COMMONWEALTH OF AUSTRALIA
THE PATENTS ACT 1952

CONVENTION APPLICATION FOR STANDARD PATENT OR A STANDARD PATENT OF ADDITION

69 465 781

Full names of Applicant(s)
‡/We JAPAN CROWN CORK COMPANY LIMITED

Address(es) of Applicant(s)
of 3-1 Uchisaiwai-cho 1-chome, Chiyoda-ku, Tokyo, Japan

hereby apply for the grant of a standard patent

for an invention entitled

"MOLDING TOOL FOR FORMING A LINER ON THE INSIDE OF A TOP PANEL OF A CONTAINER CLOSURE SHELL"

which is described in the accompanying complete specification.

DETAILS OF BASIC APPLICATION(S)
Number(s) of Basic Application(s)
55-55387

Name(s) of Convention Country(ies) in which Basic Application(s) was/were filed
Japan

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28th April, 1980

=My/Our address for service is:
C/- SPRUSON & FERGUSON
PATENT ATTORNEYS
CBA CENTRE, 60 MARGARET ST.
SYDNEY, NEW SOUTH WALES,
AUSTRALIA.

Dated this SEVENTH day of APRIL 1981
JAPAN CROWN CORK COMPANY LIMITED

By: ________________
Registered Patent Attorney

To: The Commissioner of Patents
Molding tool for forming a liner on the inside of a top panel of a container closure shell

Sanjiro Fujie
Japan Crown Cork Co., Ltd.,
C/o 3-1 Uchisaiwai-cho 1-chome,
Chiyoda-ku, Tokyo, Japan

I am the applicant for the patent
(or, in the case of an application by a body corporate)

Sanjiro Fujie
Japan Crown Cork Co., Ltd.

The basic application as defined by Section 141 of the Act was made in
January 28th day of April 1980 by
JAPAN CROWN CORK COMPANY LIMITED.

Masayoshi KAWASHIMA
of 1707-3 Minori-machi Hatori, Higashi Ibaraki-Gun
Ibaraki, Japan and Akio YUASA of 1-6-22/2 Sakurazuka
Toyonaki-shi, Osaka-Eu, Japan,

The Applicants are the assignees of the Inventors.

Sanjiro Fujie

Signature of Declarant
Sanjiro Fujie
A molding tool for forming a liner on the inside of a circular top panel of a container closure shell comprising the circular top panel, a cylindrical skirt extending downwardly from the peripheral edge of the top panel, and a circumferentially extending annular groove formed in the upper portion of the skirt, said molding tool comprising a central molding member and a position-setting external sleeve disposed externally of the central molding member; characterised in that the outside diameter of the position-setting external sleeve at a lower portion thereof extending from its lower end up to the level of the annular groove in the shell, when the molding tool has been inserted into the closure shell, is reduced by decreasing the thickness of the sleeve by an amount corresponding to the depth in the radial direction of the annular groove.
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COMPLETE SPECIFICATION
(ORIGINAL)

FOR OFFICE USE:

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Complete Specification Lodged:

Priority:

Related Art:

Name of Applicant:
JAPAN CROWN CORK COMPANY LIMITED

Address of Applicant:
3-1 Uchisaiwai-cho 1-chome, Chiyoda-ku, Tokyo, Japan

Actual Inventor(s):
MASAYOSHI KAWASHIMA and AKIO YUASA

Address for Service:
Spruson & Ferguson, Patent Attorneys, CBA Centre
60 Margaret Street, Sydney, New South Wales, 2000 Australia

Complete Specification for the invention entitled:
"MOLDING TOOL FOR FORMING A LINER ON THE INSIDE OF A TOP PANEL OF A CONTAINER CLOSURE SHELL"

The following statement is a full description of this invention, including the best method of performing it known to me/us:

SFP17
A molding tool for forming a liner on the inside of a circular top panel of a container closure shell comprising the circular top panel, a cylindrical skirt extending downwardly from the peripheral edge of the top panel, and a circumferentially extending annular groove formed in the upper portion of the skirt, said molding tool comprising a central molding member and a position-setting external sleeve disposed externally of the central molding member. The outside diameter of the position-setting external sleeve at a first region thereof extending from its lower end to that site which faces the annular groove in the shell when the molding tool has been inserted into the closure shell is reduced by decreasing the thickness of the sleeve by an amount corresponding to the depth in the radial direction of the annular groove.
This invention relates to a molding tool for forming a liner on the inner surface of the top panel of a container closure shell. More specifically, it pertains to a molding tool comprising a central molding member and a position-setting sleeve disposed externally of the central molding member and adapted for forming a liner on the inner surface of a circular top panel of a container closure shell of the type comprising a circular top panel, a cylindrical skirt extending downwardly from the peripheral edge of the top panel, and a circumferentially extending annular groove formed in the upper portion of the skirt.

