

Description

BACKGROUND OF THE INVENTION

The present invention relates generally to plastic bags and their manufacture, and more particularly provides a plastic bag having an integral, ready-to-use plastic film tie element thereon which may be easily and quickly used to tightly close the bag, and associated methods for fabricating the bag and integral tie element structure.

A wide variety of closure devices are commonly used to close the upper ends of plastic bags such as the now-common plastic trash bag. These closure devices range from simple plastic clips or twist ties packaged separately from or removably connected to the individual bags, to relatively complex draw string-type devices in which portions of the bag itself, or a separate draw string element, must be laboriously threaded through multiple openings in the bag and then pulled to close the upper bag end.

In US-A-4 077 562 a plastic bag according to the entering clause of claim 10 is disclosed having a flexible resilient tie strip which is provided with openings and which is permanently secured adjacent to the open end of the bag.

In FR-A-2 179 853 an apparatus for providing plastic bags with tie strips is disclosed. The strips are glued to one sidewall of the bags.

Conventional bag closure devices of these and various other types suffer from one or more of the following disadvantages and limitations:

1. They are relatively expensive to manufacture and/or attach to the bags in the bag manufacturing process;
2. They are separate from the bag and are thus easily lost;
3. They are difficult to use, particularly by persons with only limited manual dexterity;
4. They must be removed from the bag and then reoriented and manipulated to effect bag closure;
5. They are relatively thick and stiff and, if attached to the bags during formation thereof, can potentially interfere with both the bag-forming and bag-packaging processes;
6. They undesirably delay the bag-forming process;
7. They cannot be firmly pulled, to effect tight bag closure, without potentially damaging the bag and/or the closure device, or causing separation of the closure device from its associated bag; and
8. They are of only marginal effectiveness in maintaining firm bag closure.

It is accordingly an object of the present invention to provide a plastic bag and integral closure

element structure, and associated manufacturing methods therefor, which eliminates or minimizes above-mentioned and other disadvantages and limitations commonly associated with conventionally constructed plastic bag and closure element combinations.

SUMMARY OF THE INVENTION

In carrying out principles of the present invention, in accordance with a preferred embodiment thereof, a continuous high speed bag making process is used to fabricate a series of plastic bags with integral, ready-to-use plastic film top tie elements. Each of the bags has an open upper end, a closed lower end, a pair of opposite side edge portions defined by a plurality of plastic film layers, and a pair of opposite side walls interconnecting the side edge portions and the lower end.

To tie off an upper end portion of the bag, an elongated plastic film tie element is permanently secured thereto during the bag forming process. A relatively large end portion area of the tie element and at least two layers of one of the bag's side edge portions adjacent its upper end are weldingly intersecured, thereby leaving an elongated free end portion of the tie element which is in a ready-to-use position for tying off the upper bag end. Rapid and very tight closure of the bag may be effected simply by passing the tie element free end portion around a gathered upper end portion of the bag to form a tightening loop. The free end portion of the tie element is then passed through such loop and firmly pulled to tighten the loop around the upper bag end portion. Importantly, the multi-layer plastic weld area which secures the fixed end portion of the tie element to a side edge portion of the bag provides a sufficient tie-bag attachment strength to permit a very firm loop tightening pull on the tie element without causing the tie element to be separated from the bag.

According to a feature of the present invention, a suitable aperture, preferably an elongated slit, may be formed through the relatively large fixed end portion of the tie element and the side edge layers of the bag to which it is welded. A heated knife element may be used to form the aperture to form a fused ridge around its periphery, thereby reinforcing the aperture and inhibiting tearing thereof. To tie off the top of the bag, the free end portion of the tie element is passed around the gathered top end portion of the bag to form a tightening loop around it. However, instead of then passing the free end portion through the tightening loop which it has created, the free end portion is passed through the weld area aperture and then firmly pulled to tighten the loop and securely close the upper end of the bag.

The aperture is preferably made sufficiently small relative to the width of the tie element free end portion so that as the free end portion is initially pulled through the aperture it is laterally deformed and gathered by the aperture to inhibit reverse movement of the free end portion therethrough. This, in turn, assists in preventing loosening of the tightening loop.

The elongated plastic film tie element may be given a variety of alternate configurations and is formed from one or more strips of relatively thin plastic film material. The tie element has a thickness which is preferably only about two or three times that of the film thickness of the bag itself. Accordingly, the tie elements are considerably stronger than the bag film, but are still quite thin, pliable and unobtrusive.

In one embodiment thereof, the tie element is formed from a single elongated strip of suitable plastic film material. This strip may be of a single plastic film material, or may be a dual layer plastic film coextrusion, one of the layers being of a relatively stiff plastic film material, such as high density polyethylene, while the other layer is of a plastic film material, such as ethyl vinyl acetate or other suitable broad sealing temperature range polymer material, which is more flexible, but is more easily weldable as well and has a higher coefficient of friction to enhance the overall bag closure retention capability of the tie element. The use of this coextruded strip permits a large area end portion of its readily weldable layer to be welded to the bag side edge portion, while its stiffer outer layer improves the ability of the tie element to maintain the bag in its closed position. This is particularly true when the weld area aperture is used. When the free end portion of the coextruded strip is pulled through the aperture, and laterally gathered and compressed thereby, the stiffer strip layer portion which has been pulled through the aperture tends to spring back toward its original width, thereby inhibiting reverse movement of the strip through the aperture.

In another version of the tie element, the plastic film strip used to form such element is doubled over onto itself so that the resulting tie element free end portion has a looped configuration. When the tie element is looped around the gathered top end portion of the bag and pulled through the tightening loop, or the weld area aperture as the case may be, the outer end of the free end portion defines a convenient carrying loop through which one or more fingers may be inserted to conveniently carry the closed bag.

In another embodiment of the tie element, two separate plastic film strips are used so that the free end portion of the tie element is defined by the two free end portions of such strips. In this tie element

embodiment, which is utilized in conjunction with the weld area aperture, one of the separate strips is passed around the upper end portion of the bag and then run through the weld area aperture. The outer ends of the separate strips are then grasped and then firmly pulled in opposite directions to close the bag.

In the bag forming process used to fabricate the plastic bag and integral tie element structure of the present invention, an elongated plastic film element (preferably a flattened plastic film tube) is longitudinally conveyed toward a suitable bag packaging station. The plastic film element has a pair of opposite side walls, and a pair of opposite side edge portions each defined by a plurality of plastic film layers. The individual bags are formed on the moving plastic film element by suitable bag-forming apparatus which forms on the plastic film element appropriately positioned cutlines which define the bottom and top ends of adjacent bags in the series thereof being formed, and weld lines which close off the bottom ends of the bags.

To rapidly form the tie elements and sequentially secure them to the individual bags, a tie element attachment station is positioned adjacent one of the side edge portions of the moving plastic film element. Suitable plastic film strip material is fed to a first portion of the station from one or more strip supply rolls. The first station portion is operated to sever an appropriate length of the film strip material which it receives and preheat or weld an end portion of the severed strip material. The severed, preheated strip material is then positioned over the side edge portion of the plastic film element and its preheated end portion is welded to such side edge portion adjacent what is or will be the upper end of one of the bags.

Alternatively, the plastic film strip material may be fed to a combination forming and welding station positioned at one of the side edge portions of the plastic film element. This alternate station simultaneously severs the received plastic film strip material and welds an end portion thereof to the appropriate section of the side edge portion of the plastic film element.

The integral plastic film tie elements provided on each of the rapidly formed individual bags eliminate or minimize most if not all of the limitations and disadvantages typically associated with conventional plastic bag closure devices. They are quite inexpensive to manufacture and attach to the bags. Because they are permanently affixed to their associated bags they cannot be lost or misplaced. The tie elements are at all times in a ready-to-use position, they do not have to be removed from their associated bag to be used, and they are quite easy to use. Since the tie elements are of a thin plastic film material, they do not

interfere with or appreciably slow either the bag forming or bag packaging process. Additionally, because of the substantial, multi-layer weld area used to permanently secure the tie elements to side edge portions of their associated bags, the firm pull on the tie elements used to very effectively achieve tight closure of their bags does not damage either the bag or the tie element, and does not cause separation of the tie element from its associated bag. The tight bag closure capability provided by the tie elements in their various embodiments functions to very efficiently prevent the escape of liquids and/or odors from the sealed upper ends of the bags.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a plastic bag which embodies principles of the present invention and has a plastic film tie element fixedly secured at one end thereto to a side edge portion of the bag adjacent its open upper end; Fig. 2 is an enlarged scale fragmentary perspective view of an upper end portion of the bag illustrating the manner in which its integral tie element may be used to tightly close the upper end of the bag;

Fig. 3 is an enlarged perspective view of the tie element and an upper left corner portion of the bag to which it is fixedly secured;

Fig. 4A is a greatly enlarged exploded cross-sectional view, taken along line 4-4 of Fig. 3, illustrating a left end portion of the tie element prior to being welded to an underlying side edge portion of the bag;

Fig. 4B is a view similar to that in Fig. 4A, but illustrates the left end portion of the tie element after welding thereof to the underlying side edge portion of the bag;

Fig. 4C is a view similar to that in Fig. 4B, but illustrates a coextruded version of the tie element;

Fig. 5 is a perspective view of an alternate embodiment of the tie element secured to an upper left corner portion of the bag;

Fig. 6 is a perspective view of an upper end portion of the bag of Fig. 5 illustrating the manner in which its tie element may be used to tightly close an upper end portion of the bag;

Fig. 7 is a greatly enlarged cross-sectional view taken along line 7-7 of Fig. 5;

Fig. 8 is a cross-sectional view taken along line 8-8 of Fig. 7;

Fig. 9 is a perspective view of another alternate embodiment of the tie element secured to an upper left corner portion of the bag;

Fig. 10 is a perspective view of an upper portion of the bag of Fig. 9 illustrating the manner in

which its tie element may be used to tightly close an upper end portion of the bag;

Fig. 11 is a greatly enlarged cross-sectional view taken along line 11-11 of Fig. 9;

Fig. 12 is a perspective view of another alternate embodiment of the tie element secured to an upper left corner portion of the bag;

Fig. 13 is a perspective view of an upper end portion of the bag of Fig. 12 illustrating the manner in which its tie element may be used to tightly close an upper end portion of the bag;

Fig. 14 is a greatly enlarged cross-sectional view taken along line 14-14 of Fig. 12;

Fig. 15 is a perspective view of another alternate embodiment of the tie element secured to an upper left corner portion of the bag;

Fig. 16 is a perspective view of an upper portion of the bag of Fig. 15 illustrating the manner in which its tie element may be used to tightly close an upper end portion of the bag;

Fig. 17 is a greatly enlarged cross-sectional view taken along line 17-17 of Fig. 15;

Fig. 18 is a perspective view of another alternate embodiment of the tie element secured to an upper left corner portion of the bag;

Fig. 19 is a perspective view of an upper portion of the bag of Fig. 18 illustrating the manner in which its tie element may be used to tightly close an upper end portion of the bag;

Fig. 20 is a greatly enlarged cross-sectional view taken along line 20-20 of Fig. 18;

Fig. 21 is a perspective view of the bag having a further alternate embodiment of the tie element secured thereto;

Fig. 22 is a schematic side view of representative apparatus utilized to continuously form a series of plastic bags and integral plastic film tie element similar to the bag and integral tie element illustrated in Fig. 1;

Fig. 23 is a schematic top plan view of the apparatus of Fig. 22;

Fig. 24 is a schematic cross-sectional view through the apparatus taken along line 24-24 of Fig. 22 and illustrates apparatus used to secure to the bags tie elements similar to the tie element illustrated in Fig. 3;

Fig. 25 is a cross-sectional view similar to that in Fig. 24 but illustrating apparatus utilized to secure to the bags tie elements of the type depicted in Fig. 12;

Fig. 26 is a cross-sectional view similar to that in Fig. 24 but illustrating apparatus for securing to the bags a modified version of the tie element illustrated in Fig. 12;

Fig. 27 is a top plan view of the tie elements formed by the apparatus of Fig. 26 and secured to the bags;

Fig. 28 is an enlarged top plan view of a lower heating and cutting die element portion of the apparatus of Fig. 26;

Fig. 29 is a cross-sectional view similar to that in Fig. 24 but illustrating apparatus used to secure to the bags tie elements of the type shown in Fig. 18;

Fig. 30 is a schematic top plan view of a portion of the apparatus illustrated in Fig. 23 and depicts apparatus used to secure to the bags tie elements oriented relative to the bags as depicted in Fig. 21;

Fig. 31 is a cross-sectional view similar to that in Fig. 24 and illustrates alternate apparatus for securing to the bags tie elements of the type depicted in Fig. 3; and

Fig. 32 is a cross-sectional view similar to that in Fig. 24 and illustrates alternate apparatus for securing to the bags tie elements similar to those illustrated in Fig. 27.

