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(54) **Title**: CAPSULE FOR USE IN COFFEE EXTRACTION MACHINES

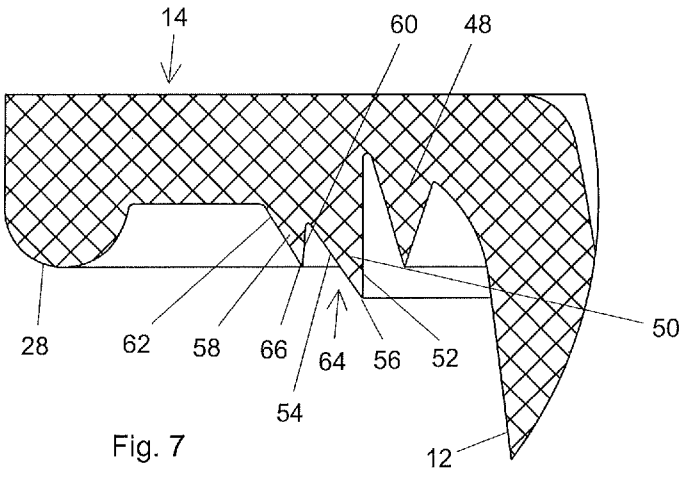


Fig. 7

(57) **Abstract**: A capsule is disclosed comprising a side wall of truncated conical form bounding an internal space for receiving coffee. A base closes the smaller diameter end of the space and there is a flange (14) extending around and protruding radially outwardly from the larger diameter end of the wall (12). A circumferentially extending sealing element (48) protrudes from the flange in the direction towards the smaller diameter end of the wall. The sealing element is triangular in radial cross-section and has its base integral with the flange. Its apex is spaced from the flange and is configured so that it is crushed by the leading end of the sleeve of the coffee extraction machine. There is a sealing protrusion radially outwardly of the sealing element (36) which protrusion is constituted by a pair of parallel circumferentially extending ribs (50, 58) each of triangular cross section.

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CAPSULE FOR USE IN COFFEE EXTRACTION MACHINES

FIELD OF THE INVENTION

This invention relates to capsules for use in coffee extraction machines.

BACKGROUND TO THE INVENTION

Coffee extraction machines sold under the name "Nespresso" (registered trade mark) use capsules which contain ground coffee. Each capsule comprises a wall of truncated form which is closed at its smaller diameter end by a base and at its larger diameter end by a foil which is secured to a radially outwardly protruding flange of the capsule.

The capsule is placed in the machine and the machine is then closed. As the machine closes the bottom of the base of the capsule is punctured by one or more spikes. Hot water is then forced through the openings formed by the spikes into the coffee in the capsule. The water forces the foil which seals the larger diameter end of the capsule against a plate which has a multitude of raised areas interspersed with depressed areas. This results in the foil failing in a multitude of areas due to water pressure in the capsule thereby to produce openings through which coffee extract can flow from the capsule.

The extraction machine includes a pressing sleeve which is forced against the underside of the flange of the capsule. Behind the capsule there is a chamber to which hot water under pressure is fed. Water passes from this chamber through the puncture holes in the base and into the capsule. Sealing between the flange and the sleeve is essential to prevent water leaking between the pressing sleeve and the capsule's flange and consequently not passing through the puncture holes into the capsule.

The present invention seeks to provide a coffee capsule with an improved sealing structure.

BRIEF DESCRIPTION OF THE INVENTION

According to the present invention there is provided a capsule comprising a side wall of truncated conical form bounding an internal space for receiving coffee, a base closing the smaller diameter end of said space, a flange extending around and protruding radially outwardly from the larger diameter end of said wall, and a circumferentially extending sealing element protruding from said flange in the direction towards the smaller diameter end of the wall, said sealing element being triangular in radial cross-section, having its base integral with said flange and its apex spaced from said flange and being configured so that it is crushed by the leading end of the sleeve of the coffee extraction machine.

Two flat flanks bound the sealing element and intersect at said apex. The flanks define an included angle of between 25 and 45° at said apex. The preferred angle is between 30 and 40°. An angle of between 35 and 40° is the most desirable and experimental work has shown that an angle of approximately 37° provides the most satisfactory seal.

