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(54) **Title:** BAG WITH CONNECTION SEAMS FORMING REINFORCING CURVES

(57) **Abstract:** There is provided a bag having first and second reinforcing pieces being connected to first and second side pieces, respectively, at an upper part of the bag, thereby forming first and second reinforcing flaps with each flap having one or more connection seams forming at least one reinforcing curve. There is also provided a bag having first and second handles being formed at an upper part of first and second side parts, respectively, with openings being formed at the upper part of the side parts to thereby form openings of the handles with connection seams extending above each opening and forming at least one reinforcing curve. The total length of connection seam(s) forming a reinforcing curve is longer than the shortest distance between the two outermost points of the formed reinforcing curve, which reinforcing curve may form a substantially sinusoidal formed curve.

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BAG WITH CONNECTION SEAMS FORMING REINFORCING CURVES

FIELD OF THE INVENTION

The present invention relates generally to a bag having reinforcing flaps at an upper part of the bag, and more specifically to a bag wherein the reinforcing flaps are connected to the sides of the bag by one or more connection or welding seams. The invention further relates to a bag for containing a gas or a liquid. The invention also relates to a bag having two handles formed by use of one or more connection seams forming one or more reinforcing curves. Furthermore, the invention relates to a method for heat sealing a multiple layer of thermoplastic film.

DESCRIPTION OF THE PRIOR ART

In EP 1 252 073 B1 is described a bag or carrier bag having two folded reinforcing parts, with each reinforcing part forming a channel and being connected to a side piece of the bag by a welding seam. Here, in a first embodiment the bag has a seize opening in each of the reinforcing parts, and in a second embodiment the bag has a loop handle being connected to each of the reinforcing parts. A draw band is provided in each channel formed by the reinforcing part. Each reinforcing part is welded to a side part of the bag by a continuously welding seam forming a straight line and extending substantially from the first to the second side edges of the bag.

For the bag described in EP 1 252 073, the weakest areas are along the connections of the reinforcing parts to the side pieces, which connections are provided by the welding seams underneath the seize openings or loop handles. Thus, there is a need for providing a bag having a stronger connection of the reinforcing parts to the side pieces, thereby allowing a heavier load in the bag, or allowing the manufacture of the bag in a thinner material.

It is an object of the present invention to provide a bag, which overcomes the above-mentioned drawbacks, and allows an improved connection or welding of the reinforcing parts to the side pieces. It is also an object of the present invention to provide an improved bag for containing a gas or a liquid. It is also an object of invention to provide an improved bag with two handles formed by use of an improved connection of the side pieces of the bag. It is furthermore an object of the invention to provide an improved method for heat sealing a multiple layer of thermoplastic film.

SUMMARY OF THE INVENTION

According to a first aspect of the present invention there is provided a bag comprising two opposing side pieces, a first and a second side piece, said side pieces being interconnected at each side edge of the bag and at a bottom thereof, said bag further comprising two reinforcing pieces, a first and a second reinforcing piece, said first and second reinforcing pieces being connected to the first and second side pieces, respectively, at an upper part of the bag, thereby forming first and second reinforcing flaps with each flap having one or more connection seams,

wherein the connection seam(s) of each flap forms/form at least one reinforcing curve, and

wherein, for at least one reinforcing curve of one or both flaps, the total length of the connection seam(s) forming a reinforcing curve is longer than the shortest distance between the two outermost points of the formed reinforcing curve.

It is within an embodiment of the first aspect of the invention that for a plurality or all reinforcing curves of one or both flaps, the total length of the connection seam(s) forming a reinforcing curve is longer than the shortest distance between the two outermost points of the formed reinforcing curve.

It is preferred that the reinforcing pieces are formed at the upper end of the bag by having each of the side pieces being bent downwards and connected to the side piece by one or more connection seams, thereby forming the first and the second reinforcing flaps.

It order not to weaken the reinforcing flap or flaps, it is preferred that for at least one reinforcing curve of one or both flaps there is only one crossing of a line extending in a

vertically direction from the bottom to the top of the bag. Here, it is further preferred that for all reinforcing curves of one or both flaps there is only one crossing of a line extending in a vertically direction from the bottom to the top of the bag.

It is also within embodiments of the bag of the first aspect of the invention that at least one reinforcing curve of one or both flaps has at least one curve part with a positive slope and/or at least one curve part with a negative slope. Here, it is also within embodiments of the bag of the invention that one, two, three, four or more reinforcing curves of one or both flaps has one, two, three, four or more curve parts with a positive slope and/or one, two, three, four or more curve parts with a negative slope. The slopes may be defined in relation to a line extending in a transverse direction of the bag from one side edge to the other.

It is preferred that the general direction of a reinforcing curve extends substantially in a transverse direction of the bag.

The bag of the first aspect of the present invention also covers embodiments wherein at least one reinforcing curve of one or both flaps forms at least one peak and/or at least one trough. It is preferred that at least one reinforcing curve of one or both flaps forms several peaks and/or troughs. It is also preferred that at least one reinforcing curve of one or both flaps forms at least 2 or 3 peaks and/or 2 or 3 troughs.

It is also within embodiments of the bag of the first aspect of the present invention that at least one reinforcing curve of one or both flaps forms a curve with alternating peaks and troughs.

For embodiments of the bag of the first aspect of the invention having a peak or trough, it is preferred that the peak(s) and/or trough(s) is/are defined in relation to a line extending in a transverse direction of the bag from one side edge to the other.

It is within a preferred embodiment of the bag of the first aspect of the invention that for at least one reinforcing curve, the total length of the connection seam(s) forming a reinforcing curve is longer than or equal to 1,2 or 1,3 times the shortest distance between the two outermost points of the formed reinforcing curve. It is further preferred that for several or all reinforcing curves, the total length of the connection seam(s)

forming a reinforcing curve is longer than or equal to 1,2 or 1,3 times the shortest distance between the two outermost points of the formed reinforcing curve.

It is also within an embodiment of the bag of the first aspect of the invention that for at least one reinforcing curve, the total length of the connection seam(s) forming a reinforcing curve is longer than or equal to 1,4 or 1,5 times the shortest distance between the two outermost points of the formed reinforcing curve. It is further preferred that for several or all reinforcing curves, the total length of the connection seam(s) forming a reinforcing curve is longer than or equal to 1,4 or 1,5 times the shortest distance between the two outermost points of the formed reinforcing curve.

Thus, a reinforcing curve of the bag of the first aspect of the invention may take on a lot of different forms. In a preferred embodiment, at least one reinforcing curve of one or both flaps forms a substantially sinusoidal formed curve or an arched formed curve. It is also within an embodiment of the bag of the invention that at least one reinforcing curve of one or both flaps has one or more angled parts or one or more pyramid shaped parts.

It should be understood that the bag of the first aspect of the invention covers embodiments wherein at least one reinforcing curve of one or both flaps is formed of several separated connection seams. However, the bag of the invention also covers embodiments wherein at least one reinforcing curve of one or both flaps is formed of a single connection seam.

It is within an embodiment of the bag of the first aspect of the invention that one or both reinforcing flaps are connected to the corresponding side piece along at least 1/5, 1/4, 1/3, 1/2 or 2/3 of the total length from one side edge of the bag to the other.

The bag of the first aspect of the present invention also covers embodiments in which a channel is formed in each reinforcing flap. It is preferred that each channel is formed by the connection of a bent downwards part to the side piece. It is also preferred that at least one draw band is provided in each channel.

The bag of the first aspect of the invention also covers embodiments wherein the bag further is provided with a carrying handle at each reinforcing flap. Here, for each flap,

the carrying handle may be a seize opening provided through the flap and arranged above the at least one reinforcing curve. It is preferred that for each flap, the carrying handle is arranged underneath the draw band and above the at least one reinforcing curve. When the carrying handle is a seize opening, the two side faces of a channel may be connected at a point between the draw band and the seize opening.

For bags having a carrying handle, it is preferred that for one or both flaps, a first reinforcing curve is provided underneath a first end section of the carrying handle and a second reinforcing curve is provided underneath the other end section of the carrying handle. However, it is also within an embodiment of the invention that for one or both flaps, a first reinforcing curve is extending underneath the carrying handle at least from the first end section of the carrying handle to the other end section of the carrying handle.

For bags of the first aspect of the invention having a carrying handle it is within an embodiment that for each flap, the carrying handle is a loop handle connected at first and second ends thereof to the flap above the at least one reinforcing curve. Here, for bags having a draw band, then for each flap, the carrying handle may be connected to the flap underneath the draw band and above the at least one reinforcing curve. It is preferred that for one or both flaps, a first reinforcing curve is provided underneath the first end of the carrying handle and a second reinforcing curve is provided underneath the second end of the carrying handle. However, it is also within an embodiment of the invention that for one or both flaps, a first reinforcing curve is extending underneath the carrying handle at least from the first end of the carrying handle to the other end of the carrying handle.

For bags of the first aspect of the invention having a draw band it is within an embodiment that each channel is provided with an opening at one or both side edges of the bag, said draw band extending out of at least one of said openings. Here, the channels may be provided with an opening at one and the same side edge of the bag only, and the draw band may be fastened to the other side edge of the bag. It is preferred that the ends of the draw band(s) that extend out of the openings are not interconnected. However, it is also within an embodiment of the invention that the ends of the draw band(s) that extend out of the openings are interconnected. Here, the interconnection may be in a tearable manner.

The bag of the first aspect of the present invention may be made from different materials, but in a preferred embodiment the bag is made from a plastic material. The draw band(s) and the loop handle(s) may also be made from a plastic material. Here, the plastic material may be polyethylene (PE) or polypropylene (PP). However, it is also within the scope of the first aspect of the invention that the draw band(s) is formed as a string made of cotton other any suitable material for forming such a string.

It is within one or more preferred embodiments that the connection curve(s) of each flap is made by welding or formed by heat sealing. It is also within an embodiment that all connections in the bag are made by welding or by heat sealing.

However, the bag of the present first aspect of the present invention also covers embodiments wherein the connection curve(s) of each flap is made by gluing or by application of adhesive. It is also within an embodiment that all connections in the bag are made by gluing or by application of adhesive.

It should be understood that the principles used in the first aspect of the invention in order to provide an improved or reinforced connection of pieces of a bag also may be used for other types of bags. Such another type of bag is provided according to a second aspect of the invention.

According to the second aspect of the invention there is provided a bag for containing a gas or a liquid, said bag comprising:

at least a first and a second side piece, and

a mouthpiece or sleeve arranged at the first side piece of the bag, said mouthpiece or sleeve being connected to the first side piece by use of a sleeve weld curve, said sleeve weld curve having at least one peak and/or trough.

Here, the sleeve weld curve may form several peaks and/or troughs. The sleeve weld curve may also form a substantially sinusoidal formed curve or an arched formed curve.

For the bag of the second aspect of the invention it is preferred that the first and second side pieces are connected to each other along side edges by one or more

continuously formed sealing curves. Here, a sealing curve may run along each of the connecting side edges.

It is within an embodiment of the bag of the second aspect of the invention that the bag has more than two side pieces being connected to each other along side edges, and wherein a sealing curve runs along each of the connecting side edges.

The side pieces of the bag of the second aspect of the invention may be substantially rectangular shaped.

For the bags of the second aspect of the invention it is preferred that the sleeve and/or side pieces are made from a weldable material. Here, the sleeve and/or side pieces may be made from a plastic material. The plastic material may be polyethylene (PE) or polypropylene (PP). Materials such as EVOH or Nylon or metallized polyester and laminates thereof may also be used for the side pieces and/or sleeve of the bag.

For the bag of the second aspect of the invention it is preferred that the sealing curves are made by welding or by heat sealing.

However, the bag of the second aspect of the invention also covers embodiments wherein the sealing curves are made by gluing or by application of adhesive.

It should be understood that a bag according to one or more embodiments of the second aspect of the invention may be formed so as to be used as a bag in a bag-in-box, as a pouch, as a colostomy bag, as a bag for containing blood or as other types of bags where reinforced sealing of side pieces may be needed.

It should further be understood that the principles used in the first aspect of the invention in order to provide an improved or reinforced connection of pieces of a bag also may be used for other types of bags having handles. Such another type of bag is provided according to a third aspect of the invention.

According to the third aspect of the invention there is provided a bag having at least two opposing bag side pieces and comprising:

a bottom end with a bottom weld or seam extending at least partly between a first side part and a second opposed side part, and
first and second handles being formed at an upper part of said first and second side parts, respectively, opposed to the bottom end with a bag opening being formed between said two handles,
a first opening being formed at the upper part of the first side part to thereby form an opening of the first handle with one or more first connection seams extending above said first opening thereby connecting a first upper part of said bag side pieces,
a second opening being formed at the upper part of the second side part to thereby form an opening of the second handle with one or more second connection seams extending above said second opening thereby connecting a second upper part of said bag side pieces, wherein the connection seam(s) of each handle forms at least one reinforcing curve, and wherein, for at least one reinforcing curve of one or both handles, the total length of the connection seam(s) forming a reinforcing curve is longer than the shortest distance between the two outermost points of the formed reinforcing curve.

It is within an embodiment of the third aspect of the invention that the bottom weld or seam is provided by a continuous connection or welding seam extending between the first and second opposed side parts to thereby obtain a closed bottom end.

It is within an embodiment of the third aspect of the invention that the bottom weld or seam is provided by a continuous connection or welding seam forming a reinforcing curve.

It is within an embodiment of the bag of the third aspect of the invention that the first and second side parts have first and second side edges, respectively, with a first lateral gusset extending inwards from said first side edge and with a second lateral gusset extending inwards from said second side edge, said first opening of the first handle being provided in the upper part of the first lateral gusset, and said second opening being provided in the upper part of the second lateral gusset, whereby the first and second handles are both formed of parts of double layered bag side pieces.

It is preferred that at least one reinforcing curve of one or both handles and/or the bottom weld has at least one curve part with a positive slope and/or at least one curve

part with a negative slope. Here, the slopes may be defined in relation to a line extending in a transverse direction of the bag from one side edge of the handle to the other.

For the bag of the third aspect of the invention it is preferred that the general direction of a reinforcing curve extends substantially in a transverse direction of the bag.

It is within an embodiment of the bag of the third aspect of the invention that at least one reinforcing curve of one or both handles and/or the bottom weld forms at least one peak and/or at least one trough. It is further preferred that at least one reinforcing curve of one or both handles and/or the bottom weld forms several peaks and/or troughs. Here, at least one reinforcing curve may form at least 2 or 3 peaks and/or 2 or 3 troughs.

