

March 24, 1970

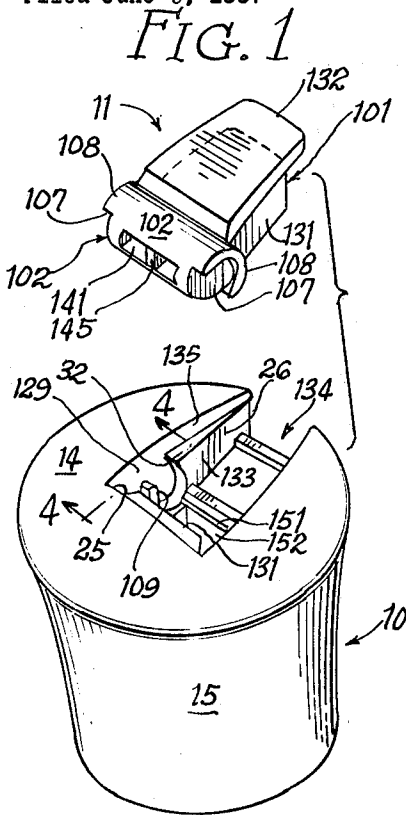
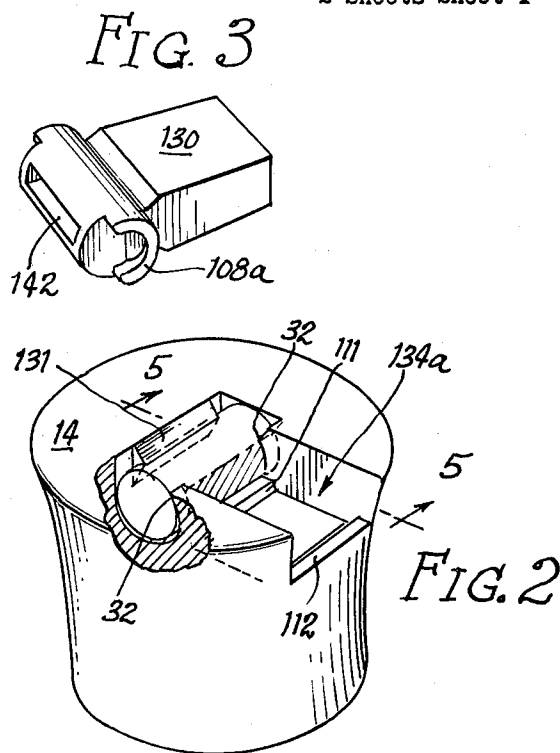
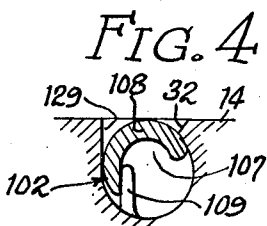
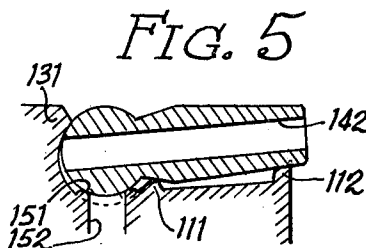
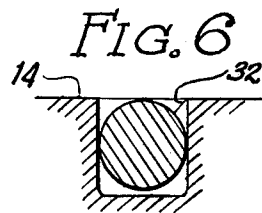
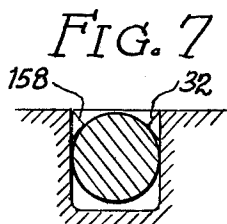
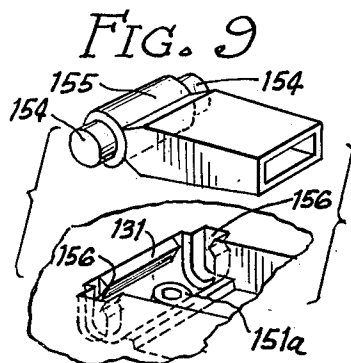
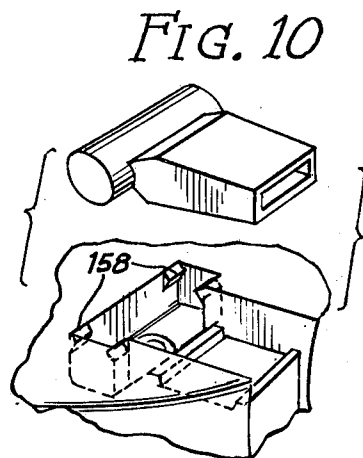
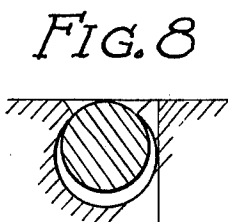
S. M. LIBIT ET AL