Closures of the above type and having a molded gasket liner have gained widespread acceptance for containers, such as bottles, having externally threaded necks. The shells of such container closures frequently include an annular groove at a position towards the upper end of the skirt of the shell.

Generally, the above container closures are produced by fabricating a metal shell of the desired shape, supplying a deposit of flowable liner material to the inner surface of the top panel of the shell, and molding the liner material
in situ. The liner material is molded by placing the inverted shell, containing a deposit of the liner material, on a support and then introducing a molding tool into the shell and pressing the liner material to the desired shape.

One widely used form of molding tool comprises a centre punch, an annular bushing mounted coaxially with said punch and a position-setting external sleeve arranged around said bushing, as disclosed, for example, in Australian Application No. 22924/77. The known molding tool, however, gives rise to various problems. For example, the action of the position-setting external sleeve upon the shell is too slow. Moreover, the position-setting external sleeve is likely to contact or abut the skirt at the annular groove to cause undesirable deformation to the annular groove or prevent correct molding of the liner material to the desired shape.

It has now been realised, according to the present invention, that the problems with the known molding tool can be avoided in a very simple manner by using a position-setting external sleeve whose outside diameter is reduced by an amount corresponding to the depth of the annular groove from its lower end up to the locality of the annular groove of a container closure shell when the molding tool has been fully inserted into the closure shell.
According to this invention, there is provided a molding tool for forming a liner in a container closure shell of the above mentioned type, said molding tool comprising a central molding member and a position-setting sleeve disposed externally of the central molding member; characterised in that the outside diameter of the position-setting sleeve from its bottom end up to the level of the annular groove in the shell is less than the inside diameter of the shell skirt at the annular groove and above such level the diameter is greater than the diameter of the skirt shell at the annular groove for at least a portion lying within the shell when said molding tool is fully inserted therein.

In the accompanying drawings:

Figure 1 is a sectional view showing a known container closure shell provided with a molded liner;

Figure 2 is a part sectional view illustrating the action of an annular groove in the skirt of the container closure shell of Figure 1;

Figure 3 is a part sectional view of a known molding tool for molding a liner in the closure of Figure 1; and

Figures 4 to 6 are part sectional views showing the construction and operation of one embodiment of the molding tool of this invention, the tool being shown in its normal start position in Figure 4.
For a better understanding of the present invention, the configuration of a container closure and a known molding tool for molding a liner are discussed at some length before going into a detailed description of one embodiment of the molding tool of this invention.

A closure for a container, such as a bottle, having a threaded neck comprises a metallic shell 6 composed of a circular top panel 2 and a cylindrical skirt 4 extending downwardly from the peripheral edge of the top panel 2, and a molded liner 3 disposed on the inside of the top panel 2, as shown in Figure 1. In such a container closure, it is important that a circumferentially extending annular groove 10 should be formed at a specified site in the upper portion of the skirt 4 of the shell 6. In many cases, the skirt 4 has knurls (an upper knurl 12a and a lower knurl 12b in the container closure illustrated in Figure 1) for preventing finger slip at the time of opening the container closure mounted on the neck portion of the container, and also a plurality of slits 14 formed circumferentially in spaced-apart relation to render the container closure pilferproof, may be provided.

The operation of the annular groove 10 is briefly described. When the closure is to be sealed about the neck portion of a container, it is the general practice to fit the container closure over the
neck portion 16 of the container, deform the shoulder (the boundary portion between the top panel 2 and the skirt 4) of the shell by a throat member 18b of a pressing tool 18 while pressing the top panel 2 of the shell 6 against the end portion of the neck 16 by a pressure block 18a of the pressing tool 18 via the liner 8, and then threading the part 22 of the skirt 4 by deforming it between the thread formations on the neck 16 by the action of thread roller 20. The annular groove 10 is so positioned that it guides the thread roller 20 into engagement with the neck thread formations.