A circumferentially extending protrusion can be provided radially outwardly of the sealing element, there being a gap between the sealing element and the protrusion and the protrusion being bounded by two flat flanks converging in the direction away from the flange and a rounded end surface joining the converging flanks. The included angle between these flanks can be between 10 and 20°, a preferred angle being approximately 15°.

The flank of the protrusion which is closest to the sealing element converges with the

adjacent flank of the sealing element in the direction towards the flange.

A circumferentially extending circumferentially extending protrusion can be provided radially outwardly of said sealing element which protrusion is constituted by a pair of parallel ribs each of triangular cross section, the radially inner rib being larger than the radially outer rib so that the apex of the radially inner rib is further from said flange than the apex of the radially outer rib.

The radially inner flank of the radially inner radially inner rib can be cylindrical and is generated by a line parallel to the longitudinal axis of the capsule and rotated about said axis. In this form it is preferred that the radially inner flank of the radially inner rib intersects the radially outer flank of the sealing element to form a groove of triangular shape, the included angle between said flank of said rib and said flank of the sealing element being between 10 and 20°. Desirably the radially inner flank of the radially outer rib is substantially parallel to the radially inner flank of the radially inner rib. Furthermore, the radially outer flank of the radially outer rib can meet its radially inner flank at an apex which has an included angle of between 40 and 50 degrees.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which;

Figure 1 is an elevation of a capsule for containing coffee;

Figure 2 is a plan view of the capsule from above;

Figures 3 and 4 are sections through the capsule of Figures 1 and 2 taken on the lines

II – II and IV - IV of Figures 1 and 2;

Figure 5 is a plan view of the capsule in a inverted postion;

Figure 6 is a section to an enlarged scale through a flange of the capsule and illustrates a first form of sealing structure;

Figure 7 is a section similar to that of Figure 6 and showing a further form of sealing structure; and

Figure 8 shows the capsule and part of a coffee extraction machine.

DETAILED DESCRIPTION OF THE DRAWINGS

The capsule 10 illustrated in Figure 1 comprises a wall 12 in the form of a truncated cone, a flange 14 extending outwardly from the larger diameter end of the wall 12, and a base 16 at the smaller diameter end of the wall 12. Alternating long and short longitudinally extending strengthening ribs 18 are provided within the space defined by the wall 12 and the base 16.

The base 16, see particularly Figures 4 and 5, comprises a circular base section 20 with a recess 22 in the external face thereof. A frustoconical section 24 of the base 16 is of the same thickness as the wall 12 and there is an intermediate frustoconical section 26 between the sections 20 and 24. The wall thickness of the section 26 is less than that of the sections 20 and 24, thereby to facilitate penetration. A thickness of between 0.4 and 0.45 mm is suitable.

There is a strengthening bead 28 around the outer periphery of the flange 14 which minimises flexing of the flange during extraction.

A first form of sealing structure 30 of the capsule 10 is illustrated in detail in Figure 6. It comprises a sealing element 32 in the zone where the wall 12 merges with the flange 14 and a protrusion 34 radially outwardly of the element 32. The element 32 and the protrusion 34 extend circumferentially in the sense that they are continuous and extend in a circle around the axis of the capsule.

The sealing element 32 is thin and flexible and flimsy and, in radial cross-section as shown in Figure 6, is triangular. The "apex" of the triangle is directed downwardly and its "base" is integral with the flange 14. The sealing element 32 is bounded by two flat flanks 36, 38 which converge in the downward direction. The included angle between the two flanks 36, 38 bounding the element 32 is preferably 35 to 40°.

The protrusion 34 is bounded by a radially outer flank 40 which is at an angle of approximately 45° with respect to the undersurface of the flange 14. A radially inner flank 42 of the protrusion 34 is at an angle which is slightly more than 90° with respect to the underside of the flange 14 when considered in radial section. The flanks 40 and 42 are joined by a rounded surface 44.

The wall 12, immediately adjacent the flange 14, thickens slightly and its inner surface flares outwardly in the zone designated 46.