3,502,248

FLUID DISPENSING CLOSURE WITH A SWIVEL SPOUT

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FLUID DISPENSING CLOSURE WITH A SWIVEL SPOUT

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FIG. 11

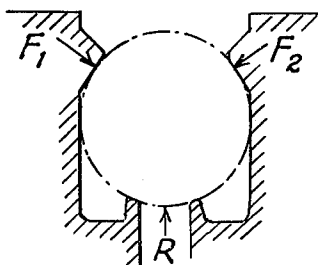


FIG. 12

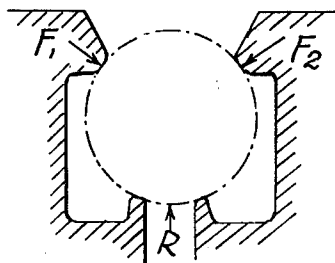


FIG. 13

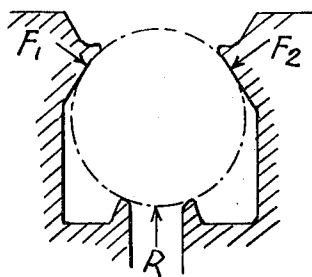
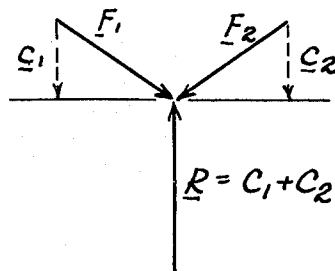
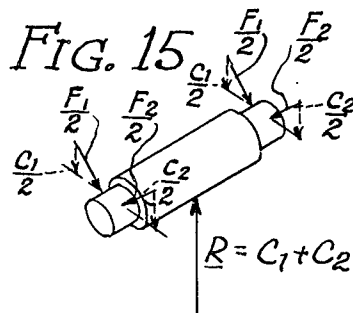
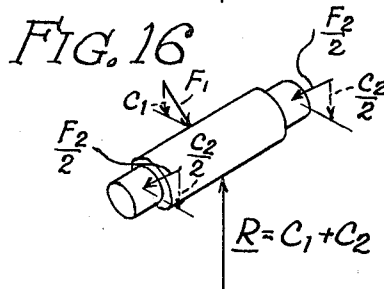


FIG. 14



1

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3,502,248 FLUID DISPENSING CLOSURE WITH A SWIVEL SPOUT

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10 Claims

ABSTRACT OF THE DISCLOSURE

Dispensing closures of the type which includes a base part including means for attaching the device to the container and a spout part held in the base with snap-type resilient engagement for swivelling movement between open and closed conditions of the device. Swivelling engagement is constituted by a pivot portion at the inner end of the spout and at least three pads or equivalent areas on the base spaced circumferentially of the pivot and acting together as a three-point support for the pivot.

This invention relates to dispensing closures of the class which comprise a base including means for incorporating the same with a container for a fluent material and a spout adapted to be swivelled between two positions, usually 90° apart, representing "on" and "off" positions of the device. The means for incorporating the device with the container may comprise an internally threaded skirt formed as part of the base and a threaded neck on the container, an interengaging bead and groove for snap-type connection, a bayonet joint, or fabrication of the base as part of the container by molding. However these and other modes of connection are well-known and need not be elaborated on herein.