Generally, a container closure having the configuration shown in Figure 1, is produced by the following procedure. First, the cup-like shell 6 is fabricated from a suitable metal blank by press-forming, drawing, etc. Then, by using a suitable device a circumferentially extending annular groove 10 is formed, at the same time as knurls 12a, 12b, slits 14 and other optional features. Then, a suitable liner material is fed to the inside of the top panel portion of the thus formed shell 6, and then the liner material is molded to form a liner of a predetermined shape therein.

In molding the liner material in the above manufacturing procedure, the inverted shell is placed on a support 26 and a molding tool is moved downwardly into the shell 6 to mold the liner material into a liner 8 of the desired shape. In view of the sealing
characteristics of an opening portion of a container sealed by a container closure, it is important that the molded liner 8 should have an appropriate shape such as the one disclosed in Australian Application No. 22924/77. In order to form such a liner 8, a known molding tool 28, as shown in Figure 3, comprises a central punch 28a, a separately movable annular bushing 28b and a position-setting external sleeve 28c. The external peripheral surface of the sleeve 28c contacts the inside of the minimum diameter portion of the skirt at the annular groove 10 thereby centering the shell 6 with the molding tool 28. The lower end surface of the sleeve 28c contacts the inside of the top panel of the shell 6, thereby defining the outside diameter of the liner 8 to be formed, and preventing the liner material from flowing outwardly and rising along the skirt 4.

In the known molding tool 28 illustrated in Figure 3, the external sleeve 28c begins to exert a position-setting or centering action on the shell 6 when the molding tool 28 has been inserted into the shell 6 to such an extent that the lower end of the sleeve 28c contacts the skirt at the annular groove 10. Frequently the centering action is too slow. For example, if the molding tool 28 is of the type in which the central punch 28a leads the sleeve 28c, the central punch 28a has already contacted the liner material.
Furthermore, the centering action of the sleeve 28c is performed by contact of the lower end portion of the sleeve 28c with the inside surface of the annular groove 10. However, this action may cause undesirable deformation to the annular groove 10.

The known molding tool 28 also has the problem that in the molded liner 8, it is desirable that the outside diameter \( d_1 \) of the liner 8 should be as close as possible to the inside diameter \( d_2 \) of the top panel 2. The outside diameter \( d_1 \) of the liner 8 is necessarily smaller than the inside diameter \( d_2 \) of the top panel of the shell 6 by the depth \( x \) of the annular groove 10 formed in the skirt 4 (i.e. the amount of radially inward projection) and the thickness of the sleeve 28c (namely, \( \frac{d_2 - d_1}{2} = x + t \)).

The depth of the annular groove 10 is generally about 0.5 mm, and the thickness of the sleeve 28c is generally at least 0.8 mm. Accordingly, \( d_2 - \frac{d_1}{2} \) is generally at least 1.3 mm. In this case, the thickness of an external wall surface portion 8a of the liner 8 is necessarily small. Experience shows that when the thickness \( y \) of the outside wall surface portion 8a of the liner 8 is small, the portion 8a of the liner will be sheared off relatively easily when an impact force is exerted by throat member 18b on the shoulder of a container closure after the closure has been sealed about the neck portion 16 of a container, thus giving
rise to the serious problem that the seal between portion 8a and the cylindrical surface on the neck 16 is rendered ineffective to seal the container.

To reduce this risk, the $d_2 - d_1$ value should be minimised. It may be possible to achieve this by decreasing the depth $x$ of the annular groove 10 and/or by decreasing the thickness $t$ of the sleeve 28c. If the depth $x$ of the annular groove 10 is made too small, it is impossible to guide the thread roller 20 (Figure 2) accurately. Consequently, it is extremely difficult to thread part 22 of the skirt as required, and after thread rolling the appearance of the closure is poor. On the other hand, if the thickness $t$ of the sleeve 28c is decreased, its strength will be reduced and the sleeve 28c will be broken within a relatively short period.

Figures 4 to 6 show one specific embodiment of the molding tool of this invention which skillfully gives a solution to the above problems of the known molding tool 28.

Referring to Figure 4, an inverted container closure shell 106 is conveyed by a suitable conveying mechanism (not shown) to a support 126. The shell 106 may be of the same form as the shell 6 illustrated in Figure 1. It is important that the inside of the top panel 2 should contain a liner material 107 of a suitable plastic material such as a polyolefin (e.g. polyethylene) or a vinyl chloride resin supplied thereto.
The molding tool 128, constructed in accordance with this invention is disposed above the support 126, and is provided with means for raising and lowering in relation to support 126 so that it can be inserted into the shell 106 to thereby mold the liner material 107 into a liner 108 (Figure 6) of the desired shape.

