Tap for use with bag-in-the-box liquid containers. The tap has a neck member (18) with a passageway (26) through the neck member. The passageway is closed at its outer end by a manipulable valve assembly (28). The neck member (18) has a liquid flow port (40) communicating laterally with the passageway, (26), and a valve member (69) is provided which normally overlies the port (40) to close the tap. A resiliently deformable diaphragm (64) is attached to the valve member (69) so as to extend across and close off the passageway (26). This diaphragm (64) is arranged such that externally applied manual deformation of it is effective to lift the valve member (69) away from the port (40) to open the tap so that a liquid flow path is established between the inner end of said passageway (26) and the exterior of said port (40). Also disclosed are an integral valve cap, another valve assembly for a tap including a conical valve member axially movable to open and close a fluid passageway, and a container assembly having an inner flexible bag within a relatively rigid outer box with a neck member attached to the inner bag and slideable through an aperture in the outer box.
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"CONTAINER ASSEMBLY, TAP AND VALVE CAP THEREFOR"

This application is concerned with taps for particular but not exclusive application to liquid containers of the type in which a flexible bag is housed within a relatively rigid box. The invention is also concerned with certain improvements in the assembly of such containers with taps. "Bag-in-the-box" containers, as the aforesaid container are hereinafter called, are now widely used in Australia in the merchandising of wines.

The tapping assemblies of present commercial bag-in-the-box containers fall into three categories according to respective basic design principles which were first elaborated some twelve to fifteen years ago. The first class of assembly, which embraces, for example those disclosed in United States patent specifications 3,400,866, 3,972,452 and 4,135,649, involves an externally concave, resiliently deformable diaphragmatic closure for the exposed end of a neck member which is heat sealed to the bag and secured within an aperture in the box. The diaphragm integrally carries an exterior lug which is grasped to deform the diaphragm and thereby uncover a lateral outlet port defined between the neck and the closure.

The second category of tapping assembly includes
the arrangements of Australian Patent Specifications 403,943 and 500,790. A neck member is again closed by a resiliently deformable diaphragm, but here the diaphragm is externally convex and is attached at its centre to a conical valve member which is slidable within the neck. Depression of the diaphragm causes the valve member to slide and thereby uncover an outlet port from the interior of the neck. A variation of this arrangement is the subject of Australian Patent Specification 500,401.

The final category of bag-in-the-box container tapping assemblies entails a neck member with a thin, "frangible" diaphragm which typically is provided by clamping the bag across the inner end of the neck. The user introduces a separate tap unit, stored in the box, into the outer end of the neck to puncture the diaphragm and so gain access to the contents of the bag.

Certain more recent patents in this field have disclosed arrangements in which a fully assembled tapping assembly is, prior to purchase by a consumer, wholly recessed within the box so as to be readily withdrawable by the consumer to an accessible wine tapping position. Such arrangements are described, for example, in United States Patent 3,223,117 in which the tapping assembly is secured to the inner container, and in Australian Patent 493,047, in which the tapping assembly is carried by a flap hinged internally to the box. In a somewhat different context, it is also known, e.g. from United States Patent 3,717,289 and French patent specification 1,285,141 to provide slidably withdrawable taps in various types of simple rigid containers.

It is an object of this invention, on the one hand, to provide a novel tap for bag-in-the-box containers, but not necessarily limited to such application, which is an improvement of existing
taps. On the other hand, it is an object of the invention to provide an improved assembly of tap and container.

The invention accordingly provides, in one aspect, a tap comprising a neck member which defines therethrough a passageway closed at its outer end by a manipulable valve assembly, characterized in that said neck member has a liquid flow port communicating laterally with the passageway, and in that the valve assembly includes a valve member overlying said port in the tap closed condition and a resiliently deformable diaphragm attached to the valve member extending across and closing off said passageway, said diaphragm being arranged such that externally applied manual deformation of the straight portion of said diaphragm is effective to lift said valve member away from said port from said tap closed condition to a tap open condition in which a liquid flow path is established between the inner end of said passageway and the exterior of said port. The diaphragm preferably includes at least a portion which extends angularly across said passageway. This angularly extending portion is advantageously substantially straight.