The spout has a through bore which is the bore of a nozzle forming part of the spout, this bore being brought into and out of registry with a passage in the base when the spout is moved between its two principal positions. The spout has a pivot portion received in bearing means in the base. Well-known devices of this type currently in commerce are exemplified in U.S. Patent No. 2,828,895 granted Apr. 1, 1958, to Harry A. Mart, No. 3,111,245, granted Nov. 19, 1963, to Sidney M. Libit et al. and No. 2,793,795, granted May 28, 1957, to Woodrow Wilson et al. The patents to Mart and Libit et al. relate to devices of the class here considered wherein the inner portion of the spout is cylindrical or has a cylindrical working face and such inner portion is rotatably received in a cavity or recess in the base with a snap-action, the material of at least one of the parts being of material which is resilient, but generally-shape retaining, to allow initial assembly and subsequent maintenance of the working relation. In these two-part devices the force resulting in an optimum fluid-tight joint between the two parts is achieved by means of a "three-point" support for the inner pivot portion of the spout, sometimes termed the knuckle: one point is a pad or ring at the bottom of the recess surrounding the exit of the passage in the base and the other two are pad-like elements spaced apart angularly on either side of the pad or ring and displaced from each other at an angle of more than 180°. The pad or ring and the latter elements bear tangentially on the inner portion of the spout and are so positioned as to translate the resiliency of the walls of the recess into forces acting to retain the inner portion of the spout in fluid-tight abutment with the pad. The Wilson et al. patent discloses a spout provided with an axle on each side of a centrally positioned hub from which a nozzle extends. The axles are received in respective bearing openings with a snap fit to allow initial

assembly and retention of the parts in working relation. In this case the resiliency of the walls of the bearings is exerted through the axles on the hub which, in turn, abuts the passage in the base.

In the fabrication of any of the devices exemplified in the several patents referred to in a plastic composition such as polyethylene, polypropylene and the like, manufacturing and marketing considerations dictate that the parts utilize a minimum amount of material not only consistent with the desired mechanical engagement and reliable assembly with the container but to reduce problems of shrinkage. Mart and Libit et al., for example, disclose the three-point mounting of the spout pivot in a manner which permits the remainder of the wall of the cavity in the base to be relieved between the elements providing rotatable support since such remainder is redundant insofar as concerns the attainment of the three-point support. By so doing the wall may be thinner in the redundant zones with consequent saving of material and avoidance of shrinkage effects. The present invention relates to improvements in devices of the types referred to, sometimes referred to in the industry as "swivel spout" closures, in which the concept of the three-point support is expanded into other configurations.

Other objects and advantages will become apparent from the ensuing description which, taken with the accompanying drawings, discloses various forms in which the principles of the invention may be carried into practice. In these drawings:

FIG. 1 is an exploded perspective view of a form of dispensing closure in accordance with the invention;

FIG. 2 is a combined view of a base similar to that shown in FIG. 1, but with the knuckle of the spout assembled therewith, the nozzle of the spout being omitted for clarity;

FIG. 3 shows a modified form of spout capable of use with the base of FIGS. 1 and 2;

FIG. 4 is a cross section taken on the line 4-4 of FIG. 1, but showing the spout in working position;

FIG. 5 is a cross section taken on the line 5-5 of FIG. 2, but showing the entire spout assembled;

FIG. 6 is a cross section similar to that of FIG. 4 showing a modified bearing construction in which redundant portions of the bearing opening have been eliminated;

FIGS. 7 and 8 illustrate modified forms of bearings;

FIG. 9 is a partial perspective of a base and a spout separated therefrom to illustrate a further form of end bearing;

FIG. 10, is a view similar to FIG. 9 but including end socket portions of the form shown in FIG. 7;

FIGS. 11, 12 and 13 are schematic showings of various arrangements of "three-point" suspensions for the spout knuckle with the attendant force vectors included;

FIG. 14 is a force diagram;

FIG. 15 is a diagrammatic showing of a spout knuckle and the associated forces acting thereon based on a device such as that of FIGS. 10; and

FIG. 16 is similar to FIG. 15, but based on a device such as that of FIG. 1.

Regarded in a broad sense the invention comprises a dispensing closure, sometimes referred to as the "device," usually including two parts, one of which is a fixed part or base having means for attaching the same to a container for a fluent material, e.g. a liquid. If desired the base may be an integral part of the container. The second part is a movable spout assembled with the base for swivel movement between closed and open positions corresponding to "off" and "on." The base and spout have passages which are brought into or out of registry when the spout is rotated between its two principal positions, i.e. between "off" and "on." In order to provide a swivel connection the base is provided with a cavity or recess