For the bag of the third aspect of the invention, it is preferred that for at least one reinforcing curve, the total length of the connection seam(s) forming a reinforcing curve is longer than or equal to 1,2, 1,3, 1,4 or 1,5 times the shortest distance between the two outermost points of the formed reinforcing curve.

It is also within an embodiment of the bag of the third aspect of the invention that at least one reinforcing curve of one or both handles and/or the bottom weld forms a curve with alternating peaks and troughs. Thus, at least one reinforcing curve may form a substantially sinusoidal formed curve or an arched formed curve.

The third aspect of the invention also covers a bag, wherein at least one reinforcing curve of one or both handles and/or the bottom weld has one or more angled parts or one or more pyramid shaped parts.

It is within an embodiment of the bag of the third aspect of the invention that at least one reinforcing curve of one or both handles is formed of several separated connection seams. However, it is preferred that at least one reinforcing curve of one or both handles is formed of a single connection seam.

For the bag of the third aspect of the invention it is preferred that opposed parts of bag side pieces of each handle are connected along at least 1/2 or 2/3 of the total length

from one side edge of the handle to the other. Here, it is preferred that for each handle the side pieces are connected along the whole length from one side edge of the handle to the other.

For the bags of the third aspect of the invention it is preferred that the bag side pieces are made from a weldable material. Here, the bag side pieces may be made from a plastic material. The plastic material may be polyethylene (PE) or polypropylene (PP). Materials such as EVOH or Nylon or metallized polyester and laminates thereof may also be used for the side pieces of the bag.

Also for the bags of the third aspect of the invention it is preferred that the connection seams or reinforcing curves are made by welding or by heat sealing. The bottom weld of the bag may also be made by welding or by heat sealing.

However, the bag of the third aspect of the invention also covers embodiments wherein the connection seams are made by gluing or by application of adhesive.

According to the present invention there is also provided a method of heat-sealing in the longitudinally direction a continuously moving multiple layer web of thermoplastic film, said method comprising the steps of:

providing a cylindrical drum mounted for rotation about the axis thereof,

providing a continuously heated area in the cylindrical surface of the drum, said heated area forming a curve extending in a direction around the cylindrical surface of the drum to thereby at least partly encircling the drum,

wrapping the moving web of film around the cylindrical surface of the drum,

providing a tension of the web film against the cylindrical surface of the drum,

rotating the cylindrical surface of the drum together with moving web or film, and

maintaining the tension of the web film against the cylindrical surface of the drum during the substantial portion of the rotation thereof to thereby heat seal part of the multiple layer web film along the heated area of the drum surface.

It is preferred that the method of the present invention further comprises providing a flow of hot air to at least part of the area of the web film covering the heated area of the cylindrical surface of the drum during the substantial portion of the rotation thereof during which said heat sealing is performed. Alternatively or additionally, a flow of hot air may be provided to preheat the part of the moving web film, which is to cover the heated area of the surface of the drum, said preheating being performed before the moving web film part reaches the surface of the drum.

For the method of the invention it is preferred that the temperature of the heated area of the cylindrical surface is maintained high enough to perform said heat sealing of the web film during the rotation of the cylindrical surface. It is also preferred that the temperature of the hot air flow is controlled so that the temperature of the hot air reaching the web film is maintained below the heat sealing temperature of the web film.

According to an embodiment of the method of the invention the curve formed by the heated area of the cylindrical surface may fully encircle the drum. It is within a preferred embodiment that the heated area of the cylindrical surface forms a curve with alternating peaks and troughs. The total length of the curve formed by the heated area of the cylindrical surface is preferably longer than or equal to 1,2 or 1,3 times the circumference of the cylindrical surface. It is also within an embodiment of the method of the invention that the heated area of the cylindrical surface forms a substantially sinusoidal formed curve or an arched formed curve.

According to an embodiment of the method of the invention the web film may be made of polyethylene, which may have a welding temperature of about 130 °C, and the temperature of the heated area of the cylindrical surface may be maintained above 130 °C, such as around 135 °C, during the heat-sealing rotation of the cylindrical surface. Here, it is also preferred that the temperature of the hot air reaching the web film is maintained around or below 120 °C during the heat-sealing rotation of the cylindrical surface. It should be understood that other film materials may be heat sealed according to an embodiment of the method of the invention, which film materials may have another welding temperature and thereby demand another temperature of the heated area and another temperature of the hot air.

It should be understood that principles covered by the method of the invention may be used as part of the manufacturing of the bags according to embodiments of the first and/or third aspects of the invention.

Other objects, features and advantages of the present invention will be more readily apparent from the detailed description of the preferred embodiments set forth below, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1a, 1b and 1c illustrate various embodiments of a bag according to the first aspect of the invention provided with a loop-handle, partly broken and in side view,

Figs. 2a, 2b and 2c illustrate various embodiments of a bag according to the first aspect oft the invention provided with an integrated handle, partly broken and in side view,

Figs. 3a, 3b and 3c illustrate various embodiments of a bag according to the first aspect of the invention having channels with draw band, partly broken and in side view,

Figs. 4a and 4b illustrate further embodiments of a bag according to the first aspect of the invention having channels with draw band, partly broken and in side view,

Fig. 5 shows an embodiment of a bag according to the first aspect of the invention having channels with draw band and a loop-handle, partly broken and in side view,

Figs. 6a, 6b, 6c, 6d, 6e, 6f and 6g illustrate various embodiments of reinforcing curves according to the invention,

Figs. 7a and 7b show a top view and a side view of an embodiment of a bag according to the second aspect of the invention,

Figs. 8a and 8b illustrate two embodiments of a bag according to the third aspect of the invention provided with two handles, and

Figs. 9a and 9b illustrates two embodiments of an apparatus for heat-sealing a multiple layer of thermoplastic film according to the method of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

A bag 1 or carrier bag according to the embodiments illustrated in Figs. 1-5 comprises two side pieces 2a, 2b and may be manufactured from a sheet material, which is preferably a plastic material, such as polyethylene (PE). The bag may be manufactured from two sheets positioned on top of each other and welded together at bottom 3 of the bag 1 and at the side edges 4a, 4b of the bag 1, or it may be manufactured from one sheet that is bent at the bottom 3 of the bag 1 and welded at the side edges 4a, 4b of the bag 1. The bottom 3 may also be gusseted.

At the open end or upper part 5 of the bag 1 two reinforcing pieces are connected to the side pieces 2a, 2b, respectively, thereby forming first and second reinforcing flaps 6a, 6b at the upper part of the bag 1. The reinforcing pieces may have a shorter length than the side pieces 2a, 2b and may have the same width as the side pieces 2a, 2b and may be manufactured from the same material as the side pieces 2a, 2b. The connection of the reinforcing pieces to the side pieces 2a, 2b may be done by or include welding at a distance underneath the open upper end 5 of the bag 1, whereby the welding or connection seams may form one or more reinforcing curves 7 on each reinforcing flap 6a, 6b.

The reinforcing pieces may be separate sheets connected to the side pieces 2a, 2b, but in a preferred embodiment, then at the upper end 5 of the bag 1 each side piece 2a or 2b is bent over, preferably inwardly, and is welded to the side piece 2a or 2b at a distance underneath the open upper end 5 of the bag 1, thereby forming a closed channel 8 in each reinforcing flap 6a, 6b. According to the present invention the reinforcing curve 7 is not formed by a single straight line, and the lower edge of a reinforcing piece 9 may be at least partly unconnected to the corresponding side piece 2a or 2b.

The embodiments of a bag illustrated in Figs. 1a-1c are provided with two loop-handles 10a, 10 b, with a loop handle 10a, 10b being connected to each reinforcing flap 6a, 6b above the reinforcing curve or curves 7. The loop handles 10a, 10b may be made from

the same material as the bag 1. The loop handles 10a, 10b may be welded or glued to the reinforcing flaps 6a, 6b. For the shown embodiments the loop handles 10a, 10b are welded to the flaps 6a, 6b at welding points 11, and preferably the inner faces of the reinforcing flaps 6a, 6b are also interconnected at these welding points 11 in order to strengthen the bag 1 at these areas.

According to the present invention one or more reinforcing curves 7 may be used for connecting a reinforcing piece to a side piece 2a, 2b. Here, a reinforcing curve 7 may be formed by a single, continuous connection or welding seam, or a reinforcing curve 7 may be formed by a number of separated connection or welding seams.

For the embodiment of a bag illustrated in Fig. 1a, a single reinforcing curve 7 is provided at each flap 6a, 6b, with the reinforcing curve 7 extending underneath the handle 10a or 10b from one side edge 4a to the other side edge 4b of the bag 1. The reinforcing curve 7 shown in Fig. 1a is formed by a single, continuous connection or welding seam, and the curve 7 is substantially sinusoidal formed with several peaks and troughs. It is seen from Fig. 1a that the total length of the connection of welding seam forming the reinforcing curve 7 is longer than the shortest distance from the side edge 4a to the side edge 4b.

For the embodiment of a bag illustrated in Fig. 1b, a single reinforcing curve 7 is provided at each flap 6a, 6b, but here the reinforcing curve 7 is only extending underneath the carrying handle 10a or 10b and a little further than the welding points 11 at both end of a handle 10a or 10b. The reinforcing curve 7 shown in Fig. 1b is also formed by a single, continuous connection or welding seam, and the curve 7 is substantially sinusoidal formed with several peaks and troughs. It is seen from Fig. 1b that the total length of the connection of welding seam forming the reinforcing curve 7 is longer than the shortest distance between the two outermost points 12a, 12b of the reinforcing curve 7.

For the embodiment of a bag illustrated in Fig. 1c, two reinforcing curves 7a, 7b are provided at each flap 6a, 6b, with each reinforcing curve 7a, 7b extending underneath a welding point 11 of the carrying handle 10a or 10b and a little further than the welding point 11. Each of the reinforcing curves 7a, 7b shown in Fig. 1c are also formed by a single, continuous connection or welding seam, and the curves 7a, 7b are substantially

sinusoidal formed with several peaks and troughs. It is seen from Fig. 1c that the total length of the connection of welding seam forming a reinforcing curve 7a or 7b is longer than the shortest distance between the two outermost points 12a, 12b or 12c, 12d of the reinforcing curve 7a or 7b.

It should be understood that by having reinforcing curves 7, which are not formed of a single straight line, underneath the connection points 11 of the handle 10a, 10b, the reinforcing flaps 6a, 6b are reinforced along the connections to the side pieces 2a, 2b when compared to a normal welded connection being a straight line. Thus, a bag 1 used as a carrier bag or waste bag and having reinforcing curves 7 according to one or more embodiments of the present invention may take a heavier load before breaking when compared to a normal carrier bag having a welded connection being a straight line.

The embodiments of a bag illustrated in Figs. 2a-2c are provided with two seize openings 13a, 13 b, with one opening 13a or 13b in each reinforcing flap 6a or 6b above the reinforcing curve or curves 7.

For the embodiment of a bag illustrated in Fig. 2a, a single reinforcing curve 7 is provided at each flap 6a, 6b, with the reinforcing curve 7 extending from one side edge 4a to the other side edge 4b of the bag 1 underneath the seize opening 13a or 13b. The reinforcing curve 7 shown in Fig. 2a is similar to the reinforcing curve 7 of Fig. 1a.

For the embodiment of a bag illustrated in Fig. 2b, a single reinforcing curve 7 is provided at each flap 6a, 6b, but here the reinforcing curve 7 is only extending underneath the opening 13a or 13b and a little further than the width of the opening 13a or 13b. The reinforcing curve 7 shown in Fig. 2b is similar to the reinforcing curve 7 of Fig. 1b.

For the embodiment of a bag illustrated in Fig. 2c, two reinforcing curves 7a, 7b are provided at each flap 6a, 6b, with each reinforcing curve 7a, 7b extending underneath an end part of the seize opening 13a or 13b. Each of the reinforcing curves 7a, 7b shown in Fig. 2c are also formed by a single, continuous connection or welding seam, and the curves 7a, 7b are similar to the reinforcing curves 7a, 7b of Fig. 1c.

The embodiments of a bag illustrated in Figs. 3a-3c have two channels, where each reinforcing flap 6a, 6b forms a channel. A draw band 14a, 14b is arranged in each channel of the reinforcing flaps 6a, 6b. Each draw band 14a, 14b may be connected to the bag 1 at each side edge 4a, 4b. Furthermore, an opening 15a, 15b is provided at the upper edge of each reinforcing flap 6a, 6b, with each opening 15a, 15b being arranged substantially in the middle between the side edges 4a and 4b. It is preferred that each draw band 14a, 14b is arranged at the upper part of the corresponding flap 6a, 6b so that the draw band 14a, 14b can be seized or grabbed by a hand of a user. By pulling in the draw bands 14a, 14b the bag can be closed. The bags illustrated in Figs. 3a-3c may be used as waste bags.

For the embodiment of a bag illustrated in Fig. 3a, a single reinforcing curve 7 is provided at each flap 6a, 6b, with the reinforcing curve 7 extending from one side edge 4a to the other side edge 4b of the bag 1 underneath an opening 15a or 15b. The reinforcing curve 7 shown in Fig. 3a is similar to the reinforcing curve 7 of Fig. 1a.

For the embodiment of a bag illustrated in Fig. 3b, a single reinforcing curve 7 is provided at each flap 6a, 6b, but here the reinforcing curve 7 is only extending underneath the opening 15a or 15b and a bit further than the width of the opening 15a or 15b. The reinforcing curve 7 shown in Fig. 3b is similar to the reinforcing curve 7 of Fig. 1b.

For the embodiment of a bag illustrated in Fig. 3c, four reinforcing curves 7a, 7b, 7c, 7d are provided at each flap 6a, 6b, with a single reinforcing curve 7a or 7b extending underneath each end part of the seize opening 15a or 15b. Each of the reinforcing curves 7a, 7b, 7c, 7d shown in Fig. 3c are also formed by a single, continuous connection or welding seam, and the curves 7a, 7b, 7b, 7d are similar to the reinforcing curves 7a, 7b of Fig. 1c.

The embodiments of a bag illustrated in Figs. 4a-4b have two channels, where each reinforcing flap 6a, 6b forms a channel. A draw band 16a, 16b is arranged in each channel of the reinforcing flaps 6a, 6b. Furthermore, an opening 17a, 17b is provided at the upper edge of each reinforcing flap 6a, 6b, with each opening 17a, 17b being arranged at one side edge 4b of the bag 1. Each draw band 16a, 16b should be connected to the bag at the opposite side edge 4a. It is preferred that each draw band

16a, 16b is arranged at the upper part of the corresponding flap 6a, 6b and extends out of the corresponding opening 17a, 17b, so that the draw band 16a, 16b can be seized or grabbed by a hand of a user. By pulling in the draw bands 16a, 16b the bag 1 can be closed. The bags illustrated in Figs. 4a-4b may be used as waste bags.