In a preferred arrangement, the or a portion of said diaphragm is elongate, being transversely bisected by a diametral plane of said passageway and being displaced longitudinally of said passageway from side portions of said diaphragm to which the straight portion is connected by parallel webs, said webs extending longitudinally of said passageway. The valve member advantageously includes a further web bridging said parallel webs at the inner extremity of said portion of the diaphragm.

The invention also provides an integral valve cap comprising an annular sleeve defining a passageway
therethrough; a peripheral skirt about the sleeve adjacent an outer end thereof; and a resiliently deformable diaphragm extending across and closing off said passageway, characterized in that said diaphragm includes at least a portion which extends angularly across said passageway from an inner extremity at which it joins said sleeve at or adjacent an inner end of the sleeve.

In a further aspect, the invention provides a tap comprising a neck member which defines therethrough a passageway closed at its outer end by an externally convex, resiliently deformable diaphragm and which has a liquid flow port communicating laterally with said passageway; a substantially conical valve member attached internally to said diaphragm and axially moveable within said passageway between a tap opened and a tap closed condition in which liquid flow between the inner end of said passageway and said port is prevented; wherein externally applied manual depression of the diaphragm is effective to move the valve member from said tap closed to said tap open condition and wherein said valve member closes against a shoulder in said passageway defined by a uniform annular sleeve projecting from said diaphragm and sealingly engaging the surface of said passageway.

The invention further provides a container assembly comprising an outer relatively rigid container and an inner relatively flexible container, a neck member forming part of or being adapted to receive a tap, which neck member is secured to the inner container and extends through an aperture or slot in the outer container, characterized in that said neck member is slidable within said aperture or slot.
Said aperture may be defined by a grommet, which advantageously comprises an annular bearing for said neck member, a transverse shoulder at the outer end of the bearing with respect to said neck member, for locating the neck member and/or an attachment thereto, and a groove for said edge of the container, which groove is axially offset from said shoulder on the opposite side of said shoulder from said bearing.

The invention will be further described by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a cross-section of a bag-in-the-box container in the vicinity of the tapping assembly and depicts a first embodiment of the tap in accordance with the invention prior to withdrawal of the tap for sampling the contents of the bag;

Figure 2 is a view similar to Figure 1, but shows the tap withdrawn and in the open condition;

Figures 3 and 4 are respectively perspective and axial cross-sectional views of the valve cap forming part of the tap illustrated in Figure 1;

Figure 5 is a cross-section on the line 5-5 in Figure 4;

Figure 6 is an end-elevational view of the valve cap;

Figures 7 and 8 are respectively an axial cross-section and an end elevational view of the grommet forming part of the assembly of Figure 1;

Figure 9 is a view similar to Figure 1 but showing a second embodiment of tap in the withdrawn but closed condition; and

Figure 10 is an enlarged view of part of
the valve member as seen in Figure 9.

The arrangements shown in Figures 1 and 10 are similar to the extent that both depict a bag-in-the-box container which includes a flexible and collapsible inner bag 12 and a relatively rigid outer box 14. In Figure 10 like parts are indicated by way of primed reference numerals. The bag is typically formed by laminating two or more films of plastics materials chosen to ensure that the bag is liquid leak-proof and substantially oxygen impermeable. The box is typically corrugated paperboard.

Secured to the bag 12 and extending through an aperture or slot 16 in a side wall of box 14 is an annular neck member 18. Neck member 18, which may suitably be moulded in high density polyethylene carries an external lip 20 at its inner end. Lip 20 is inwardly upset to provide an annular seat 22 on which the rim of an opening 24 in bag 12 is heat sealed.

Neck member 18 is slidable within aperture 16 in box 14 between a fully retracted position (e.g. Figure 1) and a fully withdrawn condition (e.g. Figures 2 and 9), and for this purpose is supported within a grommet 30 which is thicker than box 14 and which engages the side wall box by sealing the rim of aperture 16 in a groove formation 32 about its periphery. Relative rotation of the parts is prevented by a longitudinal tongue and groove key 27 (Figure 8). Grommet 16 may suitably be of polypropylene or high density polyethylene and includes an annular sleeve bearing 17 for neck member 18.

