

PATENT SPECIFICATION

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- (21) Application No. 9859/79
(22) Filed 24 June 1977
(62) Divided out of No. 1 580 576
(31) Convention Application No. 762 230
(32) Filed 28 June 1976 in
(33) Norway (NO)
(44) Complete Specification published 3 Dec. 1980
(51) INT. CL.³ B65D 88/22
(52) Index at acceptance
B8K 2G6 2K4 2K6 2L AB



(54) FLEXIBLE CONTAINER FOR THE TRANSPORTATION AND STORAGE OF BULK MATERIAL

(71) We, NORSK HYDRO A.S., a Norwegian Body Corporate of Bygdøy Alle 2, Oslo 2, Norway, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns a flexible container for transportation and storage of bulk material, especially freeflowing pulverulent or granular material.

Several types of containers for transportation of free-flowing bulk material are known. Some are of the one-trip-type and others are intended to be used several times. Such containers are usually called Intermediate Bulk Containers.

United States Patent No. 3,973,609 describes a flexible container which can be lifted when filled. This container is provided with a special lifting device which comprises a rope, one end of which is secured to its top. The other end of the rope runs through the centre of the container and is secured to its bottom, for instance to a plate below the bottom. In this way the stress is better distributed when the container is lifted. Although this lifting device distributes the stress somewhat better than do other flexible containers, its construction is rather complicated, thus increasing the cost of manufacturing the container. Another drawback is that the container is made of a number of different components and the total quantity of material per container is large.

Further, Danish Patent No. 132,877 describes a flexible container having a squareish bottom section with a discharge opening that is covered by a loose piece of material. This piece is cut before discharging. Before refilling the container, a new cover-piece is placed in it. The container is equipped with lifting loops secured

thereto, and its upper section has a lid closed with a filling opening that can be closed. This is a rather complicated container which consists of several components that have to be joined together and requires a complicated apparatus for its manufacture that accordingly makes it expensive. Such a container is intended to be used several times. The four separately fastened loops result in an uneven distribution of the vertical stresses in the container's fabric which thus must be made from strong and expensive material.

The present invention is the result of further development of the flexible container disclosed in United Kingdom Patent No. 1,475,019. That container is made from a single piece of material that is folded and sewn together along its sides and bottom. Approximately at the middle of the folded edge there is a slit which constitutes the filling opening of the container. The side seams terminate some distance from the folded edge thus providing two lifting loops which extend from the slit to the point of intersection between the imaginary extension lines of the side seams and the folded edge. The container has proved to be well suited for transportation of bulk material. It is cheap and can therefore be used as a one-trip container.

By destructive, dynamic testing it has been found that the stress distribution during lifting of the container disclosed in Patent No. 1,475,019 is not optimal due to the design of the bottom of the container. The aim of the present invention is therefore to develop an improved base design that can be adapted to a container that has already proved to be a success. One important object of the invention is to get an efficient and economical method for manufacturing flexible containers having the new base design.

According to the present invention, a

container for the transportation and storage of bulk material comprises sheet material formed into a tube having four sidewalls and a closed end, each sidewall being coextensive with an adjacent sidewall to form a lifting loop at the top of the container, the two lifting loops so formed defining an inlet opening therebetween, and the closed end comprising extensions of the container sidewalls secured along at least one seam to form a substantially planar base. Typically the base comprises four flaps each of which is an extension of a container sidewall.

In one embodiment of the invention, the container is formed from a single piece of material folded double and slit such that the fold forms said two lifting loops on either side of the inlet opening, wherein the flaps are formed by cuts extending from the edges of the piece of material farthest from the fold. The single piece may itself be formed from two strips of material sewn together along seams, the seams terminating at a distance from the respective edges remote from the fold corresponding to the length of the flaps, and at a distance from the respective folds to form the slit defining the inlet opening.

In a further modification of the construction last described, the container is formed from a single strip of material having a width substantially equal to that of a sidewall, the strip extending from the container base to form a first sidewall; a first loop; a second sidewall adjacent the first; and extending across the base and therefrom to form a third sidewall; a second loop; and a fourth sidewall between the third and first the edges of the sidewalls being sewn together along four seams to close the wall of the container and the ends of the strip being sewn at the base to close the bottom.

A container having a particularly preferred base design in which opposed flaps are joined to one another is described and claimed in our co-pending Application No. 26607/77 (Serial No. 1580576) to which reference is directed.

Containers according to the invention with four sidewalls have a squarish base when the container is filled. A base comprising four flaps need not be completely closed as the flaps can be joined only at their free edges. This results in a particularly good stress distribution because the overlapping flaps constituting the base can shift somewhat relative to each other. Because the base is in fact a double one the load on each joining seam is halved.