For the embodiment of a bag illustrated in Fig. 4a, a single reinforcing curve 7 is provided at each flap 6a, 6b, with the reinforcing curve 7 extending from one side edge 4a to the other side edge 4b of the bag 1 thereby also extending underneath the opening 17a or 17b. The reinforcing curve 7 shown in Fig. 4a is similar to the reinforcing curve 7 of Fig. 1a.

For the embodiment of a bag illustrated in Fig. 4c, four reinforcing curves 7a, 7b, 7c, 7d are provided at each flap 6a, 6b. Here, for each flap 6a, 6b, the reinforcing curve 7d is extending underneath the opening 17a, 17b. Each of the reinforcing curves 7a, 7b, 7c, 7d shown in Fig. 4b are also formed by a single, continuous connection or welding seam, and the curves 7a, 7b, 7b, 7d are similar to the reinforcing curves 7a, 7b of Fig. 1c.

Fig. 5 shows an embodiment of a carrier bag 1 according to the invention having two channels with draw bands 16a, 16b and two loop handle 10a, 10b, with a loop handle 10a, 10b being connected to each reinforcing flap 6a, 6b above a reinforcing curve 7 extending underneath the handle 10a or 10b from one side edge 4a to the other side edge 4b of the bag 1. Thus, the bag 1 of Fig. 5 is a combination of the bags shown in Figs. 1a and 4a. Each reinforcing flap 6a, 6b forms a channel with a draw band 16a, 16b being arranged in each channel. Furthermore, an opening 17a, 17b is provided at the upper edge of each reinforcing flap 6a, 6b, with each opening 17a, 17b being arranged at one side edge 4b of the bag 1. Each draw band 16a, 16b should be connected to the bag 1 at the opposite side edge 4a. Each draw band 16a, 16b is arranged at the upper part of the corresponding flap 6a, 6b and above the welding points 11 of the loop handle 10a, 10b, and each draw band 16a, 16b extends out of the corresponding opening 17a, 17b, so that the draw band 16a, 16b can be seized or grabbed by a hand of a user. By pulling in the draw bands 16a, 16b the bag 1 can be closed. The bags illustrated in Fig. 5 may be used both as a carrier bag and as a waste bag.

For the embodiments of bags according to the invention illustrated in Figs. 1-5, the shown reinforcing curves 7 are formed by a single, continuous connection or welding seam, and the reinforcing curves are substantially sinusoidal formed with several peaks and troughs. It has been mentioned above that according to the present invention a reinforcing curve 7 may not be formed by a single straight line. However, it is within embodiments of the present invention that the reinforcing curve or curves 7 of a reinforcing flap 6a, 6b may have a number of different forms. Examples of different forms of a reinforcing curve according to the present invention are shown in Figs. 6a, 6b, 6c, 6d, 6e, 6f and 6g.

The reinforcing curve of Fig. 6a is substantially sinusoidal formed with several peaks and troughs and formed by a single, continuous connection or welding seam. The reinforcing curve of Fig. 6b is also formed by a by a single, continuous connection or welding seam, but here the resulting reinforcing curve is made of pyramid shaped parts with several peaks or troughs. The form of the reinforcing curve of Fig. 6c is substantially the same as the form of the reinforcing curve of Fig. 6b, but in Fig. 6c the resulting reinforcing curve is formed by several separated connection or welding seams, where each welding seam is a straight line having a positive or negative slope.

The reinforcing curve of Fig. 6d is formed of several, separated upwards arched curve parts, with each arch curve part being formed by a single connection or welding seam. The reinforcing curve of Fig. 6e is formed of several, separated downwards arched curve parts, and also here each arch curve part is formed by a single connection or welding seam.

The reinforcing curve of Fig. 6f is also formed of several, separated curve parts. Here the separated curve parts include upwards and downwards arched curve parts, and upwards and downwards pyramid or triangle shaped curve parts. Also here each curve part is formed by a single connection or welding seam. A further example of a reinforcing curve formed of several, separated curve parts is illustrated in Fig. 6g, where each curve part is a straight line with all curve parts being tilted with the same angle, and with each curve part being formed by a single connection or welding seam.

It should be understood that by having reinforcing curves, which are not formed of a single straight line, the pulling strength of the reinforcing flaps of a bag according to the

invention may be increased considerably when compared to a normal carrier bag having the reinforcing flaps welded by a welding seam being a straight line. However, the increase in the pulling strength may vary in accordance with the form and the total length of the welded parts of the reinforcing curve.

The total length of the welded parts of a reinforcing curve may vary with the amplitude of the curve or the distance between the lower parts and the upper parts of the reinforcing curve. Here, the distance between the upper and lower parts of a reinforcing curve, i.e. the distance between the peaks and troughs of Fig. 6a, 6b or 6f, may in preferred embodiments of the invention be in the range of 0,5-15 mm, in the range of 1-15 mm, in the range of 1-10 mm, in the range of 2-9 mm, in the range of 2-7 mm, in the range of2-6 mm, in the range of 3-5 mm, or in the range of 2-3 mm. However, it is also within embodiments of the invention that the distance between the upper and lower parts of a reinforcing curve is larger than 1 mm, larger than 2 mm, larger than 3 mm, larger than 5 mm, larger than 10 mm, larger than 15 mm, or larger than 20 mm.

Bags 1 have been described above which are provided with reinforcing flaps 6a, 6b having the inner part formed of an upper part of a side piece 2a, 2b and the outer part formed of a reinforcing piece. A reinforcing piece may be a single sided sheet material and it may be a folded part of a side piece 2a, 2b. However, a reinforcing piece may also have several sheet layers and/or be doubled folded.

The first aspect of the invention has been described with reference to bags made of plastic material, but the first aspect of the invention may also be applied in connection with bags of paper or other foil materials. By foil materials is to be understood all types of thin, flexible materials that are suitable for bags, including different types of biodegradable films made of cellulose or starch. However, bags made of a plastic material have the advantage of being impermeable to liquid, which may be critical when the bag is used as a waste bag.

For embodiments of the invention having draw band, the draw band may also be of any suitable material, such as those mentioned above. However, the use of plastics material in combination with a bag mad of plastics material has some manufacturing advantages, such as the possibility of welding together the bag and the draw band at certain areas.

Figs. 7a and 7b show a top view and a side view, respectively, of an embodiment of a bag according to the second aspect of the invention. This bag may be used for containing a fluid or liquid, and may also be use as a bag in a bag-in-box. The bag 70 has a first side piece 71 and a second side piece 72 being sealingly connected to each other along side edges 73a, 73b, 73c and 73d by corresponding continuously formed sealing curves 74a, 74b, 74c and 74d. A mouthpiece or sleeve 75 is arranged at the first side piece 71 in order to a allow a fluid to pass into and out of the bag. The sleeve is connected to the first side piece 71 by a sleeve weld curve 76.

For the embodiment of a bag illustrated in Fig. 7a, a single sealing curve 74a, 74b, 74c and 74d is provided along each side edge 73a, 73b, 73c and 73d. The sealing curves 74a, 74b, 74c and 74d shown in Fig. 7a are each formed by a single, continuous connection or welding seam, and each curve 74a, 74b, 74c and 74d is substantially sinusoidal formed with several peaks and troughs. It is seen from Fig. 7a that the total length of the connection of a welding seam forming a sealing curve 74a, 74b, 74c and 74d is longer than the shortest distance between the corresponding side edges 73a, 73b, 73c and 73d.

The bag 70 shown in Figs. 7a and 7b is formed of two side pieces, which are sealingly connected to each other by four sealing curves. However, it should be understood that the scope of the second aspect of the invention also covers bags formed by two folded side pieces or bags formed by more than two side pieces. Thus, the second aspect of the invention also covers bags having a cube like form or a pyramid shaped form. In order to obtain a watertight connection between the side pieces, the side pieces should be sealingly connected to each other when two side pieces faces each other along a common side edge. The connection of side pieces along a side edge may be formed by continuously formed sealing curves according to the second aspect of the invention having at least one curve peak and/or at least one trough.

It is preferred that a bag according to the second aspect of the invention is made of a watertight material such as a plastic film or any other weldable films being impermeable to a liquid. The welding curves or sealing curves 74a, 74b, 74c, 74d and 76 may be formed by heat sealing to thereby obtain a watertight sealing.

Figs. 8a and 8b show a side view of two embodiments of a bag according to the third aspect of the invention, which covers a bag having two handles. The bags 80a, 80b of Figs. 8a and 8b may be used as carrier bags or waste bags. Each bag 80a, 80b may be made from a tube of plastic film, and the tube may be flattened and provided with lateral gussets 81a, 81b, 82a, 82b at each side part 83a, 83b, 84a, 84b. Inner folds of the lateral gussets 81a, 81b, 82a, 82b are illustrated by the dotted lines 85a, 85b, 86a, 86b. A transverse weld curve 87a, 87b formed as a continuous reinforcing curve extends between the side edges at the bottom of the bag 80a, 80b to thereby obtain a closed bottom end.

A bag opening 88a, 88b is cut in the upper part of the bag, and the cut is formed so as to extend into the lateral gussets 81a, 81b, 82a, 82b at the upper part of each side part 83a, 83b, 84a, 84b, thereby forming first and second openings, 89a, 89b, 90a, 90b, in the gussets 81a, 81b, 82a, 82b. By cutting the bag opening 88a, 88b and the first and second openings 89a, 89b, 90a, 90b, first and second handles 91a, 91b, 92a, 92b are formed. Transverse weld curves 93a, 93b, 94a, 94b formed as a continuous reinforcing curves are extending between the handle side edges at the top of the bag 80a, 80b to thereby finish the formation of the handles 91a, 91b, 92a, 92b.

For the bag 80a of Fig. 8a the reinforcing curves 93a, 94a of the handles 91a, 92a are formed as one continuous connection seam being sinusoidal formed and comprising several peaks and troughs. For the bag 80b of Fig. 8b the reinforcing curves 93b, 94b of the handles 91b, 92b are also formed as one continuous connection seam, but here there is only one sinusoidal formed trough.

It is noted that by having a bag with lateral gussets 81a, 81b, 82a, 82b, each side of a handle 91a, 91b, 92a, 92b has two layers of bag side material, i.e. each side of a handle is double layered, thereby giving more strength to a handle and allowing a heavier load in the bag.

It is preferred that a bag according to the third aspect of the invention is made of a plastic material, but the third aspect of the invention may also be applied in connection with bags of paper or other foil materials. By foil materials is also here to be understood all types of thin, flexible materials that are suitable for bags, including different types of biodegradable films made of cellulose or starch. However, bags made of a plastic

material have the advantage of being impermeable to liquid, which may be critical when the bag is used as a waste bag. The welding curves or reinforcing curves 87a, 87b, 93a, 93b, 94a, 94b may be formed by heat sealing.

The present invention also provides a method for heat-sealing in the longitudinally direction a moving multiple layer web of thermoplastic film, and Figs. 9a and 9b illustrates two embodiments of an apparatus for performing such heat-sealing. The heat-sealing methods according to the apparatuses of Figs. 9a and 9b may be used in order to obtain a heat-sealing or welding used for the reinforcing flaps of the bags illustrated in Figs. 1a, 2a, 3a, 4a and 5.

In Figs. 9a and 9b a thermoplastic film 101 is bended along a first side to thereby obtain a double-layered web of film 102 along the first side part. The bended film part 102 is welded by use of a welding string or heating wire 103, which is arranged around the surface of a roller or drum 104, so that the outer surface of the area comprising the welding string 103 is in level with the surface of the drum 104. The welding string 103 is electrically heated with electrical power supplied via the inside of the roller or drum 104. The temperature of the welding string is controlled to be above the melting temperature of the film 101, and so as to obtain a welding according to the specifications of the material of the film 101. The welding string 103 may be formed as a straight curve, but according to a preferred embodiment the welding string 103 is curve shaped and may be forming a sinusoidal formed curve. When the bended double-layered film 102 is welded together by a curved welding curve, the welded part of the film 101 may be used in order to obtain the reinforcing flaps of the bags of Figs. 1a, 2a, 3a, 4a and 5.

Fig. 9b includes an enlarged drawing 107 showing the area comprising the welding string 103. For this embodiment the welding string 103 is sinusoidal formed, and an insulating layer 108 is arranged around the welding string of heating wire 103.

In order to weld the bended film 101, the bended film 101 is pulled along the surface of the roller or drum 104 under light and even tension. Guiding means 105 are provided to guide the film 101 when being wrapped around the roller or drum 104, and by adjusting the position of the guiding means 105, the area of the film 101 being in contact with the surface of the drum 104 can be controlled. The drum 104 is free to rotate, when the film 101 is pulled along the surface of the drum 104, whereby the surface of the drum may

be rotating at the substantially same speed as the movement of film 101. During the pulling process the welding string 103 heats the film to thereby perform a proper welding. In order to minimize tension inside and around the weld, and in order to assist in the welding process, the doubled layered part of the film 102 is heated or preheated by warm air, 106a, 106b, along the area, where the film web is to be welded. The warm air should not be allowed to heat up the film 101 to the welding temperature, but only to a temperature below the welding temperature, whereby the actual welding is performed by the heated welding string 103. The warm air could be sourced from a warm air knife, 106a, arranged above the roller or drum 104 as illustrated in Fig. 9a, but warm air could also be provided at both sides of the film 106b so as to preheat the film 101 before the film 101 reaches the roller or drum 104, as illustrated in Fig. 9b. Preheating of the film 101 could also be done by use of one or more heated rollers instead of the use of warm air.

It should be understood that different types of thermoplastic film could be used in accordance with the methods illustrated in Figs. 9a and 9b, but as an example, a linear low density polyethylene LDPE film having a welding temperature of around 130 °C may be used. When using an LDPE film, the welding string 103 may be heated to a temperature of about 135 °C and the warm air may be delivered at a temperature of about 120 °C or about 115 °C.

When using the heat-sealing or welding methods described above, three variables may be controlled in order to obtain a high quality welding, i.e. temperature of the welding string, temperature of the heating or preheating warm air and the time of exposure of the moving film 101 to the warm air and the welding string.

