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3,482,815

COLLAPSIBLE CORE FOR A MOLD

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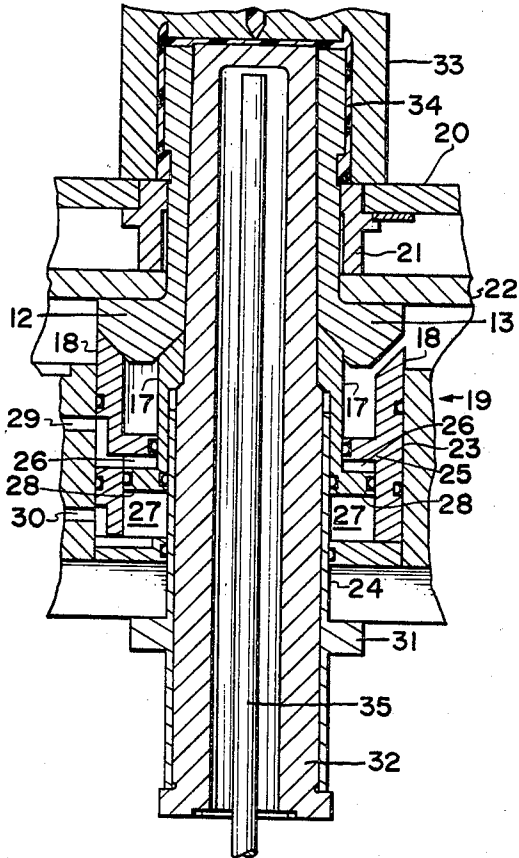


FIG. 1

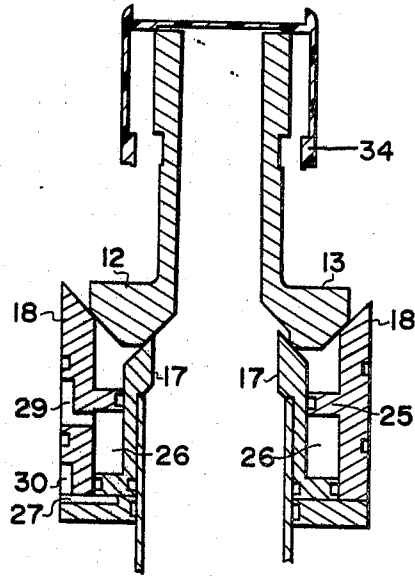


FIG. 4

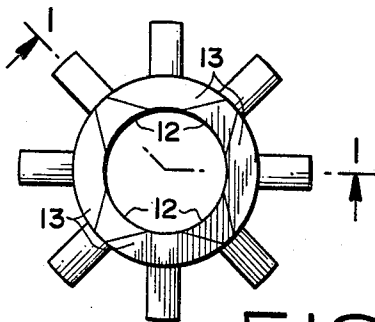


FIG. 2

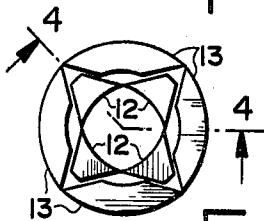


FIG. 3

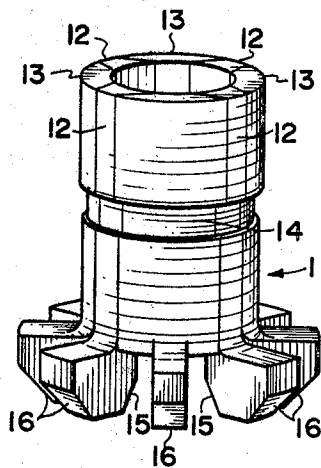


FIG. 5

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COLLAPSIBLE CORE FOR A MOLD

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9 Claims

ABSTRACT OF THE DISCLOSURE

A collapsible core for a mold in which oppositely acting inner and outer pairs of cams (17, 18) constitute two alternate sets of cams; two pressure chambers (26, 27) when pressurized alternately reciprocate the inner cams (17) and the outer cams (18) alternately in an axial direction; the outer cams (18) drive the core segments (12, 13) centripetally, to collapse the core (11) and the inner cams (17) drive the core segments centrifugally to set up the core (11).

It is known that there are numerous forms of collapsible cores for molds that enable the molding of objects having internal enlargements, such as threaded bottle caps. Some of these collapsible cores are mechanical. Others are in the form of bladders. Some of the mechanically collapsible mold cores sometimes have resiliently deformable segments. The resiliently deformable segments have elastic limits, that prevents sufficient movement of core segments to permit molding of gross internal enlargements, limiting the molding to rather small internal enlargements such as threads.