Figure 7 illustrates a further form of sealing structure. The flimsy sealing element 48 of Figure 7 is somewhat larger than the corresponding element 32 of Figure 6. The protrusion 34 of Figure 6, and which has a rounded circumferentially extending surface 44, is replaced by a pair of circumferentially extending ribs. The radially inner rib, designated 50, is bounded by flanks 52 and 54 which meet at an apex 56. The flank 52 closest to the element 48 is substantially cylindrical in form and is generated by a line parallel to the longitudinal axis of the capsule and rotated about it. The flank 54 is frustoconical in form.

The radially outer rib, designated 58, is smaller than the rib 50, but is of the same cross-sectional configuration having a generally cylindrical radially inner flank 60 and a frustoconical radially outer flank 62. The flanks 54 and 60 define a groove 64 between them, the groove 64 being triangular in cross sectional shape. The flanks 60,62 meet at an apex 66.

Turning now to Figure 8, the sealing and pressing sleeve of the coffee extraction machine is shown at 68. In some forms of extraction machine the leading edge of the sleeve 56 has shallow radial grooves in it and the sleeve 68 has an inner diameter which is slightly less than the outer diameter of the wall 12 at the zone 46. The inner periphery of the sleeve 68 adjacent its circular leading edge consequently touches the outer surface of the wall 12 outwardly of the circular zone 46 which is immediately adjacent the flange 14.

The circular leading edge of the sleeve 68 contacts and crushes the flimsy sealing element 32 as the extraction machine is closed if the sealing structure of Figure 6 is used. The crushed element 32 forms a seal between the leading circular edge of the sleeve 68 and the flange 14. The nature of the element 32 is such that it fills any radial grooves of the sleeve 68 and prevents leakage.

The outer periphery of the sleeve 68 immediately adjacent the leading edge touches and presses upon the radially inner flank of the protrusion 34 thereby to form a third seal between the flange 14 and the circular leading end of the sleeve 68. Thus there are three seals in series between the pressing sleeve and the capsule. This ensures that sealing takes place even if the sleeve 68 and capsule 10 are not accurately aligned.

The provision of the element 48 and the ribs 50, 58 of Figure 7 also ensures that if the capsule 10 and sleeve 58 are misaligned, there is still an adequate seal to prevent water leakage between the capsule and the sleeve.

CLAIMS

1. A capsule comprising a side wall of truncated conical form bounding an internal space for receiving coffee, a base closing the smaller diameter end of said space, a flange extending around and protruding radially outwardly from the larger diameter end of said wall, and a circumferentially extending sealing element protruding from said flange in the direction towards the smaller diameter end of the wall, said sealing element being triangular in radial cross-section, having its base integral with said flange and its apex spaced from said flange and being configured so that it is crushed by the leading end of the sleeve of the coffee extraction machine.

2. A capsule as claimed in claim 1, wherein two flat flanks bound the sealing element, the flanks intersecting at said apex.

3. A capsule as claimed in claim 2, wherein the flanks define an included angle of between 25 and 45° at said apex.

4. A capsule as claimed in claim 1, 2 or 3, wherein a circumferentially extending protrusion is provided radially outwardly of the sealing element, there being a gap between the sealing element and the protrusion and the protrusion being bounded by two flat flanks converging in the direction away from the flange and a rounded end surface joining the converging flanks.

5. A capsule as claimed in claim 4, wherein the flank of the protrusion which is closest to the sealing element converges with the adjacent flank of the sealing element in the direction towards the flange.

6. A capsule as claimed in claim 1, 2 or 3 and including a circumferentially extending protrusion radially outwardly of said sealing element which protrusion is constituted

by a pair of parallel circumferentially extending ribs each of triangular cross section, the radially inner rib being larger than the radially outer rib so that the apex of the radially inner rib is further from said flange than the apex of the radially outer rib.

7. A capsule as claimed in claim 6, wherein the radially inner flank of the radially inner rib is cylindrical and is generated by a line parallel to the longitudinal axis of the capsule and rotated about said axis.

8. A capsule as claimed in claim 7, wherein said radially inner flank of the radially inner rib intersects the radially outer flank of the sealing element to form a groove of triangular shape, the included angle between said flank of said rib and said flank of the sealing element being between 10 and 20°.