The molding tool 128, constructed in accordance with this invention, comprises a centre punch 128a and an annular bushing 128b disposed externally of the centre punch 128a, and a position-setting sleeve 128c disposed externally of the annular bushing 128b. In the illustrated embodiment, the centre punch 128a and the annular bushing 128b of the central molding member are separate and independent, but if desired, they may be formed as an integral one-piece unit. The three elements constituting the molding tool 128, that is, the centre punch 128a, annular bushing 128b and position-setting external sleeve 128c, are connected to each other and to a drive mechanism in a conventional manner. Accordingly, a description is omitted, and for details, reference may be made, for example, to U.S. Patent No. 3,278,985.

The profiles of the undersurfaces of the centre punch 128a and annular bushing 128b of the molding tool 128 correspond to the desired shape of the liner 108 (Figure 6) formed by the molding operation.
The sleeve 128c, on the other hand, is in the form described below in accordance with this invention.

As shown clearly in Figures 4 to 6, a lower end portion 130 of the sleeve 128c has an external diameter $D_1$ no greater and preferably slightly less than the diameter $d_4$ of the inside of the skirt at the annular groove 110 of the closure shell 106. As seen in Figure 6 portion 130 extends from its lower end at least up to a level facing the bottom of annular groove 110 when the sleeve 128c had been fully inserted into the shell 106. The external surface of the lower end of the portion 130 of sleeve 128c is preferably tapered as shown in Figures 4 to 6.

On the other hand, a second portion 132 of the sleeve 128c joins the portion 130 through a tapered portion 134 having a progressively increasing outside diameter from the diameter $D_1$ of the portion 130 to the diameter $D_2$ of the portion 132. The outside diameter $D_2$ of the portion 132 corresponds to the inside diameter $d_3$ of that portion of the skirt 104 above the annular groove 110.

Preferably, the diameter $D_1$ is set with respect to the internal diameter $d_4$ of the skirt 104 at the annular groove 110, at $0.05 \text{ mm} \leq d_4 - D_1 \leq 0.40 \text{ mm}$, more preferably $0.10 \text{ mm} \leq d_4 - D_1 \leq 0.20 \text{ mm}$. It is also preferred that the diameter $D_2$ of the portion 132 should
be set with respect to the inside diameter $d_3$ of the skirt 104 at $0.05 \text{ mm} \leq d_3 - D_2 \leq 0.040 \text{ mm}$, particularly $0.10 \text{ mm} \leq d_3 - D_2 \leq 0.020 \text{ mm}$.

The internal diameter of the sleeve 128c should be increased as much as possible if it is desired to cr-use the diameter $d_1$ of the liner 108 (Figure 6) to approach the value of the inside diameter $d_2$ of the top panel cf the shell 106 as closely as possible. However, increase of the internal diameter of the sleeve 128c necessarily results in a decrease in the strength of the sleeve 128c. In view of this, it is desirable to set the internal diameter of the sleeve 128c such that the thickness $t_1$ of the sleeve 128c at the portion 130 is at least 0.45 mm, and the thickness $t_2$ at the portion 132 is at least 0.50 mm.

If desired, an annular recess 136 may be formed on the inside surface of the sleeve 128c as shown by chain lines in Figures 4 to 6 in order to maximise the thickness $t_2$ of the sleeve 128c at the portion 132 and its thickness $t_1$ for most of the portion 130, and to make the outside diameter $d_1$ of the liner 108 as close as possible to the inside diameter $d_2$ of the top panel of the shell 106 while retaining a satisfactory wall thickness of the sleeve 128c to provide strength.