Sleeve bearing 17 is provided with three equiangularly spaced shallow projections 34 on its inner surface to ensure a smooth sliding
engagement between the grommet and the neck member
in case of some out of round distortion in the
grommet and/or neck member. It will be noted that
by providing grommet 30 within aperture 16, a stable
slidable mount can be provided for neck member 18
without necessarily requiring fine manufacturing
tolerances.

Neck member 18 is of essentially uniform
internal diameter and defines a passageway 26 extending
from an inner end open to the interior of bag 12 to an
outer end closed by a valve assembly 28. A lateral
port 40 from passageway 26 is located adjacent the
outer end of the underside of neck member 18 and the
purpose of the valve assembly 28 is to control fluid
flow from the inner end of passageway 26 to the exterior
of this outlet port 40. Prior to the final sale of
the filled bag-in-the-box container to a consumer,
neck member 18 is largely retracted within box 14
in a position in which port 40 is hygienically located
within bearing 17 and in which valve assembly 28 lies
within groove formation 32. When the consumer wishes
to extract the contents of bag 12, he pulls the neck
member 18 out from box 14 until a rib 42 on the neck
member strikes the rear of grommet 30 to determine the
operative position of the assembly. Neck member 18
incorporates two small steps 88 in its outside diameter
in order to provide location for the grommet in its
extreme pulled-out and retracted positions. As
will become clearer in due course, operation of the
valve assembly 28 will cause the liquid contents to
flow downwardly from port 40. The consumer may if he
wishes readily return neck member 18 to its retracted
position, port 40 within sleeve bearing 17.
Different embodiments of valve assembly are depicted respectively in Figures 1 to 8 and in Figures 9 and 10. In the first illustrated arrangement, mention should first be made of the detailed structure of grommet 16. In this case, the grommet is of generally U-shaped configuration and locates in a matching slot at the bottom edge of a side wall 14a of box 14. The grommet includes a plate 33 integrally connected to U-shaped groove formation 32 and sleeve bearing 17 so that the latter elements are axially offset to opposite sides of plate 33. Plate 33 defines a shoulder against which an exterior skirt 58 of valve assembly 28 abuts in the retracted condition of the tap, as seen in Figure 1. Here, the outer extremity of the tap is recessed within groove formation 32 and is accordingly almost flush with box side wall 14a. The inside face of plate 33 includes a transverse locating lip 31 to define a seat from the bottom wall 14b of the box.

Valve assembly 28 of the first illustrated embodiment consists of a one-piece integral plug cap 50 which may suitably be made of thermoplastic elastomer or EVA, a resiliently deformable material. Cap 50 includes a relatively long annular sleeve 52 which is a tight fit within neck member 18, extending well into neck member 18 and carrying a sealing rib 54 rearwardly of port 40. This rib normally engages the surface of passageway 26 and seals off the inner end thereof from port 40. Neck member 18 may carry a shallow groove for pre-assembly location of the cap sealing rib. The cap is then pulled out of the neck member, just prior to filling, and re-capped to the full depth after filling.
Laterally outstanding from the outer end of internal sleeve 52 is a flange 56 which carries a relatively short external skirt 58. Skirt 58 fits over the outer end of neck member 18 and snap fastens thereto by engagement of an annular rib 60 on skirt 58 into a complementary groove 62 formed in the neck member. It will be noted that rib 60 is such as to further secure cap 50 against withdrawal from neck member 18, since radial finger pressure on skirt 58 tends to enhance engagement of rib 60 in groove 62.

Extending across and closing off the interior of cap 50 is a resiliently deformable diaphragm 64. This diaphragm includes an elongate, substantially straight and flat portion 61 which extends angularly across passageway 26 from an outer extremity at the juncture of sleeve 52 with flange 56 to an inner extremity on sleeve 52 adjacent port 40 but displaced from the inner rim or end of the sleeve. It will be seen that straight diaphragm portion 61 is transversely bisected by a diametral plane of passageway 26 and that it determines a correct rotational position for cap 50, which position is indicated by an engraved arrow 66 on the exposed face 68 of flange 56. Arrow 66 and port 40 should both be directed downwardly when the plug 50 is secured onto neck member 18 after filling of bag 12.

