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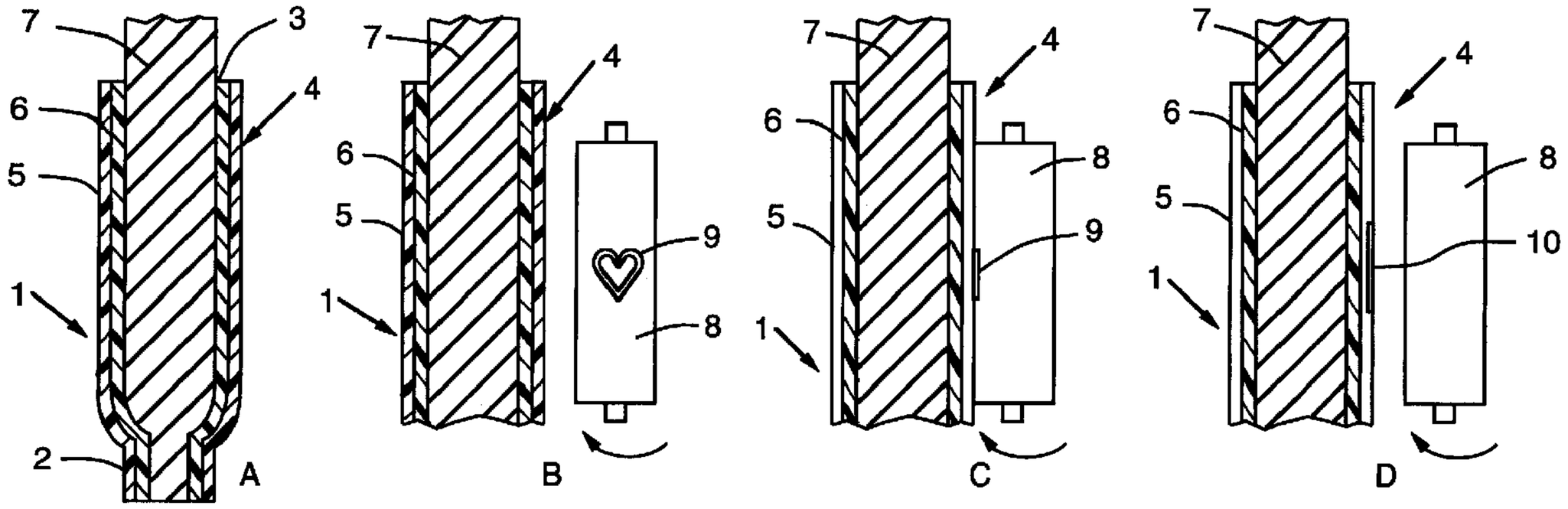
(72) Inventeur/Inventor:
KIERAS, Ronald E., US

(73) Propriétaire/Owner:
COURTAULDS PACKAGING INC., US

(74) Agent: SMART & BIGGAR

(54) Titre : METHODE DE DECORATION DE TUBES PLASTIQUES MULTICOUCHES
(54) Title: METHOD OF DECORATING MULTI-LAYERED PLASTIC TUBES



(57) Abrégé/Abstract:
A decorative feature is formed in the side wall of a longitudinally stretched, extruded, thermoplastic tube comprised of at least two different thermoplastic layers by heating a selected portion of an outer layer of the tube to a temperature sufficient to soften and allow displacement of sections of the outer layer without causing substantial deformation of an adhered layer. The heating is by contact with a hot fluid or a heated die and the displacement of the section of the outer layer by contact with a die.

ABSTRACT

A decorative feature is formed in the side wall of a longitudinally stretched, extruded, thermoplastic tube comprised of at least two different thermoplastic layers by heating a selected portion of an outer layer of the tube to a temperature sufficient to soften and allow displacement of sections of the outer layer without causing substantial deformation of an adhered layer. The heating is by contact with a hot fluid or a heated die and the displacement of the section of the outer layer by contact with a die.

METHOD OF DECORATING MULTI-LAYERED PLASTIC TUBES

Field of the Invention

The present invention relates to a method of forming a decorative feature in the outer surface of the side wall of a multi-layered tube, where the tube is formed from a longitudinally stretched, extruded, thermoplastic cylinder having at least two layers which are composed of different thermoplastic materials.

