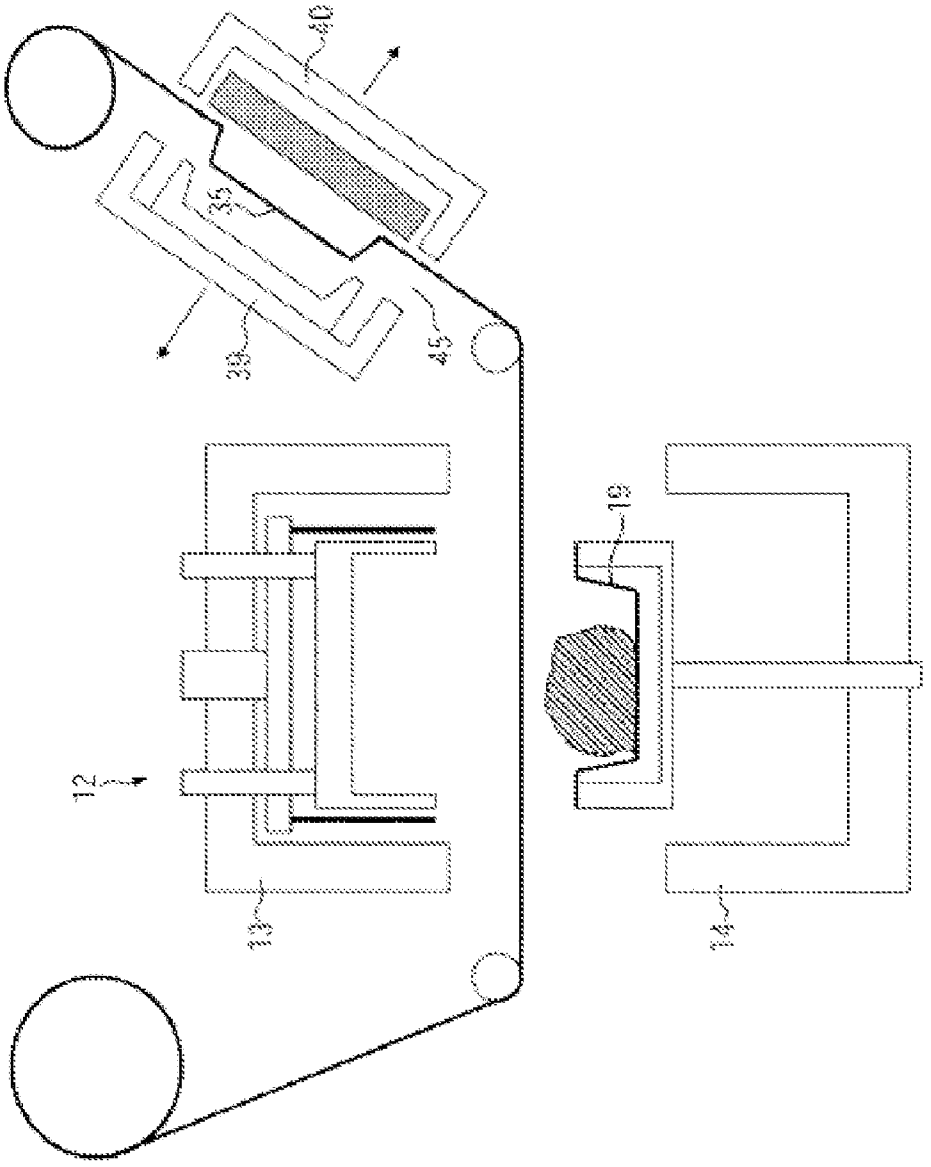


FIG. 12

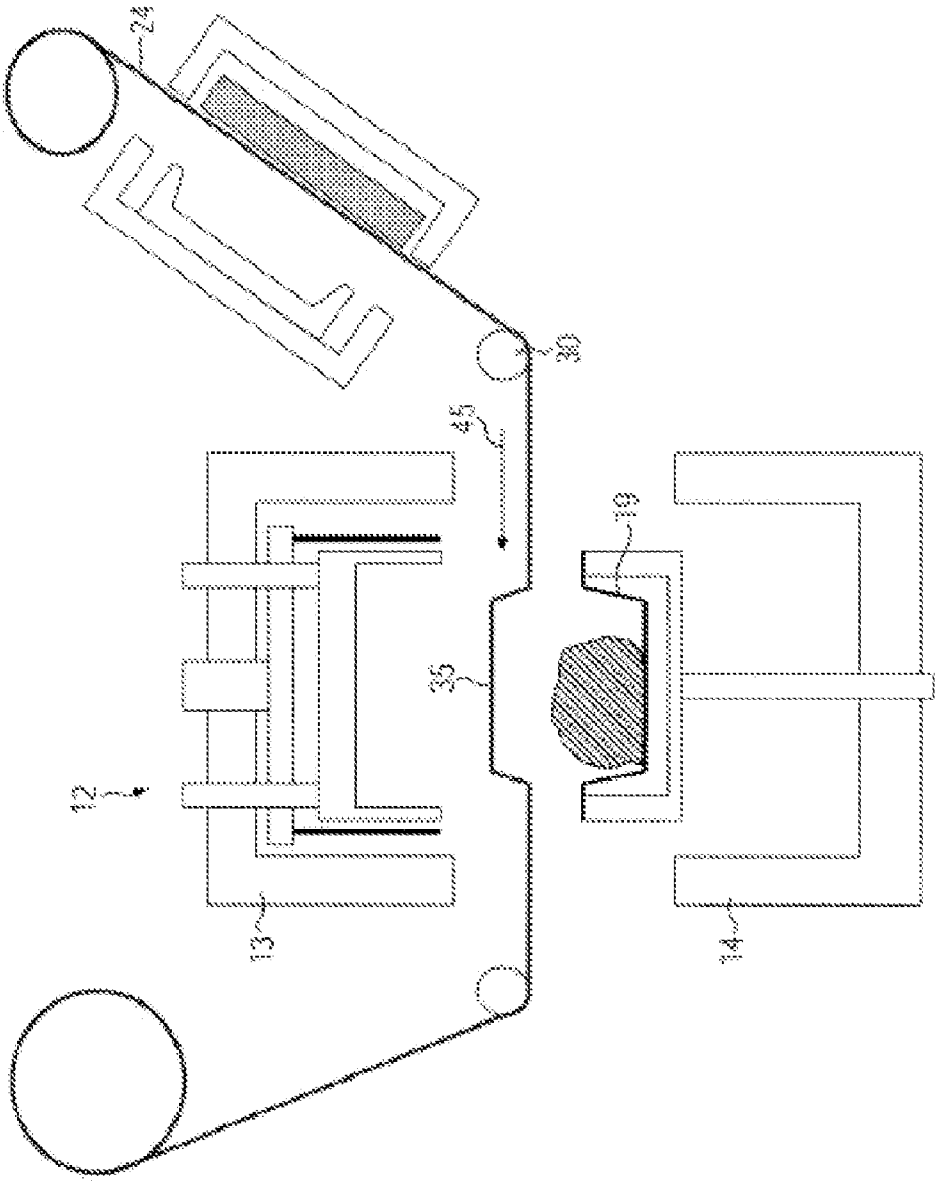


FIG. 13

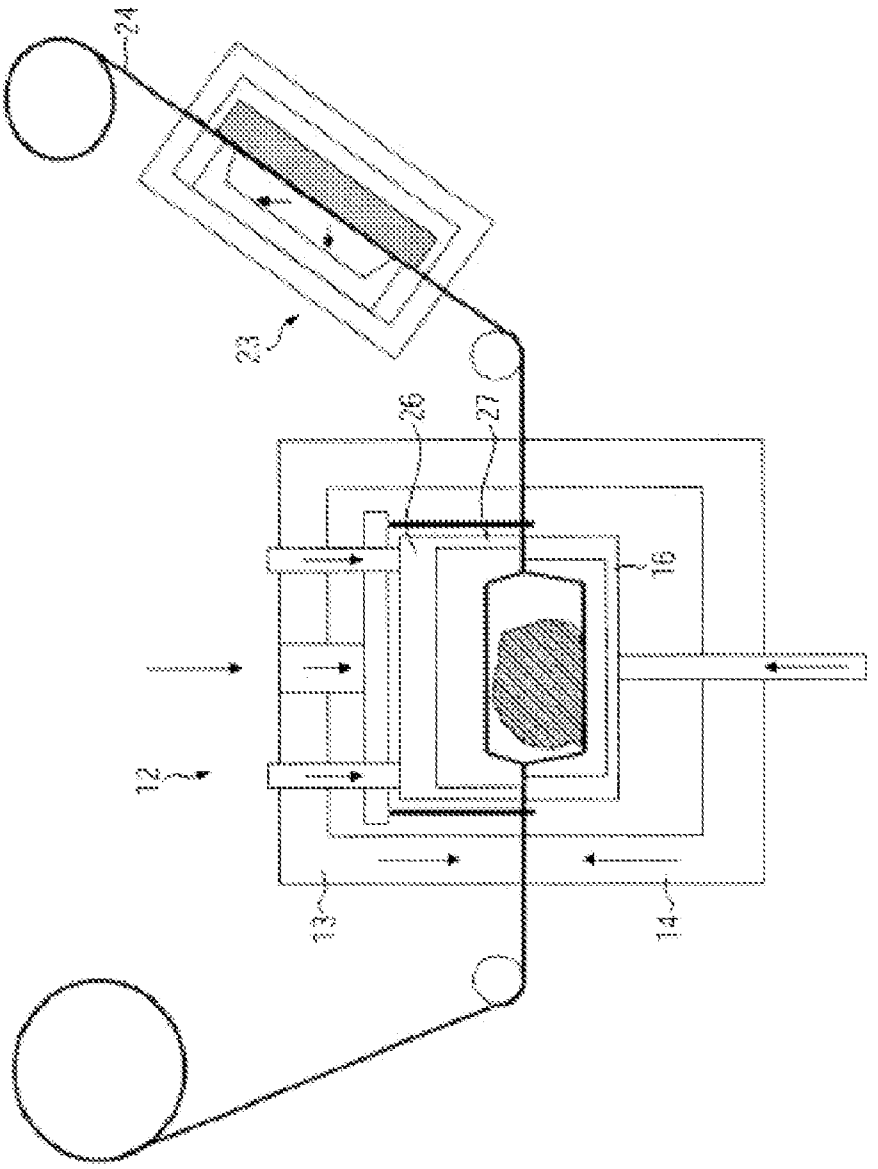


FIG. 14

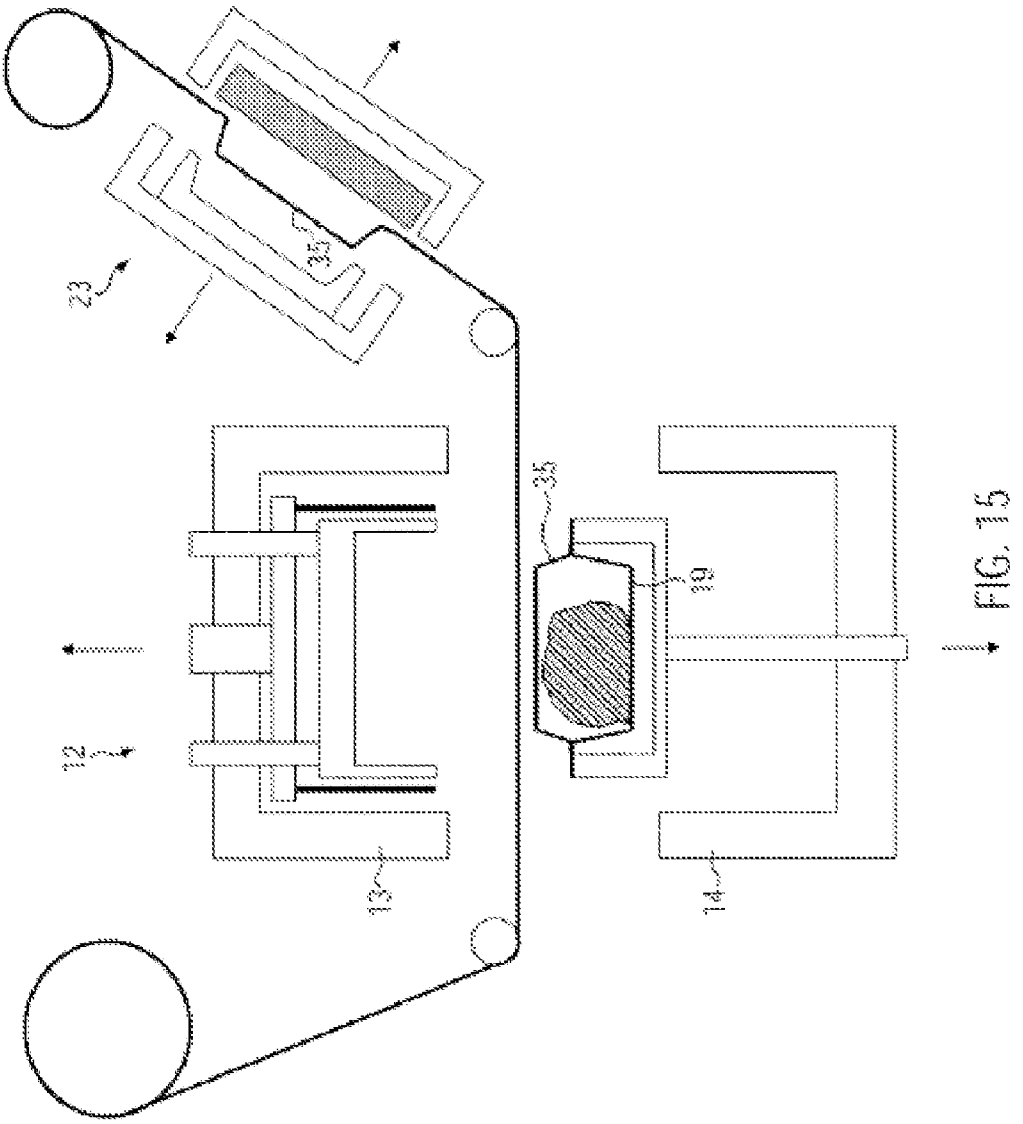


FIG. 15

PACKAGING MACHINE AND METHOD FOR CLOSING CONTAINERS WITH LIDS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims foreign priority benefits under 35 U.S.C. §119(a)-(d) to German patent application number DE 102009020892.5, filed May 13, 2009, which is hereby incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] The present invention relates to a method for closing containers, as well as to a packaging machine for carrying out such a method.

BACKGROUND

[0003] Packaging machines for closing already preformed and separated containers are known in the form of so-called tray sealers, for example from DE 10 2006 018 327 A1. Such machines are fed with already preformed and separated trays which are usually stacked and stocked after they have been formed. The containers are individually removed from the stock and placed onto a conveying belt where they are filled with a product from above. In the conventional tray sealer, a sealing foil is subsequently applied onto the trays that are open to the top which closes as well as seals the trays.