DETAILED DESCRIPTION

Perspectively illustrated in Fig. 1 is a plastic bag and integral tie element structure 10 that embodies principles of the present invention. The structure 10 includes a plastic film bag 12 which, for illustrative purposes, is a large disposable trash bag that has an open upper end 14, front and rear side walls 16 and 18, left and right side edge portions 20 and 22, and a closed bottom end 24 defined by a transverse weld line 26 intersecuring the side walls 16 and 18 and extending between the left and right side edges 28 and 30 of the bag. The left side edge portion 20 of the bag is defined by laterally outer portions 16_a and 18_a of the side walls 16 and 18 immediately adjacent the left side edge 28, while the right side edge portion 22 of the bag is defined by laterally outer portions 16_b and 18_b of the side walls 16 and 18 immediately adjacent the right side edge 30 of the bag.

The structure 10 also includes a relatively thin plastic film tie element 32 which is fixedly secured to the bag in a ready-to-use form and is utilized in a manner subsequently described to very conveniently and rapidly effect a tight closure of an upper end portion of the bag. The tie element 32 comprises an elongated, single strip 34 of a relatively thin plastic film material having a thickness on the order of only about 2 to 3 times the thickness of the plastic film used to form the bag 12. The illustrated strip 34 is approximately 25.4 mm (one inch) wide and approximately 177.8 to 203.2 mm (seven to eight inches) long.

According to an important aspect of the present invention, the strip 34 has an end portion 36 which has a substantial area (approximately 645 mm² [one square inch]) and, in a manner subse-

quently described, is positioned over the left side edge portion 20 of the bag adjacent its upper end (see Fig. 4A) and is then secured to the bag by weldingly intersecuring the strip end portion 36 and the lateral side wall portions 16_a and 18_a as illustrated in Fig. 4B. For illustrative clarity, the welded strip end portion 36 has been stippled in Figs. 1-3. Corresponding weld areas in subsequent drawing figures have also been stippled for illustrative purposes. As best illustrated in Fig. 1, the welding together of these three layers (i.e., the strip end portion 36 and the lateral bag side wall portions 16_a and 18_a) positions the plastic film strip 34 so that an elongated free end portion 38 thereof extends transversely across the front bag side wall 16 toward the right side edge 30 of the bag.

To rapidly close the bag 12, an upper end portion 40 of the bag is gathered adjacent the strip 34 and the free strip end portion 38 is wrapped around the gathered upper end portion to form a loop 42 therearound as illustrated in Fig. 2. The free end portion 38 is then passed through the loop 42 and firmly pulled to tighten the loop, thereby tightly closing the upper bag end. Importantly, the welding of the relatively large area strip end portion 36 to the two side edge layer portions of the bag secures the end portion 36 to the bag with sufficient strength so that firmly pulling the free strip end portion 38 to tightly cinch the loop 42 around the gathered upper end portion of the bag does not separate the strip end portion 36 from the bag - it remains securely affixed thereto.

Referring to Fig. 4C, the single plastic film strip 34 may be replaced, if desired, with a coextruded strip 44 having an outer layer 46 of a relatively stiff thin plastic film such as high density polyethylene, and an inner layer 48 of a more flexible plastic film material, such as ethyl vinyl acetate or other suitable broad sealing temperature range polymer material, which may be more easily welded to the bag and has a higher coefficient of friction than the outer layer to thereby enhance the overall bag closure retention capability of the tie element. The relative stiffness of the outer film layer 46 facilitates holding the cinched loop 42 (Fig. 2) in a closed position, while the more flexible inner layer 48 facilitates the welding of the strip 44 to the bag. The single film strip 34 previously described may be of a plastic film material which is both relatively easy to weld to the bag and provides at least some relative degree of stiffness to the strip.

Illustrated in Fig. 5 is an alternate embodiment 10_a of the bag and tie structure in which a modified tie element 50 is fixedly secured to a side edge portion of the bag 12 adjacent its upper end 14. The tie element 50 comprises a single, elongated strip 52 of relatively thin plastic film material which is similar to the previously described strip 34, or

may be formed as a coextrusion like the strip 44 of Fig. 4C. The strip 52 has a relatively large area end portion 54 which, as illustrated in Figs. 7 and 8, is welded to the lateral side wall portions 16_a and 18_a of the bag 12 as previously described in conjunction with the strip 34, thereby leaving an elongated free end portion 56 of the strip which extends transversely across the bag.

However, an elongated slit 58 (or other suitably configured opening) is formed entirely through the welded area defined by the strip end portion 58 and the sections of the lateral side wall portions 16_a and 18_a intersecured therewith. To tightly close the gathered upper end portion 40 of the bag 12, the free strip end portion 56 is wrapped around it to form a loop 60, and the free end portion 56 is then passed through the slit 58 and firmly pulled to tighten the loop 60 and close the bag.

The length of the slit 58 is at least somewhat shorter than the width of the strip 52 so that as the free strip end portion 56 is pulled through the slit 58 it is laterally foreshortened and gathered. Particularly when the coextruded version of the strip 52 is utilized, the part of the free end portion 56 which has been passed through the slit 58 tends to spring back to its normal width which is greater than the length of the slit 58 as indicated by the numeral 62 in Fig. 6. This rewidening of the free end portion 56 forms a natural restraint against the strip being pulled rearwardly through the slit, thereby tending to hold the loop 60 in its tightly sensed configuration. To augment this feature of the strip 52, small projections (not shown) may be formed on its free end portion 56 if desired, such projections forming "stops" to hinder widening of the loop 60.

Referring now to Fig. 8, the elongated slit 58 may be conveniently formed by a heated slitting knife which, when passed through the interwelded bag-tie area, forms a laterally outwardly projecting area 64 of the strip end portion 54 which circumscribes and tends to reinforce the wall area surrounding the slit. This reinforced area around the slit 58 further restrains the free strip end portion 56 from being pulled rearwardly through the slit and loosening the tightening loop 60.

Another alternate embodiment 10_b of the bag and integral tie structure is depicted in Fig. 9. In this embodiment, a tie element 66, which comprises an elongated strip 68 of relatively thin plastic film material (which may be either a single layer or a coextruded construction as previously described) is fixedly secured to the bag 12 adjacent its upper end 14. The strip 68 has an end portion 70 which is welded to the side edge portion 20 of the bag 12 along longitudinally spaced sections 72 and 74 of the strip end portion 70 to define with the front side surface of the bag 12 a gap 76 (Fig. 11) extending

between the welded strip portions 72 and 74.

To tightly close the gathered upper end portion 40 of the bag 12 (Fig. 10) the free end portion 78 of the strip 68 is wrapped around the gathered upper end portion to form a tightening loop 80. The free end portion 78 is then passed through the gap 76 and firmly pulled to tighten the loop 80. The gap 76 may conveniently be configured so that its width (i.e., its left-to-right dimension in Fig. 11) is shorter than the width of the strip 68 so that the strip is laterally gathered within the gap 76 to inhibit the strip from being pulled rearwardly through the gap in a manner similar to that described in conjunction with the strip 52 in Fig. 6.

Two additional embodiments 10_c and 10_d of the bag and integral tie element structure are respectively depicted in Figs. 12 and 15. The tie element 82 shown in Fig. 12 is formed from an elongated single strip 84 of relatively thin plastic film material which is doubled over onto itself to form a looped free end portion 86 of the tie element, while outer end portions 88 and 90 of the strip (see also Fig. 14) are welded to each other and to the side edge portion 20 of the bag 12 adjacent its upper end, thereby forming a welded area 92 having four separate layers. To tightly close the gathered upper end portion 40 of the bag 12, the looped free end portion 86 of the tie element 82 is passed around the gathered upper end portion to form a tightening loop 94 and then passed through the loop 94. The looped end portion 86 is then firmly pulled to tighten the loop 94. It can be seen in Fig. 13 that after such tightening, an outer end section of the looped portion 86 defines a small carrying loop 96 through which one or more fingers may be inserted to conveniently carry the closed bag.

In the alternate embodiment 10_d of the bag and integral tie structure depicted in Fig. 15, a looped tie element 98 is provided which is similar to the tie element 82 of Fig. 12 except that the welded area 92 has an elongated slit 100 (or other suitably configured opening) formed therethrough, the slit 100 passing through the aligned outer end portions 102 and 104 of the tie element 98, and the side edge portion 20 of the bag 12 as depicted in Fig. 17. To close the gathered upper end portion 40 of the bag 12, the looped free end portion 106 of the tie element 98 is passed around the gathered upper end portion to form a tightening loop 108. The looped free end portion 106 is then passed through the slit 100 and firmly pulled to tighten the loop 108. In a manner similar to that described in conjunction with Fig. 13, this final step in the bag closing process provides a small carrying loop 96 by means of which the closed bag may be conveniently carried simply by inserting one or more fingers into the loop 96.

A further embodiment 10_a of the bag and integral tie element structure is illustrated in Fig. 18 and is provided with tie element 110 which is substantially identical to the tie element 98 depicted in Fig. 15 except that the free end portion of the tie element 110 does not have a looped configuration. Instead, such free end portion is defined by inner and outer strip sections 112 and 114 having aligned inner end portions 116 and 118 which are welded to each other and to the side edge portion 20 of the bag adjacent its upper end to form a welded area 120 through which an elongated slit 122 is formed as depicted in Fig. 20. To close the gathered upper end portion 40 of the bag 12, the inner strip section 112 is passed around the gathered upper end portion to form a tightening loop 124 (Fig. 19) and then is passed through the slit 122. The strip sections 112 and 114 are then firmly pulled in opposite directions to tighten the loop 124.

While each of the previously described tie element embodiments has been illustrated as being welded to the bag in a manner such that the free end portion of the particular tie element extends transversely to the side edge portions of the bag, any of these tie element embodiments could be alternatively secured to the bag so that the tie element extends generally parallel to one of the side edge portions of the bag. For example, as depicted in Fig. 21, the tie element 32 of Fig. 1 could have its welded strip end portion 36 secured to the side edge portion 20 of the bag 12 adjacent its top end 14 so that the free end portion 38 of the strip extends parallel to the side edge 28 of the bag. To close the gathered end portion of the bag 12, the free end portion 38 of the strip 34 would simply be moved to the horizontal, dotted line position 38_a and then wrapped around the gathered upper end portion of the bag as previously described. To facilitate the reorientation of the free strip end portion 38 to its transverse, dotted line position 38_a, the welded area 36 could be given a generally triangularly shaped configuration as illustrated in Fig. 21.