Background of the Invention

Squeeze tubes formed from thermoplastic materials are extensively used in the packaging of consumer products such as cosmetics, toothpaste, shampoo, foodstuffs and the like. Often, such tubes are formed from an extruded cylinder of thermoplastic material layers that have been extruded and longitudinally stretched in the axial direction, the layers of thermoplastic materials having different physical properties and secured together by a thin layer of adhesive material to provide a cohesive tubular unit. The longitudinally stretched, extruded, thermoplastic cylinder is then cut to length for use in making tubes and a head formed on the tube at one end. Examples of the formation of a head on a tube are described, for example, in US 3,047,910 to Downs and in US 5,069,856 to Holoubek & Rhoades.

Since squeeze tubes are used for packaging of retail products, the formation of decorative features as well as other indicia on the tubes is very important so that the tube is pleasing to the eye. Various decorative processes have been developed, such as printing on the tube surface, application of a decorative foil in combination with printed matter, such as described in US 4,484,970 to Burzlaff and Holoubek, and other processes.

It is an object of the present invention to provide a method of forming a tactile decorative feature on a tube formed from a longitudinally stretched extruded, thermoplastic tube of at least two different thermoplastic materials.

It is another object to provide a method of forming a tactile decorative feature in a tube formed from a longitudinally stretched, extruded, thermoplastic tube of at least two different thermoplastic materials where an outer layer of thermoplastic material contains said decorative feature while the inner surface of an adhered layer of thermoplastic material remains substantially smooth.

Summary of the Invention

Decorative features are formed in the side wall of a longitudinally stretched, extruded, thermoplastic tube comprised of at least two different thermoplastic layers. A longitudinally stretched, extruded, thermoplastic tube is formed from at least two different thermoplastic layers which comprise an outer layer of a first thermoplastic material, such as a low density polyethylene, and an adhered layer of a second thermoplastic material different from the first material, such as a high density polyethylene, the adhered layer having a softening temperature higher than the softening temperature of the outer layer.

A selected portion of the outer layer of the thermoplastic tube is heated to a temperature that is sufficient to soften and allow displacement of sections of the outer layer so as to produce a decorative feature on the side wall of the tube without causing substantial deformation of the adhered layer. The heating of the selected portion of the outer layer may be effected by contacting a heated die, carrying the decorative feature, with

the outer layer or by heating the outer layer, such as by application of hot air, and contacting the heated selected portion with an embossing die.

The displacement of the section of the outer layer can be used to form various embossed decorations in the side wall of the tube, and where the outer layer and adhered layer are of different colors, color contrast can also be created in the decorative feature.

Brief Description of the Drawings

The present method will be more fully understood by reference to the following description and the accompanying drawings of embodiments thereof, wherein:

Figure 1 is a schematic illustration of an embodiment of the method of the present invention;

Figure 2 is a cross-sectional view of a portion of the side wall of a tube decorated according to the method of the present invention;

Figure 3 is a plan view of the side wall of the tube illustrated in Figure 2; and

Figure 4 is a schematic illustration of a step in a further embodiment of the method of the present invention wherein a selected portion of the side wall is heated prior to contact with a die carrying a decorative feature.

Detailed Description

The present method provides the application of a decorative feature on the side wall of a tube that is formed from a longitudinally stretched, extruded, thermoplastic cylinder, the

side wall having at least two layers of different thermoplastic material forming the side wall.

The tube that is decorated by the present method is formed from a longitudinally stretched, extruded, thermoplastic tube formed from various thermoplastic materials, such as polyethylene, polypropylene, polyvinyl chloride, and the like. The tube is formed from multi-layered or laminates of different thermoplastic materials, with adhesive layers preferably provided between two contiguous layers to bond the layers together. The longitudinally stretched, extruded, thermoplastic cylinder from which the tube is initially formed is produced from a tubular extrusion which has a wall thickness in the molten state that is two to three times the wall thickness of the final cooled extruded thickness. Such a tubular extrusion is formed by extruding the layers of thermoplastic material, and any adhesive, from an extrusion annulus in a molten state and stretching the hot tubular form, in the direction of the longitudinal axis thereof, into a cylinder having a wall thickness one-half to one-third, or less, than the extrusion annulus. Such extrusion and stretching techniques are known, and further described in U.S. 5,069,856, which is assigned to the assignee of the present invention.