While the invention has been particularly shown and described with reference to particular embodiments, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention, and it is intended that such changes come within the scope of the following claims.

CLAIMS

1. A bag comprising two opposing side pieces, a first and a second side piece, said side pieces being interconnected at each side edge of the bag and at a bottom thereof, said bag further comprising two reinforcing pieces, a first and a second reinforcing piece, said first and second reinforcing pieces being connected to the first and second side pieces, respectively, at an upper part of the bag, thereby forming first and second reinforcing flaps with each flap having one or more connection seams, wherein the connection seam(s) of each flap forms/form at least one reinforcing curve, and wherein, for at least one reinforcing curve of one or both flaps, the total length of the connection seam(s) forming a reinforcing curve is longer than the shortest distance between the two outermost points of the formed reinforcing curve.

2. A bag according to claim 1, wherein the reinforcing pieces are formed at the upper end of the bag by having each of the side pieces being bent downwards and connected to the side piece by one or more connection seams, thereby forming the first and the second reinforcing flaps.

3. A bag according to claim 1 or 2, wherein for at least one reinforcing curve of one or both flaps there is only one crossing of a line extending in a lengthwise direction of the bag.

4. A bag according to claim 3, wherein for all reinforcing curves of one or both flaps there are only one crossing of a line extending in a lengthwise direction of the bag.

5. A bag according to any one of the claims 1-4, wherein at least one reinforcing curve of one or both flaps has at least one curve part with a positive slope and/or at least one curve part with a negative slope.

6. A bag according to claim 5, wherein said slopes are defined in relation to a line extending in a transverse direction of the bag from one side edge to the other.

7. A bag according to any one of the claims 1-6, wherein the general direction of a reinforcing curve extends substantially in a transverse direction of the bag.

8. A bag according to any one of the claims 1-7, wherein at least one reinforcing curve of one or both flaps forms at least one peak and/or at least one trough.

9. A bag according to any one of the claims 1-8, wherein at least one reinforcing curve of one or both flaps forms several peaks and/or troughs.

10. A bag according to any of the claims 1-8, wherein at least one reinforcing curve of one or both flaps forms at least 2 or 3 peaks and/or 2 or 3 troughs.

11. A bag according to any one of the claims 1-10, wherein at least one reinforcing curve of one or both flaps forms a curve with alternating peaks and troughs.

12. A bag according to any one of the claims 8-11, wherein said peak(s) and/or trough(s) is/are defined in relation to a line extending in a transverse direction of the bag from one side edge to the other.

13. A bag according to any one of the claims 1-12, wherein for at least one reinforcing curve, the total length of the connection seam(s) forming a reinforcing curve is longer than or equal to 1,2 or 1,3 times the shortest distance between the two outermost points of the formed reinforcing curve.

14. A bag according to any one of the claims 1-13, wherein for at least one reinforcing curve, the total length of the connection seam(s) forming a reinforcing curve is longer than or equal to 1,4 or 1,5 times the shortest distance between the two outermost points of the formed reinforcing curve.

15. A bag according to any one of the claims 1-14, wherein at least one reinforcing curve of one or both flaps forms a substantially sinusoidal formed curve or an arched formed curve.

16. A bag according to any one of the claims 1-14, wherein at least one reinforcing curve of one or both flaps has one or more angled parts or one or more pyramid shaped parts.

17. A bag according to any one of the claims 1-16, wherein at least one reinforcing curve of one or both flaps is formed of several separated connection seams.

18. A bag according to any one of the claims 1-17, wherein at least one reinforcing curve of one or both flaps is formed of a single connection seam.

19. A bag according to any one of the claims 1-18, wherein one or both reinforcing flaps are connected to the corresponding side piece along at least 1/5 or 1/4 of the total length from one side edge of the bag to the other.

20. A bag according to any one of the claims 1-19, wherein one or both reinforcing flaps are connected to the corresponding side piece along at least 1/3 or 1/2 of the total length from one side edge of the bag to the other.

21. A bag according to any one of the claims 1-20, wherein a channel is formed in each reinforcing flap.

22. A bag according to claims 2 and 21, wherein each channel is formed by the connection of the bent downwards part to the side piece.

23. A bag according to claim 21 or 22, wherein at least one draw band is provided in each channel.

24. A bag according to any one of the claims 1-23, said bag further being provided with a carrying handle at each reinforcing flap.

25. A bag according to claim 24, wherein for each flap, the carrying handle is a seize opening provided through the flap and arranged above the at least one reinforcing curve.

26. A bag according to claims 23 and 25, wherein for each flap, the carrying handle is arranged underneath the draw band and above the at least one reinforcing curve.

27. A bag according to claim 26, wherein the two side faces of a channel are connected at a point between the draw band and the seize opening.

28. A bag according to any one of the claims 24-27, wherein for one or both flaps, a first reinforcing curve is provided underneath a first end section of the carrying handle and a second reinforcing curve is provided underneath the other end section of the carrying handle.

29. A bag according to any one of the claims 24-27, wherein for one or both flaps, a first reinforcing curve is extending underneath the carrying handle at least from the first end section of the carrying handle to the other end section of the carrying handle.

30. A bag according to claim 24, wherein for each flap, the carrying handle is a loop handle connected at first and second ends thereof to the flap above the at least one reinforcing curve.

31. A bag according to claims 23 and 30, wherein for each flap, the carrying handle is connected to the flap underneath the draw band and above the at least one reinforcing curve.

32. A bag according to claim 30 or 31, wherein for one or both flaps, a first reinforcing curve is provided underneath the first end of the carrying handle and a second reinforcing curve is provided underneath the second end of the carrying handle.

33. A bag according to claim 30 or 31, wherein for one or both flaps, a first reinforcing curve is extending underneath the carrying handle at least from the first end of the carrying handle to the other end of the carrying handle.

34. A bag according to any one of the claims 23-33, wherein each channel is provided with an opening at one or both side edges of the bag, said draw band extending out of at least one of said openings.

35. A bag according to claim 34, wherein the channels are provided with an opening at one and the same side edge of the bag only.

36. A bag according to claim 35, wherein the draw band is fastened to the other side edge of the bag.

37. A bag according to any one of the claims 34-36, wherein the ends of the draw band(s) that extend out of the openings are not interconnected.

38. A bag according to any one of the preceding claims, wherein the bag is made from a plastic material.

39. A bag according to any one of the claims 23-38, wherein the draw band(s) is/are made from a plastic material.

40. A bag according to claim 38 or 39, wherein said plastic material is polyethylene (PE) or polypropylene (PP).

41. A bag according to any one of the preceding claims, wherein the connection curve(s) of each flap is/are made by welding or formed by heat sealing.

42. A bag according to any one of the preceding claims, wherein all connections in the bag are made by welding or by heat sealing.

43. A bag according to any one of the claims 1-40, wherein the connection curve(s) of each flap is/are made by gluing or by application of adhesive.

44. A bag according to any one of the claims 1-40, wherein all connections in the bag are made by gluing or by application of adhesive.

45 . A bag having at least two opposing bag side pieces and comprising:

a closed bottom end extending between a first side part and a second opposed side part, and first and second handles being formed at an upper part of said first and second side parts, respectively, opposed to the closed bottom end with a bag opening being formed between said two handles, a first opening being formed at the upper part of the first side part to thereby form an opening of the first handle with one or more first connection seams extending above said first opening thereby connecting a first upper part of said bag side pieces, a second opening being formed at the upper part of the second side part to thereby form an opening of the second handle with one or more second connection seams extending above said second opening thereby connecting a second upper part of said bag side pieces, wherein the connection seam(s) of each handle forms at least one reinforcing curve, and wherein, for at least one reinforcing curve of one or both handles, the total length of the connection seam(s) forming a reinforcing curve is longer than the shortest distance between the two outermost points of the formed reinforcing curve.

46. A bag according to claim 45, wherein the first and second side parts have first and second side edges, respectively, with a first lateral gusset extending inwards from said first side edge and with a second lateral gusset extending inwards from said second side edge, said first opening of the first handle being provided in the upper part of the first lateral gusset, and said second opening being provided in the upper part of the second lateral gusset, whereby the first and second handles are both formed of parts of double layered bag side pieces.

47. A bag according to claim 45 or 46, wherein at least one reinforcing curve of one or both handles has at least one curve part with a positive slope and/or at least one curve part with a negative slope.

48. A bag according to claim 47, wherein said slopes are defined in relation to a line extending in a transverse direction of the bag from one side edge of the handle to the other.

49. A bag according to any one of the claims 45-48, wherein the general direction of a reinforcing curve extends substantially in a transverse direction of the bag.

50. A bag according to any one of the claims 45-49, wherein at least one reinforcing curve of one or both handles forms at least one peak and/or at least one trough.

51. A bag according to any one of the claims 45-50, wherein at least one reinforcing curve of one or both handles forms several peaks and/or troughs.

52. A bag according to any of the claims 45-51, wherein at least one reinforcing curve of one or both handles forms at least 2 or 3 peaks and/or 2 or 3 troughs.

53. A bag according to any one of the claims 45-52, wherein at least one reinforcing curve of one or both handles forms a curve with alternating peaks and troughs.

54. A bag according to any one of the claims 45-53, wherein for at least one reinforcing curve, the total length of the connection seam(s) forming a reinforcing curve is longer than or equal to 1,2 or 1,3 times the shortest distance between the two outermost points of the formed reinforcing curve.

55. A bag according to any one of the claims 45-54, wherein for at least one reinforcing curve, the total length of the connection seam(s) forming a reinforcing curve is longer than or equal to 1,4 or 1,5 times the shortest distance between the two outermost points of the formed reinforcing curve.

56. A bag according to any one of the claims 45-55, wherein at least one reinforcing curve of one or both handles forms a substantially sinusoidal formed curve or an arched formed curve.

57. A bag according to any one of the claims 45-56, wherein at least one reinforcing curve of one or both handles has one or more angled parts or one or more pyramid shaped parts.

58. A bag according to any one of the claims 45-57, wherein at least one reinforcing curve of one or both handles is formed of several separated connection seams.

59. A bag according to any one of the claims 45-58, wherein at least one reinforcing curve of one or both handles is formed of a single connection seam.

60. A bag according to any one of the claims 45-59, wherein opposed parts of bag side pieces of each handle are connected along at least 1/2 or 2/3 of the total length from one side edge of the handle to the other.

61. A bag according to any one of the claims 45-60, wherein the bag is made from a plastic material.

62. A bag according to claim 61, wherein said plastic material is polyethylene (PE) or polypropylene (PP).

63. A bag according to any one of the claims 45-62, wherein the connection curve(s) of each handle is/are made by welding or formed by heat sealing.

64. A bag according to any one of the claims 45-63, wherein the closed bottom end of the bag is made by welding or by heat sealing.

65. A method of heat sealing in the longitudinally direction a continuously moving multiple layer web of thermoplastic film, said method comprising the steps of: providing a cylindrical drum mounted for rotation about the axis thereof, providing a continuously heated area in the cylindrical surface of the drum, said heated area forming a curve extending in a direction around the cylindrical surface of the drum to thereby at least partly encircling the drum, wrapping the moving web of film around the cylindrical surface of the drum,

providing a tension of the web film against the cylindrical surface of the drum, rotating the cylindrical surface of the drum together with the moving web or film, and

maintaining the tension of the web film against the cylindrical surface of the drum during the substantial portion of the rotation thereof to thereby heat seal part of the multiple layer web film along the heated area of the drum surface.

66. A method according to claim 65, said method further comprising: providing a flow of hot air to at least part of the area of the web film covering the heated area of the cylindrical surface of the drum during the substantial portion of the rotation thereof during which said heat sealing is performed.

67. A method according to claim 65 or 66, wherein the temperature of the heated area of the cylindrical surface is maintained high enough to perform said heat sealing of the web film during the rotation of the cylindrical surface.

68. A method according to claim 66 or 67, wherein the temperature of the hot air flow is controlled so that the temperature of the hot air reaching the web film is maintained below the heat sealing temperature of the web film.

69. A method according to any one of the claims 65-68, wherein the curve formed by the heated area of the cylindrical surface fully encircles the drum.

70. A method according to any one of the claims 65-69, wherein said heated area of the cylindrical surface forms a curve with alternating peaks and troughs.

71. A method according to claim 69 or 70, wherein the total length of the curve formed by the heated area of the cylindrical surface is longer than or equal to 1,2 or 1,3 times the circumference of the cylindrical surface.

72. A method according to any one of the claims 65-71, wherein the heated area of the cylindrical surface forms a substantially sinusoidal formed curve or an arched formed curve.

73. A method according to any one of the claims 65-72, wherein the web film is made of polyethylene, and the temperature of the heated area of the cylindrical surface is maintained above 130 °C during the heat-sealing rotation of the cylindrical surface.

74. A method according to claims 68 and 73, wherein the temperature of the hot air reaching the web film is maintained about or below 120 °C during the heat-sealing rotation of the cylindrical surface.

