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(56) Documents Cited:
**GB 2214486 A** **GB 2194507 A**
**GB 2169869 A** **GB 0756093 A**
**JP 070089567 A** **US 4240482 A**

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UK CL (Edition X ) **B8K, B8P**
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Other: **ONLINE:WPI,EPODOC**

(54) Abstract Title: **Depletion device for bag in box containing viscous liquid**

(57) A depletion device (10) of a bag-in-box container for viscous ink comprises an elongate tube (10b) for extending into the bag. The tube is preferably cylindrical and has a plurality of holes (14) in its side wall. The holes (14) are arranged in columns so as to define longitudinal ribs (12) in the side wall of the tube. Holes in adjacent columns are offset relative to one another. The depletion device maximises the amount of ink that can be extracted from the bag by preventing the collapsing bag closing off the depletion device.

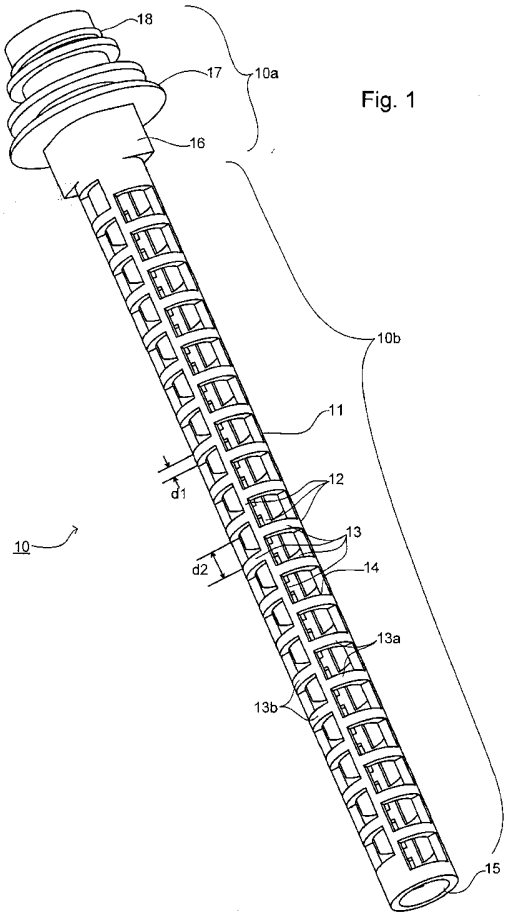


Fig. 1

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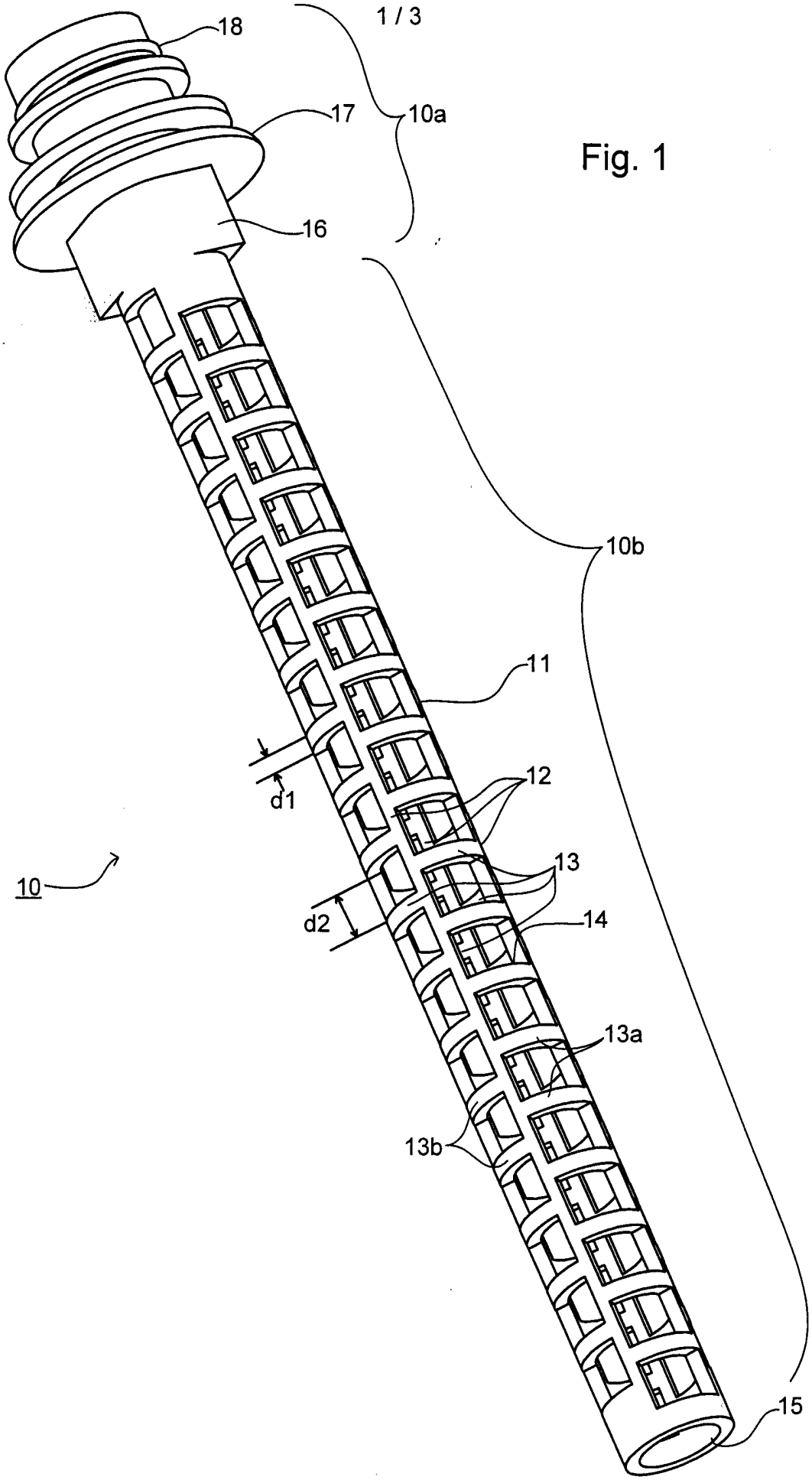