In the present method, the longitudinally stretched, extruded, thermoplastic cylinder is formed from at least two different adhered layers of thermoplastic material, an outer layer of a first thermoplastic material and an adhered layer of a second thermoplastic material which is different from the material of the first layer and which adhered layer has a

softening temperature that is greater than the softening temperature of the outer layer. The outer layer may, for example, be a low density polyethylene,

identified by ASTM standards as having a density of between about 0.910 to 0.925, while the adhered layer may, for example, be a high density polyethylene, identified by ASTM standards as having a density of between about 0.941 to 0.959. Or, the outer layer may be an ultra low density polyethylene, generally described by ASTM standards as having density of about 0.905 or below, and the adhered layer may be a high density polyethylene.

Tubes formed from such longitudinally stretched, extruded, thermoplastic cylinders will generally have a side wall of a thickness of about 0.010 to 0.050 inch, preferably about 0.012 to 0.020 inch, with the outer layer having a thickness of between about 0.002 to 0.010 inch, preferably between about 0.002 to 0.005 inch, and the adhered layer having a thickness of between about 0.008 to 0.040 inch, preferably between about 0.008 to 0.020 inch. An adhesive layer maybe used to secure the outer layer and adhered layer together and is very thin, usually between about 0.0002 to 0.0015 inch in thickness.

In accordance with the present method, the side wall of the tube is heated to a temperature sufficient to soften and allow displacement of sections of the outer layer of tube to produce a decorative feature therein without causing any substantial deformation or displacement of the adhered layer. Selected portions of the side wall are heated to the desired temperature and displacement of sections of the softened outer layer are effected by contact with an embossing die carrying the desired decorative feature. The pressure of contact and time of contact of the die, as well as the specific temperatures used will depend on the thermoplastic material of the tube and are readily determined to produce a desired displacement. For example, with a tube having a side wall composed of an inner (adhered) layer of a high density

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polyethylene polymer, such as (Alathon*L5045 by Occidental Chemical Corp.) and an outer layer of low density polyethylene polymer, such as (Dupont* 2020T by Du Pont De Nemours E I & Co.) heating of the outer tube wall to a temperature of at least about 170 - 175°F is required to produce a decorative feature therein. At a temperature of about 190°F, a more definitive displacement and clear impression or decorative feature is achieved. Optimum results are achieved at a temperature of about 230 - 260°F, while heating to a temperature above about 280 - 290°F can result in distortion of the tube wall.

The selected portion of the side wall of the tube is raised to the desired elevated temperature preferably by contacting the outer layer of the tube with a heated die carrying the decorative feature. Or, the outer layer of the tube may be heated by applying heat to the selected portion, such as by contacting the outer layer with a stream of hot fluid, such as hot air, and then contacting the heated selected portion with a die carrying the decorative feature. Or, if desired, a combination of use of a hot fluid and a heated die carrying the decorative feature may be used. The present description, will refer to an outer layer and adhered layer forming the wall of the tube, while it is to be understood that an additional layer or layers may be provided on the surface of the adhered layer opposite the outer layer. For example, a further thermoplastic layer may be adhesively or otherwise secured to the exposed surface of the adhered layer without affecting the decorative method. Whether such additional layers are present or not, however, an advantage of the present

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method lies in the decoration of the outer layer of the tube with a textured or tactile, i.e. perceptible by touch, surface, while the inner surface of the tube will be unaffected and still provide a smooth

surface for flow of the contents of the tube therealong for dispersal from the tube.

Reference is now made to the drawings which schematically illustrate the embodiments of the present process.