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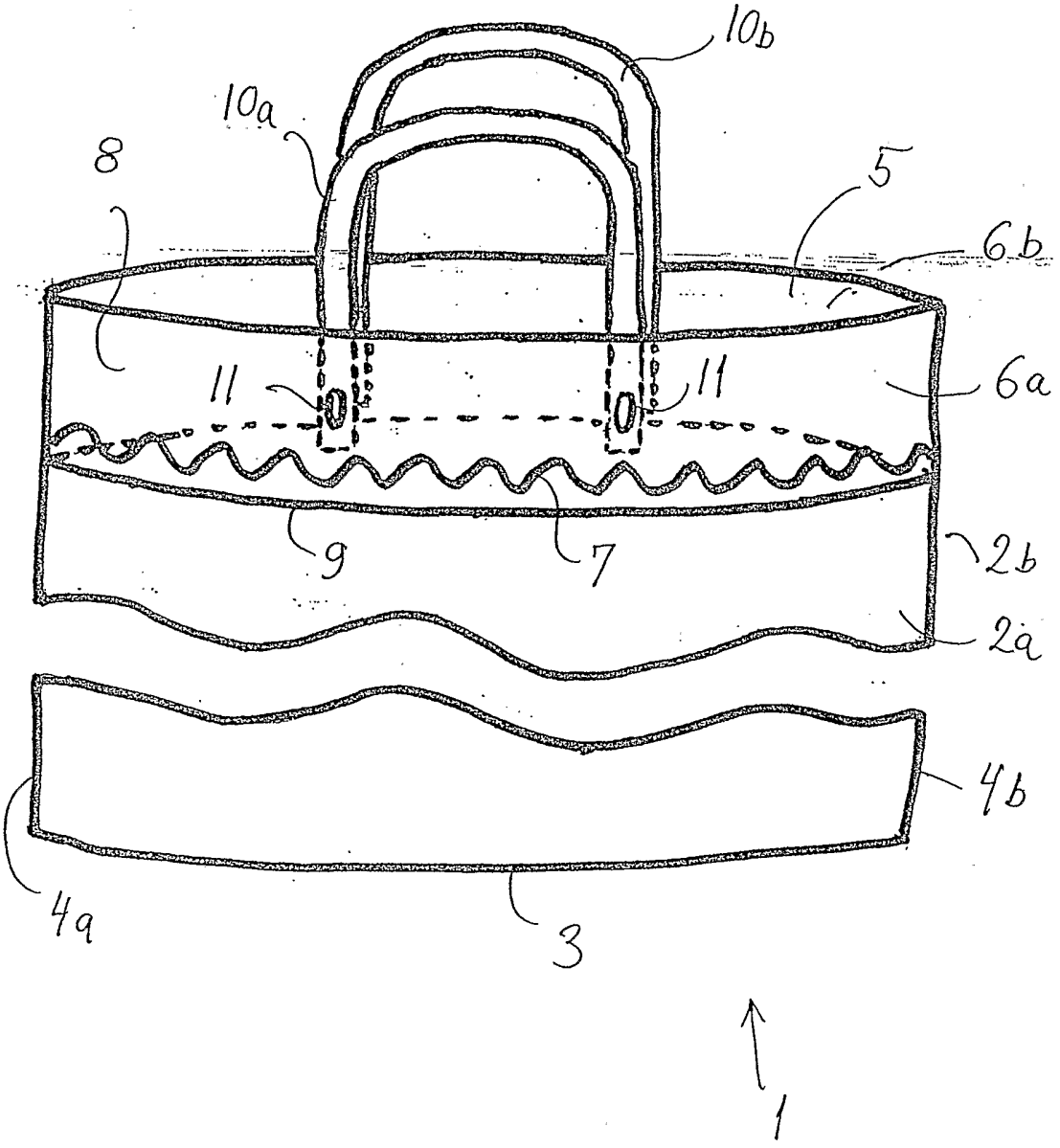