[0004] In conventional tray sealers, the sealing foil must not be stretched by the product, as otherwise the sealing foil might tear off. Consequently, the trays must be comparably deep to prevent the products from projecting over the edge of the trays. This excessive height of the trays, however, also involves drawbacks. On the one hand, this leads to an increase in the required amount of material and costs of a package. On the other hand, less preformed or filled trays can be accommodated per volume, so that costs increase for the stock-keeping of the empty trays as well as for the distribution of the filled and closed trays.

SUMMARY

[0005] It is an object of the present disclosure to overcome these drawbacks with structural means that are as simple as possible.

[0006] An embodiment of the present disclosure involves using a deep-drawable foil for closing already preformed and separated containers, and the foil is deep-drawn in a forming means or device of a packaging machine before the containers are closed with the lid foil. This deep-drawing offers the advantage that the package can be much better adapted to the respective product than before, although the containers are already preformed. In particular, products projecting over the container edge can also be accommodated in the containers, without the lid foil stretching over the product. Moreover, there are also esthetic advantages as, in contrast to conventional tray sealers, the upper side of each package does no longer have to be flat, but can be structured.

[0007] The lid foil may be heated upstream of and/or in the forming device to permit deep-drawing. The preheating of the lid foil upstream of the forming device can accelerate deep-drawing and reduce superfluous waiting times of other components of the packaging machine.

[0008] It is conceivable to deep-draw the lid foil towards the side of the lid foil facing the container during closing altogether or at least in sections. In this manner, a lid section which projects into the interior of the container is formed in the lid foil. This is in particular suited for products or regions of a product which are situated at a lower level than the edge of the container.

[0009] As an alternative or in addition, it is conceivable to deep-draw the lid foil towards the side of the lid foil facing away from the container during closing altogether or at least in sections. In this manner, a dome shaped lid section is formed which projects upwards over the container edge and permits the accommodation of projecting products without the lid foil stretching over the product.

[0010] By the method according to the present disclosure, in the deep-drawing process, at least one concave and/or one convex section can be formed on the side of the lid foil facing the container during closing. They can facilitate the placement of complementary formed regions of the products against the lid to prevent, for example, shifting of the products in the containers.

[0011] The forming device can be provided separately from the closing station. The complete packaging machine, however, becomes more compact and the method thereby less complex, if deep-drawing is carried out within the closing station itself.

