July 5, 1960 J. H. RITTERSKAMP ET AL 2,943,445

MISSILE SAFETY CLOSURE

Filed June 27, 1955 3 Sheets-Sheet 1

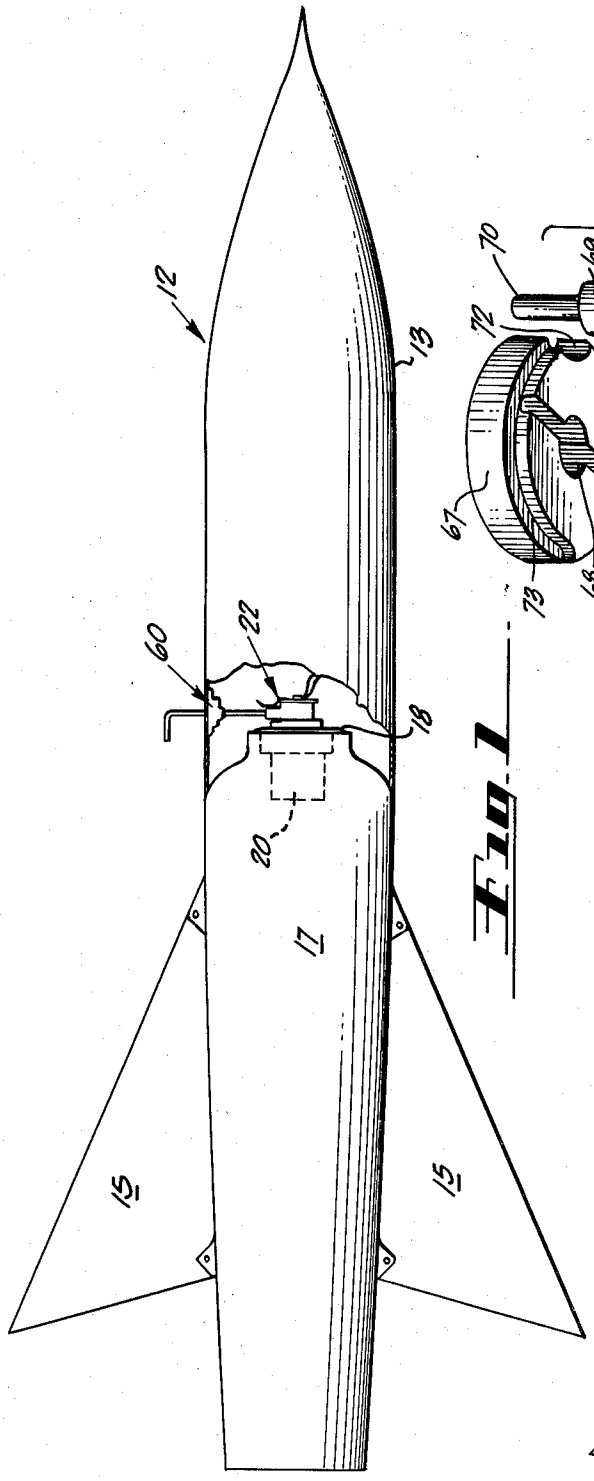


Fig. 1

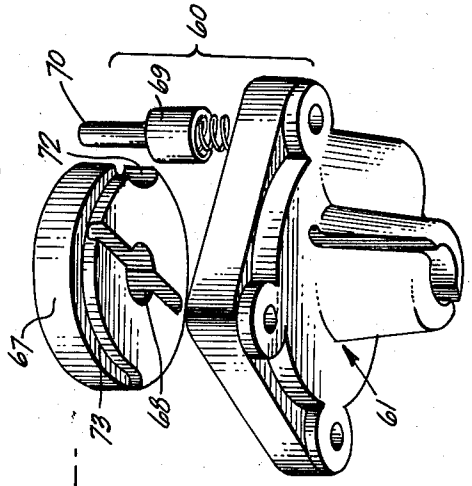


Fig. 8