Fig. 1a

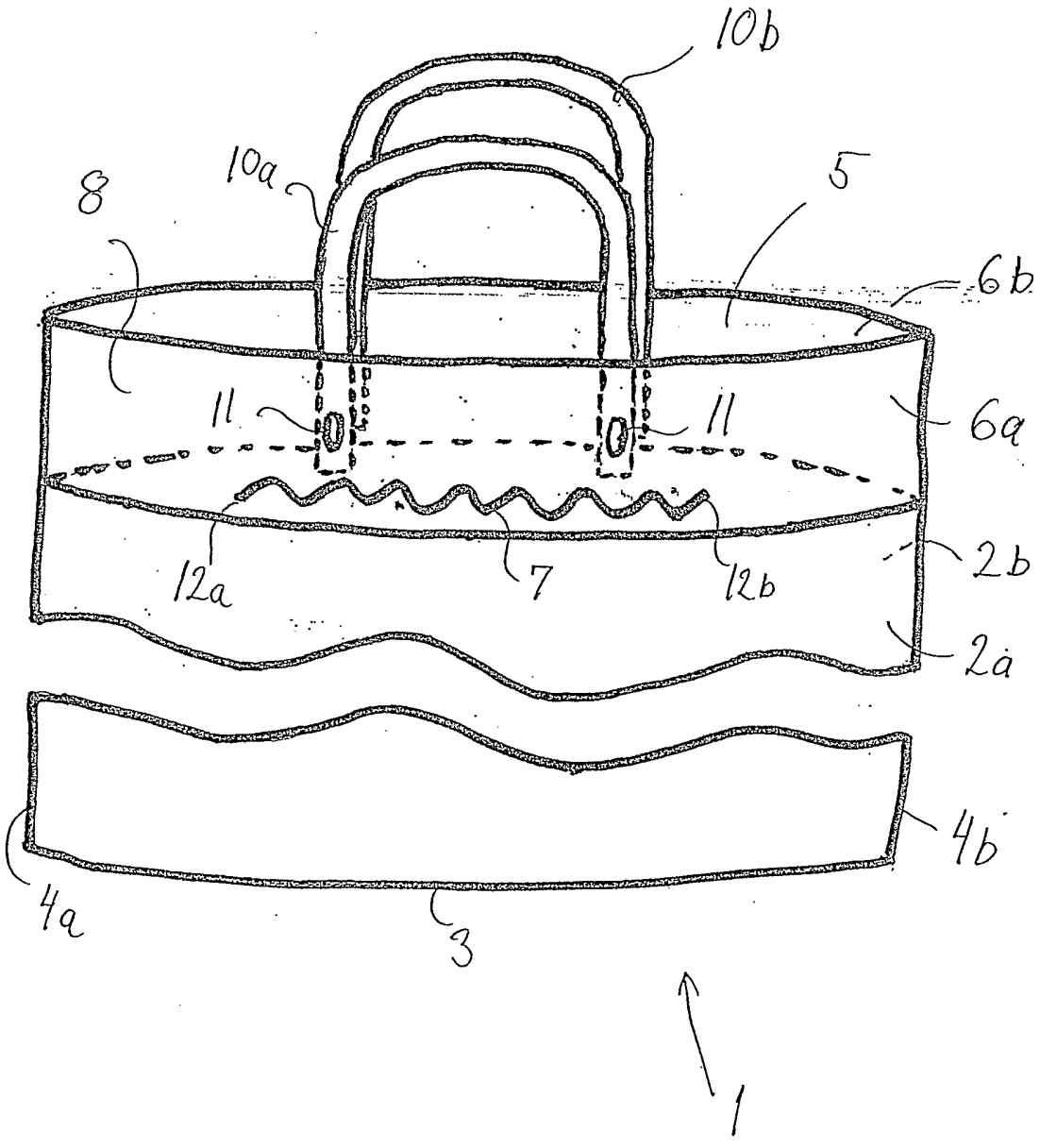

Fig. 1b

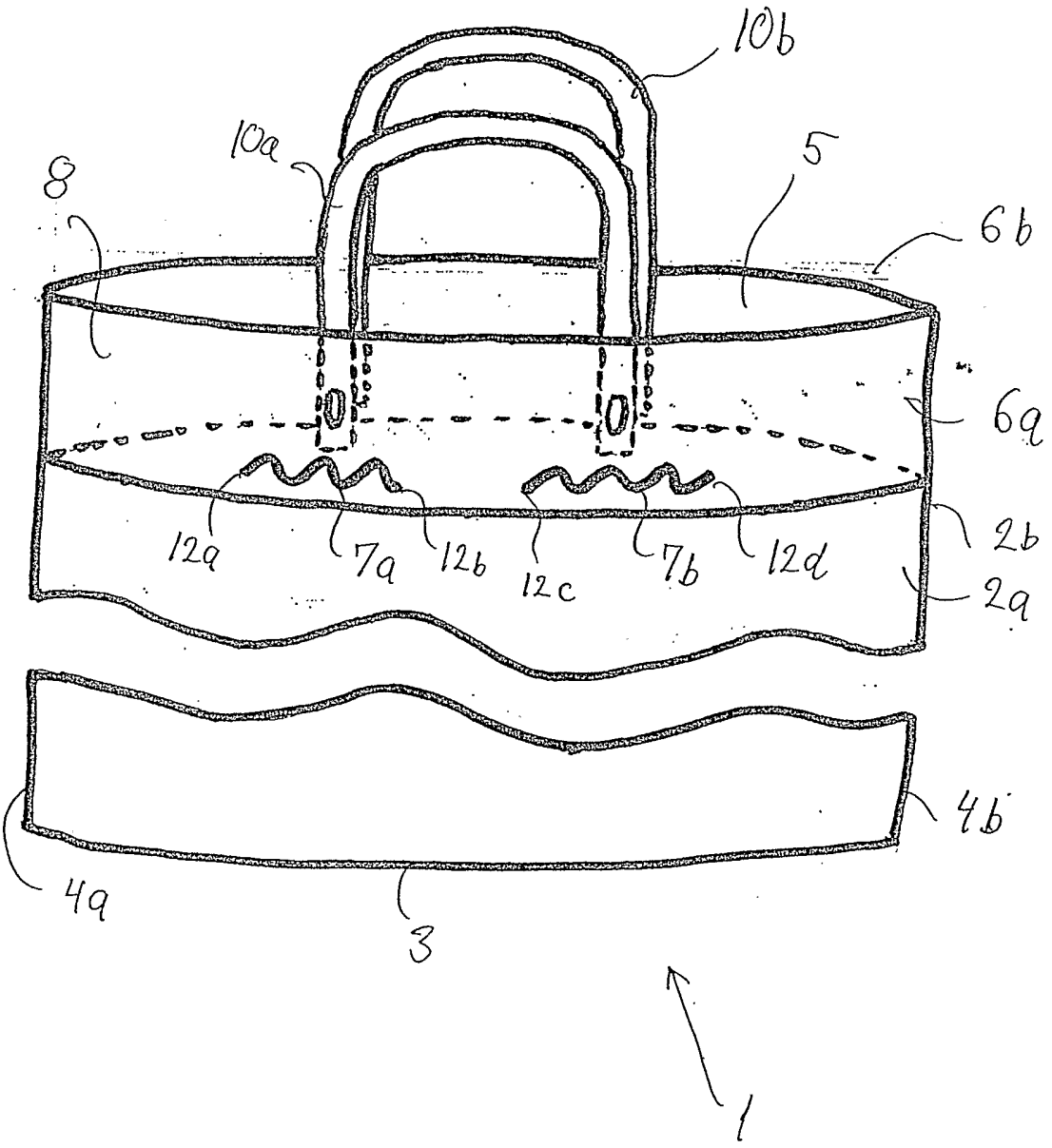

Fig. 1c

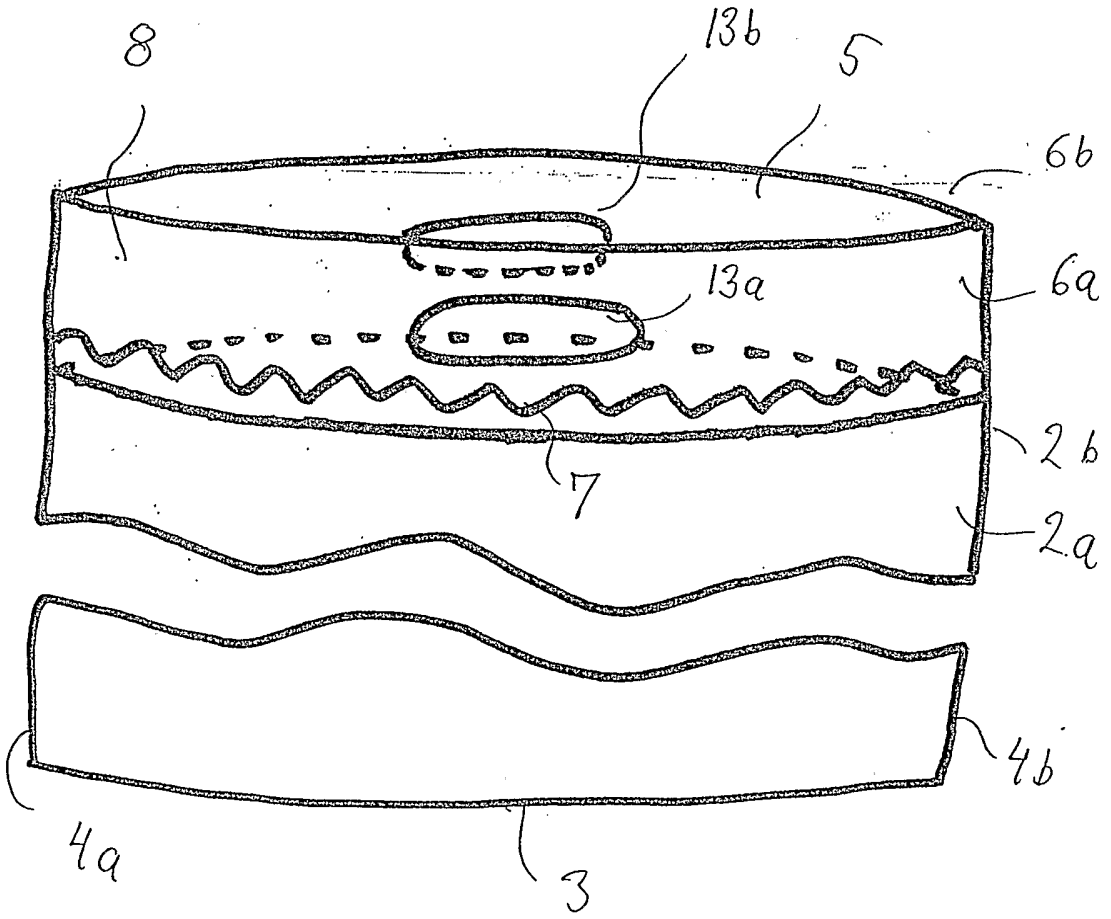

Fig. 2a

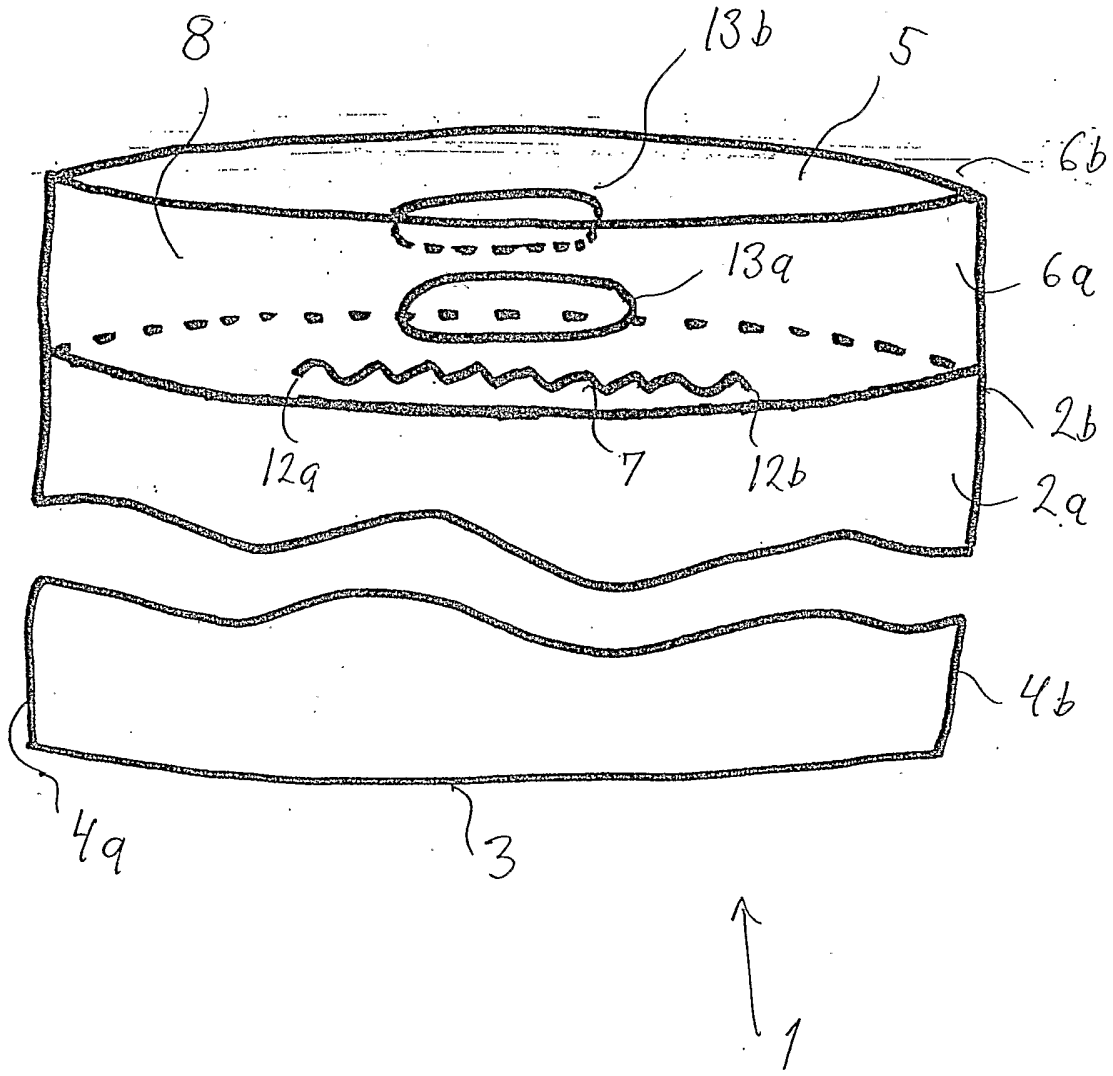

Fig. 2b

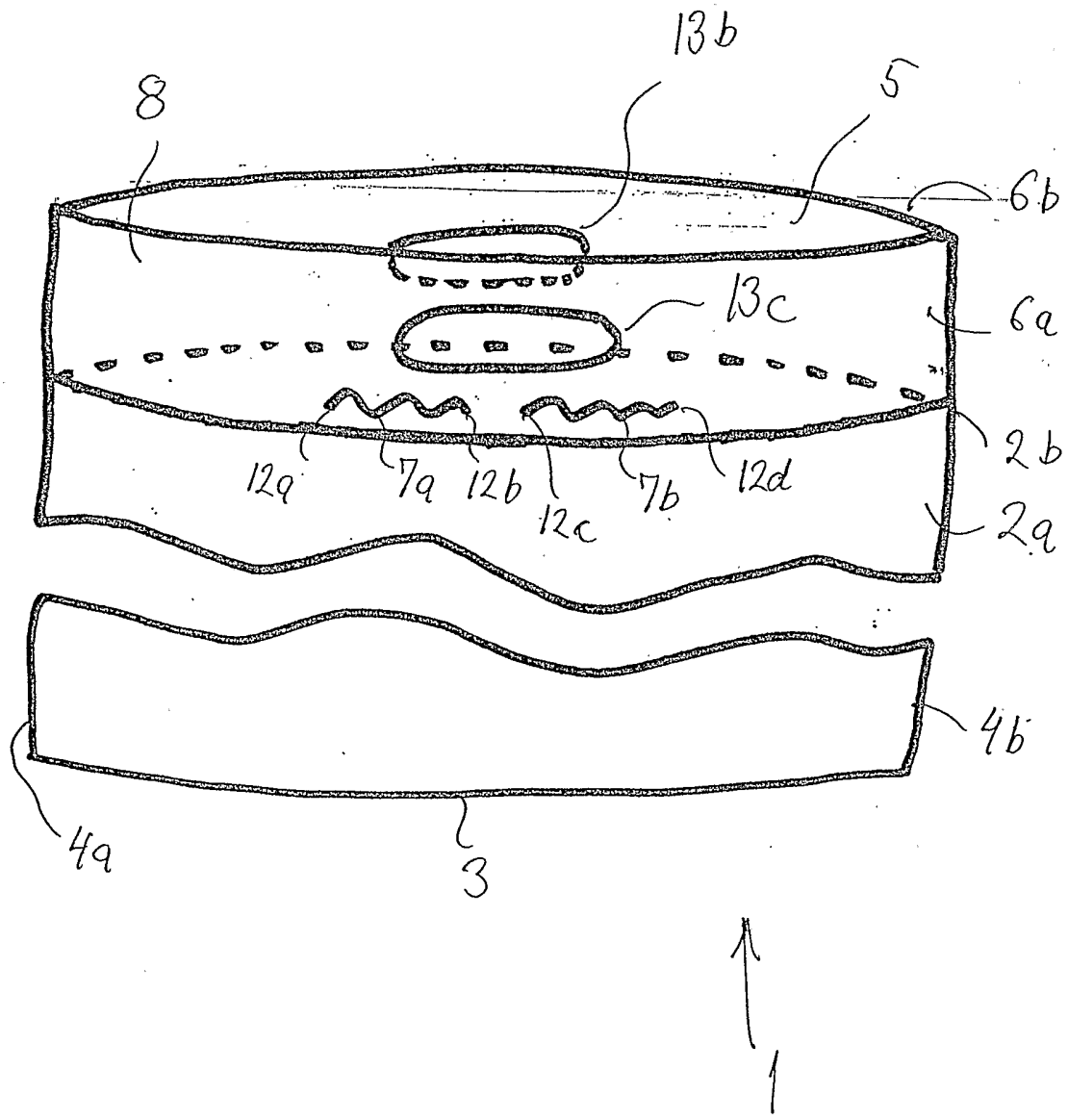

Fig. 2c

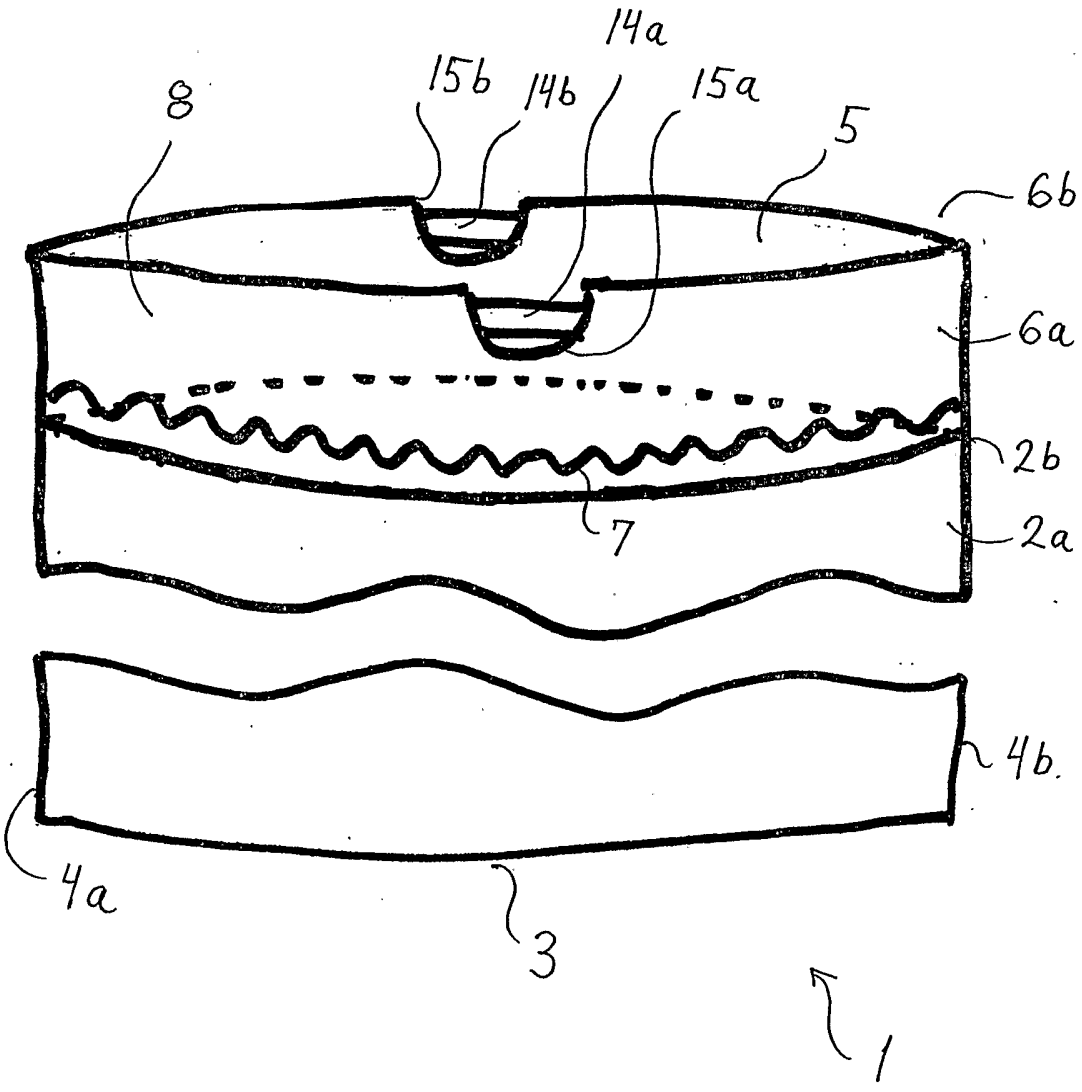

Fig. 3a

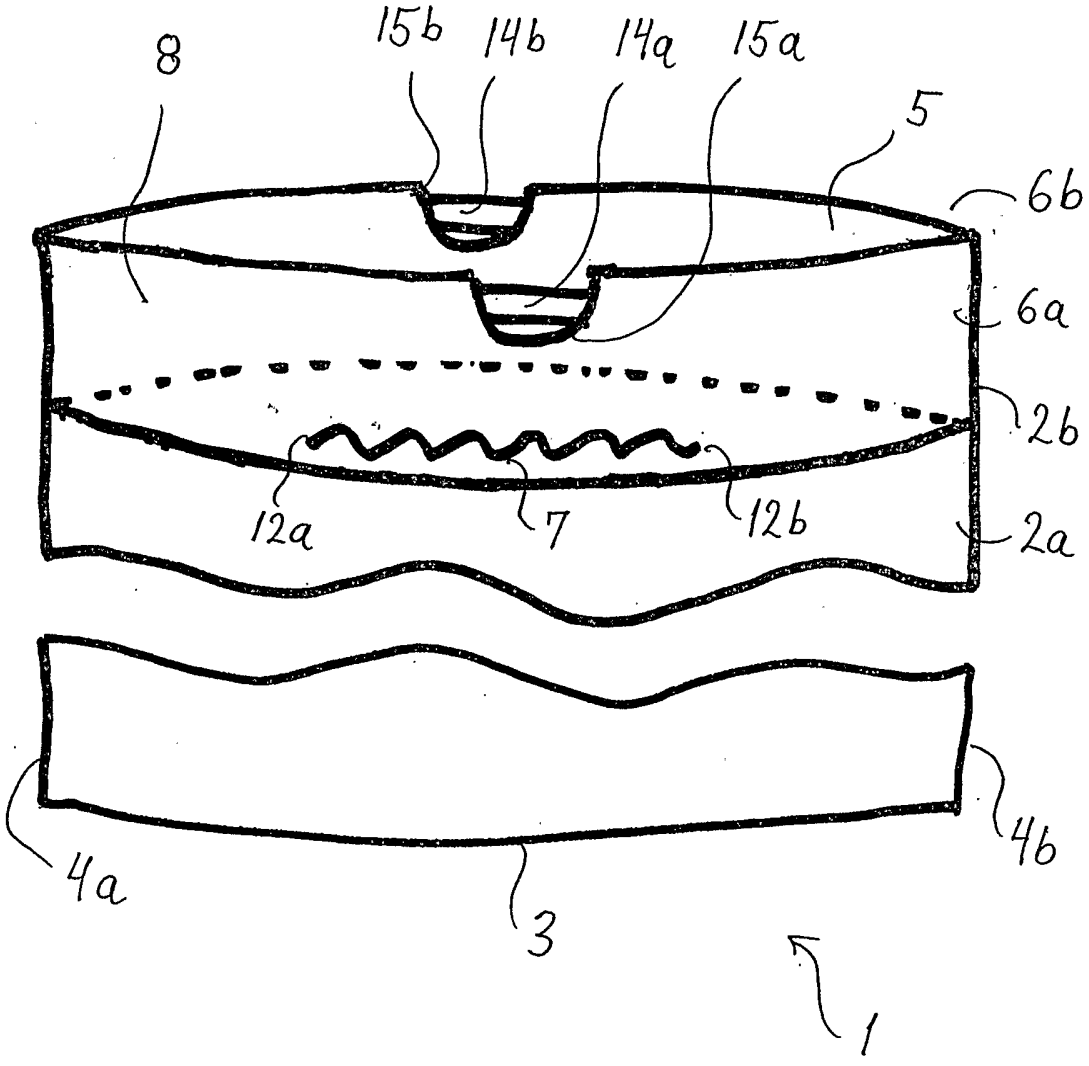

