United States Patent

Blau et al.

[15] **3,667,642**

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[54] SCREW-ON CLOSURE MEMBERS FOR CONTAINERS, ETC.

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[21] Appl. No.: **94,410**

[30] **Foreign Application Priority Data**

Dec. 3, 1969 Germany ..... P 19 60 674.7

[52] **U.S. Cl.** ..... **220/39 R,** 215/43 R, 215/49

[51] **Int. Cl.** **B65d 41/04**

[58] **Field of Search** ..... 220/39 R; 215/49, 50, 55, 43 R

[56] **References Cited**

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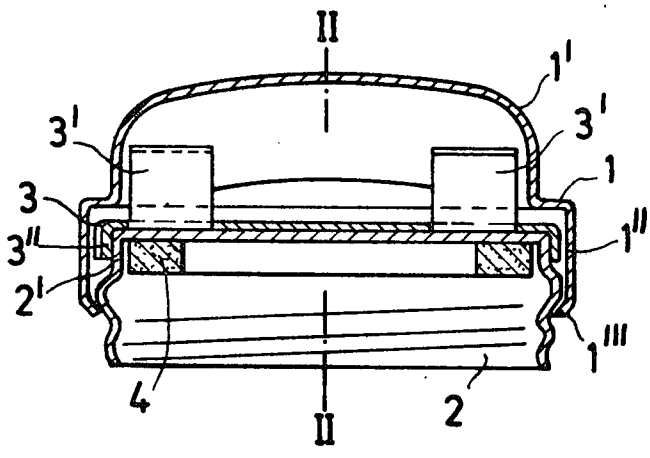
Assistant Examiner—John J. Love
Attorney—Michael S. Striker

[57] **ABSTRACT**

A screw-on closure cap for closing the filling opening of a container or a tubular spout, the cap comprising relatively rotatable upper and threaded lower cap parts assembled together coaxially and having a resilient drive connection between them capable of transmitting a predetermined maximum torque between the upper and lower cap parts in the closing direction. When during the screwing on of the cap onto the neck of a container or filling spout by the manual application of closing torque to the upper cap part, directly the closure cap reaches a certain degree of tightness on the cooperating part of the container or spout such that the predetermined transmitted closing torque is exceeded, the resilient drive connection yields ratchetwise to allow the continued free rotation of the upper cap part relatively to the threaded lower cap part. In this way excessive tightening of the closure, such as would lead to difficulty in loosening it manually, is prevented. The resilient drive connection may comprise a disc having oblique spring tongues engaging ratchetwise in cooperating recess for example in the interior of a hollow pressed-out hand grip portion on the upper cap part; or spring-loaded ball catches cooperating with recesses; or dog-like projections with oblique or rounded faces cooperating with recesses; or oblique spring tongues engaging behind rigid projections.