In Figure 1, (A) illustrates a tube 1 formed from a longitudinally stretched, extruded, thermoplastic cylinder having a head 2 formed at one end and an open end 3 at the other end, the side wall 4 of the tube formed from two different adhered layers, an outer layer 5 of a first thermoplastic material and an adhered layer 6 of a second thermoplastic material that has a softening temperature greater than the softening temperature of the outer layer 5, the tube 1 being supported on a mandrel 7. As shown at (B) of Figure 1, the tube 1, carried by mandrel 7 is brought into proximity to a die 8, which die may be a flat or concave shape that reciprocates towards and away from the tube, but is preferably a roller that is rotated as shown by the arrow, which die 8 carries a decorative feature 9 that is to be formed in the side wall 4 of the tube 1, the die having been heated to a temperature sufficient to heat the tube side wall 4 and displace sections of the tube side wall outer layer 5. As shown at (C) of Figure 1, the heated die 8 is brought into contact with the side wall 4 of the tube 1 and heats the same so as to raise the temperature of the outer layer 5 and softens the outer layer to allow displacement of heated sections of the outer layer 5 and produce the decorative feature 10 therein of a design the same as the decorative feature 9 carried on die 8. The die 8 is then removed from contact with the side wall 4 of tube 1 and the tube cooled such that the decorative feature 10 remains in the outer layer 5 of the side wall 4, as illustrated in Figures 2 and 3. In Figure 3, the decorative feature, illustrated as a heart-shaped design, shows a land 11 and recess 12 formed by

softening and displacing a section of the outer layer 5 of the side wall 4. As shown in Figure 2, the formation of the decorative feature 10 in outer layer 5 is effected without causing any substantial deformation of the adhered layer 6, such that the inner surface 13 of the adhered layer 6 remains smooth and substantially undisturbed.

In an alternate embodiment of the present invention, rather than heating the die 8 and contacting the heated die with the outer layer 5 of the side wall 4 of tube 1, a selected portion only of outer layer 5 may be heated, such as by application of a flow of heated fluid 14, preferably hot air, from a source 15 as illustrated in Figure 4. The selected portion of the outer layer 5, after heating by a hot fluid to raise the temperature of the outer layer to a temperature sufficient such that contact of a die 8 carrying a decorative feature 9 will displace sections of the heated selected portion of the outer layer, is then brought into contact with the die 8 carrying decorative feature 9. The contact of the die 8 with the heated side wall 4 will then form the decorative feature 10 in the outer layer 5 without causing any substantial deformation of the adhered layer 6. Or, as a further embodiment, the die 8 may be heated and also a selected portion of the side wall 4 heated by a hot fluid prior to contact of the heated die 8 carrying decorative feature 9 with the heated selected portion of the side wall 4.

As an illustration of the temperature used in the present method, thermoplastic tubes were found having a two layer structure tube was provided having a low density polyethylene outer layer and a high density polyethylene adhered or inner layer. In order to form a decorative feature in the outer layer, a temperature of the outer layer of about 170 - 175°F was required, with a clear defined

"melted" impression being obtained at a temperature of above about 190°F. At a temperature of between about 230 - 260°F, an optimum "melted" impression was formed in the outer layer. Temperatures in excess of about 280°F result in distortion and are not usable.

An advantage of the present decorative method is the ability to form a decorative feature over an existing decoration or indicia that may already be present on the side wall of the tube. Thus, an existing decoration may be altered or enhanced by use of the present method. Also, where the outer layer and the adhered layer of thermoplastic materials are of different colors, the displacement of sections of the outer layer to form the decorative feature can result in different hues or color contrasts being produced in the decorative feature.

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CLAIMS:

1. A method of forming a decorative feature into a side wall of a thermoplastic tube, intermediate two opposed ends thereof, the tube formed from a longitudinally stretched, extruded, thermoplastic cylinder, comprising:

forming a longitudinally stretched, extruded, thermoplastic tube from at least two different thermoplastic layers, the tube having an outer layer of a first thermoplastic material, and an adhered layer of a second thermoplastic material different from the first material, the adhered layer having a softening temperature greater than the softening temperature of the outer layer;

heating a selected portion of the side wall of the tube to raise the temperature of the outer layer to a temperature sufficient such that contact of a die carrying a decorative feature will displace sections of the heated selected portion of the outer layer and produce the decorative feature therein, without causing substantial deformation of the adhered layer such that an inner surface of the adhered layer remains smooth; and

contacting the heated side wall of the tube with the die so as to form the decorative feature in the outer layer.

