Jan. 22, 1952 E. C. SLOAN 2,583,308

ACCORDION BELLOWS CONSTRUCTION

Filed April 19, 1946

FIG. 1

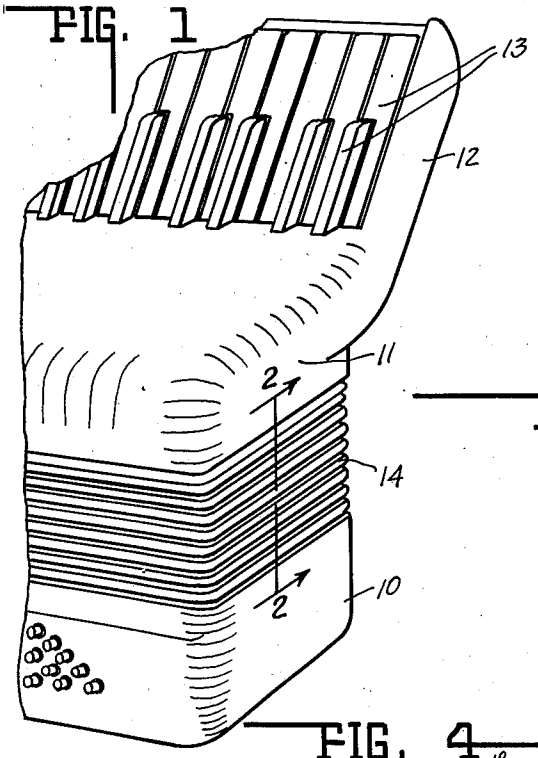


FIG. 2

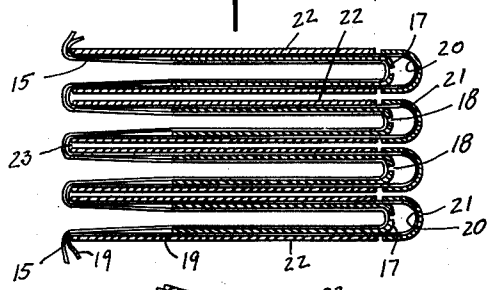


FIG. 3

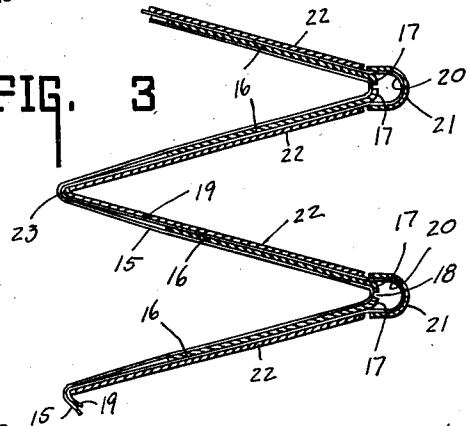


FIG. 4

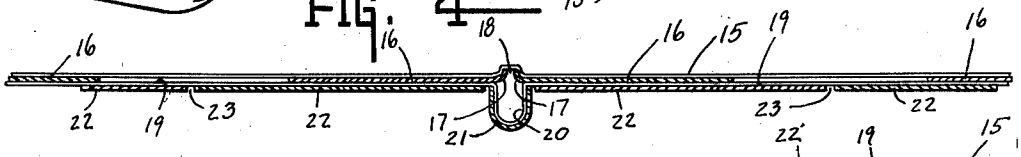


FIG. 5

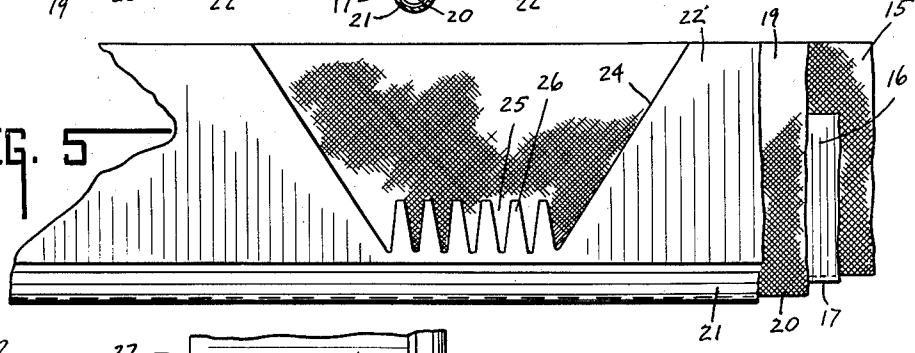
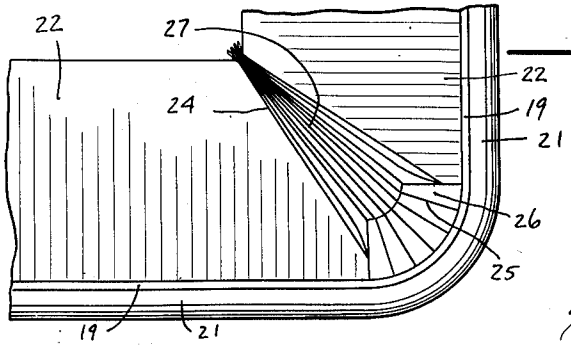