15 Claims, 12 Drawing Figures



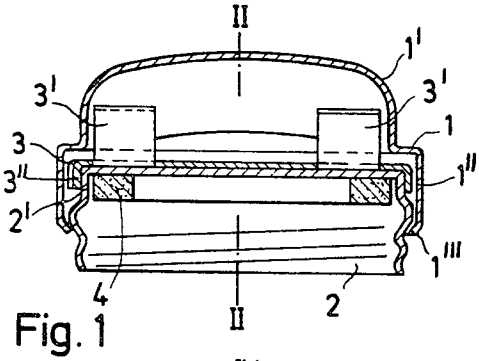


Fig. 1

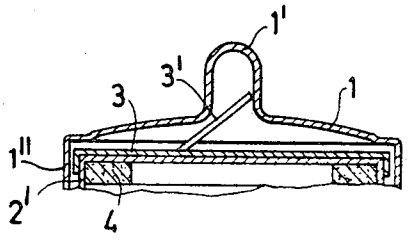


Fig. 2

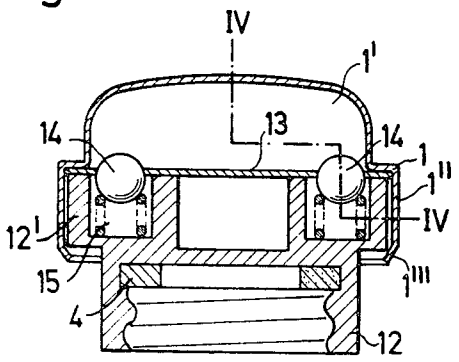


Fig. 3

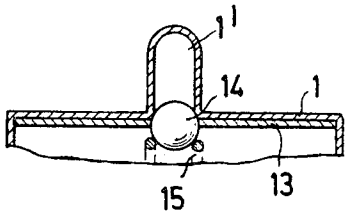


Fig. 4

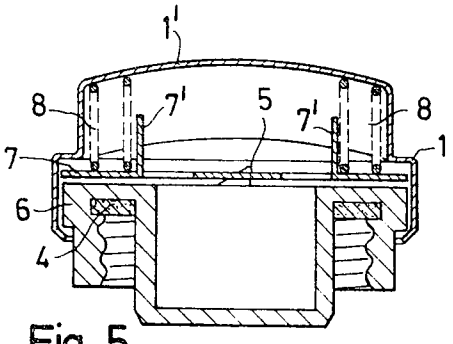


Fig. 5

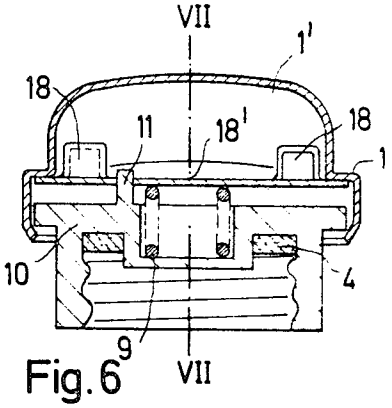


Fig. 6

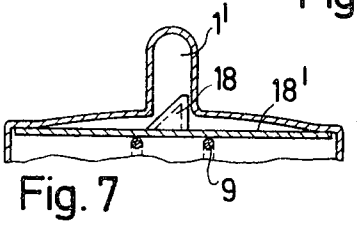


Fig. 7

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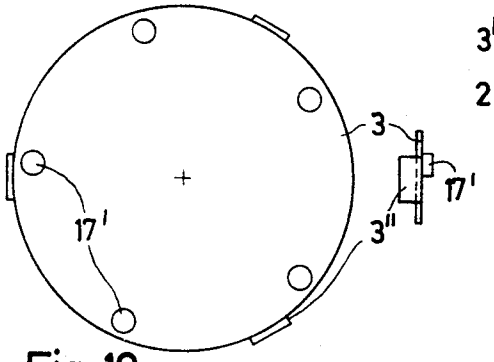