2. The method as defined in Claim 1, wherein the heating is effected by contacting the outer layer with a heated die carrying the decorative feature.

3. The method as defined in Claim 1, wherein the heating is effected by applying heat to the selected portion only of the outer layer and contacting the heated selected portion with a die carrying the decorative feature.

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4. The method as defined in Claim 1, wherein the heating is effected by applying heat to the selected portion only of the outer layer and contacting the outer layer with a heated die carrying the decorative feature.

5. The method as defined in any one of Claims 1 to 4, wherein the adhered layer comprises a high density polyethylene and the outer layer comprises a low density polyethylene.

6. The method as defined in Claim 5 wherein the selected portion of the side wall of the tube is heated to a temperature greater than about 170°F.

7. The method as defined in Claim 6 wherein the selected portion of the side wall of the tube is heated to a temperature greater than about 190°F.

8. The method as defined in Claim 5 wherein the selected portion of the side wall of the tube is heated to a temperature of between about 230 - 260°F.

9. The method as defined in any one of Claims 1 to 4, wherein the adhered layer comprises a high density polyethylene and the outer layer comprises an ultra low density polyethylene.

10. The method as defined in any one of Claims 1 to 9, wherein the adhered layer is of a different color than the outer layer.

11. The method as defined in any one of Claims 1 to 4, wherein the outer layer has a thickness of between about 0.002 to 0.010 inch and comprises a low density polyethylene and the adhered layer has a thickness of between about 0.008 to 0.040 inch and comprises a high density polyethylene.

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12. A method of forming a decorative feature into a side wall of a thermoplastic tube, intermediate two opposed ends thereof, the tube formed from a longitudinally stretched, extruded, thermoplastic cylinder, comprising:

forming a longitudinally stretched, extruded, thermoplastic tube from at least two different thermoplastic layers, the tube having an outer layer of a low density polyethylene polymer, and an adhered layer of a high density polyethylene polymer, the adhered layer having a softening temperature greater than the softening temperature of the outer layer;

heating a selected portion of the side wall of the tube to raise the temperature of the outer layer to a temperature of between about 230 - 260°F by contact of a die carrying a decorative feature to displace sections of the heated selected portion of the outer layer and produce the decorative feature therein, without causing substantial deformation of the adhered layer such that an inner surface of the adhered layer remains smooth; and

contacting the heated side wall of the tube with the die so as to form the decorative feature therein.

13. A method of forming a decorative feature into a side wall of a thermoplastic tube, intermediate two opposed ends thereof, the tube formed from a longitudinally stretched, extruded, thermoplastic cylinder, comprising:

forming a longitudinally stretched, extruded, thermoplastic tube from at least two different thermoplastic layers, the tube having an outer layer of a first thermoplastic material of a thickness of between about 0.002 to 0.010 inch,

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and an adhered layer of a second thermoplastic material different from the first material of a thickness of between about 0.008 to 0.040 inch, the adhered layer having a softening temperature greater than the softening temperature of the outer layer; and

heating a selected portion of the side wall of the tube, by contact with a heated die carrying the decorative feature, to raise the temperature of the outer layer to a temperature sufficient such that the contact will displace sections of the heated selected portion of the outer layer and produce the decorative feature therein, without causing substantial deformation of the adhered layer such that an inner surface of the adhered layer remains smooth, whereby the decorative feature is formed in the outer layer.

14. A method of forming a decorative feature into a side wall of a thermoplastic tube, intermediate two opposed ends thereof, the tube formed from a longitudinally stretched, extruded, thermoplastic cylinder, comprising:

forming a longitudinally stretched, extruded, thermoplastic tube from at least two different thermoplastic layers, the tube having an outer layer of a first thermoplastic material having a thickness of between about 0.002 to 0.010 inch, and an adhered layer of a second thermoplastic material different from the first material of a thickness of between about 0.008 to 0.040 inch, the adhered layer having a softening temperature greater than the softening temperature of the outer layer;

heating a selected portion of the side wall of the tube, by applying a hot fluid thereto, to raise the temperature of the outer layer to a temperature sufficient such that

contact of a die carrying a decorative feature will displace sections of the heated selected portion of the outer layer and produce the decorative feature therein, without causing substantial deformation of the adhered layer such that an inner surface of the adhered layer remains smooth; and

contacting the heated side wall of the tube with the die so as to form the decorative feature in the outer layer.