Straight diaphragm portion 61 is connected at its inclined edges by parallel webs 63, 63a to side portions 65 of diaphragm 64. Webs 63, 63a lie in planes extending longitudinally of passageway 26. Diaphragm side portions 65 include first segments 65a which lie in a common plane normal to the axis of passageway 26, being contiguous with the inner rim of sleeve 52. Second segments 65b are in a further common
plan substantially parallel to but inwardly longitudinally displaced from straight diaphragm portion 61. It will be seen that this portion 61 may be viewed as a belt at the base of a channel defined between webs 63, 63a and that the residual portion of sleeve 52 at the foot of diaphragm segments 65a to the rear of straight portion 61 constitutes a web 67 bridging parallel webs 63, 63a.

That portion of sleeve 52 including web 67 overlying and in the vicinity of port 40 constitutes a valve member 69 connected to diaphragm 64 and in particular to straight diaphragm portion 61. It will be appreciated that diaphragm portion 61, being straight and flat, must contract in the direction of its major dimensions if it is deformed from its equilibrium plane. Thus an operator may place his finger against the outer face of diaphragm portion 61 (or grasp a suitable lug or other formation thereof) and push it (arrows 73 in Figure 2) inwardly and upwardly. Alternatively, he may grasp the webs 63, 63a and push sideways. If necessary, balance is maintained by placing two fingers behind skirt 58. The upper end of diaphragm portion 61 is anchored in position by external skirt 58 and either of these manipulations of the diaphragm will therefore be effective to lift valve member 69 away from the neck member 18 and thereby establish a liquid flow path 71 (Figure 2) from the inner part of passageway 26 to the port 40. The principal observed deformations of the diaphragm apart from that of portion 61, are found to be an appreciable convex protrusion of webs 63, 63a towards each other, slight inwardly axial movement of the lower parts of segments 65a and a marked upward pinching of web 67. The various parts of the diaphragm are able to readily deform without appreciable stretching, and the manipulation may thus be performed with reasonable
ease. It is to be noted that typical wall thickness in the cap would be 1.0mm in the case of sleeve 52 and about 0.7mm for the diaphragm.

On release of the finger, diaphragm portion 61 will revert to its flat condition and the valve member 69 will return to its sealing position overlying port 40.

Flange 56 of cap 50 may be closed by a membrane 50a extending across both the cap and grommet which must be broken to obtain access to diaphragm 64. Hence, a damaged membrane will confirm to the trader or consumer that the assembly has been tampered with and the contents of bag 12 perhaps diminished. This membrane, would also have a second function of being an oxygen barrier when made of aluminium foil, metalized paper or plastic laminated film with low oxygen permeability properties. This is an important preferred feature when packaging oxygen sensitive beverages, such as wine.

A second embodiment of valve assembly 28' is shown in Figures 6 and 7. Here, a one-piece plug 50' includes an inner sleeve 52' with sealing ribs 54', and outwardly convex diaphragm 70 bridging the outer end of sleeve 52' and a peripheral winged flange 72. In this case, sleeve 52' is not a valve member and remains fixed in position against the inner-wall of sleeve member 18'. It includes an aperture 74 in registry with port 40'.

A conical, hollow valve member 76 has an outer-convex wall portion 78 which matches the centre part of diaphragm 70 and is secured thereto by heat-rivetting a pin 80 integral with the centre of the diaphragm within a hole 82 in valve wall 78.
Projecting inwardly from convex wall 78 is an inverted frustoconical skirt 84 of substantially uniform thickness which in the equilibrium outwardly convex position of diaphragm 70 sealingly seats against the inner-rim 86 afforded by the inner extremity of sleeve 52'. By designing skirt 84 with a substantial cone angle, for example, of the order of 20° included, the seal at rim 86 is substantially a line contact and not liable to leakage through deposit of wine sediment or the like. The breadth and length of the valve member 76 both contribute to floating self-alignment and out-of-round adjustment to overcome any moulding ovality. Prior to first use the skirt 84 may be ultrasonically light-welded to rim 86 for enhanced shelf-time sealing.

