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(54) **INCREASED-STRENGTH CUP**

(57) An increased-strength cup containing a round bottom and a curved wall, wherein the curved wall of the cup is created by rotating a tangent-shaped curve (2), forming the lateral surface, around the vertical axis (4) of the cup, whereas the diameter of the curved wall of the cup increases in the direction from the bottom (1) of the cup towards the drinking edge (3).

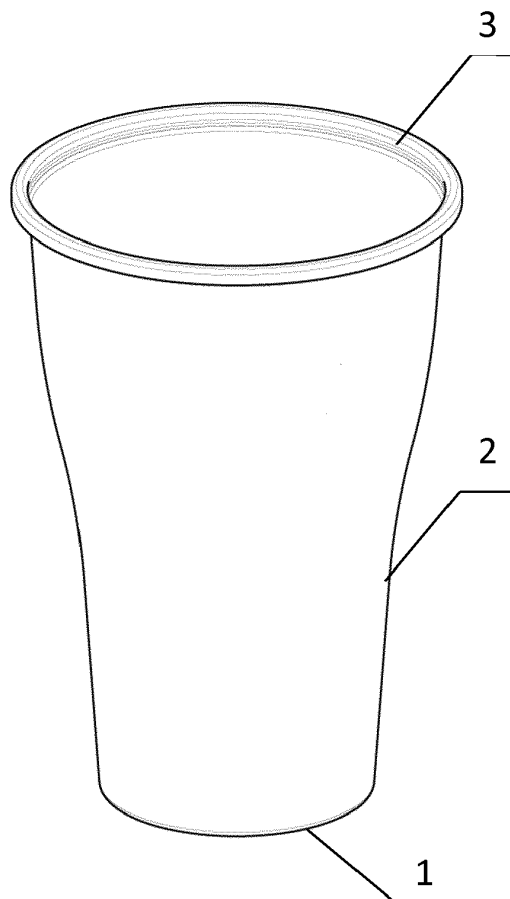


Fig 1.

Description

[0001] The invention concerns a cup with increased compressive strength.

[0002] Patent description ref. US2015008255 presents a deform-proof cup with lateral-oriented fibers. Thanks to these lateral fibers and a rim in the upper part of the cup, it can withstand deformations when held in hand. The invention is applied in cups of different heights, it reinforces its structure, reduces its weight and reduces its production costs. The cup can be made of polyethylene, polypropylene or polyethene terephthalate.

[0003] Patent description ref. US5449089 presents a bell fountain cup, containing a lower surface and side walls, which extend upwards. The side walls have a lower part and an upper part which creates an opening in the cup, and a radially widening part situated between the upper and lower parts. The maximum diameter of the broadening part is larger than the diameter of the lower surface and larger than the diameter of the upper opening. The side wall is approximately of the same thickness in the lower part, in the middle, broadening part, and at least in a fragment of the upper part. The side walls are approximately 0.020 inch thick +/- c.a. 0.005 in the lower, middle parts and in a fragment of the upper part. The cup can be made of PET.

[0004] Patent description ref. DE202007016006 presents a container for storing liquids and pastes, and particularly dairy products, with its inner limiting surface and its outer, printable shell. At least one cavity, pointing inwards in a radial manner, is situated on the outer surface of the lower part of the vessel. The inner surface can be made of polystyrene or polypropylene or PET.

[0005] The increased-strength cup according to the invention is made of plastic, selected from polyethene terephthalate (PET), recycled polyethene terephthalate (rPET), polypropylene (PP) or polylactic acid (PLA). The cup has a round bottom and a curved wall. The curved wall of the cup is created by rotating a tangent-shaped curve forming the lateral surface of the cup around the vertical axis of the cup, whereas the diameter of the curved wall of the cup increases in the direction from the bottom of the cup towards the drinking edge. The cup's tangent wall curve includes at least four, permanently connected and inseparable sections. In the lower, straight section connecting the bottom and the wall of the cup, the cup's wall curve is inclined at 3 to 6 degrees. In another section, the cup's wall curve is concave in reference to the vertical cup symmetry axis. In another section, the cup's wall curve is convex in reference to the cup symmetry axis. The last, straight section of the cup's wall curve is inclined at 3 to 6 degrees and finished with a reinforcing outward fold, which serves as a drinking edge. In a beneficial embodiment of the invention, the upper surface of the reinforcing outward fold is perpendicular to the cup symmetry axis, creating a flat edge surface, as to enable product packing by wrapping foil or the application of aluminum lid on the top opening. The bottom of the cup is inseparably connected to the cup's wall. In a beneficial embodiment of the invention, the bottom is concave and includes a cavity, preferably cylindrical, as to prevent cups from sticking, when one of them is inserted into another.

