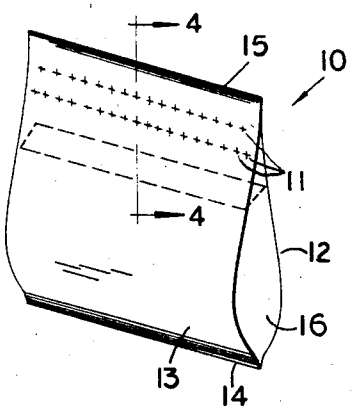
Sept. 3, 1968 E. KUGLER 3,399,822

PLASTIC BAG

Filed Aug. 1, 1967

FIG. 1



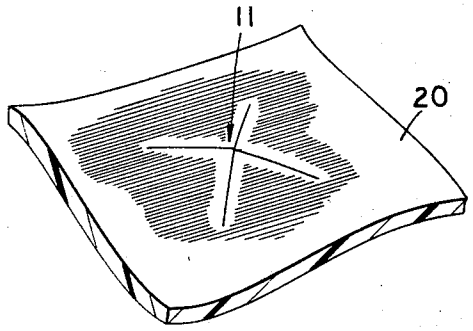


FIG. 2

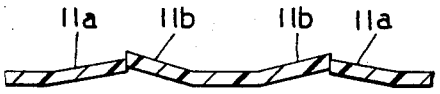


FIG. 4

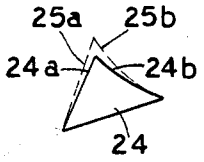


FIG. 3

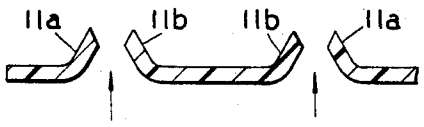


FIG. 5

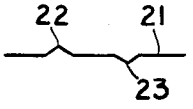


FIG. 7

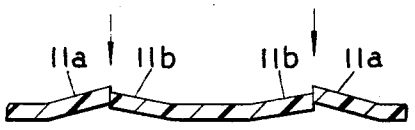


FIG. 6

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PLASTIC BAG

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ABSTRACT OF THE DISCLOSURE

A plastic bag having a plurality of valve-forming miniature flaps. Each valve consists of at least two flaps capable of partial overlap. The flaps permit air flow in only one direction. Thus, for example, gas formed in a food contained within the bag may flow out of the bag through the flaps, the flaps however preventing moisture, dirt or other contaminants from entering the bag from the outside.

This invention relates to plastic bags, and more particularly to plastic bags which permit the flow through the walls thereof of gas or vapor in a predetermined direction.

Many food products are packaged in plastic bags. The bag serves not only to prevent contamination of the food, but in addition enables the consumer to see what he is buying. Certain foods, however, are not perfectly suitable for packaging in plastic bags, and although they are often packaged in such bags are deleteriously affected thereby. Many vegetables give off gas while contained in a plastic bag from the time they are first put in the bag until they are removed by the housewife. A mechanism must be provided to permit the gas to escape from the bag. Similarly, moisture often accumulates in the bag and it is preferable that it be allowed to escape from the bag. For this reason, in many situations holes or vents are made in the bag to allow gases and water vapor to escape. The obvious disadvantage of this approach is, of course, that the food inside the bag may be contaminated by dirt or undesirable gases entering the bag from the outside through the holes.

There are other situations in which a two-way flow of air or water vapor is desirable. Although holes formed in the plastic material also permit this two-way flow, the holes also allow the food inside the bag to be become contaminated.

It is an object of this invention to provide a plastic bag which permits gas and vapor flow in a predetermined direction or directions, without the concomitant food contamination as in prior art designs.

Briefly, in accordance with the principles of my invention I provide a plurality of miniature deformations in the plastic material out of which the bag is formed. The deformations consist of flaps formed from the plastic material. Slits in the plastic material are formed where adjacent flaps meet. The slits are straight lines in the illustrative embodiment of the invention, but need not be so in all cases. Each flap is formed of a section of the plastic material which is stretched during the bag making operation. Accordingly, where the flaps meet at their adjacent edges, or where they overlap, there is a preferred direction of flow through the overall deformation. Gas or water vapor easily flow through the plastic material in one direction, that is, the direction in which the flaps were originally bent away from the plane of the plastic sheet during the bag making operation. Flow in the other direction is prevented by the flaps as a result of the natural tendency of the plastic material, in its deformed state, to resist bending in this reverse direction.

