The present invention relates to a forming shoulder of a tubular bag forming, filling and sealing machine, wherein the forming shoulder (2) is produced from a porous material and is divided into individual segments (3). (FIG. 1)
Microporous Surface, Compressed Air Function – Compressed Air

Microporous Surface, Compressed Air and Vacuum Function – Vacuum

FIG. 3

FIG. 4

FIG. 5

FIG. 6
FORMING SHOULDER OF A TUBULAR BAG PACKAGING MACHINE

BACKGROUND OF THE INVENTION

[0001] The invention relates to a forming shoulder of a tubular bag forming, filling and sealing machine. Such forming shoulders are known from the prior art. Said forming shoulders are primarily produced from plastic or structured sheet metal, wherein the surface properties of the forming shoulder and of the plastic material (packaging material) to be formed by the forming shoulder have to be matched to one another such that the packaging material slides on the forming shoulder in order to subsequently be formed from a flat web to a film tube. Due to the friction arising between the packaging material and the forming shoulder, it is not possible without special measures to process sensitive, structured or adhering packaging material. It has particularly been proven to be disadvantageous that the forming shoulder tends to wear particularly in the region of the forming edge.

[0002] A forming shoulder is known from the European patent specification EP 1 186 535 A1 in which bore holes are made in the inlet section. Gas, preferably air, is discharged through said bore holes; thus enabling an air cushion to develop between the forming shoulder surface and the packaging material (film).

[0003] The WIPO patent publication WO 2009/04998 depicts a forming shoulder for producing very small tubular bags. Provision is thereby made for bore holes to be configured on the forming shoulder, to which bore holes a vacuum is applied. In so doing, the film of the packaging material is applied to the forming shoulder geometry.

[0004] The patent publication DD 111 346 B depicts a tubular bag forming, filling and sealing machine, in which a tube provided with perforations is disposed at an edge of the forming shoulder and produces an air cushion.

SUMMARY OF THE INVENTION

[0005] According to the invention, the entire forming shoulder and particularly the surface of the forming shoulder is produced from a porous material and is divided into individual segments. By means of the porous design, in particular of the surface of the forming shoulder, and by means of the division into individual segments, it is possible to produce local air cushions in a targeted manner through the supply of a gas, preferably air, in order to prevent direct contact between the packaging material and the forming shoulder. As a result, favorable friction ratios are created. As a result of the division of the forming shoulder respectively the forming shoulder surface into individual segments, said segments can be individually actuated so that there is the possibility of influencing the packaging material webs via the forming shoulder in a targeted manner during the processing and forming thereof. It is thus possible to optimize and control the course of the packaging material web and to measure web loads of said packaging material. In contrast to the prior art in which only a binary control (switching off or switching on) is provided, it is therefore possible according to the invention to influence the friction ratios in the individual segments in a targeted manner in order to facilitate a control of the movement of the packaging material web and in the aggregate to lead the packaging material web over the forming shoulder in a targeted manner.

[0006] Provision is made in a particularly favorable modification to the invention for the forming shoulder to be produced by means of a sintering process or by means of a generative method, such as, for example, a rapid prototyping.

[0007] The gist of the invention is therefore inter alia a forming shoulder manufactured in a sintered or generative manner. In so doing, the invention provides the following advantages: porosities can be introduced in a targeted manner into a sintered forming shoulder and be used, for example, to produce an air cushion between the forming shoulder surface and the film. The porous surfaces can therefore be disposed on the forming shoulder surface in a manner which is free in shape and design. In addition, direct feed lines can additionally be generated by these porosities in the bulk material, which in turn are permeable to gas. This variant of the application is also possible with a generatively produced forming shoulder because said variant can be produced, for example, by means of rapid prototyping. In this variant, diverse channels for gas transport can be implemented. A further advantage is that measuring tasks can be implemented by means of these porous surfaces. According to the invention, ram pressure measurements are thus possible which allow for inferences to be made about the web force distribution and correspondingly about the loads on the web. A control of the web behavior and thus of the positional fidelity of the packaging material web on the forming shoulder is likewise to be seen as an advantage. The friction ratios on the forming shoulder and therefore the position of the film on the forming shoulder can be controlled here by means of the porous surfaces and the airflow through the same. In a particularly advantageous manner, the invention can be used with intermittently operating processing machines, because said machines cannot build up a stationary air cushion between the forming shoulder and the film. This is a result of the start-stop operation of said machines.

[0008] In a favorable modification to the invention, provision is furthermore made for gas to be selectively applied via a gas supply to individual segments or for gas to be suctioned off from individual segments in order to form an air cushion or vacuum which is effective on the surface of the segment. Hence, it is also possible in addition to producing a selective air cushion in the individual segments as described above to hold the packaging material on the forming shoulder by means of negative pressure or vacuum. This is particularly advantageous in the inlet region when the machine is shut down or during a clocked operation.