[0006] The advantages of the increased-strength cup according to the invention is its high compressive strength in the direction of the vertical axis, and a reduction in the amount of raw material used, as well as elimination of the problem of jammed cups, when one of them is inserted into another.

[0007] An example of the invention was presented in various embodiments in the figure, in which Fig. 1 presents a view of a 555 ml cup, Fig. 2 presents a longitudinal section of a 555 ml cup, Fig. 3 and Fig. 4 present, respectively, zooms on the longitudinal section of the drinking edge and the bottom of a 555 ml cup, when one cup is placed in another, Fig. 5 presents a 243 ml cup, and Fig. 6 presents the shape of a classic-shaped 550 ml cup, which was used in a comparative study of compressive strengths in Example 3.

Example 1. A 550 ml cup

[0008] A polyethene terephthalate cup was made by thermoforming. The cup has a round bottom 1 and a curved wall. The curved wall of the cup is created by rotating the tangent-shaped curve 2, forming the lateral surface, around the vertical axis 4 of the cup, whereas the diameter of the curved wall of the cup increases in the direction from the bottom 1 of the cup towards the drinking edge 3. The cup's tangent wall curve 2 includes at least four, permanently connected and inseparable sections. In the lower, straight section 5 connecting the bottom 1 and the wall of the cup, the cup's wall curve 2 is inclined at 4 degrees. In another section 6, the cup's wall curve 2 is concave in reference to the vertical cup symmetry axis 4, whereas the radius of the curve is 185 mm. In another section 7, the cup's wall curve 2 is convex in reference to the cup symmetry axis 4, whereas the radius of the curve is 185 mm. The last, straight section 8 of the cup's wall curve 2 is inclined at 4 degrees and finished with a reinforcing outward fold 9, which serves as a drinking edge 3. The upper surface of the reinforcing outward fold is perpendicular to the cup symmetry axis 4, creating a flat edge surface, as to enable product packing by wrapping foil or the application of aluminum lid on the top opening. The bottom 1 of the cup is inseparably connected to the cup's wall. The bottom 1 is concave and includes a cavity 10, preferably cylindrical, as to prevent cups from sticking when one of them is inserted into another.

[0009] The cup is 136.7 mm high, the external diameter of the fold is 94.7 mm, the diameter of the bottom 1 is 58 mm, and the diameter of the cavity 10 is 38 mm. The height of the cavity is 9.4 mm. The volume of the cup is 555 ± 10 ml.

Example 2. A 243 ml cup

[0010] A polyethene terephthalate cup was made by thermoforming. The cup has a round bottom 1 and a curved wall. The curved wall of the cup is created by rotating the tangent-shaped curve 2, forming the lateral surface, around the vertical axis 4 of the cup, whereas the diameter of the curved wall of the cup increases in the direction from the bottom 1 of the cup towards the drinking edge 3. The cup's tangent wall curve 2 includes at least four, permanently connected and inseparable sections. In the lower, straight section 5 connecting the bottom 1 and the wall of the cup, the cup's wall curve 2 is inclined at 4 degrees. In another section 6, the cup's wall curve 2 is concave in reference to the vertical cup symmetry axis 4, whereas the radius of the curve is 120 mm. In another section 7, the cup's wall curve 2 is convex in reference to the cup symmetry axis 4, whereas the radius of the curve is 200 mm. The last, straight section 8 of the cup's wall curve 2 is inclined at 4 degrees and finished with a reinforcing outward fold 9, which serves as a drinking edge 3. The upper surface of the reinforcing outward fold is perpendicular to the cup symmetry axis 4, creating a flat edge surface, as to enable product packing by wrapping foil or the application of aluminum lid on the top opening. The bottom 1 of the cup is inseparably connected to the cup's wall. The bottom 1 is concave and includes a cavity 10, preferably cylindrical, as to prevent cups from sticking when one of them is inserted into another.