15. A thermoplastic tube formed from a longitudinally stretched, extruded, thermoplastic cylinder, having a side wall comprised of at least two different thermoplastic layers and having an outer layer of a first thermoplastic material and an adhered layer of a second thermoplastic material, the adhered layer having a softening temperature greater than the softening temperature of the outer layer; the side wall having a decorative feature formed therein by displacement of a selected portion of the outer layer without substantial deformation of the adhered layer such that an inner surface of the adhered layer is smooth.

16. The thermoplastic tube as defined in Claim 15, wherein the adhered layer comprises a high density polyethylene and the outer layer comprises a low density polyethylene.

17. The method as defined in Claim 12, 13 or 14, wherein the selected portion of the side wall of the tube is heated to a temperature greater than about 170°F.

18. The method as defined in Claim 17 wherein the selected portion of the side wall of the tube is heated to a temperature greater than about 190°F.

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19. The method as defined in Claim 17 wherein the selected portion of the side wall of the tube is heated to a temperature of between about 230 - 260°F.

20. The thermoplastic tube as defined in Claim 15, wherein the adhered layer comprises a high density polyethylene and the outer layer comprises an ultra low density polyethylene.

21. The thermoplastic tube as defined in Claim 15, wherein the adhered layer is of a different color than the outer layer.

22. The thermoplastic tube as defined in Claim 15, wherein the outer layer has a thickness of between about 0.002 to 0.010 inch and comprises a low density polyethylene and the adhered layer has a thickness of between about 0.008 to 0.040 inch and comprised a high density polyethylene.

23. The method as defined in any one of Claims 1 to 14 or any one of claims 17 to 19, wherein the tube has been obtained by cutting to length a longitudinally stretched, extruded, thermoplastic cylinder having the different thermoplastic layers; and the tube has a head formed at one end and an open end at the other end.

24. The method as defined in Claim 23, wherein the tube during the method is supported on a mandrel inserted into the tube through the open end.

25. The method as defined in any one of claims 1 to 14 or any one of claims 17 to 19 or claim 23 or 24, wherein the die carrying the decorative feature is a rotatable roller.