FIG. 6



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ACCORDION BELLOWS CONSTRUCTION

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9 Claims. (Cl. 137—156.5)

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This invention relates to a bellows construction for accordions and like devices, and to the method of forming bellows for protecting and reinforcing the diaphragms, and particularly their exterior folds and corners.

The object of the invention is to develop a bellows construction wherein the diaphragms are formed from cloth or fabric protected and reinforced by a substantially rigid plastic material such as Vinylite. By means of such construction the bellows is rendered more completely air tight, and the usual unsightly metal or leather corner pieces are eliminated. The bellows, while maintaining its required flexibility at the exterior folds and corners will not only be reinforced and protected but will present a more sightly appearance than heretofore.

A feature of the invention resides in the construction and method employed, such as to facilitate and render more economical the production of such bellows. In accomplishing the above, the substantially rigid Vinylite sheets are adhered to a pair of single sheets of air impervious cloth or fabric which also serves to form the hinge or fold construction of the diaphragms, the outer folds and the beading thereof comprising in effect three separate hinges which together make a free acting pivot for the substantially rigid portion of the fold such as to keep the beading in the proper relation to the bellows as a whole.

With the above construction only one air tight seam in the air impervious fabric is required, said fabric being so folded as to provide the inner and outer hinge folds such as will not be stressed in the opening and closing of the bellows. The plastic reinforcing strips, particularly the bead or roll extending about the outer folds and corner sections, also serve to protect the fabric and materially improve the appearance of the bellows as a whole.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

Fig. 1 is a perspective view showing a portion of the bellows with the attached treble and bass boxes.

Fig. 2 is a section through a portion of the bellows taken on the line 2—2 of Fig. 1 showing them in collapsed position.

Fig. 3 is the same as Fig. 2, showing a portion of the bellows dilated.

Fig. 4 is a longitudinal section through the layers of material before forming and folding the bellows.

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Fig. 5 is a plan view of one of the diaphragms showing a portion thereof cut away to provide a corner section, and with layers of material broken away.

Fig. 6 is a plan view of a formed corner section of one of the diaphragms.

In the drawings there is shown one application of the bellows wherein it is mounted in an accordion comprising a bass box 10, treble box 11, a key bed 12 and keys 13. Secured between the boxes 10 and 11 in the usual manner there is provided the bellows 14.

The bellows 14 is constructed from a series of layers of flexible material secured together in the manner best illustrated in Figs. 4 and 5. Thus, each diaphragm comprises an inner layer or strips of air impervious fabric or cloth 15 over which there is bonded the strips 16 of a substantially rigid plastic such as Vinylite. As shown in Figs. 2, 3 and 4 the strips 16 of Vinylite are formed along their adjacent edges with an inwardly curved portion 17, said curved portions being turned inwardly and arranged adjacent each other slightly spaced apart to provide a slight outer hinge gap therebetween as indicated at 18. The gap between the inturned curved portions 17 is spanned so that each adjacent pair of said strips 16 are hingedly secured together by said inner layer or strips of fabric 15. Thus, the sheets 16 are secured and hinged together by the fabric 15 to provide a substantially rigid outer fold having a flexible hinge joint. However, the fabric 15, although illustrated herein in the form of a continuous sheet, may serve equally well in the form of a series of strips sufficiently wide to span the hinge gap 18 to provide the flexible outer hinge connection between the plastic strips 16.

A continuous over-all outer layer 19 of air impervious fabric is secured over the opposite or outer faces of the plastic strips 16 and is formed with an outwardly extending looped portion 20 enveloping the hinge gap 18 between the curved portions 17 of said strips 16. Secured to said looped portion 20 of the fabric sheet 19, there is a plastic or Vinylite bead 21 U-shaped in cross section. Thus, the looped portion 20 and the bead 21 span the hinge gap 18 to cover and protect it exteriorly thereof. Said beads 21 are of such width that when the accordion is in collapsed position, as shown in Figs. 1 and 2, their side walls may abut each other and thereby maintain the outer bellows folds in evenly spaced relation.