[0012] As lid foil, a flexible foil or a hard foil could be used, if they can be deep-drawn in a suited manner.

[0013] Depending on the product, it can be advantageous to use a multilayer foil as lid foil. For example, a combination of an outer layer impermeable to oxygen and an inner layer permeable to oxygen would be conceivable to permit oxygen to flow around the products.

[0014] In one variant of the invention, the lid foil or the lid section formed in it, respectively, is only placed onto the respective containers by a form fit in the form of a "slip lid". The lid section can, for example, snap in at an edge of the container to securely connect the lid to the container.

[0015] In addition or as an alternative, it is possible for the lid foil to be sealed onto the containers, in particular if the interior of the container is to be hermetically sealed.

[0016] If the lid foil is sealed to the containers, the transport of the closed containers connected with the lid foil out of the closing station can cause further lid foil to be drawn behind, which is used for closing following containers. In this manner, one could do without a separate conveyor device for the lid foil.

[0017] The present disclosure also relates to a packaging machine for carrying out a method according to the present disclosure. The packaging machine comprises a forming means or device for deep-drawing the deep-drawable lid foil.

[0018] It is appropriate for the forming device to comprise an exchangeable insert which determines the deformation of the lid foil to a lid section. This insert can be replaced if it is worn down, or if a different shape of the lids for the containers is to be produced.

[0019] Mainly in comparably thick hard foils, the pulling force acting on the lid foil only by the movement of the closed containers still connected to the lid foil might not be sufficient. In this case, it is advantageous to provide, in addition to a transport means for the containers, such as a conveyor belt or any other suitable transport device, a separate conveying means for the lid foil, for example a clamp chain arranged on both sides which can also be used to stretch the lid foil laterally, or any other suitable conveyor device.

[0020] The packaging machine according to the present disclosure may have a tool for placing and/or sealing the lid

foil onto the containers. In this tool, the actual closing of the containers is thus accomplished.

[0021] The tool itself can comprise a lower tool and an upper tool which can be moved relative to each other. For example, they can open for receiving the unclosed containers and reduce the space between them for closing and possibly evacuating and/or gassing the containers.

[0022] It is appropriate if the lower tool and the upper tool can be spaced apart by the relative movement at least far enough to correspond to the sum of the height of a container and the height of a lid section of the lid foil. In this manner, the closing tool also permits the accommodation of containers in which the product and the lid project over the edge of the container.

[0023] In the following, two advantageous embodiments of the present disclosure are illustrated more in detail with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] FIG. **1** is a perspective view of a packaging machine according to the present disclosure;

[0025] FIGS. **2** to **8** show schematic vertical sections through a first embodiment of the packaging machine in different steps of a method according to the present disclosure; and

[0026] FIGS. **9** to **15** show a second embodiment of the packaging machine in different steps of the method according to the present disclosure.

DETAILED DESCRIPTION

[0027] In the Figures, equal and similar components are provided with the same reference numerals.

[0028] FIG. **1** shows a first embodiment of a packaging machine **1** according to the invention in a perspective view. This embodiment is a tray sealer. The packaging machine **1** has a machine frame **2** on which a closing station **3** is arranged for closing as well as possibly evacuating, gassing and/or sealing supplied, tray-shaped containers as well as for cutting a lid foil used for closing. The closing station **3** is located under a cover **4** that can be opened.

[0029] The packaging machine **1** furthermore has a feed belt **5** for feeding the containers, a discharge belt **6** for carrying away the closed containers, a foil feed roller **7** for taking up and feeding a roll of a lid foil, a foil stretching means **8** for stretching the lid foil, as well as a foil residue winder **9** for winding up the foil residues that remain after sealing. A display **10** permits the operator of the packaging machine **1** to check and control the operation of the packaging machine **1**. To this end, operational controls **11** can be provided at the display **10**, for example operator panels or switches to influence the operation of the packaging machine **1**.

[0030] FIG. **2** shows, in a first embodiment of the packaging machine **1** according to the invention, a vertical section through the closing station **3** in a schematic view. The closing station **3** has a tool **12** which in turn comprises an upper tool **13** and a lower tool **14**. The upper tool **13** and the lower tool **14** can be moved in the vertical direction relative to each other. The upper and lower tools **13**, **14** can form a closed chamber **15** between themselves in a closed state (see FIG. **3**).