In some embodiments, it can be advantageous to sew the flaps together also at their side edges with elastic or weak thread, thereby allowing the joined flaps to shift

relative to each other. By doing this, a completely closed base is obtained and an inner bag can be omitted.

The container is applicable for bulk material in quantities from 100 kg up to several tons. It can be made from fabrics, for instance woven polypropylene, from plastics material or from paper. The construction of the container according to the invention is independent of the container material as long as this is suitable for the actual use. The container is preferably fitted with an inner bag of an impervious material, for instance plastics or paper.

A flexible container according to the invention will now be described, by way of example and with reference to the accompanying drawings, in which:

Figure 1 shows a piece of material from which a flexible container can be made;

Figure 2 shows the completed container made from the piece of material shown in Figure 1; and

Figure 3 shows a piece of material that is first to be folded lengthwise when making a flexible container.

In Figure 1 is shown an unfolded piece of material 1 from which the container according to the preferred method is made. This piece 1 is folded along the folding line 2. The cuts 3 for filling and the cuts for forming the flaps 4 with the lower edges a , a' , b and b' are made at the container's upper edge (the folding line) and at its lower edge respectively, and preferably after the piece 1 has been folded.

To illustrate the flaps 4 more clearly, two of them are shaded. The two side edges 6 are joined together along the dotted lines whereupon the bottom flaps being opposite each other are joined together in pairs such that, in the case of four flaps, the edges are joined together a to a' and b to b' , i.e. crosswise.

Alternatively the container can be made from two pieces of material having a width of half of that shown in Figure 1. The two pieces are joined together along the edges $d-e$ and $f-g$ shown in Figure 1, before folding along the folding line 2. Cutting of the filling opening 3 and the bottom flaps 4 will therefore be unnecessary, and the container has four vertical side seams.

The container can also be made from one long piece of material. This is done in the same manner as in the case of the four side seams, but now there are only two bottom flaps 4 as two of them already form one bottom part because the piece of material is not cut in two. This implies that a and a' are already joined together.

Figure 2 is a perspective view of the preferred design viewed from below, such that the joints 8, 8' of the flaps 4 are visible.

Figure 3 shows a design in which the folded edge 2 constitutes one of the vertical edges of the material. In this case the upper edge of the container must be joined together whereby its load carrying capacity is reduced according to the relationship between the tenacity of the warp of the material and that of the joints, compared with the preferred design shown in Figure 1.

WHAT WE CLAIM IS:—

1. A container for the transportation and storage of bulk material comprising sheet material formed into a tube having four sidewalls and a closed end, each sidewall being coextensive with an adjacent sidewall to form a lifting loop at the top of the container, the two lifting loops so formed defining an inlet opening therebetween, and the closed end comprising extensions of the container sidewalls secured along at least one seam to form a substantially planar base.

2. A container according to Claim 1 wherein the base comprises four flaps each of which is an extension of a container sidewall.

3. A container according to Claim 2 wherein opposed flaps are secured to each other remote from the respective sidewall, forming seams which traverse one another.

4. A container according to Claim 2 or Claim 3 formed from a single piece of material folded double and slit such that the fold forms the two lifting loops on either side of said inlet opening, and wherein the flaps are formed by cuts extending from the edges of the piece of material farthest from the fold.

5. A container according to Claim 2 or Claim 3 formed from two strips of material folded double and sewn together along four

seams, the seams terminating at a distance from the respective edges remote from the folds corresponding to the length of the flaps, and at a distance from the respective folds to form the slit defining the inlet opening.

6. A container according to any of Claims 3 to 5 wherein extensions from the respective sidewalls form a base consisting of two layers, which layers are capable of movement relative to one another.

7. A container according to Claim 1 formed from a single strip of material having a width substantially equal to that of a sidewall, the strip extending from the container base to form a first sidewall; a first said lifting loop; a second sidewall adjacent the first; and extending across the base and therefrom to form a third sidewall; a second said lifting loop; and a fourth sidewall between the third and first, the edges of the sidewalls being sewn together along four seams to close the wall of the container and the ends of the strip being sewn at the base to close the bottom.

8. A container according to Claim 7 wherein the ends of the strip are sewn together to form a seam traversing the container base.

9. A container according to any preceding Claim wherein the sides of the extensions from the sidewalls are sewn together with flexible threads.

10. Containers for the transportation and storage of bulk material substantially as described herein with reference to and as illustrated by the accompanying drawings.

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