[0011] The cup is 83.2 mm high, the external diameter of the fold is 78.2 mm, the diameter of the bottom 1 is 50 mm, and the diameter of the cavity 10 is 31 mm. The height of the cavity is 8 mm. The volume of the cup is 243 ± 10 ml.

Example 3. Compressive strength analysis

[0012] The analysis was carried out for the cup described in Example 1 of 555 ml, and for two classic cups of 550 and 650 ml, both with straight walls. The test was carried out on a sample of 50 cups of each type. Cups were pressed on Imada MX-500N until a first permanent deformation was recorded. Table 1 contains the results of the compressive test in the vertical axis of the cups according to the invention, with curved walls (a), and cups with straight walls, of 650 (b) and 550 (c) ml. The results have been averaged out for the analysis of 50 cups of each type $\pm$ standard deviation.

Cup	Diameter (mm)	Weight (g)	Height (mm)	Load		
				kg	kg/g (indicator 1)	kg/mm (indicator 2)
a	94.7	13.5	136.7	13.86 ± 1.703	1.027	0.1014
b	94.7	13	148.6	9.455 ± 2.285	0.727	0.0636
c	94.7	12.1	122	9.348 ± 1.161	0.773	0.0766

[0013] The compressive strength analysis indicated that the increased-strength cup according to the invention was characterized by higher compressive strength in the vertical axis in average by 41% compared to cup (b) and by 32% compared to cup (c), as measured by index 2.

Claims

1. An increased-strength cup containing a round bottom and a curved wall, **characterized in that** the curved wall of the cup is created by rotating a tangent-shaped curve (2), forming the lateral surface, around the vertical axis (4) of the cup, whereas the diameter of the curved wall of the cup increases in the direction from the bottom (1) of the cup towards the drinking edge (3).
2. The cup according to claim 1, **characterized in that** it is made of plastic, selected from polyethene terephthalate (PET), recycled polyethene terephthalate (rPET), polypropylene (PP) or polylactic acid (PLA).
3. The cup according to claim 1 or 2, **characterized in that** its tangent wall curve (2) includes at least four, permanently connected and inseparable sections.
4. The cup according to claim 3, **characterized in that** in the lower, straight section (5) of the wall of the cup, the cup's wall curve (2) is inclined at 3 to 6 degrees, and in another section (6), the cup's wall curve (2) is concave in reference to the vertical cup symmetry axis (4), and in another section (7), the cup's wall curve (2) is convex in reference to the cup symmetry axis (4), and in the last, straight section (8) of the cup's wall curve (2) is inclined at 3 to 6 degrees and finished with a drinking edge (3).

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5. The cup according to claim 4, **characterized in that** the drinking edge (3) is equipped with a reinforcing outward fold (9).

5 6. The cup according to claim 5, **characterized in that** the upper surface of the reinforcing outward fold (9) is perpendicular to the cup symmetry axis (4), creating a flat edge surface.

7. The cup according to claim 1 or 2 or 3 or 4 or 5, **characterized in that** the bottom (1) of the cup concave and includes a cavity (10).

10 8. The cup according to claim 7, **characterized in that** the cavity (10) is cylindrical.