[0031] A lifting table **16** is provided at the lower tool **14** which can be traveled in the vertical direction via a lifting rod **17** independent of the lower tool **14**. The lifting table **16** forms a recess or cavity **18** for receiving a prefabricated, tray-shaped container **19**. This container **19** can consist, for example, of hard plastics. After preforming, a plurality of containers **19** are stacked and stocked in this manner. They can be individually removed from this stock and placed onto the feed belt **5** of the packaging machine **1** to be filled there.

[0032] One can see in FIG. **2** that an edge **20** of the container rests on an edge of the lifting table **16** or cavity **18**. One can also see that the container **19** is filled with a product **21** which projects upwards beyond the level formed by the edge **20** of the container **19**.

[0033] In the present embodiment, the upper tool **13** has a more complex design. It has on its part three tool components which can be traveled relatively to each other in the vertical direction within the upper tool **13** independent of each other as well as independent of the outer wall **22** of the upper tool **13**. The innermost tool component is a forming means **23** for forming a lid section in the single- or multilayer lid foil **24** advance by the foil feed roller **7**. In the present embodiment, the forming means **23** may comprise any suitable forming device, such as a forming mold or tool having a concave design on a surface **25** facing the container **19**. The forming means **23** can have vacuum lines (not shown) to create a vacuum between the surface **25** and the lid foil **24**.

[0034] Above the forming means **23**, a sealing plate **26** is arranged which has sealing edges **27** projecting downwards. The sealing edges **27** are shaped such that they can contact the edge **20** of the container **19** when the sealing plate **26** is lowered.

[0035] A cutting means **28** is provided above the sealing plate **26**, between the sealing plate **26** and the outer wall **22** of the upper tool **13**. The cutting means **28** may comprise any suitable cutting device, such as a movable cutting tool having cutting edges **29** projecting downwards which are configured for cutting the lid foil **24** in two. The tool **12** can moreover have means for evacuating and/or gassing the chamber **15** formed between the upper and the lower tool **13**, **14**. For example, the tool **12** may be connected to a vacuum pump, or any other suitable evacuating device, and/or a gas supply system.

[0036] The deep-drawable (e.g., thermoplastic) lid foil **24** passes over a first deflection roller **30** and is there deflected such that it traverses the interior of the tool **12** essentially in parallel to the level formed by the edge **20** of the container **19**. The residual sections of the lid foil **24** remaining after the containers **19** have been closed and the lid sections punched out pass over a second deflection roller **31** to a residual foil winder **9** to be accumulated there. Between the foil feed roller **7** and the tool **12**, a foil stretching means **8**, which is not represented in FIG. **2** for a better overview, can be moreover provided. The foil stretching means **8** may be any suitable device, such as a movable plate or a system of rotatable drums or cylinders that includes one or more cylinders that are movable toward and away from another cylinder.

[0037] Between the foil feed roller **7** and the first deflection roller **30**, a heating means or a preheating means **32** (if a further heating step is performed), respectively, is moreover provided. The heating means **32** can be a heating plate which is heated, for example, via a thermal fluid or an electric heating medium. The heating means **32** is used to heat a given section **33** of the lid foil **24** to a temperature which permits thermoplastic forming of the lid foil **24** during a deep-drawing operation.

[0038] With reference to FIGS. **2** to **8**, a method according to the present disclosure and the operating sequence of the packaging machine **1**, respectively, will now be illustrated.

[0039] FIG. **2** shows the tool **12** of the packaging machine **1** in a state in which a tray **19** filled with a product **21** has been inserted into the cavity **18** of the lifting table **16** and guided into the interior of the tool **12**. For this purpose, the upper and the lower tools **13**, **14** can be removed from each other to such an extent that the distance A between the lower edge of the upper tool **13** and the upper edge of the lower tool **14** is larger than the sum of the height of the container **19** and the projecting part of the product **21**, to permit in this manner the introduction of the filled container **19** into the tool **12**. A certain section **33** of the lid foil **24** is heated under the heating means **32**.

[0040] FIG. **3** shows the tool **12** in a state in which first the lid foil **24** has been conveyed far enough for the heated section **33** to be located underneath the forming means **23**. At this time, the feed of the lid foil **24** is stopped. One can see in FIG. **3** that the upper tool **13** and the lower tool **14** move towards each other until they clamp the lid foil **24** between their edges and form a closed chamber **15** between themselves. As the feed of the lid foil **24** is stopped, now a further section **33'** of the lid foil can be brought to the temperature required for forming under or in the heating means **32**.