It will be appreciated that the valve is actuated by depressing resiliently deformable diaphragm 70 to a substantially externally concave position in which conical valve member 76 unseats from the sealing rim 86 and moves inwardly well clear of sleeve 52' to open a flow path from the inner end of passageway 26' to aperture 74 and port 40'.

It is believed that the alternative embodiments of tap described and illustrated herein constitute an improvement with respect to known designs of tap primarily intended for "bag-in-the-box" containers.
CLAIMS:

1. A tap comprising a neck member (18) which defines therethrough a passageway (26) closed at its outer end by a manipulable valve assembly (28) characterized in that said neck member (18) has a liquid flow port (40) communicating laterally with the passageway, and in that the valve assembly includes a valve member (69) overlying said port in the tap closed condition and a resiliently deformable diaphragm (64) attached to the valve member extending across and closing off said passageway, said diaphragm (64) being arranged such that externally applied manual deformation of said diaphragm (64) is effective to lift said valve member (69) away from said port (40) from said tap closed condition to a tap open condition in which a liquid flow path is established between the inner end of said passageway (26) and the exterior of said port (40).

2. A tap according to claim 1 further characterized in that said diaphragm (64) includes at least a portion (61) which extends angularly across said passageway.

3. A tap according to claim 2 wherein said angularly extending portion (61) of the diaphragm is substantially straight.

4. A tap according to claim 1, 2 or 3 further characterized in that the or a portion (61) of said diaphragm is elongate being transversely bisected by a diametral plane of said passageway and being displaced longitudinally of said passageway from side portions (65) of said diaphragm to which the elongate portion (61) is connected by parallel webs, (63, 63a) said webs extending longitudinally of said passageway.
5. A tap according to claim 4 further characterized in that said valve member (69) includes a further web (67) bridging said parallel webs (63, 63a) at the inner extremity of said portion of the diaphragm (64).

6. A tap according to any preceding claim further characterized in that said valve assembly includes an annular sleeve (52) extending about said diaphragm (64), which sleeve includes said valve member (69) and sealingly engages the wall of said passageway.

7. A tap according to any preceding claim further characterized in that the tap is assembled with a flexible bag (12) housed within a substantially rigid outer container (14), said neck member (18) extending through an opening in the outer container and being sealingly connected to said bag at its inner end so that said passageway (26) communicates with the interior of the bag (12).

8. An integral valve cap comprising an annular sleeve (52) defining a passageway therethrough; a peripheral skirt (58) about the sleeve (52) adjacent an outer end thereof; and a resiliently deformable diaphragm (64) extending across and closing off said passageway, characterized in that said diaphragm (64) includes at least a portion (61) which extends angularly across said passageway from an inner extremity at which it joins said sleeve (52) at or adjacent an end of the sleeve.

9. A valve cap according to claim 8 further characterized in that said angularly extending portion (61) of the diaphragm is substantially straight.
10. A valve cap according to claim 8 or 9 further characterized in that the angular portion (61) of said diaphragm is elongate and is transversely bisected by a diametral plane of said passageway, being displaced longitudinally of said passageway from side portions (65) of said diaphragm to which the elongate portion is connected by parallel webs (63, 63a) said webs extending longitudinally of said passageway.

11. A valve cap according to claim 10 further characterized in that said valve cap includes a further web (67) bridging said parallel webs (63, 63a) at the inner extremity of the angular portion (61) of said diaphragm.

12. A valve cap comprising an annular sleeve (52') defining a passageway therethrough, a liquid flow port (74) in said sleeve communicating laterally with said passageway, an externally convex, resiliently deformable diaphragm (50') closing off the outer end of said passageway, characterized by a substantially conical valve member (76) which is attached internally to said diaphragm (50') and is axially moveable within said passageway between a tap opened and a tap closed condition in which liquid flow between the inner end of said passageway and said port is prevented, wherein externally applied annual depression of the diaphragm (50') is effective to move the valve member (76) from said tap closed to said tap open condition and wherein said valve member closes against a shoulder (86) defined by said sleeve (52').
13. A cap according to claim 12 assembled with a neck member (18') which receives said annular sleeve (52') and which has a port (40') in register with said port (74) in the sleeve (52').