The variety of alternate tie element embodiments just described have in common an important feature of the present invention - namely the welding of a relatively large area end portion of the tie element to a side edge portion of its associated bag positioned adjacent its open upper end. More specifically, these relatively large area end portions of the tie elements (whether they are defined by single or double layers of plastic film material), and portions of the opposite plastic film layers which define a side edge portion of the bag, are weldingly intersecured to form a bag-tie element interconnection of sufficient strength to permit the free end portion of the particular tie element to be firmly

pulled to tighten a loop around the gathered upper end portion of the bag, to tightly close it, without causing separation of the tie element from the bag side edge portion at the welded area.

This feature is of particular importance in the tie element embodiments in which the free end portion of the tie element is simply passed through the tightening loop which such free end defines. In these instances, the tightening pull on the free end portion of the tie element exerts a force directly against the welded area in a manner tending to separate the tie element portion of such welded area from the bag portion thereof. However, by welding the tie element to the side edge portion of the bag in the previously described manner, this weld joint is made of sufficient strength to prevent separation of the tie element from the bag side edge portion during this important tightening process.

In this regard it should be noted that even in the tie element embodiments which incorporate the slit formed through the tie element-bag welded area, the bags may be alternately closed without passing the free end portion of the tie element through its provided slot or other aperture in the weld area. Instead, the free end portion of such tie elements may simply be wrapped around the gathered upper end portion of the bag to form a tightening loop and then passed through such tightening loop without using the aperture, if desired.

The plastic bag 12 described in conjunction with each embodiment of the bag and integral tie structure, is representatively depicted as having non-gusseted side edge portions defined by only two plastic film layers which meet at an outer side edge of the bag. However, the bag could also be formed with gusseted side edges so that the side edge portions of the bag would be defined by four layers of plastic film material. In this case, the inner end portions of the tie elements could be welded to two of the plastic film layers which define the gusseted side edge portions - such two layers being defined by an edge portions of one of the outer side walls of the bag and the next adjacent gusset layer.

Any of the representative plastic film tie element embodiments 32, 50, 66, 82, 98 and 110 may be quickly and easily secured to the bag 12 during its fabrication in a continuous, high speed bag forming process which will now be described with reference to Figs. 22 and 23 that schematically depict representative apparatus 130 for continuously forming the bags 12 and welding tie elements 32 thereto along a side portion thereof adjacent their upper ends.

In the bag forming apparatus 130, plastic film material is supplied to a suitable extruding die 132 and is heated therein while air is blown upwardly

through the die. The upward flow of air through the die forms a vertically extending blown plastic film tube 134 which is fed at its upper end through a pair of flattening rollers 136, 138 which flatten the tube 134 and forms therefrom a flattened film tube 140. The flattened tube 140 is pulled by drive rollers 142, 144 sequentially around guide rollers 146 and 148, through a suitable imprinter 150 used to form on the flattened tube 140 desired logos or other advertising indicia, and through a spaced apart pair of idler roller sets 152, 154 and 156, 158. As the flattened film tube 140 exits the drive rollers 142, 144 it is fed into a suitable packaging station 160 which packages in a desired fashion the bag and integral tie element structures formed by the apparatus 130 on the flattened film tube 140 in a manner subsequently described.

Positioned between the idler roller sets 152, 154 and 156, 158 is a cutting and welding station 162 which comprises a stationary anvil member 164 positioned beneath the flattened film tube 140, and a vertically reciprocable welding and cutting die element 166 aligned with the anvil 164 and positioned above the flattened film tube. The cutting and welding die 166 is provided along its lower face with an elongated heat welding element 168 and an elongated perforated cutline die 170 which is parallel thereto. As the flattened film tube 140 is longitudinally conveyed in a rightward direction, the cutting and welding die element 166 is caused to intermittently reciprocate to periodically press the flattened film tube 140 against the anvil 164 to form on the flattened film tube a longitudinally spaced series of adjacent lateral weld lines 26 and perforated cutlines 172. The weld lines 26 extend transversely between the side edges 28, 30 of the flattened film tube 140 and form the bottom enclosing weld lines on the illustrated individual bags 12_a, 12_b and 12_c (see Fig. 1), while the perforated cutlines 172 define the bottom end 24 of one bag and the upper end 14 of an immediately adjacent bag in the series of bags being continuously formed by the apparatus 130.

Referring now to Figs. 22-24, positioned downstream from the cutting and welding station 162 between the idler roller sets 152, 154 and 156, 158 is a tie element attachment station 174 which is adjacent the outer side edge 28 of the flattened film tube 140 and its associated outer side edge portion 20 defined by two layers of plastic film. As will be appreciated by reference to previously described drawing figures, the side edge 28 and the outer side edge portion 20 of the flattened film tube 140 define in each of the finished bags the similarly numbered side edge and outer side edge portion of the bag.

The tie element attachment station 174 includes a supply roll 176 of the plastic film strip

material 34_a, an opposed pair of feed rollers 178 and 180, a stationary anvil 182 positioned laterally outwardly from and slightly below the flattened film tube side edge 28, a vertically reciprocable heating and pressing element 184 positioned beneath the flattened film tube 140 adjacent its side edge 28, and a vacuum shuttle member 186 positioned above the flattened film tube 140 and horizontally reciprocable between its solid line and dotted line position in which the shuttle is respectively aligned with and positioned above the anvil 182 and the heating and pressing element 184.

As the flattened film tube 140 is being longitudinally conveyed toward the packaging station 160, the feed rollers 178, 180 pull a length of the strip material 34_a from the roll 176 corresponding to the length of the tie element 32 and feed it rightwardly onto the upper surface of the anvil 182. The shuttle 186 is then moved from its dotted line position to its solid line position over the anvil 182 and the anvil 182 is moved upwardly to press the delivered length of strip material 34_a against the undersurface of the shuttle 186. This causes a knife element 188 on the outer end of the shuttle 186 to sever the strip segment 34 from the balance of the rolled strip supply 34_a. It also causes aligned heating portions 190 and 192 in the anvil 182 and the shuttle 186 to preheat the strip end portion 36.

The holding vacuum in the shuttle 186 is then suitably energized to hold the strip 134 to the underside of the shuttle which is then moved rightwardly to its dotted line position, carrying the strip 34 with it. The anvil 182 is then lowered to its initial position. When the shuttle 186 reaches its dotted line position, the movement of the flattened film tube is temporarily halted and the heating and pressing element 184 is moved upwardly to press an outer lateral portion of the flattened film tube 140 between the elements 184 and the shuttle 186. With the elements 184 and 186 in this position, the shuttle heating element 192 and a horizontally aligned heating element 194 weld the preheated end portion 36 of the strip 34 to the outer side edge portion of the flattened film tube 140, thereby weldingly intersecuring the two layers of the outer side edge portion 20 and the preheated strip end portion 36. After this welding process is complete, the heating and pressing element 184 is lowered and the flattened film tube 140 (which was temporarily stopped during this tie element attachment process) is again moved toward the packaging station 160. When the appropriate tie element location on the next successive bag is brought into alignment with the attachment station 174, the flattened film tube 140 is stopped again and the next successive tie element is welded to the flattened film tube as just described.

An alternate embodiment 174_a of the tie element attachment station is schematically depicted in Fig. 25 and is utilized to attach to the individual bags the looped tie element 82 depicted in Fig. 12. The station 174_a includes the anvil 182, the heating an pressing element 184, and the vacuum shuttle 186 (from which the cutting knife 188 is removed). During operation of the station 174_a, a length of plastic film strip 84_a is fed from a supply roll 196 thereof beneath a holding roller 198 onto the outer peripheral surface of a rotatable vacuum holding wheel 200 whose internal vacuum holds the strip 84_a thereon as the wheel rotates. The outer circumference of the wheel is sized so that half of such circumference is equal to the desired total length of the strip 84 depicted in Fig. 12. When the wheel 200 is rotated one half revolution in a clockwise direction, a knife element 202 is moved downwardly into engagement with the wheel 200 to sever the film strip 84 from the coiled strip supply 84_a. After the strip 84 is severed, an internal pusher element 204 is moved radially outwardly through the wheel to push a longitudinal central portion of the severed strip 84 into the feed rollers 178, 180 which then feed the strip 84, in the desired doubled over configuration, onto the anvil 182. The shuttle 186 is then moved leftwardly from its dotted line position to its solid line position over the folded strip 84 and the anvil 182 is moved upwardly to press the strip 84 against the shuttle. At this point the anvil and shuttle heating elements 190, 192 preheat and weld together the aligned outer strip end portions 88, 90. The shuttle 186 is then moved rightwardly to its dotted line position, carrying the preheated strip 84 with it. The heating and pressing element 184 is then moved upwardly to cause the heating elements 192 and 194 to weldingly intersecure the preheated strip end portions 88, 90 and the two film layers of the outer side edge portion 20 of the flattened film tube 140.

Schematically illustrated in Fig. 26 is a further alternate embodiment 174_b of the tie element attachment station which is utilized to form and secure to each of the bags 12 a modified version 98_a (Fig. 27) of the looped tie element 98 shown in Fig. 15. The station 174_b includes the anvil 182, the heating and pressing element 184, the vacuum shuttle 186, and the drive rollers 178, 180. During operation of the station 174_b, the feed rollers 178, 180 simultaneously feed lengths of plastic film strip material 206_a and 206_b from supply rolls 210, 212 thereof onto the anvil 182. The upper film strip 206_a is of a relatively stiff plastic film material such as high density polyethylene, while the lower film strip 206_b is of a more flexible (but more easily weldable) material such as ethyl vinyl acetate. After the two lengths of the upper and lower film strip material 206_a and 206_b have been moved onto the

anvil 182, the anvil is moved upwardly to press the laterally aligned film strip segments against the shuttle 186 in its leftwardly extended position. As illustrated in Fig. 28, the upper surface of the heating portion 192 of the anvil 182 is provided with a transversely extending knife element 214 positioned generally intermediately along the heating area 190, and a V-shaped knife element 216 which is positioned to the left of the knife element 214 and has a point portion closely adjacent thereto.

Each upward stroke of the anvil heater portion 190 forms on the stacked film strips between the anvil and the shuttle a generally rectangular welded area 218 on a trailing end portion of the strip segments, and a generally triangularly shaped welded area 220 on the leading ends of such strip segments. As aligned lengths of the film strips 206_a and 206_b are intermittently fed onto the anvil 182 and pressed against the shuttle 186, it can be seen that successive tie elements 98_a are formed, the successive tie elements being separated by the knife element 214 at the juncture between the leading end welded area 220 of one of the tie elements and the trailing end welded area 218 on the tie element immediately adjacent thereto.

It can be seen that the cooperative action between the anvil 182 and the shuttle 186 not only forms this juncture area 218, 220 between successive tie elements 98_a, but also preheats and welds the end portion 218 of each tie element 98_a so that when the shuttle 186 carries the element 98_a rightwardly to position it over the flattened film tube 140, and the heating and pressing element 184 is moved upwardly, the heating elements 192 and 194 may more easily weldingly intersecure the preheated strip area 218 and the two plastic film layers which define the outer edge portion 20 of the flattened film tube 140 adjacent the upper end of each bag being formed. The positioning of the ethyl vinyl acetate film strip segment immediately adjacent the upper surface of the flattened film tube 140 further facilitates this welding process. To form the slit 100 depicted in Fig. 15, a suitable knife element (not shown) may be secured to the upper side of the heating element 194. The pointed weld area 220 on the leading end of the tie element 98_a facilitates the insertion of its free end portion into and through the slit 100.