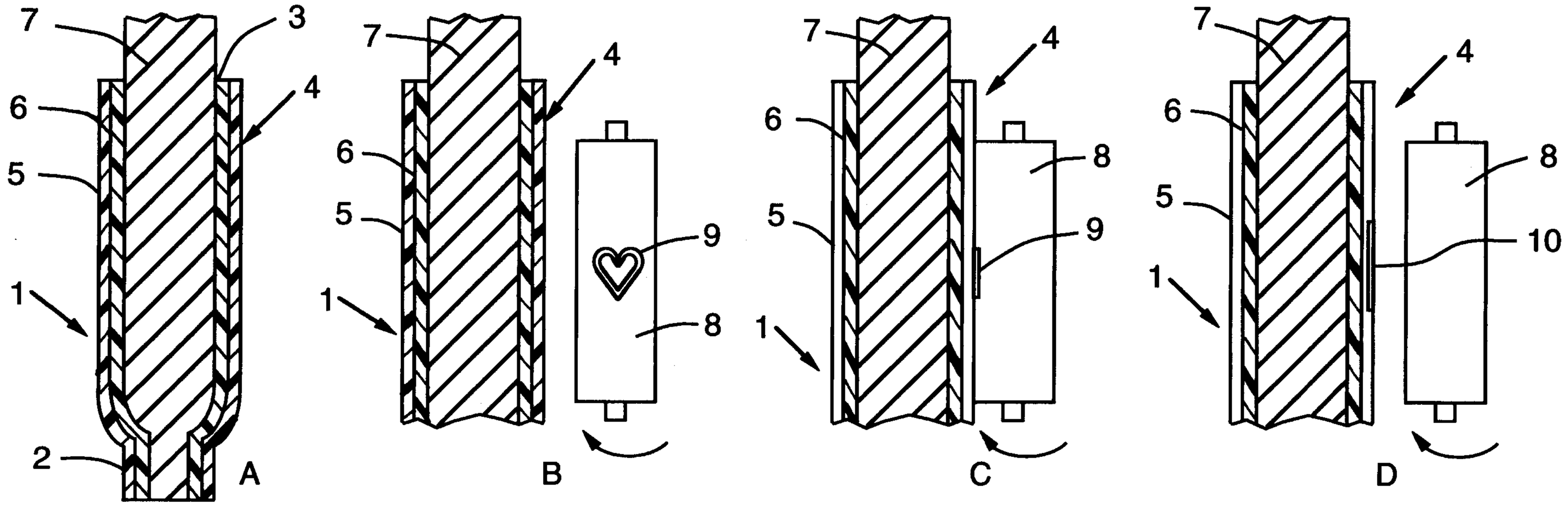


FIG. 1

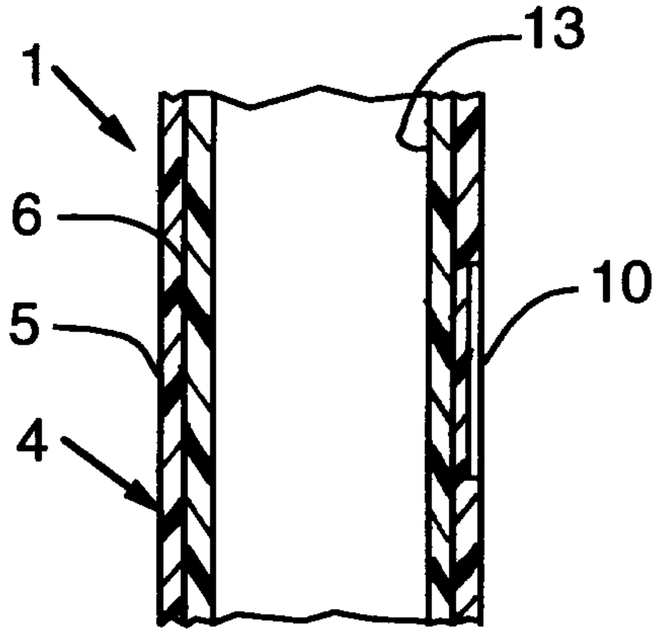


FIG. 2

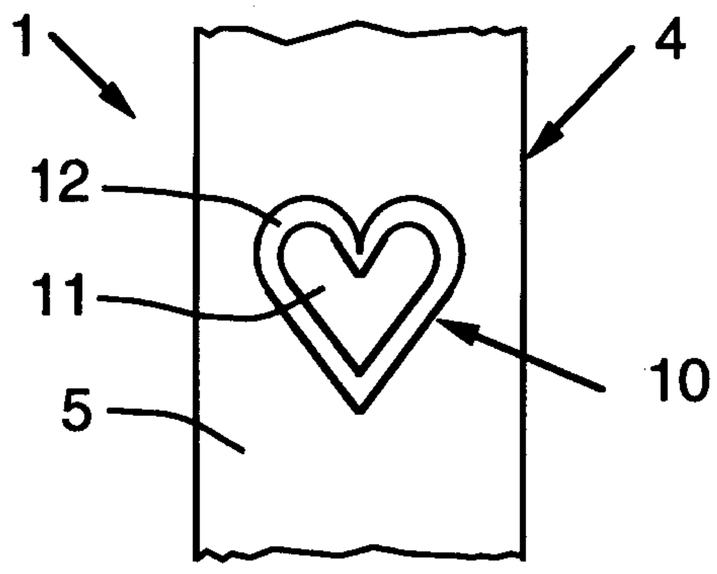