Fig. 1

Fig. 2

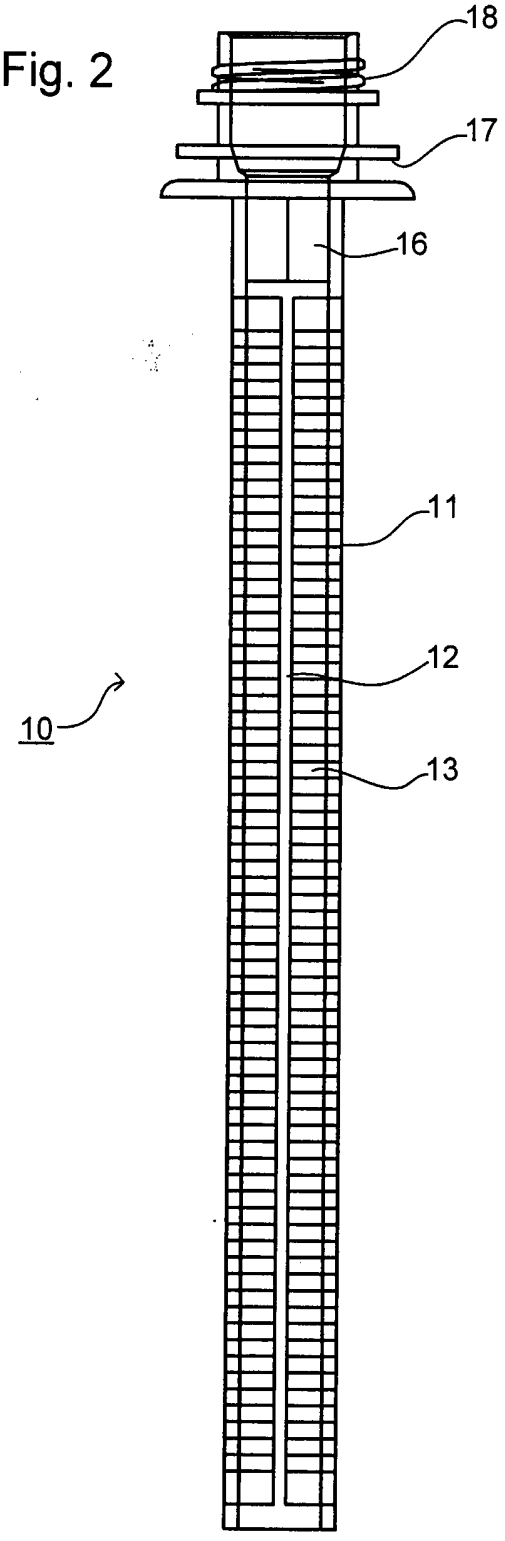
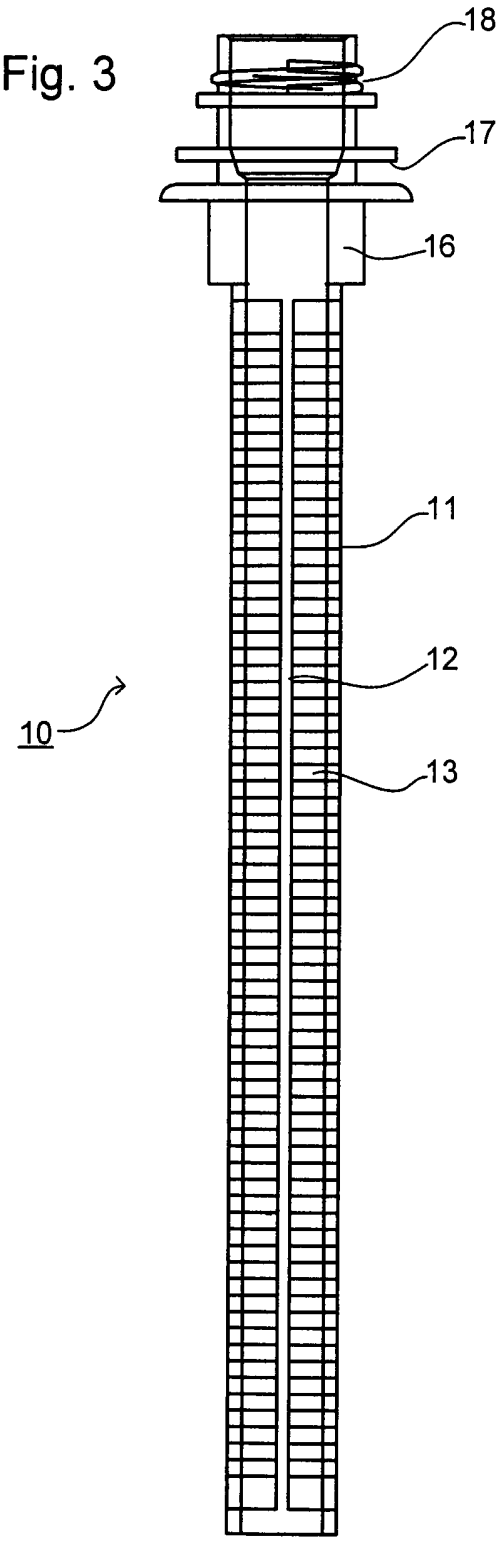