Referring now to Fig. 29, a further alternate embodiment 174_c of the tie element attachment station may be utilized to form the dual strip tie element embodiment 110 depicted in Fig. 18. In this station embodiment, lengths of upper and lower plastic film strip material 114_a, 112_a are respectively pulled from supply rolls 222, 224 thereof by feed roller sets 226, 228 and 230, 232 and fed onto the anvil 182. The lower feed roller set 230, 232 is

operated at a slightly higher speed than the upper feed roller set 226, 228 so that when upper and lower strip segments 114, 112 are fed onto the anvil 182, the lower strip segment 112 projects rightwardly beyond the upper strip segment 114. This permits the vacuum shuttle 186 to catch both the lower and upper strip segments 112, 114 and carry them to above the flattened film tube 140.

As the anvil 182 is brought upwardly against the shuttle 186, a knife element 188 on the shuttle severs the upper and lower strip segments 114, 112, and the heating elements 190, 192 preheat and weld together the strip end portions 116 and 118. The shuttle 186 then carries the preheated tie element 110 to above the flattened film tube 140 whereupon the heating and pressing element 184 is moved upwardly to weld the outer side edge portion 20 to the preheated and welded end portion area of the tie element 110. The slit 122 and the tie element 110 (Fig. 18) is formed by a knife element (not shown) suitably positioned on the heating element 194. If desired, the coiled film strips 114_a and 112_a may be respectively formed from the previously described high density polyethylene and more flexible ethyl vinyl acetate materials to facilitate both the welding process and the ability of the tie element 110 to hold its associated bag in a closed position.

To connect, for example, the tie elements 32 to their associated bags 12 so that the tie element extends parallel to the bag side edge 28, the tie element attachment station 174 is modified so that the shuttle 186 is pivotable between its solid and dotted line positions depicted in Fig. 30. In its solid line position, the shuttle 186 is disposed over its associated anvil 182 onto which the plastic film strips 34 are fed as previously described. When the shuttle picks up the preheated and severed film strip 34, it is simply pivoted to its dotted line position over the flattened film tube 140 adjacent its side edge 28. The heating and pressing element 184 is then moved upwardly toward the pivotally repositioned shuttle to operate therewith to weld the tie element 32 to its associated bag 12.

In each of the previously described embodiments of the tie element attachment station 174, a two step process was used to form and preheat the tie elements and then move the formed and preheated tie elements into welding position and then weld the tie elements to their associated bags. If desired, however, these tie element forming and welding steps may be simultaneously performed as will now be described with initial reference to Fig. 31 which depicts a further embodiment 174_d of the tie element attachment station. For purposes of illustration, the simultaneous formation and welding to the flattened film tube 140 of a single strip tie element 32 (Fig. 3) will be described.

The station 174_d includes an elongated receiving channel member 234 which has an open bottom area and is positioned over the flattened film tube 140. Channel 234 extends transversely to the flattened tube 140 and has a left end 236 positioned immediately to the right of the side edge portion 20 of the flattened tube. Operatively connected to the upper side of the channel 234, and communicating with its interior, is a vacuum holding element 238. Connected to the left end of the holding element 238, and overlying the edge portion 20, is a heating element 240. Heating element 240 is aligned with a vertically reciprocable heating element 242 positioned beneath the side edge portion 20.

During operation of the attachment station 174_d, the feed rollers 178, 180 feed a length of the plastic film strip 34_a from its supply roll 176 toward the receiving channel 234. A jet of air 244 formed by a small nozzle member 246 is flowed between the rightwardly moving strip 34_a exiting the feed rollers and the undersurfaces of the holding element 238 and the heating element 240 to create a relatively low pressure area above the rightwardly moving strip, thereby holding it relatively close to the upper side of the channel 234 as it advances toward the right end of the channel.

When the strip segment 34 reaches the right end of the channel 234, the nozzle 246 is deactivated and a vacuum is formed within the member 238 to hold the strip segment 34 against it. The lower heating element 242 is then moved upwardly to cause a knife element 248 thereon to sever the film strip 34 and, in cooperation with the upper heating element 240, to simultaneously weld the severed strip 34 to the side edge portion 20 of the flattened film tube 140, thereby operatively positioning the tie element 32 thereon.

As another example of this in situ formation of and welding to one of the bags of a tie element, a looped tie element 98_a (Fig. 27) may be secured to each of the bags by means of a slightly modified version 174_e (Fig. 32) of the in situ tie-forming and welding apparatus depicted in Fig. 31. In the apparatus 174_e, the lower heating element 242 is replaced with a heating and cutting element 250 similar in configuration and operation to the anvil heating portion 190 of Fig. 28. In this embodiment, the portion of the element 250 containing the V-knife cutting segment is offset outwardly from the side edge 28 of the flattened film tube 140. After the feed rollers 178, 180 have fed appropriate lengths of the film strips 206_a and 206_b from their supply rolls 210, 212 into the receiving channel 234, the heating and cutting element 250 is moved upwardly against the upper heating element 240 to simultaneously sever the lead tie element 98_a from its supply strip portions, weld the inner end portion

to a teen of the tie element 98_a to the outer edge portion 20 of the flattened film tube 140, and form the triangularly shaped welded outer end portion 220 of the next successive tie element 98_a.

It can be seen from the foregoing that the present invention provides methods for forming a variety of alternatively configured plastic film tie elements, and for rapidly and very securely welding the tie elements to the side edge portion 20 of the longitudinally conveyed flattened film tube 140 at positions adjacent what will be the upper ends of the sequentially formed individual bags 12. These various representative methods of attaching the tie elements to the individual plastic film bags permit the maintenance of the necessary high speed, high volume bag production necessary to economically produce the bags 12. The relatively simple mechanisms used to feed, form and weld the tie elements do not substantially increase the finished cost of the bag and integral tie element structures compared to the cost of the bags themselves. Accordingly, the present invention advantageously and relatively inexpensively provides a disposable plastic film bag which may be easily and more conveniently closed than conventional bags of this general type having separate tie elements which are easily lost, or attached tie members of more complex construction.

The foregoing detailed description is to be clearly understood as being given by way of illustration and example only, the scope of the present invention being limited solely by the appended claims.

Claims

1. A method of continuously forming plastic film bags having integral, ready-to-use top tie elements, said method comprising the steps of longitudinally conveying an elongated plastic film element at least partially defined by a duality of opposed plastic film sheets extending across the width of said plastic film element; delimiting on the plastic film element a series of individual bags (12) having an upper end (14), a pair of side edge portions (20,22) defined by a plurality of plastic film layers, and a pair of opposite side walls (16,18) extending between said side edge portions (20,22); forming a series of elongated plastic tie elements (32) having a relatively large inner end portion (36), a free outer end portion (38), and a longitudinally intermediate portion extending between said inner and outer end portions; positioning one of said series of elongated plastic tie elements (32) in overlapping relationship with a side surface of one of said side edge portions of said bag adjacent the upper end

portion (14) of each bag and weldingly inter-securing a portion of each of the series of elongated film tie elements (32) and at least two film layers (16a,18a) of side edge portions of each of the bags adjacent their upper ends, to leave on each plastic film tie element a free outer end portion (38) to use in closing a bag, characterized in that;

the relatively large inner end portion (36) of each tie element (32) is positioned directly over and weldingly intersecured to said at least two film layers (16a,18a) of the side edge portion (20) of a bag in such manner that the free outer end portion (38) of the tie element (32) may be looped around an upper end portion (40) of the bag, passed through the loop (42) and then firmly pulled to constrict around, frictionally engage and tightly close such upper end portion, without separating the welded inner end portion (36) of the tie element (32) from its bag (12).

2. The method of claim 1 further characterized in that said step of longitudinally conveying is performed utilizing an elongated section of flattened plastic film tubing.
3. The method of claim 1 or 2 characterized in that said step of weldingly intersecuring is performed subsequent to said delimiting step.
4. The method of any one of claims 1 to 3 characterized in that said plastic film element has a pair of opposite side edge portions which define said opposite side edge portions of said plastic film bags.
5. The method of any of claims 1 to 4 characterized in that said plastic film element is formed from strips (34) of relatively thin plastic film material.
6. The method of any one of claims 1 to 5 characterized in that said method further comprises the step of forming an aperture (58) through each of said relatively large end portion areas (54) of said tie elements (50), and the film layers (16a,18a) intersecured therewith, each of said apertures (58) being sized to permit its associated tie element free end portion (56) to be passed therethrough.
7. The method of claim 6 characterized in that said method further comprises the step of configuring each of said apertures (58) in a manner causing it to inhibit withdrawal therethrough of its associated tie element free end portion (56) once such free end portion (56) has ini-



to a teen of the tie element 98_a to the outer edge portion 20 of the flattened film tube 140, and form the triangularly shaped welded outer end portion 220 of the next successive tie element 98_a.

It can be seen from the foregoing that the present invention provides methods for forming a variety of alternatively configured plastic film tie elements, and for rapidly and very securely welding the tie elements to the side edge portion 20 of the longitudinally conveyed flattened film tube 140 at positions adjacent what will be the upper ends of the sequentially formed individual bags 12. These various representative methods of attaching the tie elements to the individual plastic film bags permit the maintenance of the necessary high speed, high volume bag production necessary to economically produce the bags 12. The relatively simple mechanisms used to feed, form and weld the tie elements do not substantially increase the finished cost of the bag and integral tie element structures compared to the cost of the bags themselves. Accordingly, the present invention advantageously and relatively inexpensively provides a disposable plastic film bag which may be easily and more conveniently closed than conventional bags of this general type having separate tie elements which are easily lost, or attached tie members of more complex construction.

The foregoing detailed description is to be clearly understood as being given by way of illustration and example only, the scope of the present invention being limited solely by the appended claims.

Claims

1. A method of continuously forming plastic film bags having integral, ready-to-use top tie elements, said method comprising the steps of longitudinally conveying an elongated plastic film element at least partially defined by a duality of opposed plastic film sheets extending across the width of said plastic film element; delimiting on the plastic film element a series of individual bags (12) having an upper end (14), a pair of side edge portions (20,22) defined by a plurality of plastic film layers, and a pair of opposite side walls (16,18) extending between said side edge portions (20,22); forming a series of elongated plastic tie elements (32) having a relatively large inner end portion (36), a free outer end portion (38), and a longitudinally intermediate portion extending between said inner and outer end portions; positioning one of said series of elongated plastic tie elements (32) in overlapping relationship with a side surface of one of said side edge portions of said bag adjacent the upper end portion (14) of each bag and weldingly intersecuring a portion of each of the series of elongated film tie elements (32) and at least two film layers (16a,18a) of side edge portions of each of the bags adjacent their upper ends, to leave on each plastic film tie element a free outer end portion (38) to use in closing a bag, characterized in that;
 2. The method of claim 1 further characterized in that said step of longitudinally conveying is performed utilizing an elongated section of flattened plastic film tubing.
 3. The method of claim 1 or 2 characterized in that said step of weldingly intersecuring is performed subsequent to said delimiting step.
 4. The method of any one of claims 1 to 3 characterized in that said plastic film element has a pair of opposite side edge portions which define said opposite side edge portions of said plastic film bags.
 5. The method of any of claims 1 to 4 characterized in that said plastic film element is formed from strips (34) of relatively thin plastic film material.
 6. The method of any one of claims 1 to 5 characterized in that said method further comprises the step of forming an aperture (58) through each of said relatively large end portion areas (54) of said tie elements (50), and the film layers (16a,18a) intersecured therewith, each of said apertures (58) being sized to permit its associated tie element free end portion (56) to be passed therethrough.
 7. The method of claim 6 characterized in that said method further comprises the step of configuring each of said apertures (58) in a manner causing it to inhibit withdrawal therethrough of its associated tie element free end portion (56) once such free end portion (56) has ini-



tially been inserted in and pulled through the aperture (58).