Fig. 3b

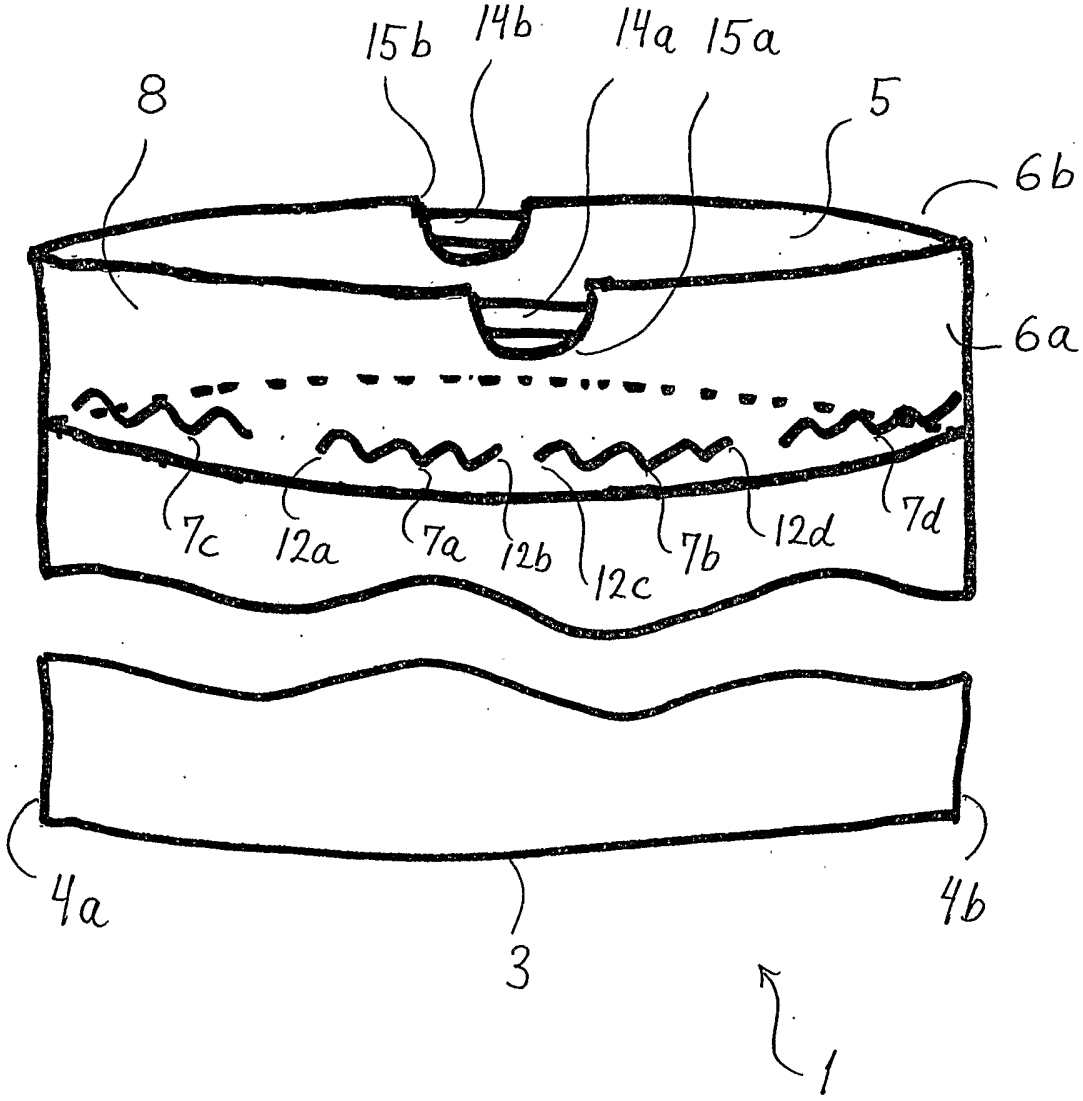

Fig. 3c

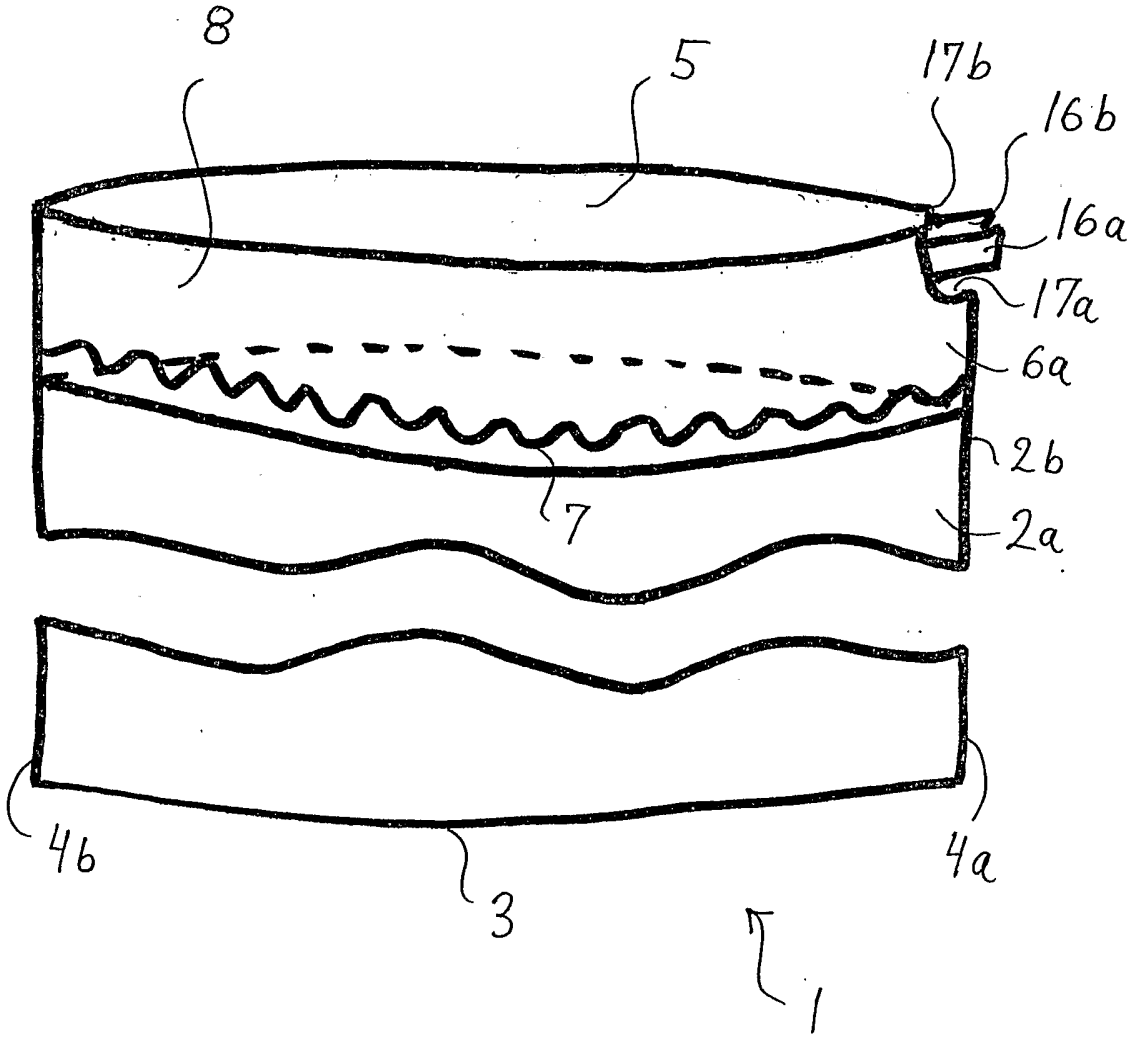

Fig. 4a

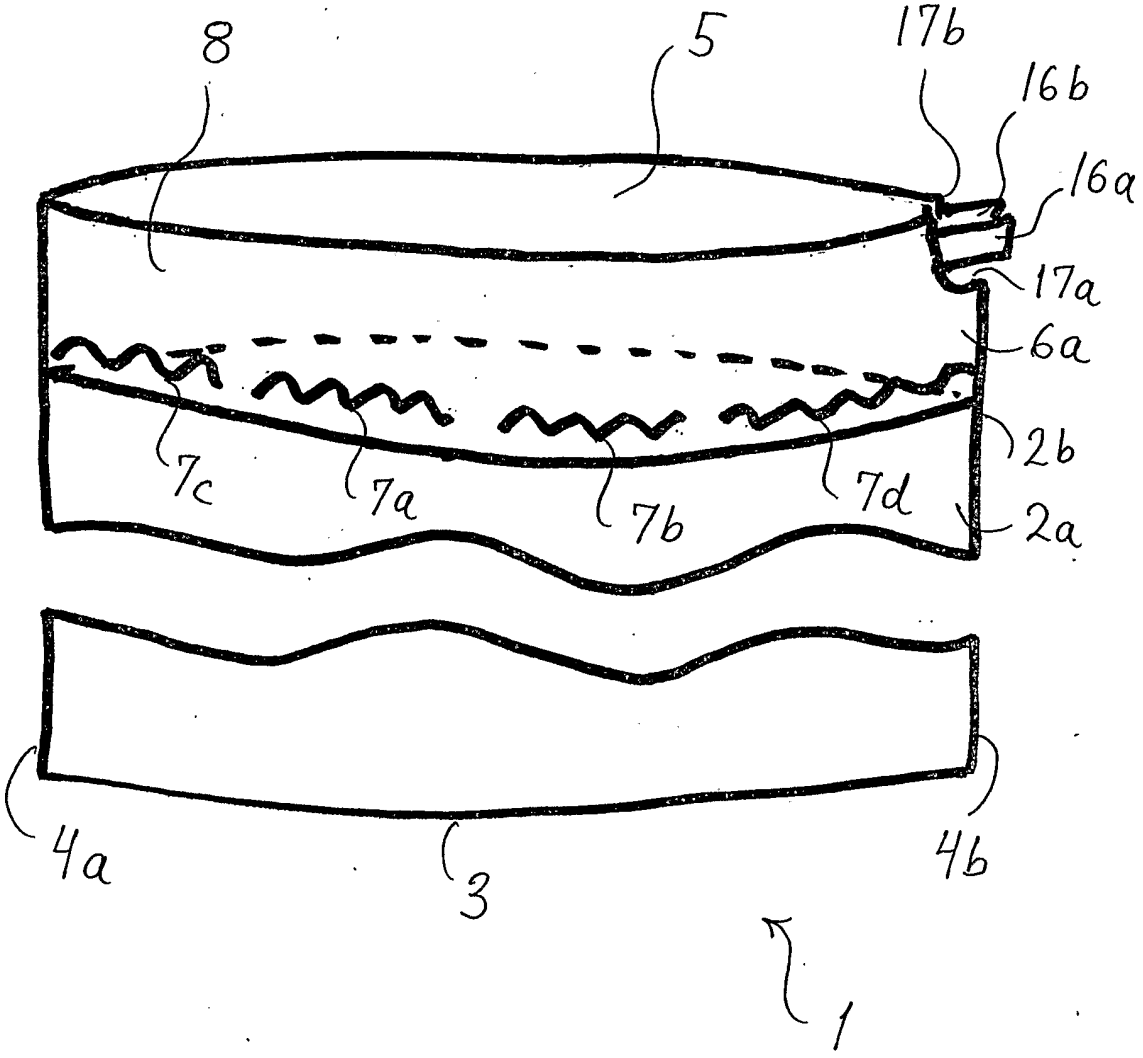

Fig. 4b

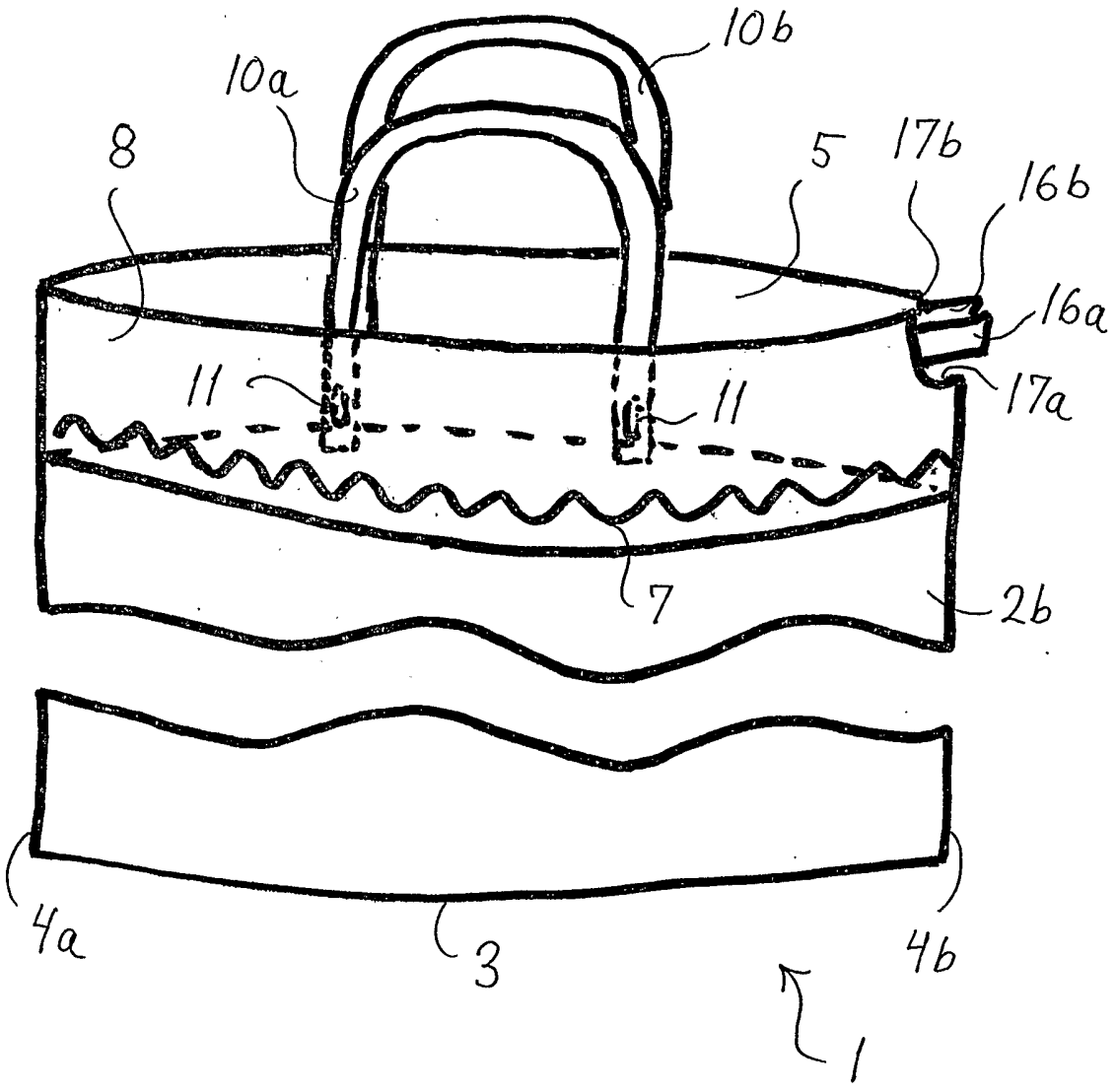

Fig. 5

Fig. 6a

Fig. 6b

Fig. 6c

Fig. 6d

Fig. 6e

Fig. 6f

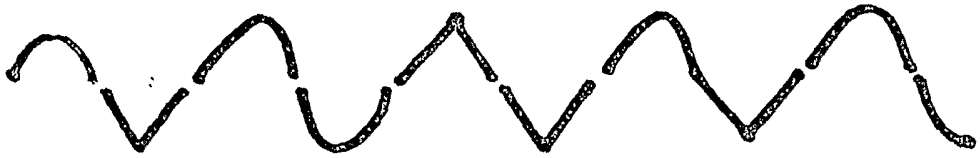

Fig. 6g

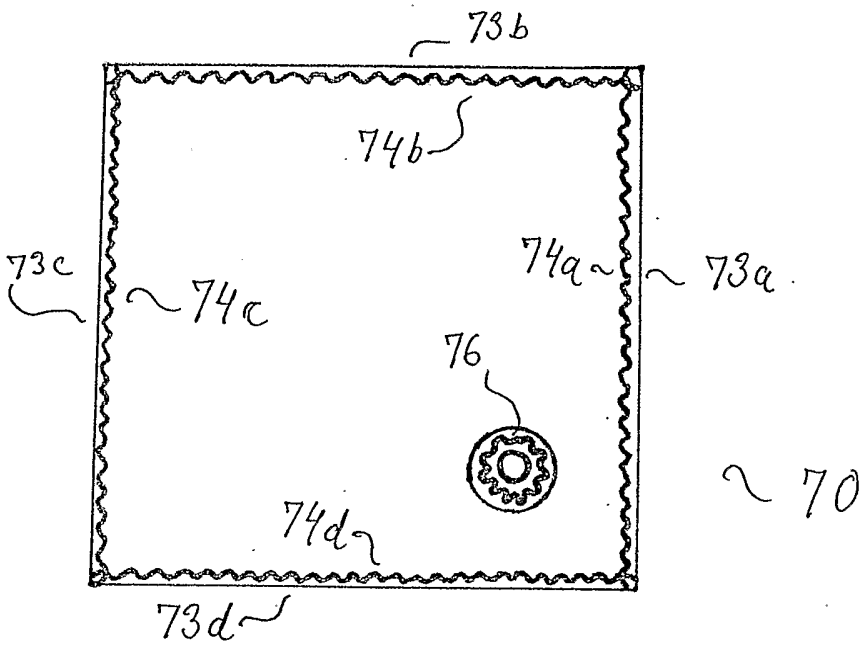