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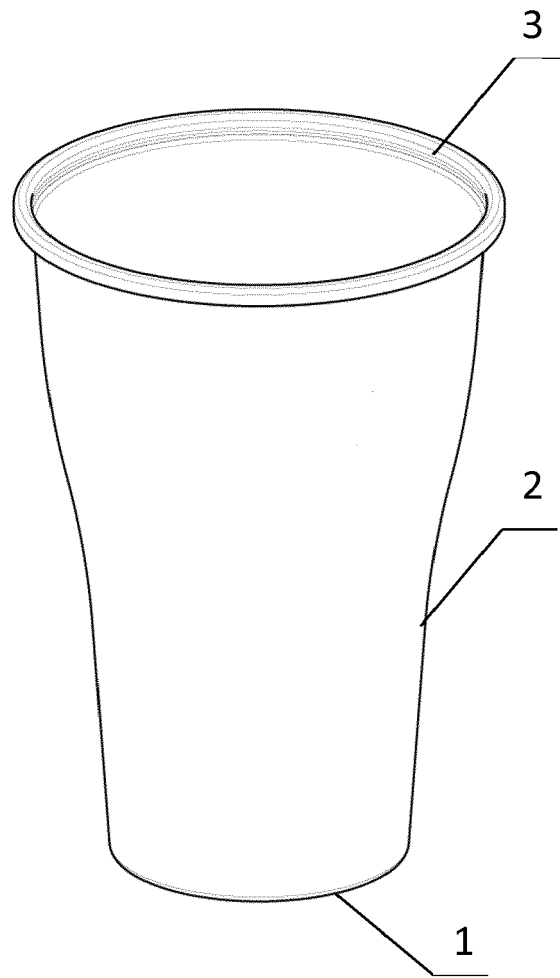
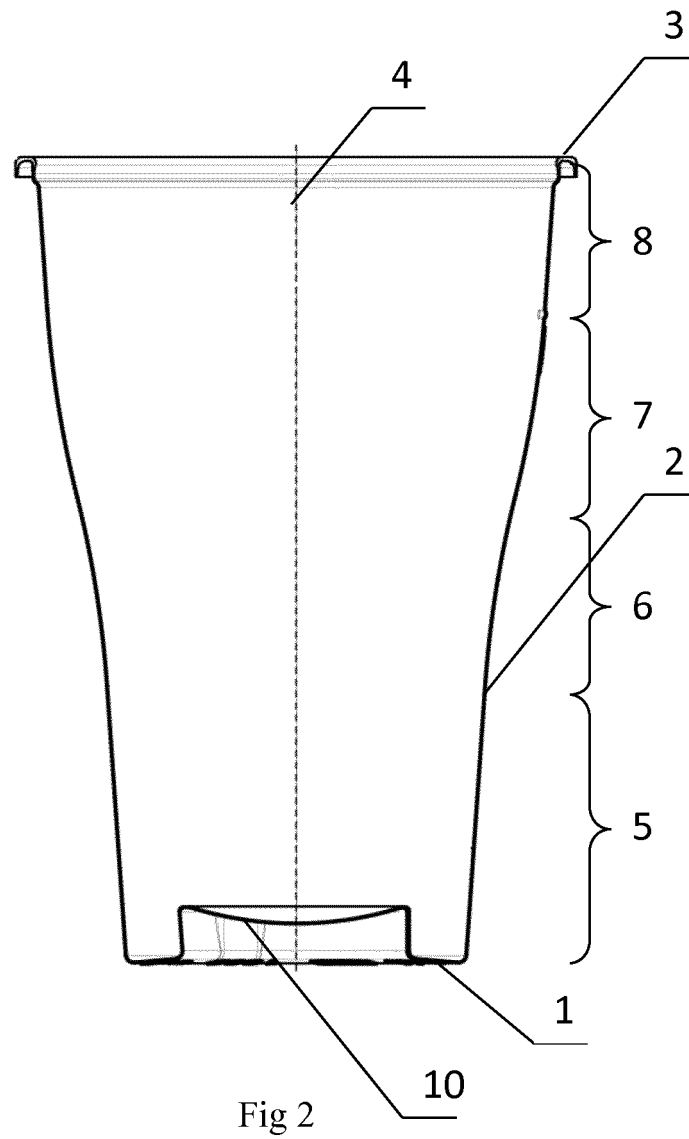


Fig 1.