8. The method of claim 7 characterized in that each of said elongated plastic film tie elements (50) has a transverse width, and

said step of forming an aperture is performed by forming an elongated slit (58) through each of said relatively large end portion areas (54) of said tie elements (50) and the film layers (16a,18a) intersecured therewith, each of said slits (58) having a length less than the width of its associated tie element free end portion (56).

9. The plastic bag and integral tie element structure formed by the method of any one of claims 1 through 8.

10. A plastic film bag comprising:

an open upper end (14);

a closed lower end (24);

a pair of opposite side edge portions (20,22) each defined by a plurality of plastic film layers (16a,18a);

a pair of opposite side walls (16,18) interconnecting said side edge portions (20,22) and said lower end (24);

a plastic film tie element (32) having a relatively large inner end portion (36) and a free outer end portion (38) positioned in overlapping relationship with a side surface of one of said side edge portions (20) and weldingly intersecured to two film layers (16a,18a) of said side edge portion (20) of the bag (12) adjacent its upper end (14), characterized in that;

the inner end portion (36) of the tie element (32) has an inner end edge abutting one of said opposite side edge portions (20,22) adjacent the upper end (14) of the bag (12), a substantial part of said relatively large end portion (36), including a section closely adjacent said inner end edge, being weldingly intersecured with at least two plastic film layers (16a,18a) of one of said side edge portions (20) with sufficient strength to permit a remaining free outer end portion (38) of the tie element (32) to be passed around an upper end portion (40) of the bag (12) to form a loop (42) therearound, passed through the loop, and then firmly pulled by the free outer end portion (38) to tighten the loop (42) and close the bag (12) without separating the welded relatively large inner end portion (36) of the tie element (32) from the bag (12);

said plastic film tie element (32) having sufficient pliability to cause the tightened loop

to frictionally engage the upper bag end (14) and hold it closed when the free outer end portion (38) of the tie element (32) is released.

11. The plastic film bag of claim 10 characterized in that said plastic film tie element (32) is an elongated single strip (34) of plastic film material having a free end portion defining said free outer end portion (38) of said tie element (32).

12. The plastic film bag of claim 11 characterized in that said single strip (44) of plastic film material has a relatively stiff first layer (46), and a more flexible second layer (48), said second layer (48) having an end portion weldingly intersecured with an outermost one of said at least two layers (16a,18a) of one of said side edge portions (20).

13. The plastic film bag of claim 12 characterized in that said second layer (48) has a higher coefficient of friction than that of said first layer (46).

14. The plastic film bag of claim 12 or 13 characterized in that said first layer (46) is of a high density polyethylene material, and

said second layer (48) is of an ethyl vinyl acetate material.

15. The plastic film bag of claim 10 characterized in that said plastic film tie element (82) comprises a single strip (84) of plastic material having contiguous outer end portions (88,90) combinatively defining said relatively large end portion area of said tie element (82), and a looped central portion (86) defining said free end portion of said tie element (82).

16. The plastic film bag of any one of claims 10 to 15 characterized in that said plastic film tie element (110) comprises a duality of separate plastic film strips (112,114) having contiguous inner end portions (116,118) combinatively defining said relatively large end portion area of said tie element (110).

17. The plastic film bag of claim 16 characterized in that said duality of separate plastic film strips (112,114) have intersecured outer end portions spaced apart from said inner end portions thereof.

18. The plastic film bag of any one of claims 10 to 17 characterized in that said end portion area (70) of said tie element (66) has a central portion which is unsecured to said one of said



- side edge portions (20) and defines therewith a gap (76) through which said free end portion (78) of said tie element (66) may be passed to effect closure of said upper end (40) of the bag (12).
19. The plastic bag of one of claims 10 to 18 characterized in that the thickness of said plastic film tie element is no more than approximately three times the film thickness of the balance of said bag (12).
20. A plastic film bag comprising:
 an open upper end (14);
 a closed lower end (24);
 a pair of opposite side edge portions (20,22) each defined by a plurality of plastic film layers (16a,18a);
 a pair of opposite side walls (16,18) interconnecting said side edge portions (20,22) and said lower end (24);
 a plastic film tie element (50) having a relatively large inner end portion (54) and a free outer end portion (56) positioned in overlapping relationship with a side surface of one of said edge portions (20) and weldingly secured to two film layers (16a,18a) of said side edge portion (20) of the bag (12) adjacent its upper end (14), characterized in that:
 a relatively large end portion area (54) of said tie element (50) is weldingly intersecured to form a multi-layer weld area of substantial size in such a manner that the elongated free end portion (56) may be firmly pulled without separating the weld area, the elongated free end portion (56) of said plastic film tie element (50) extending outwardly from said multi-layer weld area; and
 an aperture (58) is formed through said multi-layer weld area and adapted to have passed therethrough said free end portion (56) of said tie element (50) whereby an upper end portion (40) of said bag (12) may be tightly closed by passing said free end portion (56) of said tie element (50) around said upper end portion to form a loop (60) therearound, passing said free end portion through said aperture (58), and then pulling on said free end portion (56) to tighten the loop (60) around said upper end portion.
21. The plastic film bag of claim 20 characterized in that said aperture (58) is sized to cause lateral foreshortening and gathering (62) of said free end portion (56) as it is pulled through said aperture (58).
22. The plastic film bag of claim 21 characterized in that said aperture is an elongated slit (58) having a length shorter than the transverse width (52) of said elongated free end portion (56) of said tie element (50).
23. The plastic film bag of any one of claims 20 to 22 characterized in that said multi-layer weld area has a deformed portion (64) circumscribing and reinforcing the periphery of said aperture.
24. The plastic film bag of any one of claims 20 to 23 characterized in that said plastic film tie element is an elongated single strip (52) of plastic film material having a free end portion (56) defining said free end portion of said tie element.
25. The plastic film bag of claim 24 characterized in that said single strip of plastic film material has a relatively stiff first layer (46), and a more flexible second layer (48), said second layer (48) having an end portion weldingly intersecured with an outermost one of said at least two layers (16a,18a) of one of said side edge portions.
26. The plastic film bag of claim 25 characterized in that said first layer (46) is of a high density polyethylene material, and
 said second layer (48) is of an ethyl vinyl acetate material.
27. The plastic film bag of one of claims 20 to 26 characterized in that said plastic film tie element (98) comprises a single strip of plastic film material having contiguous outer end portions (102,104) combinatively defining said relatively large end portion area (92) of said tie element, and a looped central portion (106) defining said free end portion of said tie element.
28. The plastic film bag of any one of claims 20 to 27 characterized in that said plastic film tie element (110) comprises a duality of separate plastic film strips (112,114) having contiguous inner end portions (116,118) combinatively defining said relatively large end portion area of said tie element.
29. The plastic film bag of claim 28 characterized in that said duality of separate plastic film strips (112,114) have intersecured outer end portions spaced apart from said inner end portions thereof.



30. A high speed, continuous method of forming plastic bags with integral top tie elements, said method comprising the steps of:

longitudinally conveying an elongated plastic film element (140) through bag forming apparatus adapted to form therefrom a series of individual plastic film bags (12), said plastic film element having opposite side edge portions (20,22) each defined by a plurality of plastic film layers (16a,18a;16b,18b), said opposite side edge portions of said plastic film elements defining opposite side edge portions (16a,18a;16b,18b) in each of the individual bags in said series thereof;

feeding lengths (34a,84a) of plastic film strip material from at least one supply roll (176) thereof;

successively severing lengths (34,84) of plastic film strip material from said at least one supply roll;

positioning a length of plastic film strip material (34,84) over the side edge portion (20) of plastic film element (140) adjacent the top of each successive one of the series of bags (12) and attaching the length of plastic film strip (34,84) near the top of each bag to form a top tie element, characterized in that:

relatively large end portion areas (36,92) of the severed lengths of plastic film strip material (34,84) are sequentially weldingly inter-secured to at least two plastic film layers (16a,18a) of one of said side edge portions (20,22) of said plastic film element (140) at longitudinally spaced positions thereon adjacent locations (172) corresponding to the upper ends (14) of the finished individual bags (12) to thereby provide each of the finished bags (12) with a plastic top tie element (32,82) secured at one end thereof to the bag (12) along a relatively large multi-layer weld area (36,92) disposed on a side edge portion (20,22) of the bag adjacent its upper end (14), each of said tie elements (32,82) having an elongated free outer end portion (38,86) extending outwardly from its associated multi-layer weld area, the welding being performed in such a manner that the elongated free outer end portion (38,86) may be firmly pulled without separating the weld area.

31. The method of claim 30 characterized in that:

an aperture (58,100) is formed through each of said multi-layer weld areas, each of said apertures (58,100) being configured to permit its associated tie element free end portion (56,106) to be passed therethrough.

32. The method of claim 30 or 31 characterized in that:

said severing step is performed prior to said weldingly intersecuring step, and

said method further comprises the step, performed between said severing and weldingly intersecuring steps, of moving the severed lengths of plastic film strip material (34,84) from severing positions to welding positions.

33. The method of claim 30 or 31 characterized in that:

said severing and weldingly intersecuring steps are performed essentially simultaneously.

34. The method of any one of claims 30 to 33 characterized in that:

said relatively large end portion areas of the lengths of plastic film strip material (34,84) are preheated prior to performing said weldingly intersecuring step.

Patentansprüche

1. Verfahren zum kontinuierlichen Bilden von Kunststofffilmbeuteln mit integrierten, gebrauchsfertigen oberen Bindeelementen, folgende Schritte aufweisend: Befördern eines länglichen Kunststofffilmelements in Längsrichtung, das zumindest teilweise durch eine Dualität von einander gegenüberliegenden Kunststofffilm-Flachmaterialstücken, die sich über die Breite des Kunststofffilmelements erstrecken, definiert ist; Abgrenzen einer Reihe einzelner Beutel (12) auf dem Kunststofffilmelement, die ein oberes Ende (14) besitzen, ein Paar Seitenkantenbereiche (20,22), die durch eine Mehrzahl an Kunststofffilmschichten definiert sind, und ein Paar sich gegenüberliegender Seitenwände (16,18), die sich zwischen den Seitenkantenbereichen (20,22) erstrecken; Bilden einer Reihe länglicher Kunststoffbindeelemente (32), die einen relativ großen inneren Endbereich (36) besitzen, einen freien äußeren Endbereich (38) und einen in Längsrichtung mittigen Bereich, der sich zwischen den inneren und äußeren Endbereichen erstreckt; Anordnen eines aus der Reihe länglicher Kunststoffbindeelemente (32) in überlappender Beziehung mit einer Seitenoberfläche eines der Seitenkantenbereiche des Beutels, in der Nähe des oberen Endbereichs (14) eines jeden Beutels, und durch Schweißen aneinander Befestigen eines Bereichs eines jeden aus der Reihe der länglichen Filmbindeelemente (32) und mindestens zweier Filmschichten (16a,18a) von Seitenkantenbereichen eines jeden der Beutel