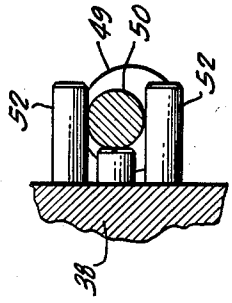


Fig. 7

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MISSILE SAFETY CLOSURE

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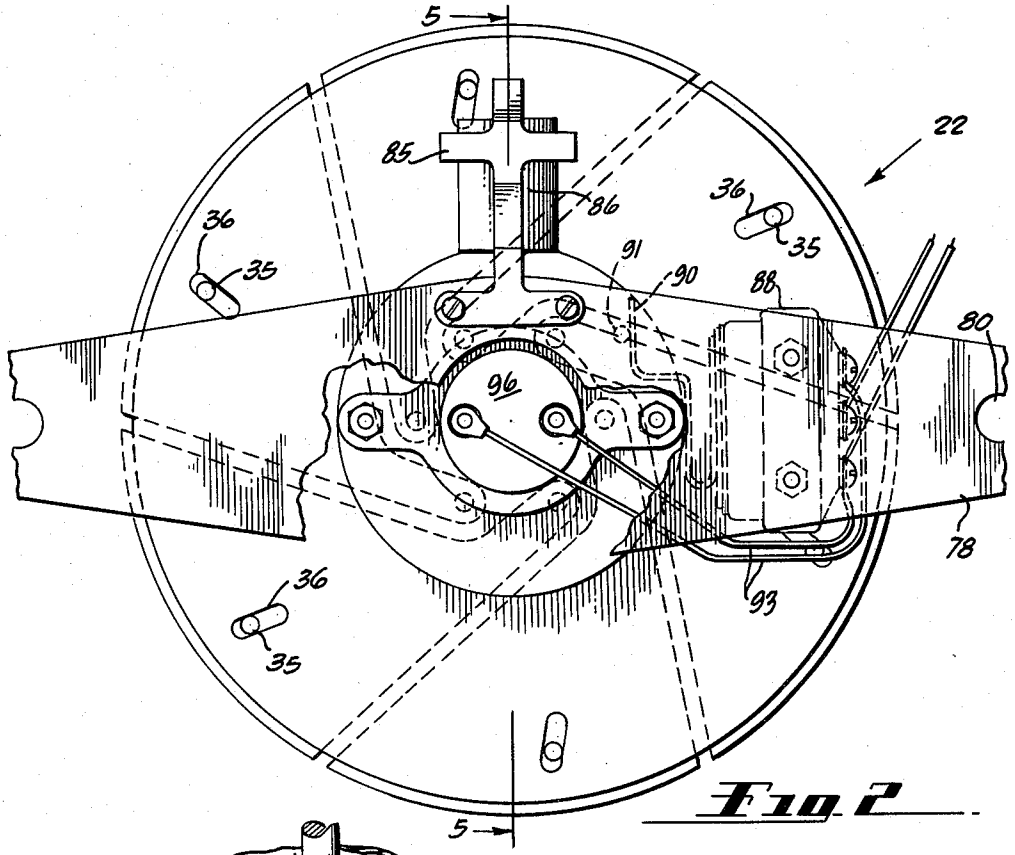