[0041] It could already be seen in FIG. **3** that the forming means **23** contacts the lid foil **24** when the upper tool **13** is lowered. Arrows **34** in FIG. **4** indicate that now a vacuum is created at the surface **25** of the forming means **23** by suited provisions. In connection with the contact between the forming means **23** and the lid foil **24**, this vacuum takes care that the heated section **33** of the lid foil **24** is pulled against the concave surface **25** of the forming means **23** and in this manner deep-drawn to form a lid section **35**.

[0042] The lid section **35** is represented in FIG. **5**. It has a shape which is complementary to the edge **20** of the container **19** on the outer surface. On the side facing the product **21**, the lid section **35** is concave.

[0043] FIG. **6** shows the tool **12** in a state in which—starting from the state in FIG. **5**—the lifting table **16** was lifted until the edge **20** of the container **19** came into contact with the lid foil **24**. This movement of the lifting table **16** is indicated by arrow **36**. Simultaneously—as indicated by arrow **37**—the sealing plate **26** was lowered until its sealing edges **27** came into contact with the lid foil **24** from above. In this state, the lid foil **24** is now sealed onto the edge **20** of the container **19**.

[0044] Subsequently or simultaneously with the sealing, the cutting means **28** is lowered—as shown in FIG. **7**—, so that its cutting edges **29** cut out the lid foil **24** all around the closed container **19**. This movement of the cutting means **28** is indicated by arrow **38**.

[0045] In FIG. **8**, the tool **12** is opened. This is done by moving the lower tool **14** and the lifting table **16** downwards and the upper tool **13** with the forming means **23**, the sealing plate **26** and the cutting means **28** upwards. The lid section **35** is firmly connected to the rest of the container **19** by the sealing and remains at the container **19**. The filled container **19** can now be removed from the tool **12**. At the same time, the lid foil **24** can be transported forwards, while the rest of the lid foil **24** that remains during cutting is winding up on the foil residue winder **9**. The closing process can now be performed in the same manner for a subsequent container.

[0046] FIG. **9** shows a second embodiment of a packaging machine **1** according to the present disclosure. It differs from the first embodiment in that the forming means **23** for forming the lid sections is now no longer provided in the closing tool **12**, but in the region of the heating means **32**. Apart from that, the upper tool **13** and the lower tool **14** of the closing tool **12** remain unchanged. In particular, the upper tool **13** still comprises a sealing plate **26** and a cutting means **28**, while the lower tool **14** still comprises a lifting table **16**.

[0047] In the second embodiment, the forming means **23** comprises a first forming half **39** and a second forming half **40**. As indicated by the arrows **41**, the two forming halves **39**, **40** can be moved relative to each other perpendicular to the plane of the lid foil **24**, so that they can close around the lid foil **24** or can release the lid foil **24**, respectively.

[0048] In the first forming half **39**, an exchangeable inset **42** is provided. Its surface **43** facing the lid foil **24** defines the shape of the lid section **35** if the section of the lid foil **24** heated by the heating means **32** in the opposite second forming half **40** is pulled closer by applying a vacuum to the surface **43** of the inset **42** to deep-draw the lid foil **24**.

[0049] FIGS. **9** to **15** show various steps of the method according to the present disclosure during the operation of the packaging machine **1** according to the second embodiment. FIG. **9** shows the packaging machine **1** in a state in which a fresh section of the lid foil **24** has been brought into the forming means **23**.

[0050] In FIG. **10**, the two forming halves **39**, **40** of the forming means **23** have been closed. Arrows **44** indicate that a vacuum is created at the inset **42** of the forming means to place the lid foil **24** in this region against the inset **42** of the first forming half **39** and to form a lid section **35** in this manner. The inset **42** can be exchanged if lid sections **35** having a different shape are to be produced.

[0051] FIG. **11** shows the state of the packaging machine **1** after the lid foil **24** has been deep-drawn in the forming means **23**. The lid foil **24** now has a lid section **35**.

[0052] In FIG. **12**, the two forming halves **39**, **40** have been removed from each other. The opening **45** formed between them now must be large enough—at least in the exiting direction out of the forming means **23**—to let the domed lid section **35** pass.

[0053] Between the state in FIG. **12** and the state in FIG. **13**, the lid foil **24** has been moved into the conveying direction **45** far enough for the lid section **35** now to be positioned within the closing tool **12** over the container **19** to be closed. The first deflection roller **30** here only lies against an outer edge of the lid foil **24**, so that it does not collide with the lid section **35** in the central region of the lid foil **24**.