- in der Nähe ihrer oberen Enden, um an jedem Kunststoffilmbindeelement einen freien äußeren Endbereich (38) zur Verwendung beim Verschließen eines Beutels zu belassen, **dadurch gekennzeichnet**, daß der relativ große innere Endbereich (36) eines jeden Bindeelements (32) direkt über den mindestens zwei Filmschichten (16a,18a) des Seitenkantenbereichs (20) eines Beutels angeordnet und durch Schweißen dergestalt an ihnen befestigt wird, daß der freie äußere Endbereich (38) des Bindeelements (32) um einen oberen Endbereich (40) des Beutels geschlungen, durch die Schlinge (42) geführt und dann fest angezogen werden kann, um sich um diesen oberen Endbereich zusammenzuziehen, mit ihm im Reibschluß zu stehen und ihn dicht zu verschließen, ohne den verschweißten inneren Endbereich (36) des Bindeelements (32) von seinem Beutel (12) abzutrennen.
2. Verfahren nach Anspruch 1, weiterhin **dadurch gekennzeichnet**, daß der Schritt des Beförderns in Längsrichtung unter Verwendung eines länglichen Teils eines flachgemachten Kunststofffilmschlauchs durchgeführt wird.
 3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet**, daß der Schritt des Befestigens durch Schweißen nach dem Abgrenzschritt durchgeführt wird.
 4. Verfahren nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet**, daß das Kunststoffilmelement ein Paar gegenüberliegender Seitenkantenbereiche besitzt, die die einander gegenüberliegenden Seitenkantenbereiche der Kunststoffilmbeutel definieren.
 5. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet**, daß das Kunststoffilmelement aus Streifen (34) eines relativ dünnen Kunststoffilmmaterials gebildet ist.
 6. Verfahren nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet**, daß das Verfahren weiterhin aufweist den Schritt des Bildens einer Öffnung (58) durch jede der relativ großen Endbereichsflächen (54) der Bindeelemente (50) und die an ihnen befestigten Filmschichten (16a,18a), wobei jede der Öffnungen (58) in einer Größe angefertigt wird, die es erlaubt, daß ihr zugehöriger freier Bindeelement-Endbereich (56) durch sie hindurchgeführt werden kann.
 7. Verfahren nach Anspruch 6, **dadurch gekennzeichnet**, daß das Verfahren weiterhin aufweist den Schritt der Gestaltung einer jeden der Öffnungen (58) derart, daß hierdurch die betreffende Öffnung ein Zurückziehen ihres zugehörigen freien Bindeelement-Endbereichs (56) durch sie hemmt, sobald ein solcher freier Endbereich (56) zu Beginn in die Öffnung (58) eingeführt und durch sie gezogen wurde.
 8. Verfahren nach Anspruch 7, **dadurch gekennzeichnet**, daß jedes der länglichen Kunststoffilm-Bindeelemente (50) eine Breite in Querrichtung besitzt, und daß der Schritt des Bildens einer Öffnung durchgeführt wird durch Bilden eines länglichen Schlitzes (58) durch jede der relativ großen Endbereichsflächen (54) des Bindeelements (50) und der daran befestigten Filmschichten (16a,18a), wobei jeder der Schlitz (58) eine Länge von weniger als der Breite seines zugehörigen freien Bindeelement-Endbereichs (56) besitzt.
 9. Struktur aus Kunststoffbeutel und integriertem Bindeelement, gebildet nach dem Verfahren gemäß einem der Ansprüche 1 bis 8.
 10. Kunststoffilmbeutel, aufweisend: ein offenes oberes Ende (14); ein geschlossenes unteres Ende (24); ein Paar einander gegenüberliegender Seitenkantenbereiche (20,22), jeder durch eine Mehrzahl an Kunststoffilmschichten (16a,18a) definiert; ein Paar einander gegenüberliegender Seitenwände (16,18), die die Seitenkantenbereiche (20,22) und das untere Ende (24) verbinden; ein Kunststoffilm-Bindeelement (32) mit einem relativ großen inneren Endbereich (36) und einem freien äußeren Endbereich (38), das in überlappender Beziehung mit einer Seitenoberfläche eines der Seitenkantenbereiche (20) angeordnet und durch Schweißen an zwei Filmschichten (16a,18a) des Seitenkantenbereichs (20) des Beutels (12) in der Nähe seines oberen Endes (14) befestigt ist, **dadurch gekennzeichnet**, daß der innere Endbereich (36) des Bindeelements (32) eine innere Endkante hat, die an einen der einander gegenüberliegenden Seitenkantenbereiche (20,22) in der Nähe des oberen Endes (14) des Beutels (12) angrenzt, wobei ein wesentlicher Teil des relativ großen Endbereichs (36) einschließlich eines der inne-



- ren Endkante nahe benachbarten Abschnitts mit mindestens zwei Kunststofffilmschichten (16a,18a) eines der Seitenkantenbereiche (20) durch Schweißen mit ausreichender Festigkeit verbunden ist, um zu erlauben, daß ein verbleibender freier äußerer Endbereich (38) des Bindeelements (32) um einen oberen Endbereich (40) des Beutels (12) herumgeführt wird, um darum herum eine Schlinge (42) zu bilden, durch die Schlinge geführt und dann mittels des freien äußeren Endbereichs (38) fest angezogen wird, um die Schlinge (42) anzuziehen und den Beutel (12) zu schließen, ohne den geschweißen, relativ großen inneren Endbereich (36) des Bindeelements (32) von dem Beutel (12) zu trennen; wobei das Kunststoffilm-Bindeelement (32) eine ausreichende Biegsamkeit besitzt, um die angezogene Schlinge dazu zu veranlassen, mit dem oberen Beutelende (14) in Reibschluß zu gelangen und es geschlossen zu halten, wenn der freie äußere Endbereich (38) des Bindeelements (32) freigegeben wird.
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11. Kunststoffilmbeutel nach Anspruch 10, **dadurch gekennzeichnet**, daß das Kunststoffilm-Bindeelement (32) ein länglicher Einzelstreifen (34) aus Kunststoffilmmaterial ist mit einem freien Endbereich, der den freien äußeren Endbereich (38) des Bindeelements (32) definiert.
12. Kunststoffilmbeutel nach Anspruch 11, **dadurch gekennzeichnet**, daß der Einzelstreifen (44) aus Kunststoffilmmaterial eine relativ steife erste Schicht (46) besitzt und eine flexiblere zweite Schicht (48), wobei die zweite Schicht (48) einen Endbereich hat, der mit einer äußersten der mindestens zwei Schichten (16a,18a) eines der Seitenkantenbereiche (20) durch Schweißen verbunden ist.
13. Kunststoffilmbeutel nach Anspruch 12, **dadurch gekennzeichnet**, daß die zweite Schicht (48) einen höheren Reibungskoeffizienten hat als die erste Schicht (46).
14. Kunststoffilmbeutel nach Anspruch 12 oder 13, **dadurch gekennzeichnet**, daß die erste Schicht (46) aus einem Polyethylenmaterial hoher Dichte besteht, und die zweite Schicht (48) aus einem Ethylvinylacetat-Material besteht.
15. Kunststoffilmbeutel nach Anspruch 10, **dadurch gekennzeichnet**, daß das Kunststoffilm-Bindeelement (82) einen Einzelstreifen (84) aus Kunststoffmaterial mit sich berührenden äußeren Endbereichen (88,90) aufweist, die in Kombination die relativ große Endbereichsfläche des Bindeelements (82) definieren, und einem Schlingen-Zentralbereich (86), der den freien Endbereich des Bindeelements (82) definiert.
16. Kunststoffilmbeutel nach einem der Ansprüche 10 bis 15, **dadurch gekennzeichnet**, daß das Kunststoffilm-Bindeelement (110) eine Dualität getrennter Kunststoffilmstreifen (112,114) aufweist mit sich berührenden inneren Endbereichen (116,118), die in Kombination die relativ große Endbereichsfläche des Bindeelements (110) definieren.
17. Kunststoffilmbeutel nach Anspruch 16, **dadurch gekennzeichnet**, daß die Dualität getrennter Kunststoffilmstreifen (112,114) aneinander befestigte äußere Endbereiche besitzt, räumlich beabstandet von ihren inneren Endbereichen.
18. Kunststoffilmbeutel nach einem der Ansprüche 10 bis 17, **dadurch gekennzeichnet**, daß die Endbereichsfläche (70) des Bindeelements (66) einen Zentralbereich hat, der nicht befestigt ist an dem einen der Seitenkantenbereiche (20) und mit diesem einen Spalt (76) definiert, durch den der freie Endbereich (78) des Bindeelements (66) hindurchgeführt werden kann, um das Schließen des oberen Endes (40) des Beutels (12) zu bewirken.
19. Kunststoffilmbeutel nach einem der Ansprüche 10 bis 18, **dadurch gekennzeichnet**, daß die Dicke des Kunststoffilm-Bindeelements nicht mehr als etwa die dreifache Filmdicke des Rests des Beutels (12) beträgt.
20. Kunststoffilmbeutel, aufweisend:
ein offenes oberes Ende (14),
ein geschlossenes unteres Ende (24);
ein Paar einander gegenüberliegende Seitenkantenbereiche (20,22), jeder definiert durch eine Mehrzahl an Kunststoffilmschichten (16a,18a);
ein Paar einander gegenüberliegende Seitenwände (16,18), die die Seitenkantenbereiche (20,22) und das untere Ende (24) verbinden;
ein Kunststoffilm-Bindeelement (50) mit einem relativ großen inneren Endbereich (54) und einem freien äußeren Endbereich (56), das in



- überlappender Beziehung mit einer Seitenoberfläche eines der Seitenkantenbereiche (20) angeordnet und durch Schweißen an zwei Filmschichten (16a,18a) des Seitenkantenbereichs (20) des Beutels (12) in der Nähe seines oberen Endes (14) befestigt ist, **dadurch gekennzeichnet**, daß: eine relativ große Endbereichsfläche (54) des Bindeelements (50) durch Schweißen befestigt ist, um einen Vielschicht-Schweißbereich wesentlicher Größe dergestalt auszubilden, daß der längliche freie Endbereich (56) fest angezogen werden kann, ohne den Schweißbereich abzutrennen, wobei der längliche freie Endbereich (56) des Kunststoffilm-Bindeelements (50) sich von dem Vielschicht-Schweißbereich nach außen erstreckt; und eine Öffnung (58) durch den Vielschicht-Schweißbereich ausgebildet ist und geeignet ist, daß durch sie der freie Endbereich (56) des Bindeelements (50) hindurchgeführt wird, wodurch ein oberer Endbereich (40) des Beutels (12) dicht geschlossen werden kann, indem man den freien Endbereich (56) des Bindeelements (50) um den oberen Endbereich zur Bildung einer Schlinge (60) um ihn herumführt, den oberen Endbereich durch die Öffnung (58) führt und dann an dem freien Endbereich (56) zieht, um die Schlinge (60) um den oberen Endbereich zusammenzuziehen.
21. Kunststoffilmbeutel nach Anspruch 20, **dadurch gekennzeichnet**, daß die Öffnung (58) größtmäßig so ausgebildet ist, daß sie ein Verkürzen in seitlicher Richtung und Ankrausen (62) des freien Endbereichs (56) bewirkt, wenn er durch die Öffnung (58) gezogen wird.
22. Kunststoffilmbeutel nach Anspruch 21, **dadurch gekennzeichnet**, daß die Öffnung ein länglicher Schlitz (58) ist, mit einer Länge, die kürzer ist als die Breite (52) in Querrichtung des länglichen freien Endbereichs (56) des Bindeelements (50).
23. Kunststoffilmbeutel nach einem der Ansprüche 20 bis 22, **dadurch gekennzeichnet**, daß der Vielschicht-Schweißbereich einen verformten Bereich (64) besitzt, der die Umgebung der Öffnung umgibt und verstärkt.
24. Kunststoffilmbeutel nach einem der Ansprüche 20 bis 23, **dadurch gekennzeichnet**, daß das Kunststoffilm-Bindeelement ein länglicher Einzelstreifen (52) aus Kunststoffilmmaterial ist mit einem freien Endbereich (56), der den freien Endbereich des Bindeelements definiert.
25. Kunststoffilmbeutel nach Anspruch 24, **dadurch gekennzeichnet**, daß der Einzelstreifen aus Kunststoffilmmaterial eine relativ steife erste Schicht (46) und eine flexiblere zweite Schicht (48) besitzt, wobei die zweite Schicht (48) einen Endbereich hat, der durch Schweißen mit einer äußersten der mindestens zwei Schichten (16a,18a) eines der Seitenkantenbereiche verbunden ist.
26. Kunststoffilmbeutel nach Anspruch 25, **dadurch gekennzeichnet**, daß die erste Schicht (46) aus einem Polyethylenmaterial hoher Dichte und die zweite Schicht (48) aus einem Ethylvinylacetat-Material ist.
27. Kunststoffilmbeutel nach einem der Ansprüche 20 bis 26, **dadurch gekennzeichnet**, daß das Kunststoffilm-Bindeelement (98) einen Einzelstreifen aus Kunststoffilm-Material aufweist mit sich berührenden äußeren Endbereichen (102,104), die in Kombination die relativ große Endbereichsfläche (92) des Bindeelements definieren, und einem Schlingen-Zentralbereich (106), der den freien Endbereich des Bindeelements definiert.
28. Kunststoffilmbeutel nach einem der Ansprüche 20 bis 27, **dadurch gekennzeichnet**, daß das Kunststoffilm-Bindeelement (110) eine Dualität getrennter Kunststoffilmstreifen (112,114) aufweist, mit sich berührenden inneren Endbereichen (116,118), die in Kombination die relativ große Endbereichsfläche des Bindeelements definieren.
29. Kunststoffilmbeutel nach Anspruch 28, **dadurch gekennzeichnet**, daß die getrennten Kunststoffilmstreifen (112,114) der Dualität aneinander befestigte äußere Endbereiche besitzen, räumlich beabstandet von ihren inneren Endbereichen.
30. Kontinuierliches Hochgeschwindigkeitsverfahren zur Bildung von Kunststoffbeuteln mit integrierten oberen Bindeelementen, folgende Schritte aufweisend:
Befördern eines länglichen Kunststoffilmelements (140) in Längsrichtung durch eine Beutelbildungsvorrichtung, die dazu geeignet ist, daraus eine Reihe einzelner Kunststoffilmbeu-