Fig. 3



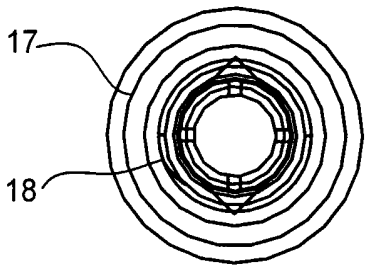
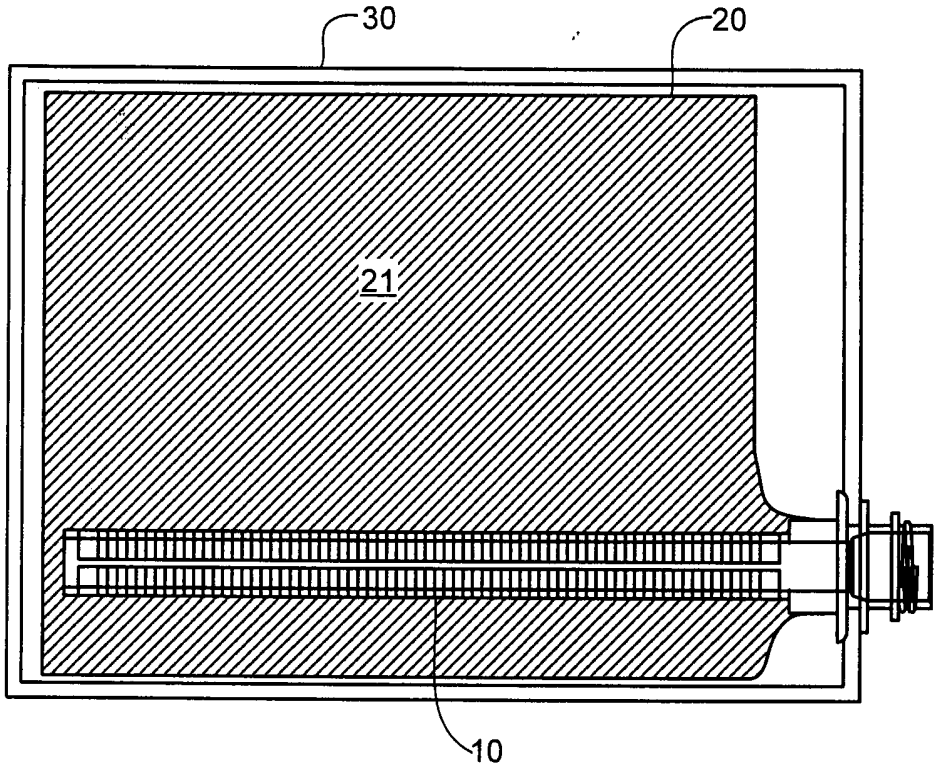