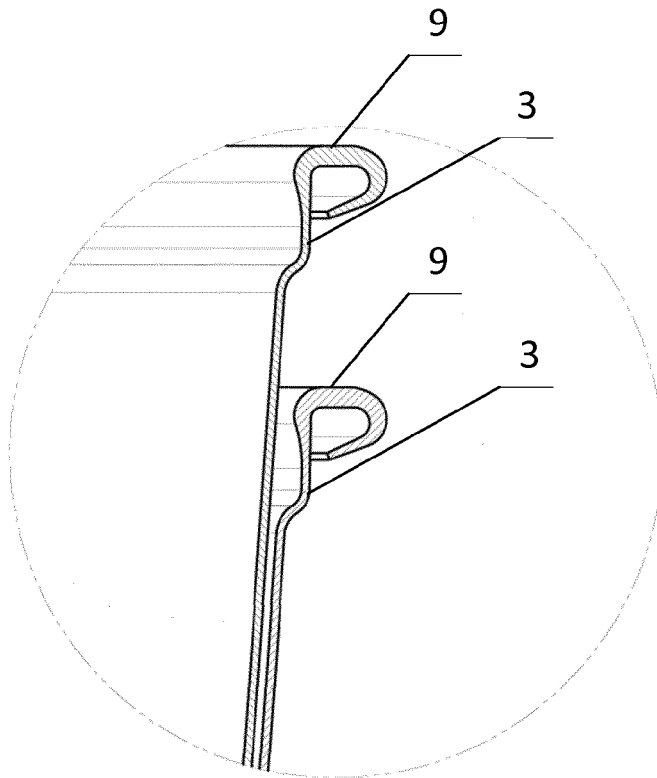


Fig 3.

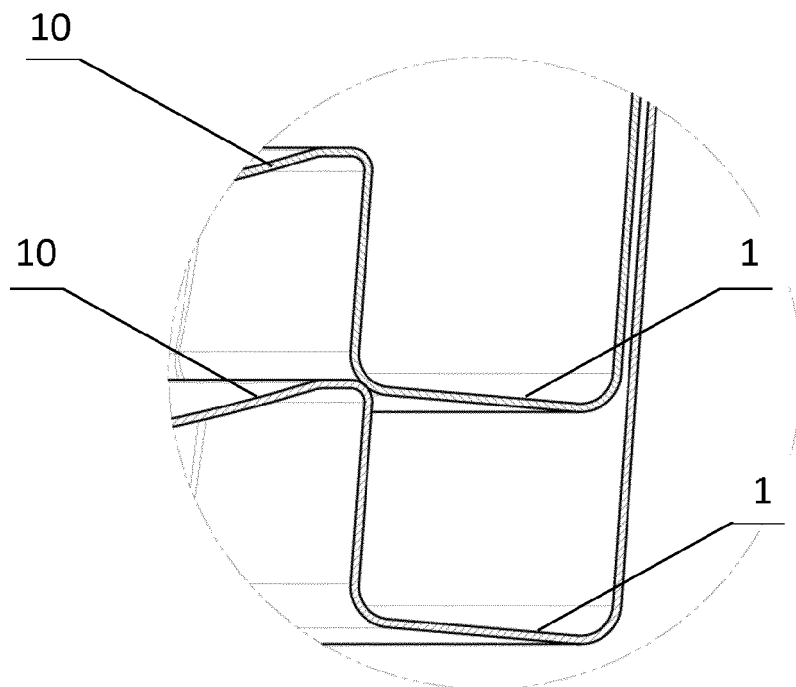


Fig 4.