tel (12) zu bilden, wobei das Kunststofffilmelement einander gegenüberliegende Seitenkantenbereiche (20,22) besitzt, die jeweils durch eine Mehrzahl an Kunststofffilmschichten (16a,18a;16b,18b) definiert sind, und wobei die einander gegenüberliegenden Seitenkantenbereiche des Kunststofffilmelements bei jedem der einzelnen Beutel in ihrer Reihe einander gegenüberliegende Seitenkantenbereiche (16a,18a;16b,18b) definieren;

Zuführen von Längen (34a,84a) an Kunststofffilm-Streifenmaterial von mindestens einer Vorratsrolle (176) davon; nacheinander Abtrennen von Längen (34,84) an Kunststofffilm-Streifenmaterial von der mindestens einen Vorratsrolle;

Anordnen einer Länge an Kunststofffilm-Streifenmaterial (34,84) über dem Seitenkantenbereich (20) des Kunststofffilmelements (140) nahe an dem oberen Ende eines jeden der aufeinanderfolgenden Beutel der Reihe an Beuteln (12), und Anbringen der Länge des Kunststofffilm-Streifens (34,84) nahe dem oberen Ende jedes Beutels zur Bildung eines oberen Bindeelements,

dadurch gekennzeichnet, daß:

relativ große Endbereichsflächen (36,92) der abgetrennten Längen an Kunststofffilm-Streifenmaterial (34,84) in Folge durch Schweißen an mindestens zwei Kunststofffilmschichten (16a,18a) eines der Seitenkantenbereiche (20,22) des Kunststofffilmelements (140) an in Längsrichtung beabstandeten Stellen auf ihm befestigt werden nahe an Stellen (172), die den oberen Enden (14) der fertigen einzelnen Beutel (12) entsprechen, um dadurch jeden der fertigen Beutel (12) mit einem oberen Bindeelement aus Kunststoff (32,82) zu versehen, das an einem seiner Enden entlang eines relativ großen Vielschicht-Schweißbereichs (36,92), der an einem Seitenkantenbereich (20,22) des Beutels nahe an seinem oberen Ende (14) angeordnet ist, an dem Beutel (12) befestigt ist, wobei jedes der Bindeelemente (32,82) einen länglichen, freien äußeren Endbereich (38,86) besitzt, der sich von seinem zugehörigen Vielschicht-Schweißbereich nach außen erstreckt, und das Schweißen dergestalt durchgeführt wird, daß der längliche freie äußere Endbereich (38,86) fest angezogen werden kann, ohne den Schweißbereich abzutrennen.

31. Verfahren nach Anspruch 30,

dadurch gekennzeichnet, daß:

eine Öffnung (58,100) durch jede der Vielschicht-Schweißbereiche gebildet wird, wobei jede der Öffnungen (58,100) so gestaltet ist, daß sie es erlaubt, daß ihr zugehöriger

freier Bindeelement-Endbereich (56,106) durch sie hindurchgeführt wird.

32. Verfahren nach Anspruch 30 oder 31,

dadurch gekennzeichnet, daß:

der Abtrennschritt vor dem Schritt des Befestigens durch Schweißen durchgeführt wird, und das Verfahren weiterhin den zwischen den Schritten des Abtrennens und durch Schweißen Befestigens ausgeführten Schritt des Bewegens der abgetrennten Längen an Kunststofffilm-Streifenmaterial (34,84) von Abtrennpositionen zu Schweißpositionen aufweist.

33. Verfahren nach Anspruch 30 oder 31,

dadurch gekennzeichnet, daß:

die Schritte des Abtrennens und durch Schweißen Befestigens im wesentlichen gleichzeitig ausgeführt werden.

34. Verfahren nach einem der Ansprüche 30 bis 33,

dadurch gekennzeichnet, daß:

die relativ großen Endbereichsflächen der Längen an Plastikfilm-Streifenmaterial (34,84) vor dem Durchführen des Schritts des Befestigens durch Schweißen vorerhitzt werden.

Revendications

1. Un procédé pour former de façon continue des sacs en film de matière plastique comprenant des éléments de liage supérieurs intégrés, prêts à être utilisés, ledit procédé comprenant les étapes consistant à acheminer longitudinalement un élément de film en matière plastique allongé défini au moins partiellement par deux feuilles de film de matière plastique opposées s'étendant suivant la largeur de l'élément de film en matière plastique; délimiter sur l'élément de film en matière plastique une série de sacs individuels (12) comprenant une extrémité supérieure (14), une paire de portions de bord latérales (20, 22) définies par plusieurs couches de film en matière plastique et une paire de parois latérales opposées (16, 18) s'étendant entre lesdites portions de bord latérales (20, 22); former une série d'éléments de liage en matière plastique allongés (32) présentant une portion d'extrémité interne de surface relativement importante (36), une portion d'extrémité externe libre (38), et une portion longitudinale intermédiaire s'étendant entre lesdites portions d'extrémité interne et externe; positionner l'un des éléments de liage allongés en matière plastique (32) de ladite série en recouvrement sur une surface latérale de l'une desdites portions de bord latérales du sac qui est



adjacente à la portion d'extrémité supérieure (14) de chaque sac; et souder mutuellement une portion de chacun des éléments de liage allongés en film (32) de la série et au moins deux couches de film (16a, 18a) des portions de bord latérales de chacun des sacs en une position adjacente à leurs extrémités supérieures, de manière à laisser subsister sur chaque élément de liage en film en matière plastique une portion d'extrémité externe libre (38) utilisée pour fermer un sac, caractérisé en ce que:

la portion d'extrémité interne relativement importante (36) de chaque élément de liage (32) est positionnée directement sur et soudée avec lesdites au moins deux couches de film (16a, 18a) de la portion de bord latérale (20) d'un sac de manière que la portion d'extrémité externe libre (38) de l'élément de liage (32) puisse former une boucle autour d'une portion d'extrémité supérieure (40) du sac, être passée dans la boucle (42) puis être tirée fermement pour se serrer autour, venir en engagement par friction et fermer étroitement la portion d'extrémité supérieure sans détacher la portion d'extrémité interne soudée (36) de l'élément de liage (32) de son sac (12).

2. Le procédé selon la revendication 1, caractérisé en outre en ce que l'étape d'acheminement en direction longitudinale est effectuée en utilisant une section allongée d'un tube aplati en film en matière plastique.
3. Le procédé selon la revendication 1 ou 2, caractérisé en ce que l'étape de soudage mutuel est effectuée à la suite de l'étape de délimitation.
4. Le procédé selon l'une quelconque des revendications 1 à 3, caractérisé en ce que l'élément de film en matière plastique comprend une paire de portions de bord latérales opposées qui définissent les portions de bord latérales opposées desdits sacs en matière plastique.
5. Le procédé selon l'une quelconque des revendications 1 à 4, caractérisé en ce que l'élément de film en matière plastique est formé à partir de bandes (34) d'un film en matière plastique relativement mince.
6. Le procédé selon l'une quelconque des revendications 1 à 5, caractérisé en ce que le procédé comprend en outre l'étape consistant à former un orifice (58) dans chacune des régions des portions d'extrémité de surface rela-

tivement importantes (54) des éléments de liage (50), et dans les couches de film (16a, 18a) fixées à celles-ci, chacun des orifices (58) étant dimensionné pour permettre à la portion d'extrémité libre (56) de l'élément de liage associé de le traverser.

7. Le procédé selon la revendication 6, caractérisé en ce que le procédé comprend en outre l'étape consistant à configurer chacun desdits orifices (58) de manière qu'il empêche le dégagement de la portion d'extrémité libre (56) de son élément de liage associé quand cette portion d'extrémité libre (56) a été initialement insérée dans l'orifice (58) et tirée dans celui-ci.
8. Le procédé selon la revendication 7, caractérisé en ce que chacun des éléments de liage allongé (50) en film en matière plastique présente une largeur transversale, et

l'étape de formation d'un orifice est effectuée en formant une fente allongée (58) à travers chacune des portions d'extrémité (54) de surface relativement importante des éléments de liage (50) et des couches de film (16a, 18a) fixées avec elles, chacune des fentes (58) ayant une longueur inférieure à la largeur de la portion d'extrémité libre (56) de l'élément de liage associé.

9. La structure constituée par un sac en matière plastique et un élément de liage intégré formée par le procédé selon l'une quelconque des revendications 1 à 8.
10. Un sac en matière plastique comprenant :

une ouverture supérieure ouverte (14);

une extrémité inférieure fermée (24);

une paire de portions de bord latérales opposées (20,22) définies chacune par plusieurs couches de film en matière plastique (16a, 18a);

une paire de parois latérales opposées (16, 18) reliant les portions de bord latérales (20, 22) et l'extrémité inférieure (24);

un élément de liage en film en matière plastique (32) comportant une portion d'extrémité interne (36) relativement importante et une portion d'extrémité externe libre (38), positionné en chevauchement sur une surface latérale de l'une des portions de bord latérales (20) et fixé par soudage à deux couches de film (16a, 18a)



de ladite portion de bord latérale (20) du sac (12) qui est adjacente à son extrémité supérieure (14);

caractérisé en ce que :

la portion d'extrémité interne (36) de l'élément de liage (32) comprend un bord d'extrémité interne venant s'appliquer contre l'une des portions de bord latérales opposées (20, 22) qui est adjacente de l'extrémité supérieure (14) du sac (12), une partie substantielle à la portion d'extrémité relativement importante (36), comprenant une section étroitement adjacente du bord d'extrémité interne, étant fixée par soudage à au moins deux couches de film de matière plastique (16a, 18a) de l'une des portions de bord latérales (20) avec une force suffisante pour permettre à une portion d'extrémité externe libre restante (38) de l'élément de liage (32) d'être passée autour d'une portion d'extrémité supérieure (40) du sac (12) pour former une boucle (42) qui l'entoure, d'être passée dans la boucle puis d'être tirée fermement par la portion d'extrémité externe libre (38) pour serrer la boucle (42) et fermer le sac (12) sans détacher du sac (12) la portion d'extrémité interne (36) soudée et relativement importante de l'élément de liage (32);

l'élément de liage en film de matière plastique (32) étant suffisamment souple pour que la boucle serrée vienne en engagement par friction avec l'extrémité supérieure (14) du sac et le maintienne fermé quand la portion d'extrémité externe libre (38) de l'élément de liage (32) est relâchée.