Fig. 7a

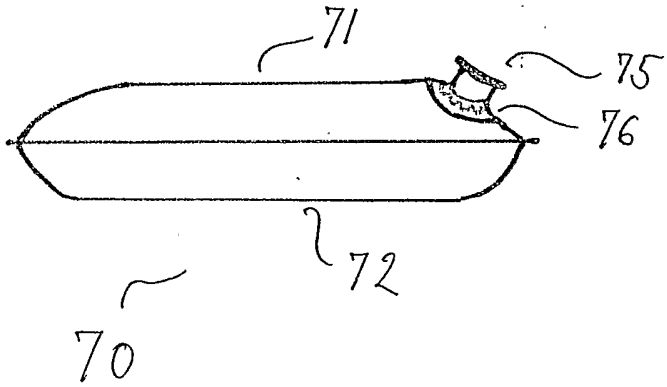

Fig. 7b

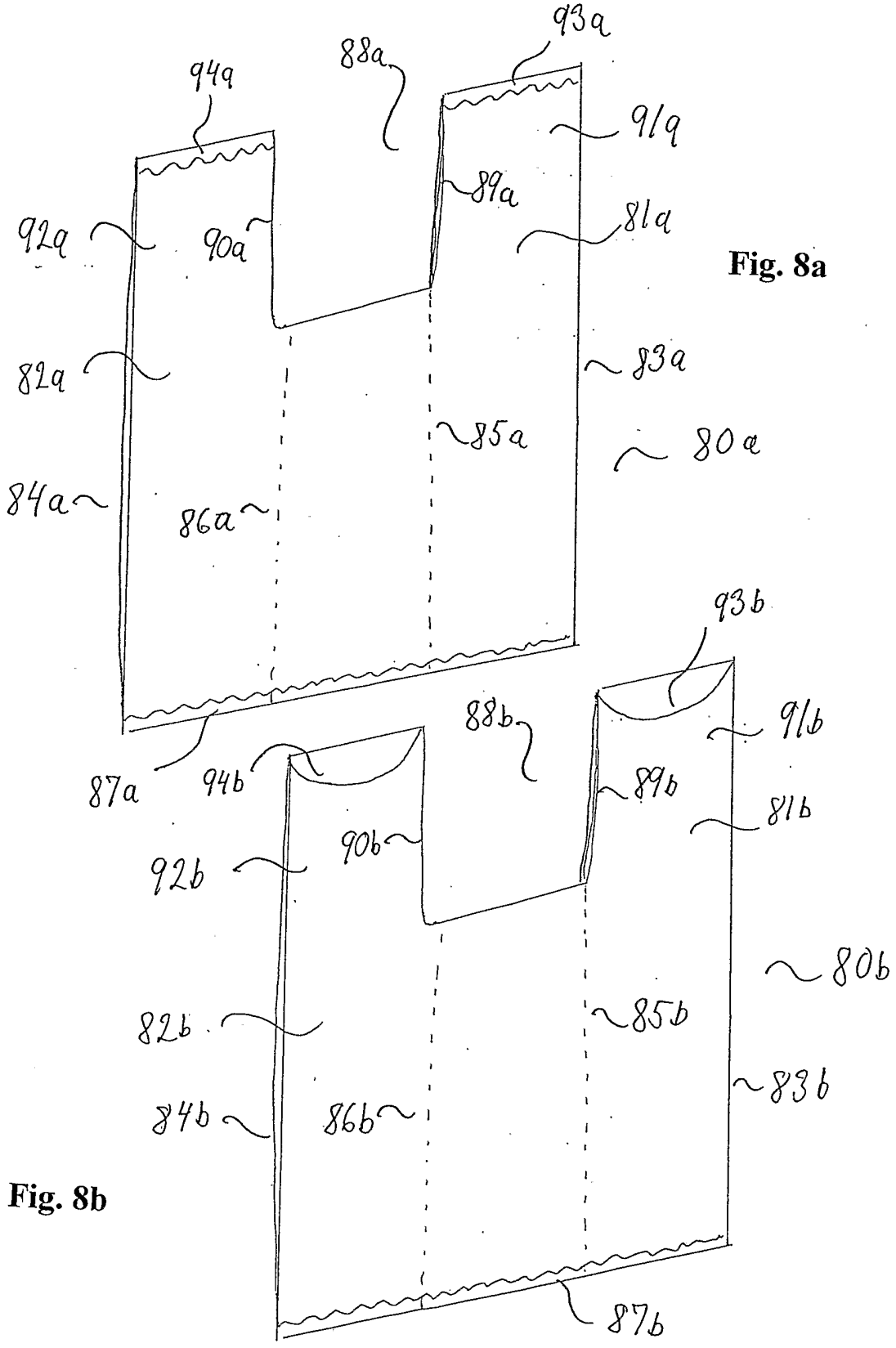
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Fig. 8a

Fig. 8b

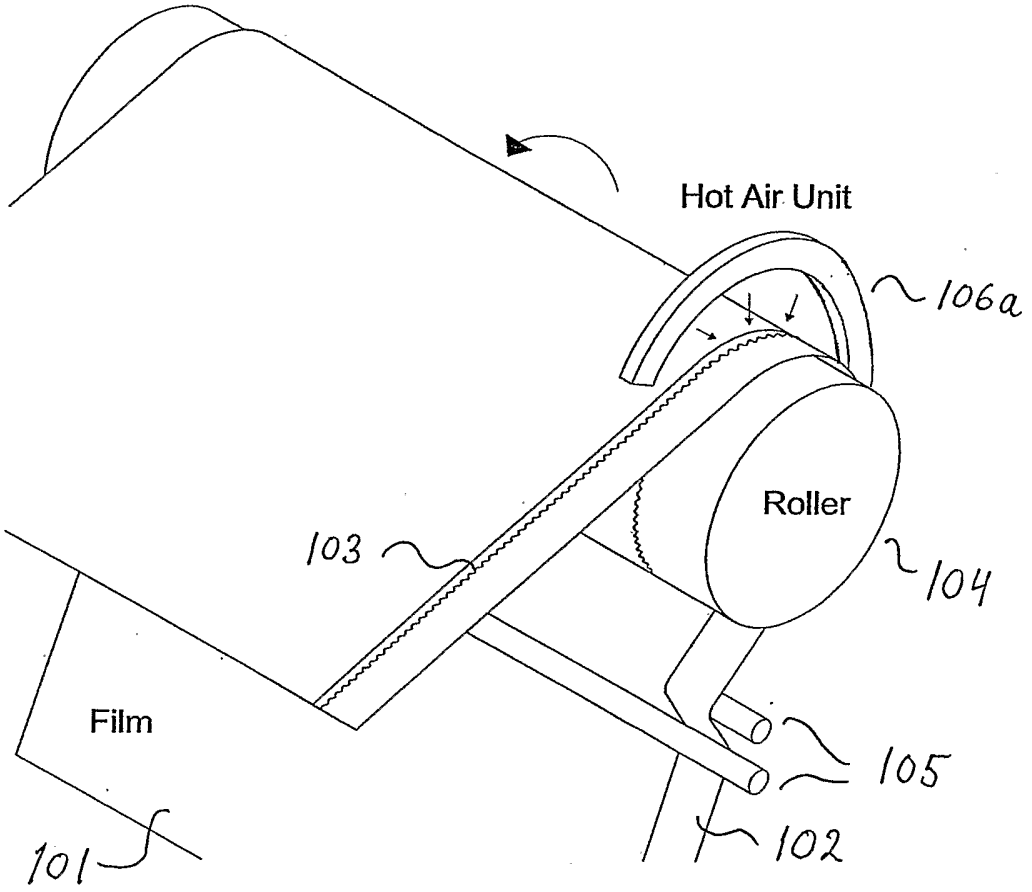

Fig. 9a

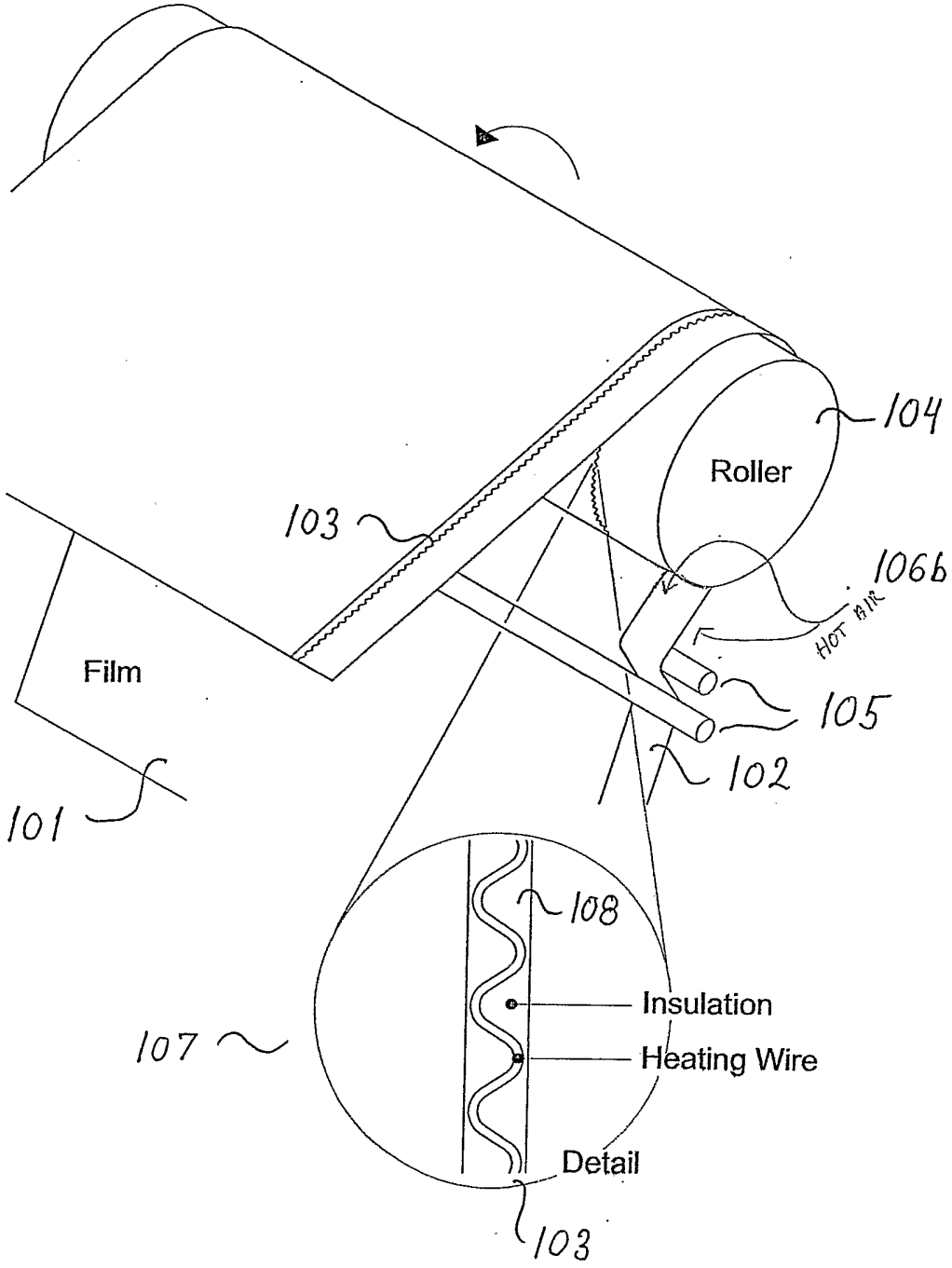
104
Roller
103
106b
HOT AIR
Film
105
102
101
108
Insulation
107
Heating Wire
Detail
103

Fig. 9b