[0009] When using air cushions in the region of the forming shoulder, the friction and therefore the required pull-off force are reduced. Packaging materials that are difficult to process, for example having high frictional coefficients in comparison to the material of the forming shoulder, can thus be used. Packaging material as well as the forming shoulder are less mechanically stressed. As a result, the processing of packaging material having a sensitive surface or structure is therefore possible according to the invention. The service life of the forming shoulder is furthermore increased due to the reduction in the mechanical stress. The possibility of holding the packaging material web directly on the forming shoulder prevents said web from sliding backwards or swerving laterally. As a result, the processing operation is stabilized and start-up times are reduced.

[0010] In order to be able to carry out a control effectively and reliably, it is particularly advantageous if individual seg-
ments are each provided with at least one pressure sensor for measuring the ram pressure or for measuring the flow resistance.

According to the invention, it is possible to either design the entire surface layer porous or to provide the entire material of the forming shoulder as porous material. It can also be advantageous, to design the individual segments differently, in particular with regard to the porosity and configuration thereof. According to the invention, said segments can preferably be designed in a linear or circular fashion.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments of the invention are described below in detail with reference to the accompanying drawings. In the drawings:

FIG. 1 shows a simplified schematic depiction of a first exemplary embodiment of a segmented forming shoulder according to the invention;

FIG. 2 shows a depiction, analogous to FIG. 1, of a further exemplary embodiment of an inventive forming shoulder as a measuring forming shoulder;

FIGS. 3 and 4 show exemplary embodiments comprising a partial microporous surface in the inlet region as well as on the forming edge;

FIGS. 5 and 6 show depictions, analogous to FIGS. 3 and 4, of a further exemplary embodiment comprising a continuous microporous surface in the inlet region and on the forming edge;

FIG. 7 shows a schematic detailed view in cross section through the material structure for depicting the air cushion function; and

FIG. 8 shows a depiction, analogous to FIG. 7, of an exemplary embodiment in order to illustrate the suction function.

DETAILED DESCRIPTION

FIGS. 1 and 2 show in each case a schematic depiction of a forming shoulder according to the invention. The forming shoulder 2 depicted in FIG. 1 is designed in a segmented manner and has in total six segments I to VI on the surface thereof, which are designed substantially strip-shaped.

In the exemplary embodiment shown in FIG. 2, the segments are designed in each case as measurement segments. This means that they are not strip-shaped but rectangular or suitably divided in order to carry out measurements over the running movement of the packaging material web, said measurements being used for the open-loop or closed-loop control of the process.

The invention thus relates, as described above, to a forming shoulder 2 which can be produced in two ways. On the one hand, production can take place by sintering and on the other hand by a generative manufacturing method, such as, for example, rapid prototyping.

The forming shoulder 2 can obtain a porous structure by means of these manufacturing methods. This porous structure leads to the forming shoulder being able to take on measuring and positioning tasks. The basic function of the porous structure is to reduce friction on the forming shoulder 2 by means of a cushion consisting of air or other gases. To this end, the entire forming shoulder body consists of porous material. The gist of the invention consists of, as previously described, measuring and positioning tasks, which the forming shoulder 2 can take on. A positioning task can be implemented by means of a segmentation of the forming shoulder body according to FIG. 1. The functionality of the segments 3 can be explained by a reduction or increase in friction. In order to displace the film in a direction transverse to the direction of transport of the packaging material web, less air is applied to the segments 3 in the displacement direction so that the friction is increased and a transverse force develops which changes the web position. As an example, the invention can be configured such that less air is applied to segment I and segment II than to the remaining segments 3 when the web is displaced in the direction of segment I. In so doing, a higher frictional force develops on the segments I and II, which leads to the web being displaced in the direction of segment I. A precondition for this function is that the segments 3 are separated by a layer impermeable to gas. This description shows the controlling effect of the inventive forming shoulder 2 which is demonstrated by means of positioning tasks.

Measuring tasks are possible if the forming shoulder is configured according to FIG. 2. In this case, the design of the forming shoulder segments is not defined. FIG. 2 shows how the segments I to VI can be divided. Depending on the resolution desired, the segment sizes can be adapted. In this case, the measuring principle is a measurement of the ram pressure. Two implementation options are available here. On the one hand, the measurement of the ram pressure takes place by measuring the flow resistance without film (Test 1) and by a comparison to the flow resistance with film on segment 3 (Test 2). As a result, a difference in pressure results between Test 1 and 2, which correlates to the web force. Another option is to separate the measurement from the application of compressed air. Here air is applied to the film by means of segment 3 and the web force is measured by means of surrounding elements which are possibly configured smaller. A web force distribution on the forming shoulder 2 can be determined from the web force per segment 3. A web tension distribution can subsequently be derived from the web force distribution. Alternatively, defined segment structures can also be introduced, which relieve defined regions of the packaging material web on the forming shoulder 2. According to the invention, line segments or circular segments are advantageous.