Fig. 4

Fig. 5



# DEPLETION DEVICE FOR BAG IN BOX CONTAINING VISCOUS LIQUID

The present invention relates to depletion devices for use with bag-in-box type containers for viscous liquids, in particular inks.

It is known to use bag-in-box packaging designs to contain viscous liquids such as ink, especially ink for use in digital duplicators. Such designs offer many benefits in terms of ease of use and protection of the product during transit and storage. Also, it has been possible to achieve designs which enable virtually all the liquid to be depleted from the bag in order to maximise product availability to the user and to minimise issues relating to disposal of the used packaging. When the liquid contained within the bag is viscous, such performance is difficult to achieve. Typically during the process of depletion under suction the difficulty in moving liquid out of the extremities of the bag allows the opposing walls of the bag to close together until a point is reached where the bag orifice becomes blocked and no further liquid can be removed. To avoid this type of failure, which leads to excessive residues of unused liquids, it has been proposed to equip bags with flow directing devices. Typically these are plastic mouldings, such as described in GB-A-2 331 065, which prevent opposing walls of the bag from sealing together during the depletion process and also provide channels for the liquid to flow to the bag orifice.

However a recently developed ink, which has a higher viscosity than those used to date in bag-in-box packaging, was found to give very high residues when used with known depletion devices.

Accordingly it is an aim of the invention to provide a depletion device that can enable improved extraction of a viscous liquid from a bag.

According to the invention there is provided a depletion device to allow a viscous liquid to be extracted from a bag, the device comprising:

a port to protrude through an aperture in the bag and having connection means for connection to an extractor and/or a cap; and

a hollow, elongate tube to extend into the interior of the bag, the interior of the tube

being in fluid communication with the port and the side wall of the tube having at least one through-hole.

The present invention also provides a container comprising a bag into which is sealed a depletion device as described above. The bag may be contained in a box and may contain a viscous ink.

The present invention will be further described below with reference to an exemplary embodiment and the accompanying schematic drawings, in which:

Figure 1 is a perspective view of a depletion device according to an embodiment of the invention;

Figure 2 is a first side view of the depletion device of Figure 1;

Figure 3 is a second side view of the depletion device of Figure 1;

Figure 4 is an end view of the depletion device of Figure 1; and

Figure 5 is a cross-sectional view of a bag-in-box type container into which the depletion device of claim 1 has been fitted.

The depletion device 10 shown in Figures 1 to 4 is designed to provide improved depletion performance with high viscosity liquids, for example when used with a bag-in-box container such as shown in Figure 5.

Depletion device 10 is hollow throughout and basically comprises two parts: a connection part 10a and extraction tube 10b. The connection part 10a provides a port which enables connection to an extraction device, such as an ink supply pump in a digital printer, and can also be capped. A thread 18 may be provided to enable a secure connection to the extraction device or cap. A pair of flanges 17 may be provided to securely locate the extraction device in an aperture of a box, as described in co-pending application no GB 0322986.1, filed 1 October 2003. To enable the depletion device to be sealed into the seam of a bag, a seal portion 16 having a parallelogram cross-section is provided.