FIG. 3

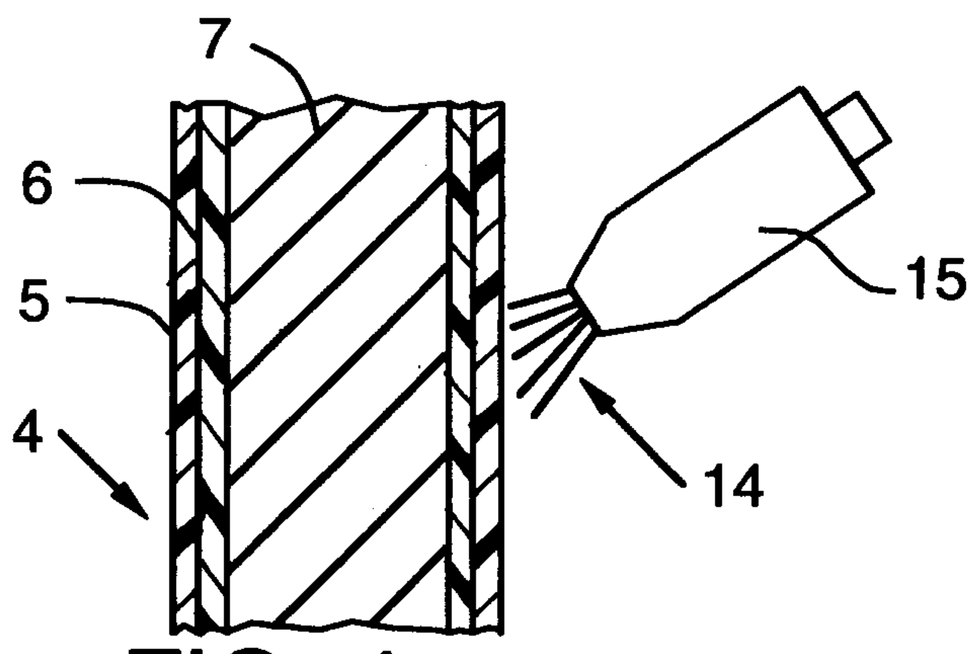
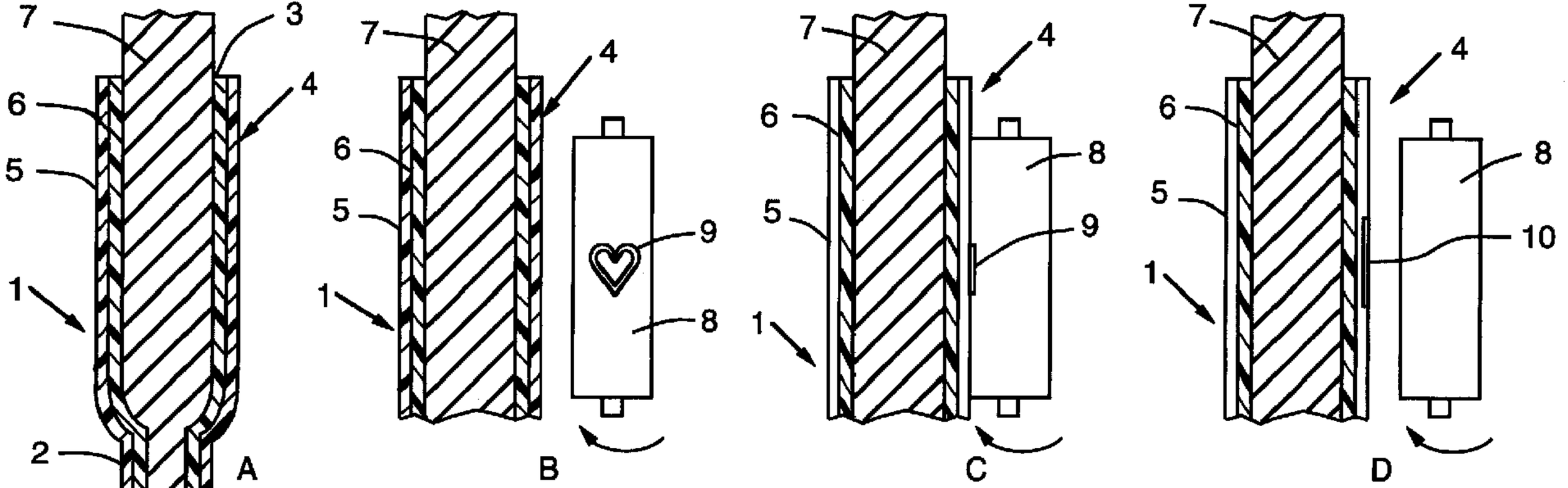


FIG. 4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