It has been found that a housing for core segments can be made in which cam surfaces can be actuated by cams to collapse the mold core into a compact bunch of two concentric layers of segments. The cams have end portions defining pressure chambers which when alternately pressurized, reciprocate the cams oppositely, either (a) to set up the mold core or (b) to collapse it into two layers of concentric core segments.

Pressure responsive cams eliminate the necessity for bulky, complex mechanical structures or resilient segments. The resultant collapsible core is easily operable, simple, durable and efficient. It can be provided with gross undercut sections whereby vast internal enlargements in molded articles can be easily made.

These objects and advantages can be obtained by the device shown by way of illustration in the drawing in which

FIGURE 1 is a vertical cross sectional view of the collapsible core inserted and expanded in a mold on the line 1—1 in FIG. 2;

FIGURE 2 is a top plan view of the collapsible core segments expanded;

FIGURE 3 is a top plan view of the alternate core segments collapsed into two concentric layers;

FIGURE 4 is a partial vertical cross sectional view of the collapsible core alone, with the cams, and an undercut molded object on the line 4—4 in FIG. 3; and

FIGURE 5 is a perspective view of the collapsible core segments assembled.

The centripetal segmented core form for a mold has a core assembly 11 (see FIGURE 4) composed of a plurality of alternate segments. The first group of alternate segments 12, 12 have side walls diverging inwardly, and converging outwardly, so that the alternate segments 12, 12 may move inwardly first without their side walls interfering with the adjacent or second group of alternate segments 13, 13. The second group of alternate segments 13, 13 have side walls which converge inwardly and diverge outwardly. The external surface of the core is shown (by way of illustration) to be circular, but it may assume

numerous other shapes. The external surface of the core assembly 11 is provided with an annular undercut 14 (by way of illustration of the type of undercut that can be attained). It is apparent that such undercuts are usually the motivating factor for the construction of collapsible cores so that a molded undercut object can be released. The annular undercut 14 is merely illustrative of one of many shapes of undercut that may be applied to the surface of the collapsible core assembly 11.

Each of the core segments 12, 13 is provided with double cam surfaces 15, 16 arranged in opposition. The inner cam surfaces 15 are slanted upwardly and inwardly, for engagement with inner correspondingly segmented cams 17, to move the segments 12, 13 centrifugally. The outer cam surfaces 16 are slanted upwardly and outwardly for engagement with outer correspondingly segmented cams 18 to move the segments 12, 13 centripetally. The segments 12 are shifted in general parallelism to the longitudinal axis of the core.

The core segments are positioned in a core housing assembly 19, which has a top plate 20; in an aperture in the top plate 20, there is an annular bushing or core positioner 21; beneath the core positioner 21, there is a bottom plate 22, which serves as a core segment guide. Below the bottom plate 22, there is a cavity 23 in the housing 19 in which the cams 17, 18 are slidably positioned for vertical movement. A partial inner wall 24 serves as the inner wall of the cavity 23.

The outer cams 18 are disposed side-by-side to form a segmented cylinder. Each outer cam 18 has a central enlargement 25 that serves as the top of an upper chamber 26. The inner cams 17 are also disposed side-by-side to form a segmented cylinder and are provided with a radial enlargement 28, that serves as the bottom wall of the top chamber 26. The enlargement 28 also serves as the top wall of the lower chamber 27. O-rings seal these chambers 26, 27 to make them pneumatically tight, yet when air is introduced through the housing assembly 19 into the passage 29, the top pressure chamber 26 is expanded to maximum size, as the enlargement 28 moves down and the enlargement 25 moves up. The outer cams 18 are urged upwardly, and the inner cams 17 are urged downwardly. The cam surfaces 16 are unblocked and the segments 12, 13 are thereby moved centripetally, collapsing the core assembly 11 (see FIGURE 3). The inner cams 17 no longer support the segments 12, 13. On the other hand, when air is introduced through the housing assembly 19 into the passage 30 (see FIGURE 1), the lower pressure chamber 27 is enlarged to maximum size, and the upper chamber 26 is correspondingly reduced (see FIGURE 4). The outer cams 18 are urged downwardly, and the inner cams 17 are urged upwardly. The outer cam surfaces 16 being unblocked and the inner cam surfaces 15 being engaged by the inner cams 17, the segments 12, 13 are moved centrifugally, to the position shown in FIGURES 2 and 5.