Typically, each deformation may be formed by a plunger having a star drill shape with a relatively blunt face. The star drill plunger forms four slits in the plastic material in the shape of an X. At the same time that the slits are formed, the plastic material is stretched in the direction of movement of the plunger toward and through the plastic material. When the plunger is removed, the four resulting flaps spring back to the plane of the plastic sheet. However, because the plastic material forming the flaps has been stretched during the formation of the flaps, they cannot restore to the original position. Either the edges come together with a resulting miniature pyramid-shaped mound remaining on the plastic sheet, or the flaps return with adjacent edges overlapping. In either case, gas and water vapor can flow upward through the pyramid-shaped mound but cannot flow in the opposite direction. (Alternatively, a roller with pins on it may be used to form the deformations. High velocity air bombardment and other fabricating techniques are also suitable for making the deformations.)

If it is desired to permit two-way flow, a series of deformations may be formed in the plastic sheet, with some of the deformations permitting flow in one direction and others permitting flow in the other. Although in such a case gas and water vapor can flow in either direction through respective deformations, dirt and other contaminants cannot flow through the bag because unlike the prior art no holes are provided in the bag. The deformations, in the presence of a pressure gradient, deform slightly so that the edges of the adjacent flaps separate to permit gas flow through them. However, the separations are not great enough to permit the relatively larger dirt particles to get through.

It is a feature of my invention to provide a plastic bag with a plurality of deformations having one or two preferred directions of gas flow therethrough, the deformations being large enough to permit gas flow but being small enough to prevent dirt and other contaminants from getting through.

Further obpects, features and advantages of my invention will become apparent upon consideration of the following detailed description in conjunction with the drawing, in which:

FIG. 1 depicts a perspective view of a bag constructed in accordance with the principles of my invention;

FIG. 2 depicts a section of a plastic sheet from which the bag of FIG. 1 is made, having a single deformation therein in accordance with the principles of my invention;

FIG. 3 depicts a typical flap of the type shown in the other figures of the drawing, in relation to the original shape of the material forming the flap prior to its construction;

FIG. 4 is a cross-sectional view through two of the deformations in the bag of FIG. 1, taken through the line 4—4;

FIG. 5 illustrates the operation of the deformations to permit gas and moisture flow in one direction;

FIG. 6 depicts the operation of the deformations to prevent gas and moisture flow in the other direction; and

FIG. 7 depicts symbolically a plastic sheet having deformations of the type shown in the other figures, but facing in both directions.

Referring to FIG. 1, bag **10** is only illustrative of one shape of plastic bag which may be provided with the deformations of my invention. Typically, the bag may be constructed of polyethylene material. It includes an upper edge **15**, a lower edge **14**, two side walls **16**, front face **13** and rear face **12**. The bag may be used as a container or package for vegetables or other foods which may discharge gas after the packaging operation, or which may cause water droplets to form in side the bag. In accordance with the principles of my invention I provide a plurality of deformations **11** in the plastic material out of which the bag is formed. These deformations allow

gas and water vapor to flow out of the bag, but prevent a flow in the reverse direction from the atmosphere to the inside of the bag. The pattern of the deformations (two rows in FIG. 1) may vary from bag to bag, depending on the particular application.

Referring to FIG. 2, a typical one of the deformations is shown in perspective view. Deformation **11** is made out of the plastic material of sheet **20**. It consists basically of four slits forming an X-shape. The slits go through the plastic sheet. At the same time that the slits are formed, the plastic material contained within each of the four angles formed by the slit is stretched. This is seen most clearly in FIG. 3. Triangle shaped section **24** depicts an original section of plastic sheet **20**. During the construction of the deformation, slits are formed along edges **24***a* and **24***b*. At the same time that the slits are formed, the plastic material within triangle shaped section **24** is stretched. The resulting bounds of the stretched plastic material are shown by dotted lines **25***a* and **25***b*.

Referring back to FIG. 2, it is seen that with both the four slits and the four stretched sections of material, a pyramid-shaped mound is formed on the plastic sheet, facing upward in FIG. 2. The area of each flap is thus greater than the area of the flap projected on the plane of the plastic sheet.