Fig. 2

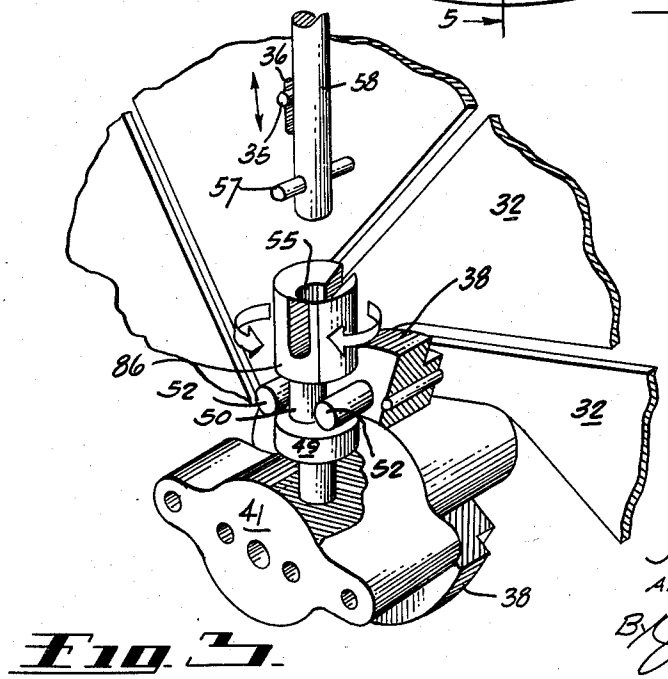


Fig. 3

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MISSILE SAFETY CLOSURE

Filed June 27, 1955 3 Sheets-Sheet 3

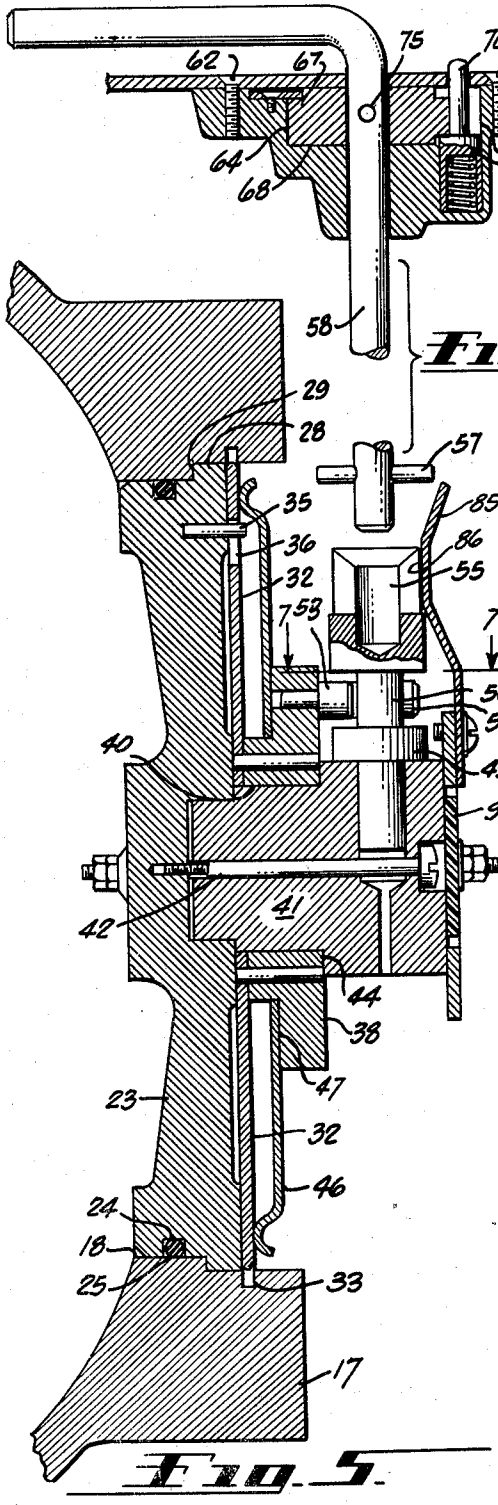


Fig. 4

Fig. 5

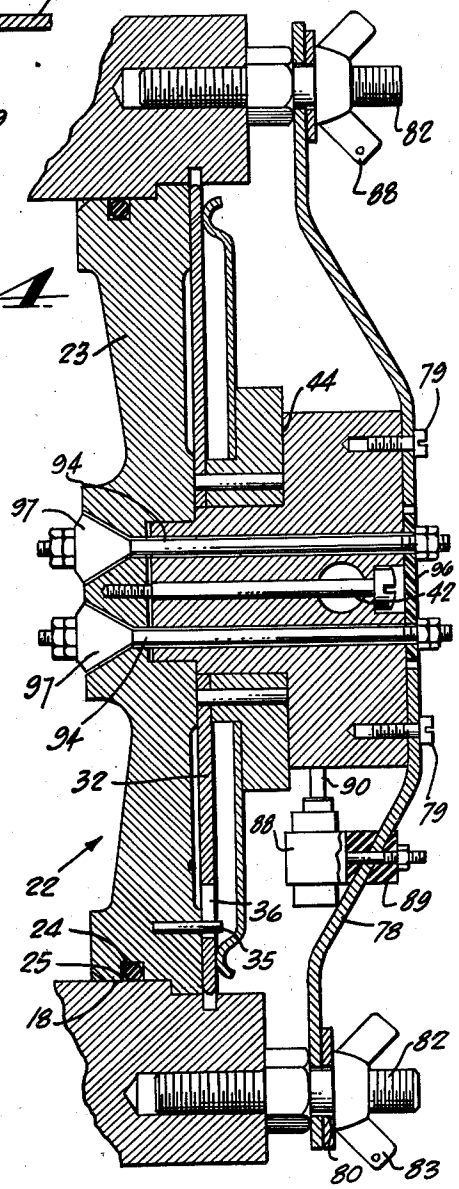


Fig. 6

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MISSILE SAFETY CLOSURE

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5 Claims. (Cl. 60—39.09)

This invention relates to self-propelled missiles and more particularly to a safety closure for the forward, or non-discharge end of the missile propellant chamber.