FIGS. 3 to 8 show in each case different embodiments of the design and arrangement of segments 3 on the surface 1 of the forming shoulder 2. Provision is made in this case for a microporous surface which can be either subjected only to compressed air in order to form an air cushion or to which it is possible to optionally apply compressed air or vacuum in order to control or regulate the movement of the film of the packaging material in a targeted manner.

The surface 1 of the forming shoulder is therefore provided with a microporous coating. Compressed air is applied to the coating from below through channels 4 lying thereunder. In so doing, an air cushion is formed on the surface 1 and the packaging material is fed without contact over the forming shoulder 2. The region of the forming edge is likewise provided with this surface 1 so that the mechanical load is minimized.

FIG. 7 shows a cross section through the forming shoulder material when an air cushion is being produced. The compressed air is brought via channels 4 underneath the microporous material and is distributed homogeneously through the structure thereof. A thin air film is formed upon air discharging on the surface 1. FIG. 8 shows a cross
section during a reverse function. In this instance, a vacuum is
drawn through the microporous surface 1.

The microporous surface can be designed to fully or
partially cover the surface area. The region of the air cushion
production or, respectively, the vacuum suction function is
likewise in each case either designed to fully or partially cover
the surface area or to be omitted.

FIGS. 3 and 4 show by way of example a partial
coating with microporous material, wherein FIG. 3, likewise
as FIG. 5, depicts a view analogous to FIGS. 1 and 2, whereas
FIGS. 4 and 6 show respectively one bottom view of the
depictions of FIGS. 3 and 5. A suction by means of vacuum is
also additionally possible in the outer region of the inlet zone.
As a result, the packaging material can be fixed on the forming
shoulder.

In the exemplary embodiment of FIGS. 5 and 6, the
full-surface coating with microporous material is depicted. In
this case, the vacuum zone is also delineated only in the outer
element region.

The forming shoulder according to the invention can
be used with vertical as well as with horizontal tubular bag
machines and has proven to be particularly advantageous
with packaging materials that are difficult to process or are
structured in a difficult manner. The aforementioned usage
with tubular bag packaging machines also particularly
includes vertical forming, filling and sealing machines.

1. A forming shoulder of a tubular bag forming, filling and
sealing machine, characterized in that the forming shoulder
(2) is produced from a porous material and is divided into
individual segments (3).

2. The forming shoulder according to claim 1, characte-
ized in that said forming shoulder is produced by a sintering
process.

3. The forming shoulder according to claim 1, characte-
ized in that said forming shoulder is produced by a generative
process.

4. The forming shoulder according to claim 1, wherein
the forming shoulder is configured such that gas can be selec-
tively applied via a gas supply to individual segments (3) or
gas can be selectively suctioned from individual segments (3)
in order to form an air cushion or a vacuum which is effective
on the surface of the segment (3).

5. The forming shoulder according to claim 1, characte-
ized in that individual segments (3) are in each case provided
with at least one pressure sensor for measuring a ram pressure
or for measuring a flow resistance.

6. The forming shoulder according to claim 1, characte-
ized in that said forming shoulder has a porous surface layer.

7. The forming shoulder according to claim 1, characte-
ized in that the entire material of the forming shoulder (2) is
porous.

8. The forming shoulder according to claim 1, characte-
ized in that at least individual segments of the segments (3)
are linear.

9. The forming shoulder according to claim 1, characte-
ized by a measuring and control unit which is operatively
connected to sensors that are associated with the individual
segments (3).

10. The forming shoulder according to claim 5, characte-
ized in that individual segments (3) are in each case provided
with at least one pressure sensor for measuring a ram pressure
or for measuring a flow resistance.

11. The forming shoulder according to claim 10, characte-
ized in that the entire material of the forming shoulder (2) is
porous.

12. The forming shoulder according to claim 10, characte-
ized in that the entire material of the forming shoulder (2) is
porous.

13. The forming shoulder according to claim 10, characte-
ized by a measuring and control unit which is operatively
connected to the sensors that are associated with the indi-
vidual segments (3).

14. The forming shoulder according to claim 1, character-
ized in that at least individual segments of the segments (3)
are circular.

* * * * *