Fig. 10

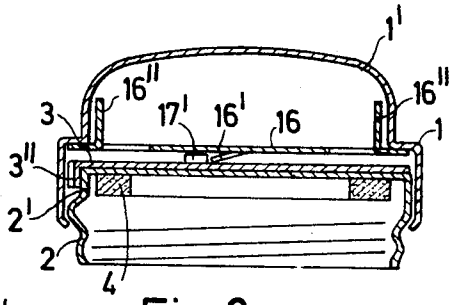

Fig. 8

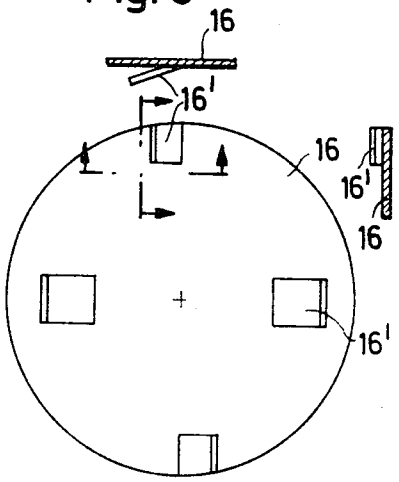

Fig. 9

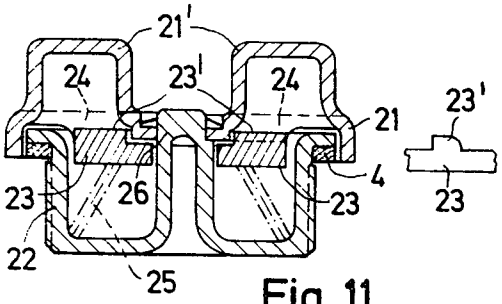

Fig. 11

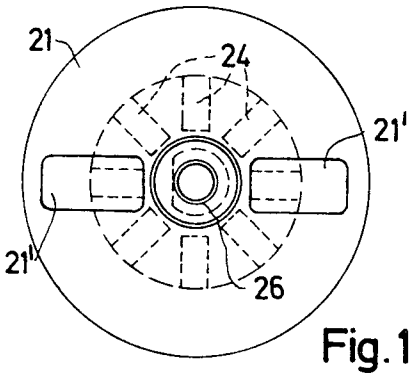

Fig. 12

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SCREW- ON CLOSURE MEMBERS FOR CONTAINERS, ETC.

This invention relates to screw-on closure caps for containers or tubular spouts, of the kind having a disc or ring-shaped seal inserted in the cap and pressing against an edge of the mouth aperture of the container neck or tubular spout when the cap is screwed on.

In the case of such screw-on caps, it is a disadvantage that they can easily be tightened so securely in the direction of closure that it becomes scarcely possible to open them by hand, since the pressure of application of the tightened screw threading is difficult to slacken by rotating the closure cap in the opposite direction. Even where special gripping facilities are provided on the outer rim of the cap, with relatively large recesses around the periphery of the cap into which individual fingers of a user's hand can be fitted, or where hand grip members extend transversely over the surface of the cap, such measures are very often insufficient to enable such screw caps to be readily loosened from their tightened position of closure.

An object of the invention is to provide such screw-on caps which on the one hand can be given only a predetermined limited tightening moment in keeping with the circumstances, so that after a definite cap torque or tightness of threading has been attained between the cap and the relevant part of the container neck or spout, the cap cannot be further tightened. On the other hand, it is desirable that the screw-on cap be easily loosened again by hand from its screwed-on position. Finally, it is desirable for the interposed seal to remain largely unaffected by torque forces, so that it will not be subject to destructive shearing forces during closure and opening.

According to the present invention a screw-on closure cap incorporating a sealing ring comprises an upper cap part adapted to be gripped and turned manually for screwing the cap on and off, and a screwthreaded lower cap part rotatably assembled coaxially together with the upper cap part, the lower cap part being adapted to be screwed onto the rim of the container opening or tubular spout to secure the cap in its closing position thereon, and includes at least one spring-loaded drive element interposed between the two cap parts, the drive element being rotationally fast with one of the two cap parts and radially spaced from the center thereof and engaging with a cooperating abutment surface on the other cap part, the drive element and the abutment constituting a limited-torque coupling which transmits torque in the closing direction between the two cap members up to a certain maximum value, the drive element under the imposition of closing torque in excess of the said maximum value yielding against its spring loading and overriding the said abutment surface ratchetwise to permit the continued free rotation of the upper cap part relatively to the lower cap part.

The spring-loaded drive element in one arrangement of the invention comprises a disc mounted on and keyed to the threaded lower cap part, the disc having upwardly pressed-out spring tongues located in positions distributed around its periphery, each tongue slanting upwardly in the direction of closure of the cap, and engaging in a recess formed in the underside of the upper cap part. The spring tongues may be located in diametrically opposed pairs on the disc and the cooperating recesses may comprise opposite ends of the interior of an upwardly pressed-out channel-section hand grip portion extending transversely across the upper cap part.

Again the spring-loaded drive element may comprise a set of spring-loaded balls each mounted in an aperture in the upper side of the threaded lower cap part and projecting partially through a hole in a cover plate thereon under the force of a biassing spring into a cooperating recess in the underside of the upper cap part.

Yet again, the spring-loaded drive element may comprise a rigid plate keyed to and axially movably mounted in the interior of the upper cap part and spring-pressed downwardly by spring means, the drive plate being formed with apertures in which engage cooperating doglike projections fixedly mounted on the upper side of the lower cap part.