It is a feature of the invention that there is provided a safety closure that, in one operative relation with the missile propellant chamber, will render the missile non-propulsive in the event of an inadvertant or accidental ignition of the propellant, and in a second operative relation will effectively close the forward end of the missile and force the propellant to discharge rearwardly to produce the desired propulsive reaction.

Another feature of the invention is in the provision of an arming switch which is actuated simultaneously with the changing of the operative relation of the closure with the propellant chamber from the first to the second position.

It is a further feature of the invention that the safety closure will at all times provide a seal for the propellant chamber which will prevent the entry of moisture and other contaminants from the time of assembly until the missile is launched.

An additional feature of novelty in the invention is the arrangement whereby the closure can be moved from its safety position to armed position by an operation that is readily performed exteriorly of the missile and which does not require any disassembly of the missile casing or other components.

Other advantageous features of the invention will be readily apparent by an understanding of the preferred embodiment shown in the accompanying drawings in which:

Figure 1 is a side elevational view of a missile with portions broken away showing the safety closure positioned on the missile propulsion chamber.

Figure 2 is a front elevational view, with portions broken away, of the safety closure.

Figure 3 is a fragmentary perspective view of the movable securing means for the safety closure.

Figure 4 is a side sectional view illustrating the closure operating rod extending through the outer missile casing.

Figure 5 is a sectional view of the closure positioned in the missile, the details of the closure viewed along line 5—5 of Figure 2.

Figure 6 is a sectional view similar to Figure 5 and being taken at a right angle thereto.

Figure 7 is a sectional view of a portion of the crank operating means for the closure securing means viewed along line 7—7 of Figure 5.

Figure 8 is an exploded perspective view of the casing mounted means shown in Figure 4 for limiting rotation of the operating rod.

Referring now to the drawings, and more particularly to Figure 1 thereof, there is shown a conventional missile 12 having an outer shell 13, of any desired aerodynamic configuration, with a series of stabilizing fins 15 attached to the aft end thereof. Within the forward end of the missile 12 there is carried the usual explosive charge or warhead (not shown) and housed interiorly of the after

section of missile 12 is a pressure vessel 17 constituting a reaction type propulsion unit adapted to discharge rearwardly, i.e. to the left as viewed in Figure 1. The front end of pressure vessel 17 is provided with an opening 18 through which igniter 20 is first inserted into the proper relation with propellant fuel within vessel 17. The opening 18 is thereafter closed and sealed by a safety closure 22 wherein are embodied the principal features of the present invention.

The specific construction of one preferred embodiment of a safety closure will now be described in detail with reference to Figure 2 through 6. The safety closure 22 is circular in plan and includes a plug 23 adapted to be snugly received in pressure vessel opening 18. In order to withstand the high degree of heat and pressure generated by the propulsive fuel when ignited, the plug 23 is preferably of heavy duty steel construction most conveniently formed by molding. Since one function of the safety closure 22 is to preclude the entry of moisture and other contaminants into the pressure vessel 17, plug 23 is peripherally grooved at 24 for the reception of an annular sealing ring 25. The extent of insertion of plug 23 into opening 18 is limited by coacting shoulders 28 and 29 respectively on plug 23 and on that portion of the pressure vessel 17 defining opening 18.

In view of the dual nature of the closure 22, which will be more fully described hereinafter, there are provided two independent means to maintain the plug 23 within opening 18. The first of these means comprises a series of sectors 32 of flat steel plate each being movable, in unison with the others, in a generally radial direction with respect to plug 23. In their innermost or retracted position sectors 32 lie within the diameter of circular plug 23 so as not to interfere with the insertion and removal of the plug in and from pressure vessel opening 18. In their extended or outermost position the outer periphery of each sector 32 enters the circumferential groove 33 into locking relation therewith. The design shear strength of the sectors 32 at the line of engagement with groove 33 is adequate to withstand the maximum pressure exerted against plug 23 during the ignition of propellant fuel within pressure vessel 17.