having elements constraining a knuckle portion of the spout to be in rotatable relation therewith. By utilizing a resilient, semi-rigid plastic composition for at least one of the parts, e.g. polyethylene, and arranging for a snap-fit of the knuckle with respect to the elements of the cavity reliable sealing against leakage and easy digital actuation may be achieved. In accordance with the invention the knuckle has a three-point support. In one form of device one of these points is a ring or pad surrounding the exit of the fluid passage in the base, a second point is a rib projecting inwardly from the wall of the cavity near its entrance and the third point is constituted as a pair of shoulders aligned along the axis of rotation of the spout, each member of the pair being disposed at opposite ends of the knuckle. Assuming the pad or ring as one point of support and the working surface of the knuckle in contact therewith as cylindrical, the remaining two points of support must be at a relative angle of more than 180° measured about the pad or ring and in contact with cylindrical portions of the knuckle or cylindrical face portions thereof. Moreover, if the minimum spacing between these latter two points of support is made less than the diameter of the related pivotal portion or portions of the knuckle the same may be snap-fitted into its permanent location. Accordingly, upon initial assembly the knuckle is forcibly introduced into the cavity by distension of the wall portions defining the same. Devices incorporating the foregoing principles are disclosed in the patents referred to above.

For some applications, e.g. for use with fluids of relative high viscosity, it is desirable to provide fluid passages through the base and spout which are somewhat larger. This in turn entails the use of a larger bore in the nozzle of the spout. However, a change in dimension of this character does not always dictate enlargement of the diameter of the knuckle throughout its length. This result may be reached by enlarging the knuckle in the vicinity of the nozzle bore and by the use of portions of smaller diameter as endwise pivots. By so doing a dual advantage results, in that the bearing openings use less material but the walls thereof will not protrude unnecessarily into the interior of the base where interference may occur, not only with the next of the container but with the sealing ring usually provided on the underside of the base to effect a fluid-tight seal with the container. From what follows it will become apparent that the respective components of the base and spout contributing to pivotal action may, in general, have active surfaces which correspond to the lateral surface of a surface of revolution, of which a cylindrical surface or a combination of coaxial cylindrical surfaces of different diameters are merely examples. With the foregoing desiderata in view, the present invention discloses various forms which the three-point support may assume in practice.

Turning first to FIGS. 1, 3, 4 and 5 there is shown a dispensing closure which, in some aspects, incorporates features disclosed in the said Libit et al. patent. The base 10 has a top 14 which is essentially flat and a peripheral skirt 15 provided interiorly with threads (not shown) or other expedient whereby the device is attached to the container. The base has a cavity or recess 25 which, in the embodiment under consideration, has essentially cylindrical opposite end sections 129—129. As will appear, the peripheral contour of the sections 129—129, other than the shoulders to be described subsequently, is not critical, since the essential purpose thereof is simply to accommodate the respective ends of the knuckle which is retained in the cavity by means now to be described. Each section 129—129 has a shoulder 32 shown as prismatic (FIG. 4) with the apex thereof being directed horizontally and one face thereof adapted to bear on associated ends of the knuckle, and the other face defining a throat to facilitate snap-type initial assembly. The shoulder, taken together, constitute one of the three sup-

ports for the knuckle as alluded to above. The other two will be particularized hereinafter.

The spout 11 (FIG. 1) comprises a nozzle portion 101 extending from a knuckle 102. Although the ends of the knuckle may be cylindrical it is preferred to shape such ends as shown in FIGS. 1 and 4 wherein these ends are cut out, as at 107—107 to define a horseshoe-shaped member 108 at each end. The outer face of each member is a working face which corresponds to the lateral surface of a cylinder, and this face extends circumferentially only so far as is dictated by the extent of angular swivelling movement imparted to the spout. The members 108 are abutable with respective lugs 109—109 on the flat end wall of each of the sections 129—129. Thus, upon movement of the spout to "on" position, involving an angle of substantially 90°, the members 108—108 abut respective lugs 109 as a limit stop. FIG. 4 shows the parts in the "on" condition.

In the example of FIG. 1 the spout has a nozzle part 131 surmounted by an overhanging part 132. The part 131 is received in the lower portion 133 of a recess extending outwardly as a branch of the cavity 25 while the part 132 fits a widened portion 135 thereof. There is thus achieved essentially flush relation of the spout with the top 14 while the lateral walls of the recess 133 are availed of to define the shoulders 32—32.

Since the devices are assembled by automatic machinery that form of spout shown in FIG. 1 must be oriented, i.e. positioned with the outer face up, prior to thrusting the same into operative relation with the base. Inasmuch as it is advantageous to avoid having to so orient the spout the construction of FIGS. 2 and 3 may be availed of, the spout being symmetrical with reference to both horizontal and vertical medial planes. Accordingly the spout may be assembled irrespective of whether it is "right side" up.