In yet another arrangement the spring-loaded drive element may comprise a spring plate inserted between the upper and lower cap parts and keyed to the upper cap part for rotation therewith, the spring plate having on its periphery downwardly pressed-out spring tongues which point in the direction opposite to the direction of closure of the cap and bear against upwardly directed doglike projections on the threaded lower cap part.

In yet another arrangement the spring-loaded drive element may comprise a disc keyed to the lower cap part and formed with radial projections engaging in cooperating recesses disposed at regular intervals around the periphery of the underside of the upper cap surface, the disc being spring-pressed against the underside of the upper cap part by a thrust spring acting between it and the lower cap part.

In yet another arrangement of the invention, the spring-loaded drive element may comprise a disc inserted in the upper cap part and formed with upwardly directed projections engaged in the interior of a hollow hand grip part pressed out from the top of the upper cap part, and in which from the lower threaded cap part, an entraining lug mounted on the lower cap part passes through the disc which is at the same time subject to the action of a thrust spring bearing in the lower cap part.

The invention may be carried into practice in various ways, but certain specific embodiments will now be described by way of example only and with reference to the accompanying drawings, in which:

FIG. 1 is an elevation in cross-section through the center of a screw cap comprising one embodiment of the invention;

FIG. 2 is a section at right-angles to that of FIG. 1, taken along the line II—II in FIG. 1;

FIG. 3 is an elevational cross-section through the center of a modified embodiment of the invention;

FIG. 4 is a section through a portion of the cap of FIG. 3, taken at right-angles thereto and along the line IV—IV thereof;

FIG. 5 is a cross-section through the center of a third embodiment;

FIG. 6 is a cross-section through the center of a fourth embodiment,

FIG. 7 is a section at right angles to that in FIG. 6, taken along the line VII—VII in FIG. 6;

FIG. 8 is a cross-section through the center of a fifth embodiment;

FIG. 9 is a plan view of the spring element in disc form which is interposed as a drive plate in the cap of FIG. 8, and includes fragmentary views which show the spring tongue members;

FIG. 10 is a plan view of a modified form of drive plate for use as a connection between the top and bottom parts of the cap of FIG. 8, and including a fragmentary lateral elevation of the drive members of the plate;

FIG. 11 is an elevation of a sixth embodiment of the invention, shown in a section through the center, and

FIG. 12 is a plan view of the cap of FIG. 11.

In the embodiment of FIGS. 1 and 2, a screw-on closure cap comprises an upper cap part 1 having a pressed-out hand grip part 1' extending transversely over it, and having a downwardly extended external rim part 1'' which engages over a lower threaded cap part 2 and which has at the bottom a turned-in edge 1''', the rim part 1'' serving to hold the individual parts of the cap together. Inserted between the cap parts 1 and 2 is a disc 3, the outer edge of which has downwardly directed projections or lugs 3'' which engage in corresponding depressions in the periphery 2' of the lower part 2 of the screw cap, to serve as drive means, while on its upper side the disc 3 has spring tongues 3' disposed in diametrically opposite relationship on the edge of the disc to engage within the hand grip part 1' on the upper part of the cap 1. For this purpose, the spring tongues 3' are pressed in an obliquely upward direction out of the intermediate part of the disc 3 and can engage the interior of the upper hand grip part 1' with a