Extraction tube 10b is hollow and elongate, so as to extend a substantial way into the container to be depleted. The tube is preferably cylindrical but oval or polygonal cross-sections may also be used. To maximise depletion, the side walls of the tube 10b are as open

as possible; the end 15 may also be open. In the present embodiment, the open area is maximised by forming the tube as an open cage 11 of longitudinal and circumferential ribs 12, 13 so as to leave through-holes 14. The longitudinal ribs 11 can be seen as dividing the through-holes 14 into columns. The circumferential ribs 13 are positioned so that through-holes 14a in one column are offset from the through-holes 14b in the adjacent column. This means that there are no continuous ribs extending around the entire circumference of the tube 10a (except at the ends). Substantially the whole area through which ink will be depleted is therefore provided with through-holes into the interior of the tube 10a.

The dimensions of the depletion device will depend on the exact application to which it is to be put, but a device for a 1000cc bag-in-box container may have an overall length of about 180mm, whilst the tube 10a may have a diameter of about 13mm, with longitudinal ribs 11 having a width of about 1.5mm. The circumferential ribs 13 may have a width d1 of about 2mm and the through-holes 14 a width d2 of about 6mm. The total open area of the tube 13a is about 63% of the total surface area of the tube.

Experiments (see below) have shown that the depletion device described above has improved performance compared to a prior art design. The improved performance is believed to derive from the following features, acting alone or in combination:

1. The tubular form of the part extending into the container.
2. The provision of drainage holes covering the total surface area of the tube where liquid depletion is required to take place. Preferably more than 40 holes are provided and most preferably more than 70.
3. Maximisation of the open area of the tube whist retaining sufficient rigidity and strength of the tube. The open area is preferably more than 50 or 60% of the total area of the tube and in a preferred embodiment is between 60 and 65% of the total area.
4. The hole pattern being such that these occupy longitudinal sections of the drainage tube but where holes in neighbouring longitudinal sections are offset so that there are no continuous ribs around the tube circumference.
5. Minimisation of the width of the longitudinal ribs, e.g. to less than 30% of the circumference of the tube, preferably to between 20 and 25%.

Experimental results demonstrate that depletion devices according to the invention

enable greater depletion of viscous liquids from bag-in-box containers than known devices. It is believed that the improved performance of the present invention arrises because the device counteracts the tendency of the bag film to collapse on the surface of the flow directing device and by maximising the opportunities for residual ink to be depleted when this occurs.

Important factors are seen to be:

- Tube form maximises surface area of flow directing device.
- Large open area maximises opportunities for ink to drain in areas where there is no film contact.
- The stepped hole pattern creates an irregularity in available drainage channels which increases the chances of the depletion device not becoming blocked by bag film collapsing on to it during depletion.

In providing an optimum design for a given application, consideration must be given to the selection of hole size and tube diameter. Generally larger holes are favoured but consideration must be given to the strength and rigidity of the fitment. Also excessively large holes may exacerbate depletion problems by bag film being sucked into the drainage tube during the depletion process. In selecting tube diameter there are two opposing requirements. Larger diameters equate to larger surface areas for the drainage tube and this is known to favour the depletion process. However the volume of liquid within the tube represents an inevitable residue within the pack. From this consideration smaller diameters are favoured. It is therefore necessary to conduct experiments in order to achieve the optimum design for a particular application.

Examples

Ink samples of varying viscosity were filled into 1000 cc bag-in-box cartridges of identical design except that one group had a flow directing device according to the above described embodiment and a second group had a fitment according to GB-A-2 331 065. The cartridges were allowed to equilibrate overnight in a test environment with a temperature of 10°C. For each ink and fitment variation ink, depletion performance was assessed by carrying out printing tests using a Priport JP5500 digital duplicator (Ricoh Company of Japan). Printing was continued until an 'out of ink' signal was given by the printing machine. At this point the cartridge was weighed and the ink residue was calculated by subtracting the average

weight for the cartridge packaging. A 'Pass' result was recorded when all 10 cartridges within a test group achieved a residue of 5% or less. Results are tabulated below to confirm the superior performance of the present invention.

Depletion Test Results

| Ink Viscosity * | Embodiment | Fitment As GB 2 331 065 |
|---|---|---|
| 11.80 Pa.s | PASS | PASS |
| 14.40 Pa.s | PASS | FAIL |
| 19.30 Pa.s | PASS | FAIL |

* Viscosity measured at 23° using a Bohlin CS10 rheometer (Bohlin Instruments Ltd, Gloucestershire, England) equipped with a 25 mm cone (2° angle) applying a Casson model.