In the spouts of FIGS. 1 and 3 the bore therethrough is indicated at 141 and 142 respectively. The partition 145 seen in FIG. 1 is simply a reinforcing rib and extends from the end visible in the figure to a point about mid-way of the length of the bore.

Reverting to FIG. 2 it will be apparent that, in order to receive the symmetrical spout of FIG. 3, the lateral walls of the recess 134a are straight, but will still define the shoulders 32—32. In the case of the horseshoe-shaped members 108a (FIG. 3) the outer perimeter conforms to a lateral segment of a cylindrical surface in order to present a bearing surface to the respective shoulders 32—32 during swivelling movement of the spout.

The rib 111 in the base of FIG. 2 is merely for reinforcement and takes no part in supporting the knuckle for rotation. The rib 112 is simply a stop to limit movement of the spout to "off" position and thereby to determine a flush relation between the surface 130 and the top 14.

The second of the three support points is the rib 131 disposed near the top of the cavity 25 and extending parallel to the axis of rotation of the spout for a distance desirably the same as the width of the nozzle. From FIG. 5 it will be seen that this rib bears essentially tangentially on the knuckle in a manner similar to the shoulders 32—32 but on the opposite side thereof. FIGS. 4 and 5 may be considered together.

The third point of support is constituted by a sealing element 151 (FIGS. 1 and 5) circumjacent the passage 152 in the base through which the material being dispensed will pass into the bore 142 when the spout is in "on" position, i.e. displaced 90° from the position of FIG. 5. This sealing element is shown in FIG. 1 as rectangular in outline in order to conform to the rectangular cross section of the illustrative bore 141 or 142. However the same may take other forms, e.g. circular in the case of a cylindrical bore in the nozzle, as in the Libit et al. patent, or a pad as in the Mart patent. In any event the essentially radially-directed forces exerted by the shoulders

32—32 and the rib 131 acting jointly may be resolved into horizontal and vertical components, the latter of which urge the knuckle against the sealing element to yield a fluid-tight joint between the same and the contiguous knuckle. The active and reactive forces are attained by the use of a resilient, generally shape retaining material for at least one of the two parts comprising the device but, in practice, both parts are so fabricated. In particular the resiliency of the base material together with suitable dimensioning of the knuckle 102, shoulders 32—32 and rib 131 and angular positioning of the "points" providing the bearing support will provide adequate application of forces consistent with relatively effortless manipulation of the device. To reduce friction and to achieve higher pressure per unit area at the sealing zone, i.e. the active surface 151, the latter is desirably rounded off as shown in FIG. 5. It will be seen that the central portion of the knuckle need not be cylindrical throughout but may have a cylindrical face over only the working area thereof.

The members 108—108 and 108a—108a, although extending less than 360° are fully effective as pivots for the spout inasmuch as the swing of the spout in the example is only 90°. However, in special applications this angle may be more or less. Further, the radius of these members may be greater or less than the radius of the knuckle per se and they may be cylindrical or cylindrical annuli. This last mentioned construction, as well as the pivots shown in the drawing, employ less material and assist in minimizing shrinkage problems.

FIG. 9 illustrates a modified form of the device wherein the knuckle pivots 154—154 are cylindrical and smaller in diameter than a central portion of the knuckle 155. In this modification the bearing openings 156—156 are of the form shown in FIG. 4. Further, the sealing pad 151a is shown alternatively as circular. At this juncture it is to be noted that the working face of the sealing zone, viz. pads 151 or 151a preferably conforms to the curvature of the knuckle, e.g. as shown in FIG. 5.

FIG. 10 illustrates an embodiment in which the three-point support is obtained by providing an additional shoulder 158 opposite each of the shoulders 32 (FIG. 7), in which event the centrally-located rib 131 may be omitted. However, the centrally-positioned rib 131 is preferred since, in such case, the force exerted thereby is above the sealing ring and produces maximum effect. It is also within contemplation to extend this rib into the bearing openings, if desired.