predetermined spring locking force, so that the lower threaded cap part 2, entrained by the interposed drive disc 3/3'/3'', can be screwed onto the neck of a container or onto the end of a tubular spout by rotation of the upper cap part 1 in the direction of closure, namely the angular direction opposite to that in which the up-turned tongues 3' point. When a predetermined cap torque or thread-tightness is achieved between the closure cap and the container neck or spout, however, the spring tongues 3' are depressed against their resilience and disengage from the interior of the hand grip part 1' in the top cap part 1, so that the part 1 of the cap, passing over the depressed spring tongues 3', is free to continue rotation without applying further tightening torque to the lower threaded cap part 2, by virtue of the connection through the drive disc 3 having been broken. The ratchet-like driving engagement of the disc 3 with the upper hand grip part 1' will depend upon the particular resilient reactive force produced between the spring tongues 3' projecting as entraining means on the disc 3, and the edges of the interior of the hand grip 1, the said driving engagement then being positively discontinued as an appropriate function of the predetermined desired screw cap tightness. For this purpose, material of appropriately selected resilience can be used in inserted drive disc 3/3', in order to achieve corresponding resistance clamping forces as well as elastically effective springing moment in the spring tongues 3', or if necessary in the disc itself, where this is serving as a resilient disc 3. Accordingly, the screw cap cannot be tightened in a direction of closure more securely than a predetermined amount which seems reasonable under the given circumstances, since when a predetermined cap torque or thread-tightness is exceeded, the entraining connection between cap top and bottom parts 1 and 2 is automatically disengaged. Accordingly the cap, depending on the dimensioning of reciprocally springing dog engagement, can also be easily loosened by hand, by the hand grip part 1' being rotated in the opposite direction, so that the tips of the spring tongues 3', in the position shown in FIG. 2, engage at once against the direction of rotation in the interior of the hand grip part 1, and the rotary connection with the lower threaded part 2 of the cap is restored through the drive disc 3/3'', and the cap can be screwed on again or opened, as the case may be.

FIGS. 3 and 4 show another embodiment of the invention in which, in the head part 12' of a threaded lower cap part 112, there are incorporated balls 14 subject to the action of thrust springs 15 and located in apertures in a cover plate 13, the balls projecting partially therefrom so that, when they are engaging within the hollow hand grip part 1' of the top cap 1, they act as the entraining means which, according to the particular force of their associated thrust springs 15, maintain the rotary connection between the top and bottom parts 1 and 12 of the cap, until a predetermined desirable moment of cap tightness is achieved, with a corresponding thread tightness. When this happens, the balls 14 run out of the interior of the underside of the hand grip part 1' since, in reaction, the tightening torque between the upper cap part 1 and the tightened threaded cap part 12 overcomes the locking force of the thrust springs 15 which bias the drive balls 14, causing the balls 14 to be positively disengaged and allowing the top cap part 1 to continue to be rotated freely, such free rotation being ineffective. The screw cap is thus again tightened only to a degree in the direction of closure such that it can easily be opened again by rotation in the opposite direction, when the drive balls 14 re-engage.

A third embodiment, shown in FIG. 5, has dog-like projections 5 on the peripheral edge of a bottom screw cap part 6, these dogs engaging in recesses in a rigid plate 7 mounted above them the plate 7 being in turn connected to the upper rotary cap part 1 through mounting lugs 7' disposed on its upper face, the said lug parts 7' being engaged in the hollow hand grip part 1'. In this case the disc 7 forms the interposed springing element by reason of superimposed thrust springs 8 which springs engage at their other ends, and being braced within, the hand grip part 1'. Rotation of the upper cap part 1 in the direction of closure rotates the lower screw cap part 6, through the dogs 5 located on its rim and engaging with the drive disc 7/7' which is under the action of thrust springs 8, until such time as the moment of cap tightness overcomes the counteracting force of the thrust springs 8, whereupon the inclined faces of the dogs 5, lying in the direction of closing rotation of the upper cap part 1, are overrun by the up-pressed drive disc 7, so that the connection between the top part 1 of the cap and the threaded lower part 6 is broken, and the upper hand grip part 1' is able to rotate freely. Rotation of the upper part 1 in the opposite direction causes the vertical face of the dog-like projections 5, facing against this direction of rotation, to engage into the spring disc part 7 again, so that the screw cap part 6, being thereby connected with the upper cap part 1, can again be easily opened.