# CLAIMS

1. A depletion device to allow a viscous liquid to be extracted from a bag, the device comprising:

a port to protrude through an aperture in the bag and having connection means for connection to an extractor and/or a cap; and

a hollow, elongate tube to extend into the interior of the bag, the interior of the tube being in fluid communication with the port and the side wall of the tube having at least one through-hole.

2. A device according to claim 1 wherein the tube is cylindrical.

3. A device according to claim 1 or 2 wherein there are a plurality of through-holes in the side wall of the tube.

4. A device according to claim 3 wherein total area of the through-holes is greater than 50% of the area of the side wall.

5. A device according to claim 3 wherein total area of the through-holes is greater than 60% of the area of the side wall.

6. A device according to claim 3 wherein total area of the through-holes is in the range of from 55 to 65% of the area of the side wall.

7. A device according to any one of claims 3 to 6 wherein the through-holes are arranged in columns separated by a plurality of longitudinal ribs.

8. A device according to claim 7 wherein through-holes in one column are offset longitudinally relative to through-holes in an adjacent column.

9. A device according to claim 8 wherein there are no continuous ribs between through-holes that extend around the complete circumference of the tube.

10. A device according to any one of claims 7 to 9 wherein the total width of said ribs is less than 30% of the circumference of said tube.

11. A device according to any one of claims 7 to 9 wherein the total width of said ribs is in the range of 20 to 25% of the circumference of said tube.

12. A device according to any one of claims 3 to 11 wherein the through-holes are disposed across substantially the whole area of the tube.

13. A device according to any one of claims 3 to 12 wherein there are 40 or more through-holes.

14. A device according to any one of claims 3 to 12 wherein there are 70 or more through-holes.

15. A device according to any one of the preceding claims wherein the end of the tube farthest from the port is open.

16. A device according to any one of the preceding claims further comprising a bag attachment portion between the port and the tube, the outer surface of the bag attachment portion being shaped so as to be sealable into the seam of a bag.

17. A device according to claim 16 wherein the bag attachment portion is substantially a parallelogram in cross-section.

18. A container comprising a bag into which is sealed a depletion device according to any one of the preceding claims.

19. A container according to claim 18 further comprising a box surrounding the bag and wherein the port of the depletion device protrudes form an aperture in said box.

20. A container according to claim 18 or 19 wherein said bag contains a viscous liquid.

21. A container according to claim 20 wherein said viscous liquid has a viscosity of greater than 12 Pa.s measured at 23° using a Bohlin CS10 rheometer equipped with a 25 mm cone (2° angle) applying a Casson model.

22. A container according to claim 20 or 21 wherein said viscous liquid is an ink.

INVESTOR IN PEOPLE

**Application No:** GB0426083.2 **Examiner:** Mike Henderson

**Claims searched:** 1 to 22 **Date of search:** 17 March 2005

# Patents Act 1977: Search Report under Section 17

**Documents considered to be relevant:**

| Category | Relevant to claims | Identity of document and passage or figure of particular relevance |
|---|---|---|
| X | 1 to 3 & 18 to 20 at least | GB 2214486 A (YAIR) (Whole disclosure relevant) |
| X | 1 to 3 & 15 to 20 at least | GB 2194507 A (KK HOSOKAWA YOKO) (Whole disclosure relevant) |
| X | 1 to 3 & 18 to 20 at least | GB 2169869 A (BURNHAM) (Whole disclosure relevant) |
| X | 1 to 3, 15, 18, 20 & 22 at least | GB 756093 A (FLEXIPAC LTD et al) (Whole disclosure relevant) |
| X | 1 to 3, 15 & 18 at least | US 4240482 A (ANDERSSON et al) (Whole disclosure relevant) |
| X | 1 to 3, 15, 16 & 18 at least | JP 07089567 A (DAIWA GRAVURE CO LTD) (See Figs) |

Categories:

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|---|---|---|---|
| X | Document indicating lack of novelty or inventive step | A | Document indicating technological background and/or state of the art. |
| Y | Document indicating lack of inventive step if combined with one or more other documents of same category. | P | Document published on or after the declared priority date but before the filing date of this invention. |
| & | Member of the same patent family | E | Patent document published on or after, but with priority date earlier than, the filing date of this application. |

**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[X] :

B8K; B8P

Worldwide search of patent documents classified in the following areas of the IPC[07]

B65D

The following online and other databases have been used in the preparation of this search report

ONLINE:WPI,EPODOC