Inasmuch as pivotal action of the spout does not depend on any support other than the three-point support described above, the configuration of the bearing openings 129—129 or 156—156, regarded perimetrically, may take any form. In FIG. 4 this is shown as mainly cylindrical; in FIGS. 6 and 7 as having straight sides and a straight bottom. Although these sides are shown as tangent to the adjacent pivot portions of the knuckle, this is optional and the same may be spaced therefrom, as in FIGS. 12 and 13. It is within contemplation to space the side walls and/or bottom wall of the bearing openings away from the pivot in order that the elements providing the three-point support are free to center the knuckle as dictated by the forces exerted at the three points and, coincidentally, dispense with spurious forces.

FIG. 8 is similar to FIG. 7 except that the bearing openings are surfaces of a cylinder of some diameter larger than that of the pivot.

Reference is now made to FIGS. 11 to 13 showing somewhat schematic cross sections of various forms of bearing opening and associated pivot. The three-point support in each case is represented by three corresponding forces F_1 , F_2 and R . The vector diagram of FIG. 14 includes the vertical components C_1 and C_2 of F_1 and F_2 represented as together equal to R in magnitude. For convenience of exposition F_1 and F_2 are shown equal, but F_1 may be greater or less than F_2 depending upon the

geometry of the pivot and bearing structure. In either case C_1 and C_2 will sum to R . Further it will be understood that, when the sealing pad conforms to the curvature of the knuckle, the force R represents the vertical component which is derived from all of the forces distributed over the abutting area of the knuckle and pad.

FIG. 15 illustrates the forces of FIG. 14 under the conditions of FIG. 10 wherein only the pivots per se are restrained.

FIG. 16 illustrates the forces under the conditions of FIG. 9 wherein each force $F_2/2$ is derived from a shoulder 32, F_1 results from the rib 131, and R is as before.

The term "shape-retaining" as used with reference to the material comprising the two parts of the closure, is a purely relative one since absolute rigidity is not a prerequisite. Similarly with respect to the meaning to be attributed to the relative words "resilient" or "resiliency" which are used only to make clear that the "generally shape-retaining" characteristic implies such degree of resiliency or elasticity as is required for initial assembly and subsequent function. In practice both parts are of material thus characterized, although it will be understood that one of the parts may be rigid and the other non-rigid.

While we have shown particular embodiments of our invention, it will be understood, of course, that we do not wish to be limited thereto since many modifications may be made and we, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of our invention.

We claim:

1. A dispensing closure for use with a container for dispensing fluent material therefrom comprising: a spout having a cylindrical bearing portion and a nozzle extending from said portion, a base having means to attach the closure to the container, said spout being rotatable on an axis relative to said base between "on" and "off" positions, said spout and base having respective passages to be brought into and out of register when the spout is moved between said positions, said base having a cavity to receive said bearing portion, a sealing pad on the wall of the cavity circumjacent the exit of the base passage and bearing on said spout portion, a pair of pads on one side of the rotational axis aligned parallel to said axis, each member of the pair extending from the wall of the cavity on opposite sides of said sealing pad to bear on respective ends of said bearing portion, a third pad extending from the wall of the cavity on the other side of the rotational axis, said pair of pads and third pad each having a face tangent to said bearing portion, the points of tangency being substantially symmetrical about said axis and more than 180° apart measured about the sealing pad and the minimum distance between the points of tangency measured transversely to said axis being so determined in relation to the diameter of the cylindrical portion as to permit snap-type assembly of said portion into the cavity, said sealing pad being between said pair of pads and third pad whereby the cylindrical portion has three-point rotational support, said base having a recess forming a branch of said cavity, said recess receiving said nozzle, the spout being symmetrical about two perpendicular planes through the axis of the nozzle bore, at least one of said base and spout comprising resilient, generally shape-retaining material.

2. A dispensing closure for use with a container for dispensing fluent material therefrom comprising: a spout having at one end thereof a portion having a cylindrical bearing surface, said portion being flanked at each end by an axle having an exterior cylindrical face, a base having means to attach the closure to the container, said base having a cavity to receive said spout portion and a pair of bearing openings, each member of the pair being dis-

the wall of the cavity circumjacent the exit of the base passage and contiguous to said bearing surface, each bearing opening being provided with a pair of confronting pads, each member of the pair of pads being on opposite sides of the respective axle and bearing thereon, the points of bearing being spaced angularly more than 180° and the members of each pair of pads being spaced apart by a distance less than the diameter of the axles to permit the axles to be forced with a snap fit past the pads into the respective bearing openings, each said bearing opening having an abutment therein and each said axle having a recess cooperative with the abutment to limit the angular extent to which the spout may be rotated to "on" position, at least one of the said base and spout comprising resilient, generally shape-retaining material.