In FIGS. 6 and 7 a fourth embodiment is shown, in which dogs 18 on the peripheral edge of a disc 18' inserted into the upper cap part 1, beneath the hollow hand grip part 1', engage into the hand grip part 1' under the action of a thrust spring 9. In this case, the thrust spring 9 is fitted in a recess in the head part 10 of the bottom screw cap part, and acts centrally from beneath against the dog plate 18, while a drive stud 11 carried by the threaded lower cap part 10 engages within a recess in the dog plate 18'. Thus when the hand grip part 1' is rotated, the lower cap part 10 is entrained and rotated until the dogs 18 which engage resiliently with the top part 1, ride out of the hand grip part 1', in other words are positively disengaged from the interior of hand grip 1' by virtue of the screw cap having reached the predetermined tightness or torque. When the screw cap is rotated in reverse in order to be opened, the vertical flanks of the dogs 18, facing against the direction of rotation, engage again into the hand grip part 1' as can be seen in FIG. 7, to enable the lower cap part 10 to be unscrewed from the opening of the container or tubular spout.

A fifth embodiment of the invention is shown in FIGS. 8, 9 and 10, in which, as a driving connection with the lower threaded cap part 2, a spring plate 16 inserted between the top cap part 1 and the drive disc 3 of lower part 2 has on its periphery obliquely and downwardly pressed-out spring tongues 16' which bear against dog-like projections or studs 17' projecting upwardly from the drive disc 3 while on the upper side of the spring plate 16, the lug parts 16'' are again engaged in the hollow hand grip part 1'. The separate drive disc 3 has downwardly angled projections or studs 3'' for engagement into appropriate recesses in the outer edge 2' of the threaded cap part, as in FIGS. 1 and 2. It is also possible to dispense with the separate drive disc 3 and to provide dog-like studs 17' mounted directly on the top of the lower cap part 2, against which the spring tongues 16' of the spring plate bear in the direction of closure, until they springingly overrun these dogs 17' when a predetermined moment of screw cap tightness is attained.

In the opposite direction of rotation, for opening the cap, the downwardly oblique edge 16' bears against and locks with the entraining dogs 17' on the disc 3 (FIG. 8), or on the lower cap part 2 as the case may be.

Finally, FIGS. 11 and 12 show yet a further embodiment of the invention in which the top cap part 21 has two diametrically opposite hand grip parts 21', and the bottom cap part 22, has an external thread, and has mounted in the center of its lower wall a cylindrical central spigot 26 on which the upper cap part 21 is rotatably mounted and secured by a circlip. A disc 23 inserted between the parts 21 and 22 has projecting members 23' on its upper surface which engage springingly into recesses 24 formed in the underside of the upper cap part 21 and disposed at regular intervals on a peripheral circle, a thrust spring 25 being located beneath the disc 23 and bearing on the bottom of the lower cap part 22 to bias the dogs 23' into the recesses 24. The disc 23 is keyed to the spigot 26 of the lower cap part 22. When a predetermined moment of cap tightness is attained, the dogs 23' become automatically disengaged from the recesses 24 disposed in the rotary upper cap part 21 as the force of the spring 25 is overcome, and then

overrun the recess **24**, allowing continued free rotation of the upper cap part **21**. For opening the cap by rotating it in the opposite direction, the driving connection between the top and bottom parts **21** and **22** of the cap is restored by the vertical rear faces of the dogs **23'** engaging into the recesses **24** in the upper rotary cap part **21**.

In all the drawings, the seal is in each case designated by the reference numeral **4** and it is advantageously disposed in such a way as to be largely relieved from rotary shearing forces, being situated under the periphery of the threaded lower cap part. According to the strength of the springing properties desired in the connection between the upper rotary cap part and the lower threaded cap part, so the previously described drive dogs can, for better abutment of spring tongue parts acting obliquely against them, likewise be inclined or be chamfered on only one side, as an alternative to the cylindrical dogs **17'** illustrated in FIGS. **8** and **10**.

What I claim as my invention and desire to secure by Letters Patent is:

1. A screw-on closure cap incorporating a sealing ring for closing a container opening or a tubular spout, comprising an upper cap part adapted to be gripped and turned manually for screwing the cap on and off, and a screwthreaded lower cap part rotatably assembled coaxially together with the upper cap part, the lower cap part being adapted to be screwed onto the rim of the container opening or tubular spout to secure the cap in its closing position thereon, and including a spring-loaded drive element interposed between the two cap parts, the drive element being rotationally fast with one of the two cap parts and radially spaced from the center thereof and engaging with a co-operating abutment surface on the other cap part, the drive element and abutment constituting a limited-torque coupling which transmits torque in the closing direction between the two cap members up to a certain maximum value, the drive element under the imposition of closing torque in excess of the said maximum value yielding against its spring loading and overriding the said abutment surface ratchetwise to permit the continued free rotation of the upper cap part relatively to the lower cap part.