11. Le sac en matière plastique selon la revendication 10, caractérisé en ce que l'élément de liage en film de matière plastique (32) est constitué par une unique bande allongée (34) de film en matière plastique comportant une portion d'extrémité libre définissant la portion d'extrémité externe libre (38) de l'élément de liage (32).

12. Le sac en matière plastique selon la revendication 11, caractérisé en ce que l'unique bande de film de matière plastique (44) comprend une première couche (46) relativement rigide et une seconde couche (48) plus flexible, la seconde couche (48) comportant une portion d'extrémité fixée par soudage à celle des au moins deux couches (16a, 18a) qui est la plus à l'extérieur de l'une des portions de bord latérales (20).

13. Le sac en matière plastique selon la revendication 12, caractérisé en ce que la seconde couche (48) présente un coefficient de friction plus élevé que celui de la première couche (46).

14. Le sac en matière plastique selon la revendication 12 ou 13, caractérisé en ce que la première couche (46) est en un polyéthylène haute densité, et

la seconde couche (48) est en acétate d'éthylvinyle.

15. Le sac en matière plastique selon la revendication 10, caractérisé en ce que l'élément de liage en film en matière plastique (82) est constitué par une unique bande (84) en matière plastique dont les portions d'extrémité externes contiguës (88, 90) définissent en combinaison ladite portion d'extrémité de surface relativement importante de l'élément de liage (82) et une portion centrale en forme de boucle (86) définissant la portion d'extrémité libre de l'élément de liage (82).

16. Le sac en matière plastique selon l'une quelconque des revendications 10 à 15, caractérisé en ce que l'élément de liage en film de matière plastique (110) comprend deux bandes de film en matière plastique séparées (112, 114) dont les portions d'extrémité internes contiguës (116, 118) définissent en combinaison la portion d'extrémité de surface relativement importante de l'élément de liage (110).

17. Le sac en matière plastique selon la revendication 16, caractérisé en ce que les deux bandes de film en matière plastique séparées (112, 114) comprennent des portions d'extrémité externes fixées l'une à l'autre et séparées de leurs portions d'extrémité internes.

18. Le sac en matière plastique selon l'une quelconque des revendications 10 à 17, caractérisé en ce que la surface de la portion d'extrémité (70) de l'élément de liage (66) comprend une portion centrale qui n'est pas fixée à l'une des portions de bord latérales (20) et définit avec elle un interstice (76) par lequel la portion d'extrémité libre (78) de l'élément de liage (66) peut être passée pour effectuer la fermeture de l'extrémité supérieure (40) du sac (12).

19. Le sac en matière plastique selon l'une des revendications 10 à 18, caractérisé en ce que l'épaisseur de l'élément de liage en film de matière plastique n'est pas supérieure à ap-



proximativement trois fois l'épaisseur du film formant le reste du sac (12).

20. Un sac en matière plastique comprenant:

une ouverture supérieure ouverte (14);

une extrémité inférieure fermée (24);

une paire de portions de bord latérales opposées (20,22) définie chacune par plusieurs couches de film en matière plastique (16a, 18a);

une paire de parois latérales opposées (16, 18) interconnectant les portions de bord (20, 22) et ladite extrémité inférieure (24);

un élément de liage (50) en film en matière plastique comprenant une portion d'extrémité interne (54) relativement importante et une portion d'extrémité externe libre (56), disposé en chevauchement mutuel avec une surface latérale de l'une des portions de bord (20) et fixé par soudage à deux couches de film (16a, 18a) de la portion de bord latérale (20) du sac (12) en une position adjacente à son extrémité supérieure (14), caractérisé en ce que:

une portion d'extrémité (54) de surface relativement importante de l'élément de liage (50) est fixée par soudage de manière à former une région de soudage multicouche de dimension importante de manière que la portion d'extrémité libre allongée (56) puisse être tirée fermement sans se détacher de la région de soudage, la portion d'extrémité libre allongée (56) de l'élément de liage en matière plastique (50) s'étendant vers l'extérieur à partir de ladite région de soudage multicouche; et

un orifice (58) est formé dans la région de soudage multicouche et adapté à laisser passer la portion d'extrémité libre (56) de l'élément de liage (50), ce qui permet à une portion d'extrémité supérieure (40) du sac (12) d'être étroitement fermée en faisant passer la portion d'extrémité libre (56) de l'élément de liage (50) autour de la portion d'extrémité supérieure pour former une boucle (60) autour de cette dernière, en faisant passer cette portion d'extrémité libre dans l'orifice (58), puis en exerçant une traction sur ladite portion d'extrémité libre (56) pour serrer la boucle (60) autour de la portion d'extrémité supérieure.

21. Le sac en matière plastique selon la revendication 20, caractérisé en ce que l'orifice (58) est

dimensionné de manière à provoquer un rétrécissement latéral et un rassemblement (62) de la portion d'extrémité libre (56) quand elle est tirée à travers ledit orifice (58).

22. Le sac en matière plastique selon la revendication 21, caractérisé en ce que ledit orifice est constitué par une fente allongée (58) dont la longueur est plus courte que la largeur transversale (52) de la portion d'extrémité libre allongée (56) de l'élément de liage (50).

23. Le sac en matière plastique selon l'une quelconque des revendications 20 à 22, caractérisé en ce que la région de soudage multicouche comprend une portion déformée (64) entourant et renforçant la périphérie de l'orifice.

24. Le sac en matière plastique selon l'une quelconque des revendications 20 à 23, caractérisé en ce que l'élément de liage en matière plastique est constitué par une unique bande allongée (52) de film en matière plastique comportant une portion d'extrémité libre (56) définissant ladite portion d'extrémité libre de l'élément de liage.

25. Le sac en matière plastique selon la revendication 24, caractérisé en ce que l'unique bande de film en matière plastique comprend une première couche relativement rigide et une seconde couche (48) plus flexible, la seconde couche (48) ayant une portion d'extrémité fixée par soudage à celle desdites au moins deux couches (16a, 18a) qui est la plus à l'extérieur de l'une des portions de bord latérales.

26. Le sac en matière plastique selon la revendication 25, caractérisé en ce que la première couche (46) est en polyéthylène haute densité et

la seconde couche (48) est en acétate d'éthylvinyle.

27. Le sac en matière plastique selon l'une des revendications 20 à 26, caractérisé en ce que l'élément de liage en matière plastique (98) comprend une unique bande de film en matière plastique comprenant des portions d'extrémité externes contiguës (102, 104) définissant en combinaison la portion d'extrémité relativement importante (92) de l'élément de liage, une portion centrale formant une boucle (106) définissant la portion d'extrémité libre de l'élément de liage.



28. Le sac en matière plastique selon l'une quelconque des revendications 20 à 27, caractérisé en ce que l'élément de liage (110) en film de matière plastique comprend deux bandes de film en matière plastique séparées (112, 114) comprenant des portions d'extrémité internes contiguës (116, 118) définissant en combinaison les portions d'extrémité de surface relativement importante de l'élément de liage.

29. Le sac en matière plastique selon la revendication 28, caractérisé en ce que les deux bandes de film en matière plastique séparées (112, 114) comprennent des portions d'extrémité externes fixées l'une à l'autre et espacées de leurs portions d'extrémité internes.

30. Le procédé continu à grande vitesse de formage de sacs en matière plastique à éléments de liage supérieurs intégrés, ledit procédé comprenant les étapes consistant à:

acheminer longitudinalement un élément de film en matière plastique allongé (140) dans un dispositif de formage de sacs adapté à former à partir de cet élément une série de sacs en matière plastique individuels (12), l'élément de film en matière plastique comprenant des portions de bord latérales opposées (20, 22) définies chacune par plusieurs couches de film en matière plastique (16a, 18a; 16b, 18b), les portions de bord latérales opposées des éléments de film en matière plastique définissant des portions de bord latérales opposées (16a, 18a; 16b, 18b) dans chacun des sacs individuels de ladite série;

faire avancer des longueurs (34a, 84a) de la bande de film en matière plastique à partir de l'un au moins de leurs rouleaux d'alimentation (176);

sectionner successivement des longueurs (34, 84) de bandes de film en matière plastique à partir de l'un au moins desdits rouleaux d'alimentation;

positionner une longueur de bande de film en matière plastique (34, 84) sur la portion de bord latérale (20) de l'élément de film en matière plastique (140) qui est adjacente de la partie supérieure de chacun des sacs successifs (12) de la série et fixer la longueur de bande de film en matière plastique (34, 84) à proximité de la partie supérieure de chaque sac pour former un élément de liage supérieur;

caractérisé en ce que:

les portions d'extrémité de surface relativement importante (36, 92) des longueurs sectionnées de bande de film en matière plastique (34, 84) sont soudées séquentiellement sur au moins deux couches de film en matière plastique (16a, 18a) de l'une des portions de bord latérales (20, 22) de l'élément de film en matière plastique (140) en des positions espacées longitudinalement et adjacentes à des emplacements (172) correspondant aux extrémités supérieures (14) des sacs individuels terminés (12) pour équiper ainsi chacun des sacs terminés (12) d'un élément de liage supérieur en matière plastique (32, 82) fixé par une extrémité au sac (12) le long d'une région de soudage multicouche (36, 92) relativement importante disposée sur une portion de bord latérale (20, 22) du sac qui est adjacente de son extrémité supérieure (14), chacun des éléments de liage (32, 82) comprenant une portion d'extrémité externe libre et allongée (38, 86) s'étendant vers l'extérieur à partir de sa région de soudage multicouche associée, le soudage étant réalisé de manière telle que la portion d'extrémité externe libre et allongée (38, 86) puisse être tirée fermement sans se détacher de la région de soudage.

31. Le procédé selon la revendication 30, caractérisé en ce que:

un orifice (58, 100) est formé à travers chacune desdites régions de soudage multicouche, chacune desdites ouvertures (58, 100) étant configurée pour permettre à la portion d'extrémité libre (56, 106) de son élément de liage associé de passer à travers.

32. Le procédé selon la revendication 30 ou 31, caractérisé en ce que:

l'étape de sectionnement est effectuée avant l'étape de fixation mutuelle par soudage et

le procédé comprend en outre l'étape, effectuée entre les étapes de sectionnement et de soudage mutuel, consistant à déplacer les longueurs sectionnées de bandes de film en matière plastique (34, 84) des positions de sectionnement vers les positions de soudage.

33. Le procédé selon la revendication 30 ou 31, caractérisé en ce que:

les étapes de sectionnement et de soudage mutuel sont effectuées essentiellement simultanément.



34. Le procédé selon l'une quelconque des revendications 30 à 33, caractérisé en ce que:

les portions d'extrémité de surface relativement importante des longueurs de bande de film en matière plastique (34, 84) sont préchauffées avant d'effectuer ladite étape de soudage.

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