The sleeve 128c may be made of a suitable material such as SKD tool steel or SKS tool steel.
In operation molding tool 128 having the improved sleeve 128c molds liner material 107 (Figure 4) on the inside of the top panel 102 into a predefined shape. It will be readily appreciated with reference to Figures 4 and 5 that when the molding tool 128 enters the closure shell, the portion 132 enters the skirt 104 before the center punch 128a and the annular bushing 129b starts to act on the liner material 107 and before the full diameter portion of the lower portion 130 of sleeve 128c comes within the annular groove 110. If the central axial line of the molding tool 128 is not fully in alignment with the axis of the closure shell 106, the tapered portion 134 and main portion 132 of the sleeve 128c successively makes contact with the upper end portion of the skirt 104 of the shell 106 during descent of the molding tool 128 from the position shown in Figure 4 to the position shown in Figure 5, thereby centering the closure shell 106 with respect to the molding tool 128. After this position-setting operation has been performed, the molding tool 128 travels to the position shown in Figure 6 to mold the liner material 107 (Figures 4 and 5) into the liner 108 of the desired shape.

Since the closure shell 106 is centered with respect to the molding tool 128 by the action of the portion 132 of the sleeve 128c before the portion 130 of the sleeve 128c enters the reduced
diameter portion of the skirt at the annular
groove 110, the lower end position of the
sleeve 128c does not cause undesirable
deformation in the skirt at the annular groove 110.

Furthermore, since it is only a limited
portion at the lower end portion of the sleeve 128c
that is decreased in thickness so as to make the
outside diameter \( d_1 \) of the liner 108 as close as
possible to the inside diameter \( d_2 \) of the top panel
of the closure shell 106, the strength of the
sleeve 128c is higher than in the case of
decreasing the thicknesses of both the upper and
lower parts of the sleeve as shown in Figure 3.
Hence, the sleeve 128c does not undergo early damage
upon repetition of the molding operation.

The closure shell 106 shown in
Figures 4 to 6 is of a special form having pilfer-
proof characteristics. It should be understood that
the molding tool 128 constructed in accordance with
this invention for molding a liner material as
required into a liner on the inside of the top panel
of a shell can be applied not only to the closure
shell 106 of such a form but also to closure shells
of any other forms having an annular groove in the
skirt.
WHAT WE CLAIM IS:

The claims defining the invention are as follows:

1. A molding tool for forming a liner on the inside of a circular top panel of a container closure shell comprising the circular top panel, a cylindrical skirt extending downwardly from the peripheral edge of the top panel, and a circumferentially extending annular groove formed in the upper portion of the skirt, said molding tool comprising a central molding member and a position-setting external sleeve disposed externally of the central molding member; characterised in that the outside diameter of the position-setting external sleeve at a lower portion thereof extending from its lower end up to the level of the annular groove in the shell, when the molding tool has been inserted into the closure shell, is reduced by decreasing the thickness of the sleeve by an amount corresponding to the depth in the radial direction of the annular groove.

2. The molding tool of claim 1 characterised in that a second portion of the position-setting external sleeve above the lower portion is tapered and has a progressively increasing outside diameter ranging from the outside diameter of the sleeve at the upper end of the lower portion to a diameter corresponding to the inside diameter of the skirt at a position located on the opening end side of the skirt in relation to the annular groove.
3. A molding tool for forming a liner on the inside surface of the top of an inverted closure shell, having a circular top and a cylindrical skirt, in which an annular groove is formed near the upper margin of the skirt, said molding tool comprising a central molding member and a position-setting sleeve arranged around said central molding member and axially slidable in relation to said central molding member, said central molding member being arranged to project downwardly in relation to said sleeve in the normal position of said tool and said sleeve being adapted to over-run said central member when said central member meets resistance during downward movement into a closure shell, said sleeve having a lower end portion of a diameter less than the internal diameter of the skirt at the location of said annular groove to permit said sleeve to pass through to contact the top of the closure shell characterised in that said sleeve has an upper portion having an external diameter greater than the skirt diameter at the location of said groove and adapted to enter the open end of the skirt to exert a centering action on the closure in relation to the tool before said central molding member contacts the top of the inverted closure shell, the lower end of said upper portion being at a greater distance from the bottom end of said sleeve than the distance between the top and the annular groove in the closure skirt.
4. A molding tool according to claim 3 further characterised in that the external surface of the sleeve tapers from the bottom end of the upper portion down to the top end of the lower portion.

5. A molding tool according to claim 4 further characterised in that said central molding member comprises a centre punch and an annular bushing slidably mounted about said centre punch, the bottom end of said annular bushing having a profile corresponding to the liner to be molded thereby and being raised above the bottom end of the centre punch in the normal position of said tool.

DATED this SEVENTH day of APRIL, 1981

JAPAN CROWN CORK COMPANY LIMITED

Patent Attorneys for the Applicant
SPRUSON & FERGUSON