9. A capsule as claimed in claim 7 or 8 wherein the radially inner flank of the radially outer rib is substantially parallel to the radially inner flank of the radially inner rib.

10. A capsule as claimed in claim 7, 8 or 9, wherein the radially outer flank of the radially outer rib meets its radially inner flank at an apex which has an included angle of between 40 and 50 degrees.

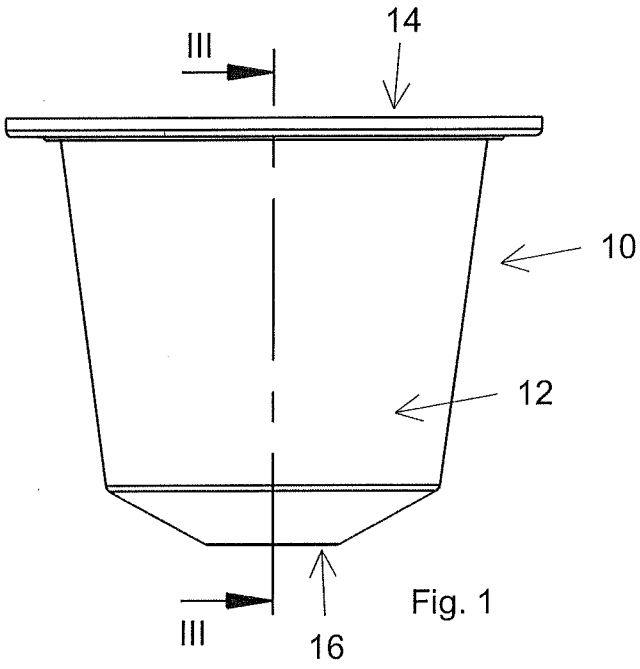


Fig. 1

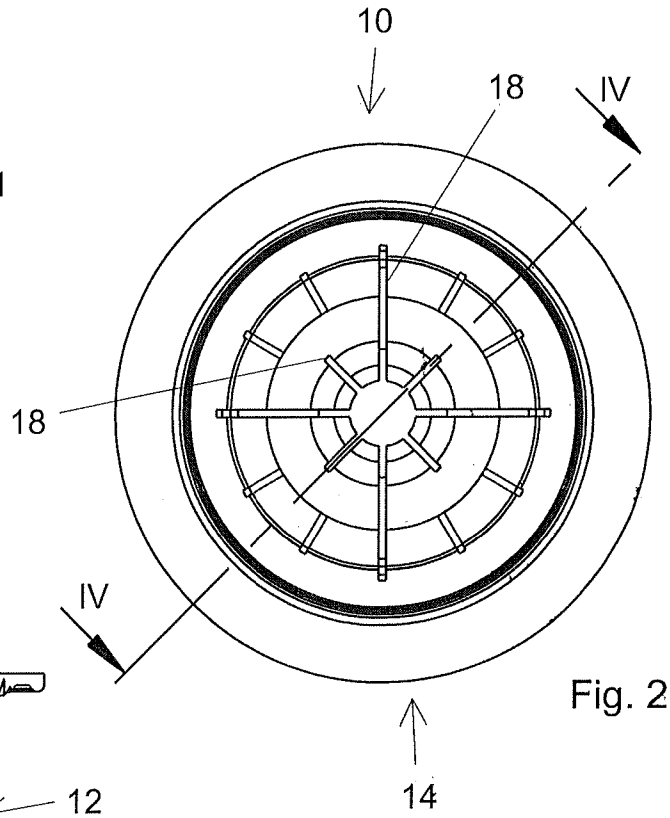


Fig. 2

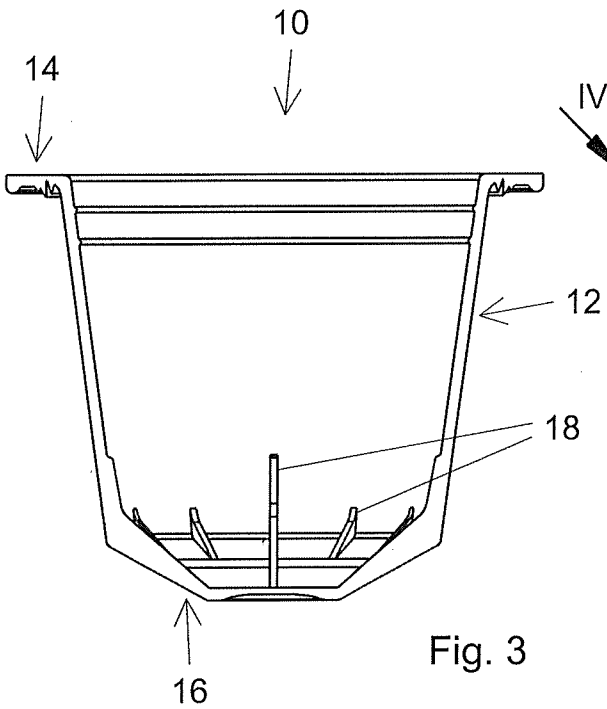


Fig. 3

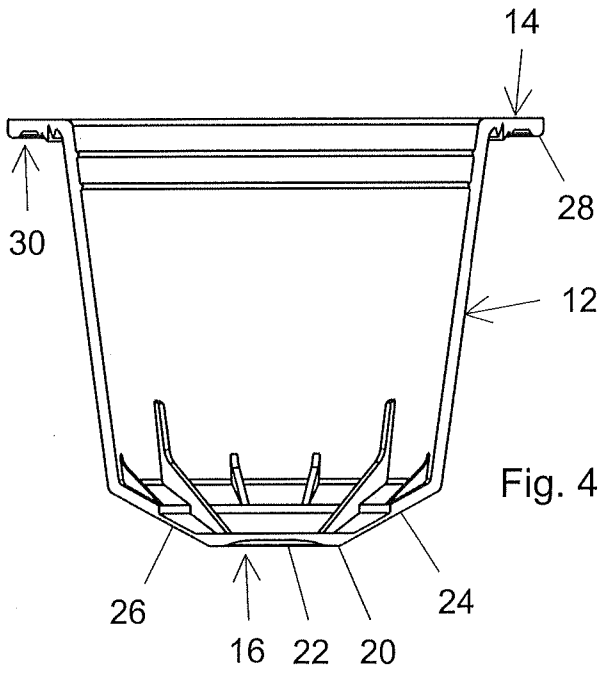


Fig. 4

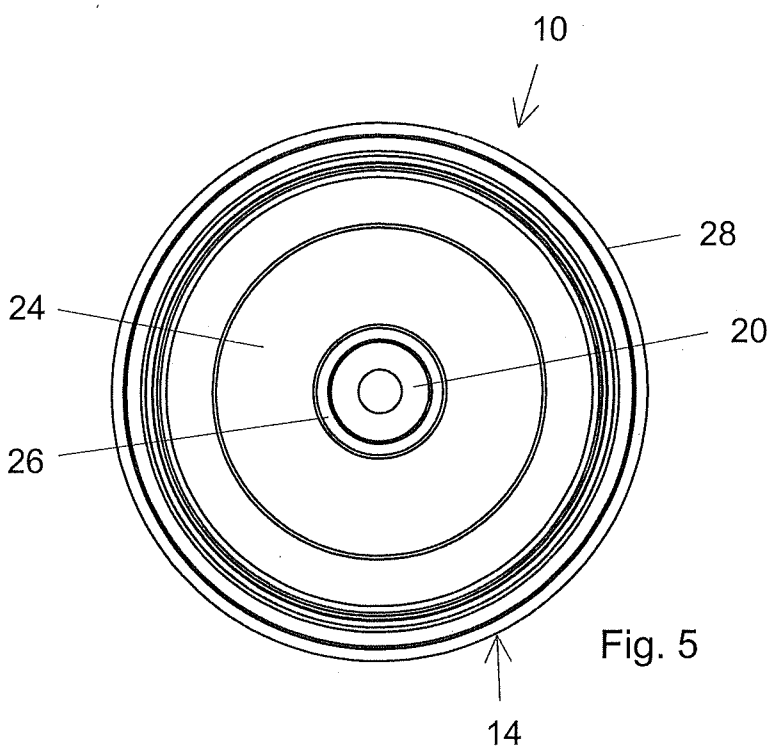


Fig. 5

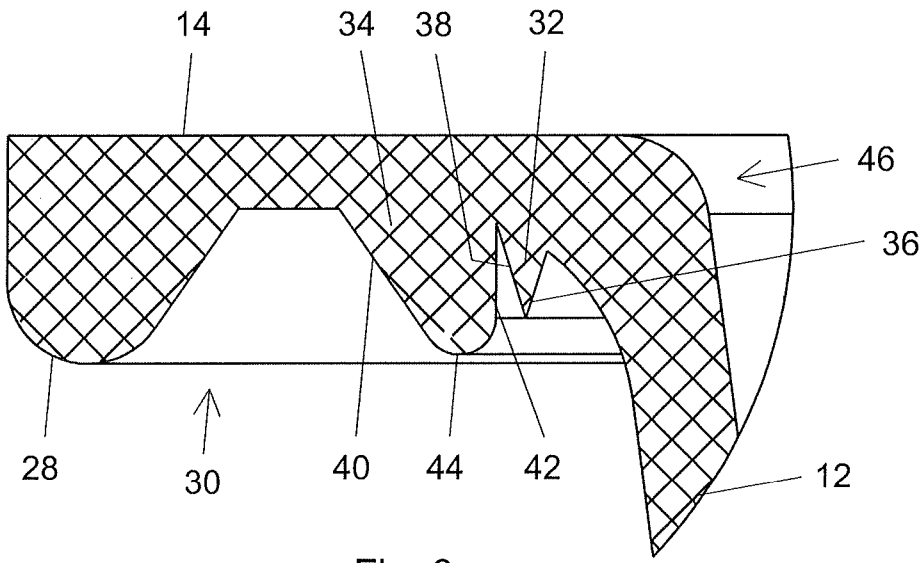


Fig. 6

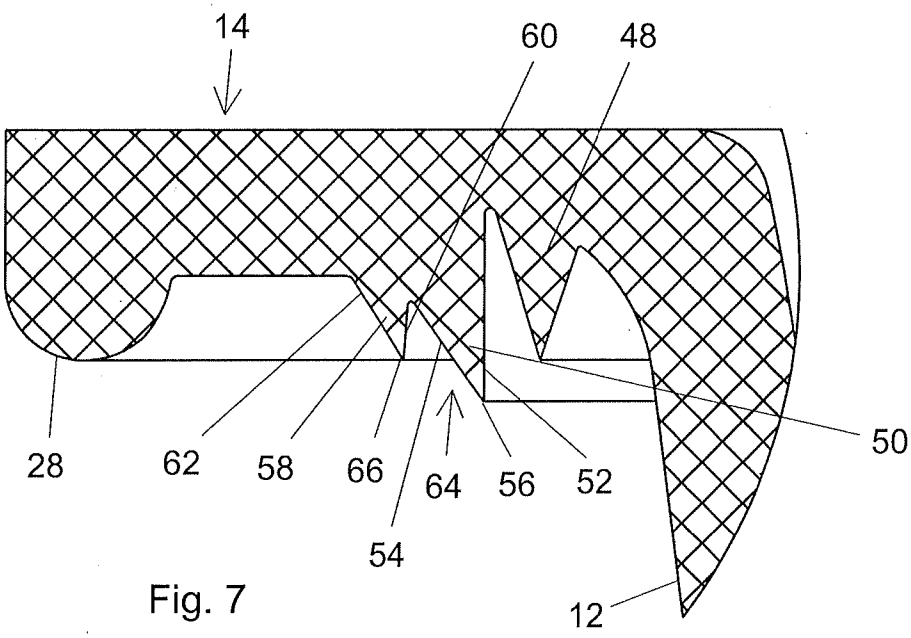


Fig. 7

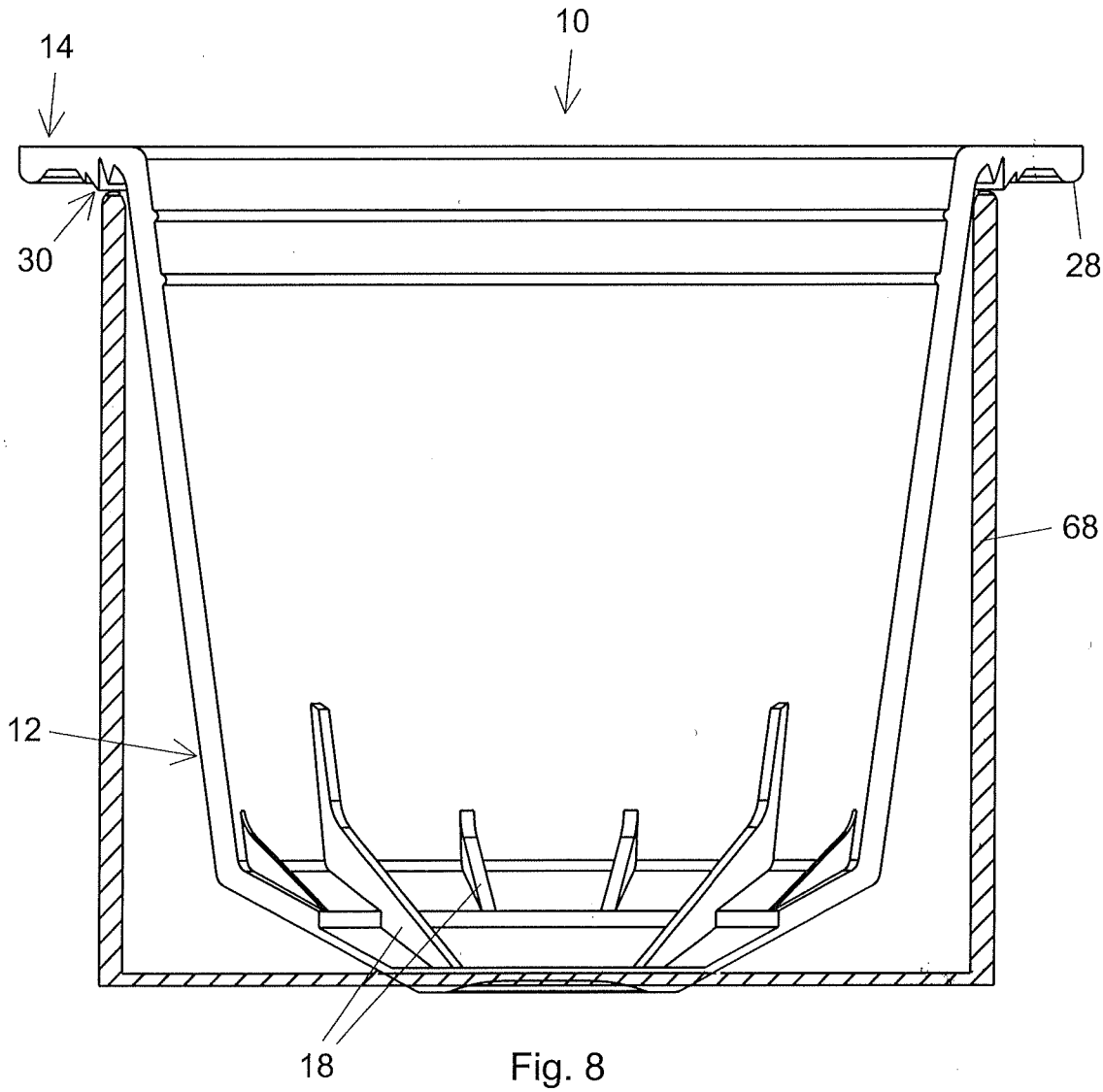


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2012/057334

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D85/804
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	WO 2013/046014 A1 (TUTTOESPRESSO SRL [IT]) 4 April 2013 (2013-04-04) page 14, line 12 - page 16, line 26 figures 2,3,3a -----	1-3
X	WO 2010/084475 A2 (ETHICAL COFFEE COMPANY SA [CH]; MARILLER ALAIN [CH]) 29 July 2010 (2010-07-29) page 4, line 10 - page 6, line 9 figure 20 figure 32 -----	1-5

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 May 2013	28/05/2013

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2012/057334

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2013046014 A1	04-04-2013	NONE	
WO 2010084475 A2	29-07-2010	CN 102292271 A	21-12-2011
		EP 2389326 A2	30-11-2011
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