It is possible that the four flaps of FIG. 2 will have their edges abutting each other. Alternatively, it is possible that the flaps will merely overlap with the slit edges not abutting against each other. In either case, the plastic material is raised at the deformation. Also, the deformation permits gas and water vapor to flow upward, but not downward. The flaps, because of their increased dimensions after they are formed, prevent downward flow in the absence of considerable pressure. On the other hand, minimal pressures are required to force the flaps to open further, to separate slightly, and to permit flow through them.

FIG. 4 shows the cross-section of two of the deformations in the bag of FIG. 1, along two of the slits in each of the deformations. As shown in FIG. 4, flaps **11***a* and **11***b* of each deformation abut against each other. But as described above, it is also possible for the flaps to overlap physically (as well as in area) rather than for their edges to abut against each other. Similarly, although throughout the drawing the deformations are shown with four flaps, it is possible to use fewer flaps for each. For example, three slits could be formed in the fabrication of each deformation, with the resulting three flaps either overlapping or having their edges abutting against each other. In the extreme case, it is even possible to provide only a single slit with two abutting stretched flaps. The deformation could be formed manually, for example, by simply forcing the tip of a screwdriver through the plastic sheet and then removing it.

Referring to FIG. 5, the drawing depicts what happens to the two deformations shown when gas or water vapor builds up on the side of the plastic sheet from which flow is permitted. The flaps simply are raised further from their positions shown in FIG. 4 as a result of the pressure build up. The scale of FIG. 5 is greatly exaggerated. In actual operation, the flaps separate to only a slight extent so that while gas and water vapor may pass through the deformations, relatively large sized particles cannot.

In FIG. 6, which depicts a reverse pressure gradient, it is seen that the flaps are simply locked together. If anything, the pressure build-up on the outside of the bag forms an even tighter seal. No flow is permitted from outside the bag to its interior.

In FIG. 7, two oppositely directed deformations are shown only symbolically. Sheet **21** includes deformation

22 facing in one direction and deformation **23** facing in the other. Each of these two deformations permits gas or vapor flow in the respective preferred direction. Consequently, gas and water vapor can flow through the plastic sheet in either direction. However, because it is the nature of each deformation to allow the flaps to separate only slightly as the result of a pressure build-up, dirt and other contaminants cannot flow through the plastic bag.

Although the invention has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the application of the principles of the invention. Numerous modifications may be made therein and other arrangements may be devised without departing from the spirit and scope of the invention.

I claim:

1. A plastic bag comprising an enclosure formed from sheet plastic, said sheet plastic including a plurality of deformations, each of said deformations comprising at least three slits in the plastic sheet and at least three flaps each having two edges along two of said slits, each of said flaps having an area greater than the area of the flap projected on the plane of said plastic sheet, all of the flaps in each of said deformations being bent slightly in the same direction away from the plane of said plastic sheet, each of said deformations being large enough to permit desirable gas flow therethrough and small enough to prevent undesirable dirt and contaminant passage therethrough.

2. A plastic bag in accordance with claim **1** wherein each of said deformations includes four slits having an X-shape and four flaps defined by said four slits.

3. A plastic bag in accordance with claim **2**, wherein the edges of the flaps in each of said deformations abut against each other to form a pyramid-shaped mound on said plastic sheet.

4. A plastic bag in accordance with claim **1** wherein one group of said plurality of deformations face away from said plastic sheet in one direction and another group of said plurality of deformations face away from said plastic sheet in the other direction.

5. A plastic bag comprising an enclosure formed from sheet plastic, said sheet plastic including a plurality of deformations each of said deformations comprising at least one slit in the plastic sheet and at least two flaps facing each other, each of said flaps having an area greater than the area of the flap projected on the plane of said plastic sheet, all of the flaps in each of said deformations being bent slightly in the same direction away from the plane of said plastic sheet, each of said deformations being large enough to permit desirable gas flow therethrough in one direction and small enough to prevent undesirable dirt and contaminant passage therethrough in the other direction.

6. A plastic bag in accordance with claim **5** wherein one group of said plurality of deformations face away from said plastic sheet in one direction and another group of said plurality of deformations face away from said plastic sheet in the other direction.

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