14. A cap according to claim 12 or 13 further characterized by an external winged flange (72) attached to said sleeve (52') for facilitating manipulation of the diaphragm (50').

15. A container assembly comprising an outer relatively rigid container (14, 14') and an inner relatively flexible container (12, 12') a neck member (18, 18') forming part of or being adapted to receive a tap (28, 28') which neck member (18, 18') is secured to the inner container (12, 12') and extends through an aperture or slot (16, 16') in the outer container (14, 14') characterized in that said neck member (18, 18') is slidable within said aperture or slot (16, 16').

16. A container assembly according to claim 15 further characterized in that said aperture (16) is defined by a grommet (30) in engagement with an edge of the outer container (14) which grommet comprises an annular bearing (17) for said neck member (18), a transverse shoulder (33) at the outer end of the bearing with respect to said neck member, for locating the neck member and/or an attachment thereto, and a groove (32) for said edge of the container, which groove is axially offset from said shoulder on the opposite side of said shoulder from said bearing.
17. A container assembly according to claim 16 further characterized in that said neck member (18) includes a dispensing port (40) communicable by said tap with the interior of the inner container, which port (40) is located within said annular bearing (17) in the retracted position of the neck member.
INTERNATIONAL SEARCH REPORT

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 3

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl. 3 F16K 7/02, 1/00; B65D 39/04, 47/20, 47/30, 77/06; B67D 3/04

II. FIELDS SEARCHED

Minimum Documentation Searched 4

Classification System Classification Symbols

IPC F16K 7/02; B65D 47/30
US Cl. 222/501, 222/544

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 5

AU: IPC as above plus Australian Classification 57S

B67D 3/04;

III. DOCUMENTS CONSIDERED TO BE RELEVANT 14

Category 1 Citation of Document, 16 with indication, where appropriate, of the relevant passages 17 Relevant to Claim No. 14


X AU, B, 42889/78 (512272), published 1979, June 28, William Charles Welsh and Peter George Kailis. (1-7)

X AU, B, 42862/78 (510198), published 1979, August 23, Scholle Corporation (1-7)

X AU, A, 25599/77, published 1978, November 30, ACI Operations Pty. Ltd. (1-7)

X AU, A, 24695/77, published 1978, November 2, Lindeman (Holdings) Ltd. (US 4135649 corresponds) (1-7)

X AU, B, 87313/75 (474900), published 1976, August 5, William Charles Welsh. (US 3972452 corresponds) (1-7)

X AU, B, 27963/67 (446218), published 1969, April 17, Lazzaro A. Fattori. (US 3400866 corresponds) (1-7)

X AU, B, 25269/45 (129050), published 1946, November 28, Double Duty Products, Inc. (1-7)

* Special categories of cited documents: 15

"A" document defining the general state of the art
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"L" document cited for special reason other than those referred to in the other categories
"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but on or after the priority date claimed

"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention

"X" document of particular relevance

IV. CERTIFICATION

Date of the Actual Completion of the International Search 3

16 OCTOBER 1980 (16.10.80)

Date of Mailing of this International Search Report 3

20 October 1980 (20.10.80)

International Searching Authority 1

AUSTRALIAN PATENT OFFICE

Signature of Authorized Officer 50

R.E.W. MAY R.E.W. MAY

Form PCT/ISA/210 (second sheet) (October 1977)
FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

VI. OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE 10

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. Claim numbers ............... because they relate to subject matter 15 not required to be searched by this Authority, namely:

2. Claim numbers ............... because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out 15, specifically:

VI. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING 11

This International Searching Authority found multiple inventions in this international application as follows:

A tap (claims 1-7); An integral valve cap (claims 8-11);

Another valve assembly including an axially movable conical valve member (claims 12-14);

A container assembly (claims 15-17).

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

(1-7)

Remark on Protest:

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.