2. A screw-on closure cap according to claim **1** in which the drive element comprises a disc mounted on and keyed to the threaded lower cap part, the disc having upwardly pressed-out spring tongues located in positions distributed arounds its periphery, each tongue slanting obliquely upwardly in the direction of closure of the cap, and engaging in a co-operating recess formed in the under side of the upper cap part.

3. A screw-on closure cap according to claim **2** in which the spring tongues are located in diametrically opposed pairs on the disc and in which the co-operating recesses comprise opposite ends of the interior of an upwardly pressed-out channel-section hand grip portion extending transversely across the upper cap part.

4. A screw-on closure cap according to claim **3** in which the disc has downwardly directed projections on its outer edge which engage in corresponding recesses in the periphery of the threaded lower cap part to key the disc thereto.

5. A screw-on closure cap according to claim **1**, in which the drive element comprises a set of spring-loaded balls each mounted in an aperture in the upper side of the threaded lower cap part and projecting partially through a hole in a cover plate thereon under the force of a biassing spring for engagement into a co-operating recess in the underside of the upper cap part.

6. A screw-on closure cap as claimed in claim **5** in which the co-operating recesses comprise opposite ends of the interior of an upwardly pressed-out channel-section hand grip portion extending transversely across the upper cap part.

7. A screw-on closure cap according to claim **1**, in which the drive member comprises a rigid plate keyed to and axially movably mounted in the interior of the upper cap part and spring-pressed downwardly by spring means, the drive plate being formed with apertures in which engage co-operating dog-like projections fixedly mounted on the upper side of the lower cap part.

8. A screw-on closure cap according to claim **7**, in which the said spring means comprises thrust springs acting between the upper face of the rigid plate and the interior of a hollow hand grip part upwardly pressed outwardly from the upper cap part, the rigid plate having upwardly projecting lugs which are engaged in the interior of the hollow hand grip portion to key the plate to the upper cap part.

9. A screw-on closure cap according to claim **1**, in which the drive member comprises a spring plate inserted between the upper and lower cap parts and keyed to the upper cap part for rotation therewith, the spring plate having on its periphery downwardly pressed-out spring tongues which point in the direction opposite to the direction of closure of the cap and bear against upwardly directed dog-like projections on the threaded lower cap part.

10. A screw-on closure cap according to claim **9**, in which the spring plate is keyed to the upper cap part by rigidly disposed lugs engaging in the interior of a hollow hand grip portion pressed out from the upper cap portion and extending transversely across it.

11. A screw-on cap according to claim **10**, in which the downwardly directed spring tongues slant obliquely downwardly in the direction opposite to the direction of closure of the cap and co-operate with correspondingly oblique faces on the dog-like projections.

12. A screw-on cap according to claim **1**, in which the spring-loaded drive element comprises a disc keyed to the lower cap part and formed with radial projections which engage in co-operating recesses disposed at regular intervals around the periphery of the underside of the upper cap surface, the disc being spring-pressed against the underside of the upper cap part by a thrust spring acting between it and the lower cap part.

13. A screw-on cap according to claim **12**, in which upper and lower cap parts are pivotally assembled together for rotary movement relative to each other about a central pivot comprising an upwardly projecting central spigot on the lower cap part.

14. A screw-on cap according to claim **13**, in which the disc is fitted on and around the central spigot of the lower cap part.

15. A screw-on cap according to claim **1**, in which the spring-loaded drive element comprises a disc inserted in the upper cap part and formed with upwardly directed projections engaged in the interior of a hollow hand grip part pressed out from the top of the upper cap part, and in which an entraining lug mounted on the lower cap part passes through an aperture in the disc to key the disc to the lower cap part, the disc being also subject to the action of a thrust spring bearing against the lower cap part and biassing the disc towards the upper cap part.

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