In FIGURE 1, it will be seen that the outer cams 18 which actuate the segments 12 are longer than the outer cams 18 which actuate the second group of alternate segments 13, to drive them inwardly. In this manner, the segments 13 are moved centripetally only after the longer outer cams 18 have first moved the first group of alternate segments 12 into an inner position (see FIGURE 3).

In FIGURE 4, it will be seen that the inner cams 17, which actuate the first group of alternate segments 12, are shorter than the opposite inner cams 17 which actuate the second group of alternate segments 13 to drive them outwardly. In this manner, the first group of alternate segments 12 are moved centrifugally only after the shorter inner cams 17 have first moved the second group of alternate segments 13 into an outer position.

By the differential lengths of the alternate outer cams

18, the retracted first group of alternate segments 12 form a compact inner circle and the retracted second group of alternate segments 13 form a compact circle of segments surrounding the first group of alternate segments 12 as shown in FIGURE 3, i.e. two concentric groups of segments. Likewise, the variant lengths of the alternate inner cams 17 move the second and first alternate groups of segments 13, 12 successively into a single core assembly 11 as shown in FIGURES 2 and 5.

The centrifugal and centripetal movement of the segments 12, 13 is independent of resilience of the core segments and entirely mechanical. Much greater collapse of the core is accomplished than could otherwise be attained. Deformation of the core is not restricted by the capacity of the segments 12, 13 to deform; they are physically displaced inwardly and outwardly, and are rigid.

The cams 17, 18 are slidably positioned in the cavity 23 by the inner, generally tubular wall 24 of the housing assembly 19. An annular enlargement 31 on the tubular wall 24 is positioned immediately below the bottom plate 22. A hollow pin 32, closed at the top 33, is insertable into the tubular wall 24 to support the segments 12, 13 when they are extended. The top 33 of the pin defines a portion of the internal wall of the mold cavity. The core assembly defines the remaining portion of the internal wall of the mold cavity. The mold 33 engages the top plate 20 and defines the external wall of the mold cavity. In FIGURE 4, the molded object 34 is shown with the core assembly 11 collapsed. Inspection of FIGURE 5 will suggest the great versatility of the core assembly 11 for molding shapes of varied configurations with gross undercut portions.

As an optional feature, the hollow pin 32 may be cooled by introducing a coolant through the central tube 35. The withdrawal of the pin 32 will permit the cams 17, 18 to collapse the core assembly 11.

The foregoing description is merely intended to illustrate an embodiment of the invention. The component parts have been shown and described. They each may have substitutes which may perform a substantially similar function; such substitutes may be known as proper substitutes for the said components and may have actually been known or invented before the present invention; these substitutes are contemplated as being within the scope of the appended claims, although they are not specifically catalogued herein.

What is claimed:

1. A collapsible core for a mold comprising
 - (a) a plurality of longitudinal segments disposed about an axis and defining a collapsible core,
 - (b) opposite cam surfaces on each of the segments,
 - (c) alternate, outer, long cams axially engageable with one of the cam surfaces of alternate segments,
 - (d) alternate, outer, short cams axially engageable with the cam surfaces of the other alternate segments,
 - (e) alternate, inner, long cams engageable with the

other of the opposite cam surfaces of alternate segments,

- (f) alternate, inner, short cams engageable with the other of the opposite cam surfaces of the other alternate cam segments,
- (g) a housing for the cams,
- (h) the cams axially slidable in the housing,
- (i) an enlargement on one of the cams defining the top of a lower pressure chamber, and the bottom of a top pressure chamber,
- (j) an enlargement on the other of the cams defining the top of the top pressure chamber,
- (k) means to alternately pressurize the pressure chambers whereby the inner cams are axially reciprocated in opposite directions from the outer cams alternately.

2. The device according to claim 1 and a pin axially insertable among the segments.

3. The device according to claim 1 and a pin axially insertable among the segments to rigidly support them during a molding step.

4. The device according to claim 1 in which the shorter outer cams move alternate segments inwardly first and the longer outer cams move the other alternate segments inwardly second.

5. The device according to claim 1 in which the shorter inner cams move alternate segments outwardly first and the longer inner cams move the alternate segments outwardly second.

6. The device according to claim 1 in which the segments of the core assembly are rigid and are reciprocated in general parallelism with the longitudinal axis of the core.

7. The device according to claim 1 in which the core assembly is provided with an undercut portion for forming an external enlargement on the inner surface of a molded object.

8. The device according to claim 1 in which the segments of the core assembly are free to move at both ends when the core assembly is collapsed.

9. The device according to claim 1 in which the segments of the core assembly collapse into two coaxially disposed concentric layers.

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18—2, 45; 249—79