Overlying and secured to the sheet of fabric

19 there are outer strips 22 of said plastic material. Said strips 22 form the outer protective surface of each of the diaphragms and lie with their outer edges approaching the bead 21 on each side and in close proximity thereto, but spaced therefrom. The inner or remote edges of said strips 22 lie adjacent to but slightly spaced from each other to permit of and provide the slight inner hinge gap 23.

By means of the above construction the diaphragms of the bellows are joined together to provide an outer fold hinge at 18 and an inner fold hinge at 23, as illustrated in Figs. 2–4. The diaphragms intermediate said hinge portions or folds are of alternate layers of air impervious cloth 15, 19, and alternate layers of the semi-rigid plastic strips 16, 22, such as Vinylite. Thus, the intermediate portions of the cloth are held substantially rigid and protected by the plastic strips, while the cloth sheets or strips 15, 19 permit of the flexing or hinging between said plastic strips at 18, 23. This is permitted at 18 by the gap between the curved portions 17 of the sheets 16, both fabric sheets or strips 15, 19 serving as a double reinforcing hinge at 23. The hinge at 18 is further protected and enclosed by the double hinge portions provided by the fabric sheet 19 between the bead 21 and adjacent edges of the strips 22. The enlarged looping of the fabric sheet 19 also supports and secures in place said protective decorative and spacing bead 21.

In constructing the bellows, the several strips of plastic are cut to proper size to permit of the above arrangement, and mounted over the single sheet of fabric 19, the sheet or strips 15 of fabric being placed over the adjacent curved portions 17 of the plastic strips 16, as best illustrated in Figs. 4 and 5, whereupon they are bonded together in the well-known manner under heat and pressure. However, in order to form the corners of the bellows, as shown in Fig. 6, the plastic strips 16, 22 are cut away at the proper spaced intervals to permit formation of the four or more corners. Said cut away portion of the strips is indicated in Figs. 5 and 6 at 24 wherein tapered notches 25 are formed to provide the corresponding radially projecting fingers 26. This permits the folded diaphragms to be bent at a 90 degree angle to each other to form the corners with a V-shaped gap therebetween embracing the pleated folds 27 of the fabric sheet 19. In so bending the folded diaphragms to provide the corner sections thereof, the plastic beads 20 are drawn into curved formation about a radius of curvature developed by fingers 26, as shown in Fig. 6. This is accomplished where necessary by conditioning them through the usual application of heat.

As a result of the above structure and method of producing bellows, the entire assembly of materials may be pre-cut and laid out, bonded together in the flat to provide a series of diaphragms, and then folded along their hinge gaps 18, 23 into the bellows structure, as above described. The resulting construction of the bellows is such that the fabric material is protected throughout substantially its entire area and strengthened by the plastic strips. But more particularly the edges of the outer hinge folds are reinforced and protected against wear and damage, as well as the corners thereof by the continuous plastic beads 21. Said plastic beads add materially to the external appearance of the bellows in that the beads 21 extend about the corner sections, as distinguished from the usual metal or leather protective corner pieces. Also, when the bellows is collapsed the plastic beads 21 provide a uniform spacing such as to give an evenly disposed scalloped appearance to the exterior surface.

The invention claimed is:

1. A rectangular bellows having a series of diaphragms formed of a sheet of flexible material, folded to provide inner and outer hinge folds for said diaphragms along their inner and outer edges respectively, said flexible material being folded at intervals on itself in the plane of the diaphragms to provide corner sections, and a plastic bead curved in cross section bonded to said flexible material along each outer hinge fold thereof and formed to extend about said corner sections to provide a continuous peripheral protective element for each of the outer hinge folds.

2. A rectangular bellows having a series of diaphragms formed of a flexible air impervious material folded to provide inner and outer hinge folds therebetween and corner sections therefor, and a peripheral bead of plastic material curved in cross section bonded to said flexible material along each outer hinge fold thereof for embracing and protecting said fold, said bead being longitudinally curved to extend about the corner sections of said diaphragms.

3. A rectangular bellows comprising a series of diaphragms formed from a sheet of flexible air impervious material folded to provide inner and outer hinge folds connecting said diaphragms and corner sections thereof, a plurality of substantially rigid sheets of plastic material bonded to said flexible material over the outer surface thereof, said sheets of plastic material being separated at the inner and outer folds, and a strip of substantially rigid plastic material bulged outwardly to extend over said outer hinge fold and bonded thereto to permit the flexing of said hinge folds as the bellows is dilated, said plastic strips and sheets providing a protective and finishing surface for said outer hinge folds and the intermediate exposed outer surface of said diaphragms.