3. A dispensing closure in accordance with claim 2 further characterized in that the support for the spout provided by the sealing pad and each set of pads in the bearing openings constitute a three-point bearing, the wall of each bearing opening extending between the pair of pads associated with each opening being spaced away from the axle individual thereto.

4. A dispensing closure in accordance with claim 2 wherein each bearing opening has a cross section transversely of the rotational axis which is substantially rectangular, each member of the pair of pads associated with the opening being on opposite side walls thereof.

5. A dispensing closure in accordance with claim 4 wherein said side walls are tangent to the associated axles at diametrically opposite points thereof.

6. A dispensing closure in accordance with claim 2 wherein each said bearing opening has a cross section transversely of the rotational axis which is U-shaped, each member of the pair of pads associated therewith being respectively disposed on a leg of the U.

7. A dispensing closure for use with a container for dispensing fluent material therefrom comprising a spout and a base wherewith the spout is engaged for swivelling movement on a rotational axis between "on" and "off" positions, said spout having a pivot part at one end and a nozzle extending from said pivot part, said pivot part comprising a central portion having a working face which is a longitudinal segment of a cylindrical surface and end portions flanking the central portion, each end portion having a working face which is a longitudinal segment of a cylindrical surface, at least said last-mentioned working faces being coaxial and the diameter of all said working surfaces being the same, a first cavity in said base receiving said central portion, a pair of second cavities in said base, each second cavity receiving respective ones of said end portions, said base and spout having respective passages to be brought into and out of register when the spout is moved between "on" and "off" positions, said base passage exiting in said first cavity, said spout passage having its entrance in said central portion working face and its exit at the distal end of the nozzle, three-point means for rotatably supporting said spout pivot part, one of said points being constituted by a pad on the wall of said first cavity circumjacent the exit of the base passage bearing on said first working face, the second of said points being constituted by second pads, one on the wall of each of the second cavities bearing on said second working faces, said second pads being mutually aligned parallel to the axis of rotation of the spout, the third of said points being constituted by third pads, one on the wall of each of the second cavities bearing on said second working faces, said third pads being opposite said second

pads respectively and mutually aligned parallel to said axis of rotation, said second and third pads individual to each second cavity being spaced about said first cavity pad at an angle greater than 180°, the minimum distance between the pads individual to each second cavity measured normally to said axis being less than the diameter of said end portions to provide an interference fit whereby said end portions may be forced with a snap fit into operative position with the respective second cavities, at least one of the base and spout comprising resilient, generally shape-retaining material.

8. A dispensing closure for use with a container for dispensing fluent material therefrom comprising a base including means to attach the closure to the container and a spout carried on said base for swivelling movement on a rotational axis between "on" and "off" positions, said spout including a nozzle and a portion at the base of the nozzle, said portion having a working face which is a longitudinal segment of a cylindrical surface, the axis of the cylinder being essentially coaxial with said rotational axis, a recess in said base to receive said portion, a pair of openings in said base respectively located on opposite sides of said recess, a pad protruding from the wall of the recess remote from the free end of the spout bearing on said working face, the side wall of each bearing opening on the side nearest the free end of the spout being respectively provided with a pad extending into the opening, said spout portion having an axle protruding from each side thereof having a diameter less than the minimum distance between the first mentioned pad and the pads individual to the bearing opening, said distance being measured normally to the plane containing said rotational axis at least one of the base and spout comprising resilient, but generally shape-retaining material whereby upon assembly of the spout with the base the axles are forced between said pads with a snap fit and thereafter retained in the bearing openings, the spout and base being provided with respective passages adapted to be brought into and out of register when the spout is in said "on" and "off" positions respectively, the passage in the base exiting opposite said spout base portion, and a sealing pad circumjacent said passage exit bearing on said spout base portion in all working positions of the spout, said first-mentioned pad, said pads in the bearing openings and said sealing pad providing forces retaining the spout in the base and effecting a fluid-tight seal at the sealing pad.

9. The combination in accordance with claim 8 in which the radius of said working face of said spout portion is greater than the radius of said axles.

10. The combination in accordance with claim 8 in which the radius of said working face of said spout portion is less than the radius of said axles.

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WALTER SOBIN, Primary Examiner