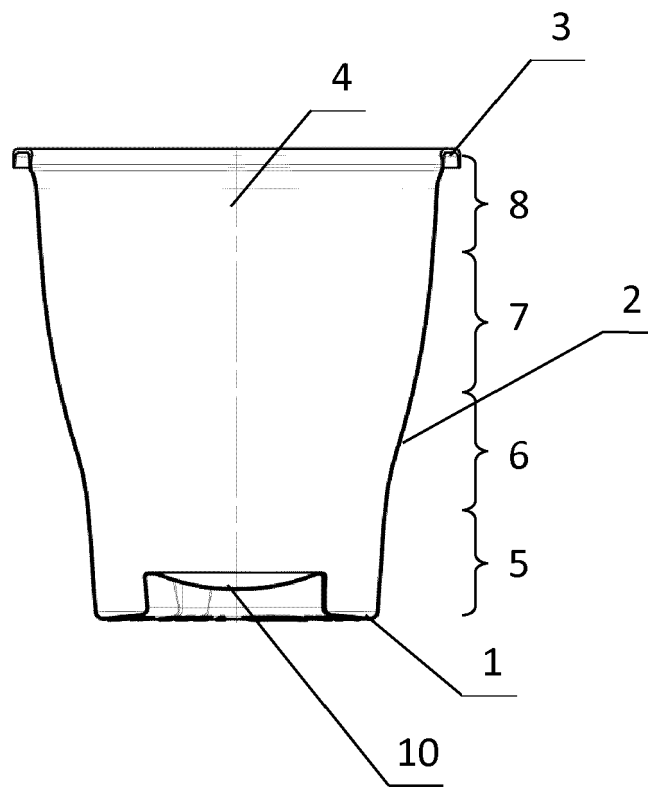


Fig 5.

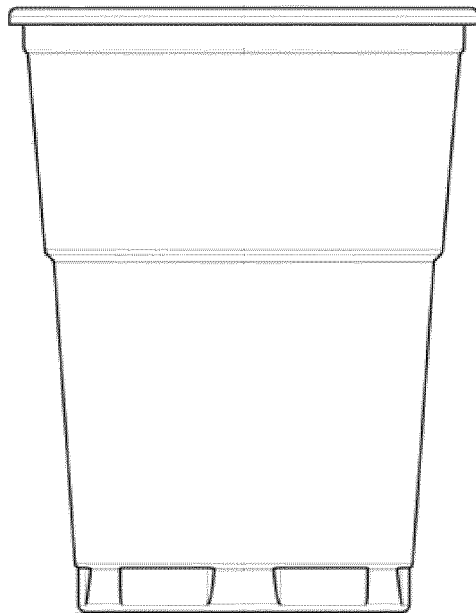


Fig 6.



EUROPEAN SEARCH REPORT

 Application Number
 EP 18 15 8699

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 441 192 A (METZLER CHARLES LEWIS ET AL) 29 April 1969 (1969-04-29)	1,3	INV. B65D1/26
Y	* column 2, line 51 - line 62; figure 1 *	2,4-8	
Y	EP 1 157 806 A1 (FORT JAMES CORP [US]) 28 November 2001 (2001-11-28) * paragraph [0019]; figure 8 *	2,4	
Y	GB 2 103 569 A (BELLAPLAST GMBH [DE]) 23 February 1983 (1983-02-23) * page 2, line 46 - line 49; figures 1, 3 *	5,6	
Y	US 3 456 864 A (TROMBLEY EDGAR F ET AL) 22 July 1969 (1969-07-22) * figure 4 *	7,8	
A	US 2010/247830 A1 (HERNANDEZ JEFFERY J [US]) 30 September 2010 (2010-09-30) * paragraph [0012]; figure 1b *	2,4	TECHNICAL FIELDS SEARCHED (IPC)
A	GB 2 501 455 A (KOBUSCH UK LTD [GB]) 30 October 2013 (2013-10-30) * figures 5, 6 *	7,8	B65D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 18 March 2019	Examiner Bridault, Alain
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3441192 A	29-04-1969	NONE	
EP 1157806 A1	28-11-2001	CA 2348832 A1 EP 1157806 A1 JP 2002053120 A US 6627278 B1 US 2004142132 A1	26-11-2001 28-11-2001 19-02-2002 30-09-2003 22-07-2004
GB 2103569 A	23-02-1983	BE 893537 A DE 8118904 U1 GB 2103569 A LU 84232 A1 NL 8202577 A	18-10-1982 17-09-1981 23-02-1983 13-04-1983 17-01-1983
US 3456864 A	22-07-1969	NONE	
US 2010247830 A1	30-09-2010	CA 2696182 A1 US 2010247830 A1	24-09-2010 30-09-2010
GB 2501455 A	30-10-2013	NONE	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 2015008255 A [0002]
- US 5449089 A [0003]
- DE 202007016006 [0004]