[0054] FIG. **14** shows the packaging machine **1** in a state in which the closing tool **12** has been closed by moving the upper tool **13** and the lower tool **14** towards each other. A contact between the sealing edges **27** of the sealing plate **26** and the edge **20** of the container **19**, that is close by due to the lifting of the lifting table **16**, permits to seal the lid foil **24** to the container **19**. Simultaneously or subsequently, the cutting means **28** has been lowered to cut out the closed container. The forming means **23** has simultaneously closed around a new section of the lid foil **24** to form a further lid section **35**.

[0055] In FIG. **15**, the forming means **23** as well as the closing tool **12** have been opened. The closed container **19** can now be removed from the tool **12**, and the cycle can start anew.

[0056] Starting from the two embodiments described in detail, a method according to the present disclosure and a packaging machine according to the present disclosure can be modified in many ways. It is, for example, conceivable for the lid sections **35** not to be sealed to the edge **20** of the container **19**, but to only be placed onto the container **19** by a form fit in the form of slip lids. It is moreover possible to impart any arbitrary shape to the lid section **35**. In the first embodiment, too, the forming means **23** can have an exchangeable inset **42**. Though it is not shown, several lid sections **35** can be manufactured one after or one next to the other in the forming means **23**, and several containers **19** can be simultaneously closed in the closing station **3**.

[0057] While exemplary embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrate and describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of the invention. Additionally, the features of various implementing embodiments may be combined to form further embodiments of the invention.

What is claimed is:

1. A method for closing already preformed and separated containers with a lid foil in a closing station of a packaging machine, the method comprising:

deep-drawing the lid foil with a forming device of the packaging machine; and

closing the containers with the lid foil in the closing station;

wherein for each container, the deep-drawing is performed prior to the closing.

2. The method according to claim **1** further comprising heating the lid foil upstream of the forming device and/or in the forming device.

3. The method according to claim **1** wherein the deep-drawing is performed such that the lid foil is deep-drawn at least in sections towards a side of the lid foil facing the containers during the closing.

4. The method according to claim **1** wherein the deep-drawing is performed such that the lid foil is deep-drawn at least in sections towards a side of the lid foil facing away from the containers during the closing.

5. The method according to claim **1** wherein for each container the deep-drawing is performed such that at least one concave and/or one convex section is formed on a side of the lid foil facing the container during the closing.

6. The method according to claim **1** wherein the deep-drawing is carried out in the closing station.

7. The method according to claim **1** wherein the lid foil comprises a flexible foil or a hard foil.

8. The method according to claim **1** wherein the lid foil comprises a multilayer foil.

9. The method according to claim **1** wherein for each container the closing comprises placing the lid foil onto the container by a form fit.

10. The method according to claim **1** wherein for each container the closing comprises sealing the lid foil onto the container.

11. The method according to claim **10** wherein, after sealing the lid foil onto the containers, the lid foil is moved along by movement of the closed containers.

12. A packaging machine for closing already preformed and separated containers with a lid foil, the packaging machine comprising:

a forming device configured to deep draw the lid foil to form lid sections; and

a closing station for closing the containers with the lid sections;

wherein the packaging machine is operated such that, for each container, a lid section is formed prior to closing the container with the lid section.

13. The packaging machine according to claim **12** wherein, for each container, the forming device is configured to form at least one concave and/or one convex section on a side of the lid foil facing the container during the closing of the container at the closing station.

14. The packaging machine according to claim **12** wherein the forming device comprises an exchangeable insert for deforming the lid foil.

15. The packaging machine according to claim **12** further comprising a conveyor device for conveying the lid foil, and a transport device for transporting the containers.

16. The packaging machine according to claim **15** wherein the conveyor device comprises a clamp chain.

17. The packaging machine according to claim **12** wherein the closing station comprises a tool for placing and/or sealing the lid foil onto the containers.

18. The packaging machine according to claim **17** wherein the tool comprises a lower tool and an upper tool, wherein at least one of the lower tool and the upper tool is movable with respect to the other of the lower tool and the upper tool.

19. The packaging machine according to claim **18** wherein the lower tool and the upper tool are configured to be spaced apart by the relative movement at least far enough to correspond to the sum of a height of a container and a height of a lid section of the lid foil.

20. The packaging machine according to claim **12** wherein the forming device is located at the closing station.

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