The actuation of sectors 32 in their generally radial direction is accomplished by imparting a rotary motion, about the center of the plug 23, to the apex of each sector 32 and simultaneously restricting movement of the outer portion of each sector 32 to a radial direction by means of fixed pin 35 extending from plug 23 into cooperating engagement with slot 36 in the sector 32. As most clearly illustrated in Figure 3, the apex of each sector 32 is pin connected to a common hub 38 which in turn is rotatively mounted on spindle portion 40 of center post 41. Center post 41 is secured to plug 23 by an axially extending screw 42 which, when threaded into place, serves in conjunction with shoulder 44 to draw hub 38 and the apices of sectors 32 snugly against the central area of plug 23. As best viewed in Figures 5 and 6 the outer peripheries of sectors 32 are maintained firmly against the surface of plug 23 by means of a disk or diaphragm type spring 46 to which pressure is applied by annular shoulder 47 of hub 38. Spring 46 in bearing against the peripheral portions of sectors 32 also performs the function of maintaining pins 35 and slots 36 in mating engagement.

Referring to Figures 3, 5 and 7, the means here employed to impart rotary motion to hub 38, thence to the apices of sectors 32, includes a crank 49 pivotally mounted at a right angle to the axis of center post 41 near the outer end thereof. Straddling the eccentric 50 of crank 49 are a pair of pin followers 52 projecting from hub 38 and being adapted to transmit motion to hub 38 to the extent of throw of eccentric 50. The

dimensioning of the sector actuating means is such that a one-half or 180 degree turn of crank 49 produces full retraction or extension of sectors 32 in accordance with the direction of crank oscillation. In order to prevent travel of crank 49 in excess of approximately 180 degrees, a stop button 53 is positioned intermediate follower pins 52 and in the path of travel of eccentric 50. The stop button 53 is of a length to enable it to contact and prevent further movement of crank 49 at the opposite extremities of the 180 degree travel.

Viewing Figure 4 in conjunction with Figure 5, the crank 49 is provided with a slotted bore 55 adapted to removably receive the end and cross pin 57 of operating rod 58. Functioning in unison with the slotted upper end of crank 49 is a second assembly 60 affixed to the inner side of missile casing 13 which also limits the arc of movement of crank 49 to 180 degrees. Assembly 60 includes a basket 61 affixed by fasteners 62 to casing 13 and having a first large central well 64 and a second smaller but deeper well 65, the peripheries of wells 64 and 65 intersecting each other. In the central well there is rotatively secured a disk 67 having a slotted bore 68 extending axially therethrough. In the smaller well 65 is positioned a spring pressed detent 69 with an extension 70 thereon protruding outwardly through casing 13 to enable the manual depression of detent 69. Detent 69 normally engages within recess 72 in disk 67 to prevent rotation thereof. Upon full depression of extension 70, detent 69 moves only partially out of interfering engagement with recess 72 but disk 67 is free to rotate by virtue of relief 73 merging into recess 72 and extending approximately 180 degrees about the lower periphery of disk 67. After rotation through the 180 degree extent of relief 73, detent 69 contacts the end of relief 73 thereby precluding further rotation of the disk 67. Upon full return rotation of disk 67, detent 69 re-enters recess 72 under pressure of its spring.

The operating rod 58 has a second or upper cross pin 75 spaced from lower cross pin 57 a distance equal to that between the slotted bores 55 and 68 respectively in the crank 49 and disk 67. By this arrangement it is apparent that when the operating rod 58 is thrust through casing 13 into full engagement with bore 55 lower and upper crosspins 57, 75 will respectively be in engaging relation with the slots extending radially of bores 55 and 67. In this position the crank 49 may then be operated to extend or retract sectors 32 into or from locking relation with groove 33 in the forward end of pressure vessel 17.

