Claims

1. A process for manufacturing a flexible package (1) suitable for containing a food or beverage ingredient and suitable for use with a food or beverage preparation machine, wherein said process comprises the steps of, in order:

(i) providing a primary flat blank sheet (5) made of flexible material, preferably a fibre-based material, said blank sheet (5) having an elongated shape with two flaps extending symmetrically around a transversal axis (*Lx*),

- providing a secondary flexible flat blank sheet (11), made preferably of a coated fibre-based material,
- punching a secondary hole (16) at least through the fibre-based material of the secondary flat blank sheet (11),
- punching a primary hole (15) throughout the primary flat blank sheet (5), that is centered across said sheet, the diameter of said primary hole (15) being equal or superior to the diameter of the secondary hole (16) in the secondary flexible flat blank sheet (11),
- sealing or otherwise attaching said secondary flat blank sheet (11) to the interior surface of the primary flat blank sheet (5), so that the centres of both holes (15, 16) are aligned,

(ii) placing the primary flat blank sheet (5) in a forming station (21) such that its centre is located between a plunger (23) and a cavity (24) that are movable relative to one another and have complementary shapes, said plunger (23) having a concave lower end side (26) and convex lateral sides (27), and the profile curvature of its lower end side (26) being identical to the profile curvature of each of its lateral sides (27),

(iii) deforming the primary flat blank sheet (5) by moving the plunger (23) and the cavity (24) towards one another, so that said blank (5) is

folded around its transversal axis (*Lx*) to lift the flaps and form an unsealed U-shaped package having side walls (2) that form a flatten package body and a bottom portion (3), said bottom portion (3) being a cup-shaped hollow volume having the shape of said plunger (23),

(iv) sealing the lateral edges (4) of said U-shaped package (1).

2. A process according to claim 1, wherein the plunger (23) has an hexagonal prism shape, said prism having two opposed vertical edges (9) aligned with the plunger transversal axis (*Lx*) that extend downwardly to form downwardly extending tips (10), said extended edges having a

height that is such that, for each transversal cross section of said plunger (23) measured all along its transversal axis (*Lx*), the sum of two heights of the plunger end portion (25) plus the width of its lower end side (26), is constant.

3. A process according to claim 2, wherein the tips (10) of the plunger (23) are rounded or otherwise smooth-edged.

4. A process according to any one of the preceding claims 1 to 3, which further comprises the steps of:

(v) filling said package (1) with a food of beverage ingredient,

(vi) sealing the top edge (34) of the package (1) to close it.

5. A process according to any one of the preceding claims 1 to 4, which further comprises:

- placing a pair of plates (31) underneath said flexible blank sheet (5) in step (ii), both plates (31) being initially coplanar and each plate supporting a flap of the primary flexible blank sheet (5), said plates being symmetrically pivotable around respective axes that are each located from either side of said plunger (23),
- pivoting both plates (31) during step (iii), so that the edge of each plate which is the most distant from said plunger (23) and cavity (24) is lifted during the pivoting movement in order to facilitate folding of the primary flexible blank sheet (5) into said U-shaped unsealed package.

6. A process according to any one of the preceding claims 1 to 5, wherein

the attachment or sealing area of the secondary flat blank sheet (11) to the interior surface of the primary flat blank sheet has a ring shape that surrounds said holes, and having a width which is comprised between 0.5mm and 10mm, preferably between 2mm and 7mm.

7. A process according to claim 6, which further comprises the steps of:

- providing a tertiary flexible flat blank sheet (14),
- sealing or otherwise attaching said tertiary flexible flat blank sheet (14) in between said primary and secondary flexible flat blank sheets (5, 11).

8. A process according to claim 7, wherein said tertiary flexible flat blank sheet (14) is a thin layer selected with the list of: polyethylene (PE), polypropylene (PP), polylactide (PLA), polyhydroxyalcanoates (PHA), polybutylene adipate terepthalate (PBAT), polybutylene succinate (PBS), polyvinyl alcohol (PVOH), starch-based polymers, a polymer comprising food-grade oxygen and/or moisture scavengers, or a combination thereof.

9. A process according to any one of the preceding claims 6 to 8, wherein the concave lower end side (26) of the plunger (23) comprises a retractable protrusion (30) that is aligned with the centre of the plunger, and extends downwardly during steps (i) and (ii), and is pressed within the plunger during step (iii) when the tip of said plunger is brought in contact with the blank sheet and the cavity (24) below.

10. A process according to claim 9, wherein the diameter of the retractable protrusion (30) is superior to the diameter of the primary and secondary punched holes (15, 16).

11. A machine for manufacturing a package (1) according to a process as claimed in claims 1 to 10, said machine comprising:

- a flexible flat blank sheet feeder,
- a forming set comprising a plunger (23) and a cavity (24) that are movable relative to one another and have complementary shapes, said plunger (23) having a concave lower end side (26) and convex lateral sides (27), and the profile curvature of its lower end side (26) being identical to the profile curvature of each of its lateral sides (27),
- an actuator for moving the plunger (23) and the cavity (24) towards one another to deform said blank by folding, around its transversal axis (Lx), to form an unsealed U-shaped package having side walls that form a flatten package body and a bottom portion having a rigid flat surface, said bottom portion being a hollow volume having the shape of said plunger,
- a set of sealing jaws (32, 33) adapted to seal the lateral edges and the cup-shaped bottom portion (3) of said U-shaped package.

12. A machine according to claim 11, wherein the plunger (23) has an hexagonal prism shape, said prism having two opposed vertical edges (9) aligned with the plunger transversal axis (*Lx*) that extend downwardly to form downwardly extending tips (10), said extended edges (9) having a height that is such that, for each transversal cross section of said plunger measured all along its transversal axis (*Lx*), the sum of two heights of the plunger end portion (25) plus the width of its lower end side (26), is constant.

13. A machine according to claim 12, wherein the tips (10) of the plunger (23) are rounded or otherwise smooth-edged.

14. A machine according to any one of the preceding claims 11 to 13, which further comprises a pair of plates (31) adapted to support said flexible blank sheet (5), and each plate supporting a flap of the primary flexible blank sheet, said plates being symmetrically pivotable around respective axes that are each located from either side of said plunger.

15. A machine according to any one of the preceding claims 11 to 14, wherein the concave lower end (26) of the plunger (23) comprises a retractable protrusion (30) that is aligned with the centre of said plunger, said protrusion (30) being spring-mounted to retract within the plunger when pressed against said primary flat blank sheet and the cavity (24) underneath.