4. A rectangular bellows comprising a series of diaphragms formed from a sheet of flexible material folded to provide inner and outer hinge folds connecting said diaphragms merging into pleated corner sections, a plurality of substantially rigid sheets of plastic material bonded to said flexible material over the outer surface thereof, said sheets of plastic material being separated at the inner and outer folds, and a strip of substantially rigid plastic material bulged outwardly to extend over said outer hinge fold and bonded thereto to permit the flexing of said hinge folds as the bellows is dilated, said plastic sheets providing a protective and finishing surface for said outer hinge folds and the intermediate exposed outer surface of said diaphragms, and a series of tapered fingers formed in said sheet of plastic material at each of the corner sections of said diaphragm tapering radially inward to permit corner formation thereof.

5. A rectangular bellows having a series of diaphragms formed of inner and outer layers of flexible air impervious material, said layers being folded to jointly provide an inner hinge fold connecting said diaphragms along their inner edges said inner layer being folded to provide hinge folds connecting said diaphragms along their outer edges and corner sections, a strip of plastic material bonded between said layers having adjacent edges thereof curved inwardly to-

ward each other about a portion of the outer hinge fold formed by said inner layer, and a bead of plastic material curved in cross section secured to said outer layer to embrace and protect the outer hinge fold of the inner layer and the inwardly curved edges of said strips.

6. A rectangular bellows having a series of diaphragms formed of inner and outer layers of flexible air impervious material, said layers being folded to jointly provide inner hinge folds connecting said diaphragms along their inner edges and corner sections said inner layer being folded to provide hinge folds connecting said diaphragms along their outer edges and corner sections, a strip of plastic material bonded between said layers having adjacent edges thereof curved inwardly toward each other about a portion of the outer hinge fold formed by said inner layer, a bead of plastic material curved in cross section secured to said outer layer to embrace and protect the outer hinge fold of the inner layer and the inwardly curved edges of said strips, and a strip of plastic material extending over and bonded to the exterior surface of said outer layer intermediate of and extending adjacent to said inner and outer hinge folds.

7. A rectangular bellows having a series of diaphragms formed of inner and outer layers of flexible air impervious material, said layers being folded to jointly provide inner hinge folds connecting said diaphragms along their inner edges and said inner layer being folded to provide hinge folds connecting said diaphragms along their outer edges and corner sections, said outer layer being looped outwardly beyond said inner layers along said outer hinge folds, outer strips of substantially rigid plastic material secured to said outer layer of each diaphragm intermediate and spaced inwardly of its hinge connections, inner strips of said plastic material secured between the layers of each diaphragm, said inner strips terminating inwardly of the respective inner hinge folds and being partially curved about the outer hinge folds of the inner layer to permit the formation of and to protect said folds, said inner and outer strips having cut away portions at intervals, pleats formed by said material within said cut away portions to provide corners for each of said diaphragms, and a plastic bead U-shaped in cross section secured about the outer looped portion of said outer layer and curved about the corners of each diaphragm.

8. The method of constructing a rectangular bellows consisting in laying out a sheet of flexible air impervious material having free ends, precutting and superimposing on said sheet a series of strips of a substantially rigid plastic material with the adjacent longitudinal edges of said strips slightly spaced apart, each of said strips being cut away at spaced intervals so as to provide tapered notches to permit bending the strips into four or more corner formations bonding said strips and sheet together under heat and pressure, folding said sheet in alternating directions intermediate the spaced strips to provide a pleated formation having inner and outer hinged folds defining a series of hinge diaphragms, forming corner sections in said folded formation of hinged diaphragms by bending the folded formation in the planes of its respective diaphragms at the cut away portions of said strips, and securing their free ends together with said corner sections formed therein.

9. The method of constructing a rectangular bellows consisting in laying out a sheet of flexible air impervious fabric having free ends, superimposing thereon a series of strips of a substantially rigid plastic of less width than the bellows diaphragms to be formed having adjacent edges of each pair slightly spaced from each other and provided with cut away corner sections therein, superimposing on said strips and fabric sheet a second flexible fabric sheet looped longitudinally thereof at spaced intervals, superimposing on the second sheet of fabric a series of said plastic strips of substantially the width of the diaphragms to be formed arranged with a slight spacing between their adjacent edges and with their opposite edges lying adjacent the looped portion of said fabric, said last-mentioned strips having corresponding corner section portions cut therefrom, mounting a curved bead-like strip of said plastic over said looped portion, bonding said sheets of fabric and strips of plastic together under heat and pressure, folding said bonded structure in alternating reverse directions intermediate said plastic strips to form said diaphragms connected by reverse inner and outer hinge folds, forming said folded diaphragms into rectangular bellows formation about the corner sections provided in said plastic strips, and securing the free ends thereof together.

EDWARD C. SLOAN.

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