As an auxiliary means to retain the plug 23 in sealing position in pressure vessel opening 18, a cross strap 78 is affixed to the outer end of post 41 by screw fasteners 79, the cross strap 78 having apertures 80 at its opposite extremities for receiving studs 82. When the plug 23 is positioned in the opening 18 with the studs 82 extending through apertures 80, wing nuts 83 or other similar means are turned down into firm contact with the cross strap 78 to maintain the parts in assembled relation. The strap 78 is of adequate strength to withstand jarring and vibration normally encountered in handling the missile but in the event of ignition of the propellant fuel when the sectors 32 are in retracted position the strap 78 will fail and allow the plug 23 to be forced out of the opening 18.

As shown in Figure 5, a spring finger 85 is attached to the strap 78 and has its upper end resiliently urged into binding engagement with the flat portions 86 on slotted upper end of crank 49. When the operating rod 58 is inserted in the missile 12 to operate the closure locking sectors 32, cross-pin 57 deflects the spring 85 out of binding engagement and in this manner serves as key to the closure 22.

As an added safety feature an electric interlock between the closure 22 and igniter 20 is incorporated whereby when the sectors 32 are withdrawn from locking groove 33 the circuit through leads 93 and conducting pins 94 to the igniter 20 is interrupted and when sectors 32 are extended the circuit is closed whereby to enable the rocket for launching. This electrical interlock comprises a switch 88 mounted by fibre blocks 89 on cross-strap 78 and having an actuating arm 90 positioned to be moved by pin 91 mounted on and moving with rotating hub 38. The outer ends of conducting pins 94 protrude through an insulating disk 96 and the inner ends of pins 94 are set in conical insulating plugs 97 which function also as a pressure seal for the openings in plug body 23. Viewing Figure 2 it will be seen that movement of hub 38 in clockwise and counterclockwise directions respectively effects closing and opening of switch 88 to effect the aforesaid purpose.

Although the now preferred embodiment of the present invention has been shown and described, it is to be understood that the invention is not limited thereto, for it is capable of modification in form and detail within the scope of the appended claims.

We claim:

1. An assembly of the type described comprising: a container having an opening at one end thereof and having a peripheral groove extending about said opening, said container being adapted to receive a propellant charge and igniter; a plug type closure adapted to engage within said opening; means for maintaining the closure in said opening including a pivot post, a hub rotatably mounted on the post, a series of shear members each being affixed at its inner end to the hub to be rotated thereby and each being constrained at its outer end to move generally radially of the closure into the peripheral groove about the container opening; means to rotate the hub; a circuit breaker secured to said closure for controlling operation of the igniter; and means for operating said circuit breaker in response to movement of the hub.

2. An assembly of the type defined comprising: a container adapted to receive a propellant charge and igniter, said container having an opening at one end thereof; a closure for sealingly engaging said opening; a series of locking means mounted on and movable in a generally radial direction of the closure into engagement with the container; actuating means for the locking means; a switch controlling the igniter, said switch being operable upon movement of the locking means; frangible means maintaining the closure in engagement with container opening, said frangible means being rupturable upon ignition of the propellant charge occurring when said series of locking means are out of container engagement to thereby allow said closure to be forced out of the opening.

3. A container sealing means comprising: a plug type closure adapted to seat in a container opening; locking means for the closure including a plurality of shear members movable radially outwardly from the closure; a post centrally located on the closure; a hub pivoted on said post and being connected to the locking means to impart motion thereto upon rotation of the hub; a crank including an eccentric, said crank being pivotally mounted on said post on an axis approximately normal thereto; means on said hub in operative engagement with the eccentric whereby movement of the crank effects motion of the shear plates.

4. Container sealing means as defined in claim 3 wherein means are provided to react against the crank to prevent inadvertent motion thereof; and removable means interacting with the crank for turning the crank from a point remote therefrom, the engagement of said removable means with the crank rendering said means reacting against the crank ineffective.

5. An assembly of the type described comprising: a container having an opening at one end thereof and having a peripheral groove extending about said open-

ing; a plug type closure adapted to engage within said opening; means for maintaining the closure in said opening including a pivot post, a hub rotatably mounted on the post, a series of shear members each being affixed at its innner end to the hub to be rotated thereby and each being constrained at its outer end to move generally radially of the closure into the peripheral groove about the container opening; means to rotate the hub including a crank engaging the hub and extending away from the axis of rotation of the hub at approximately a right

angle; and means to limit the extent of rotation of the hub.

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