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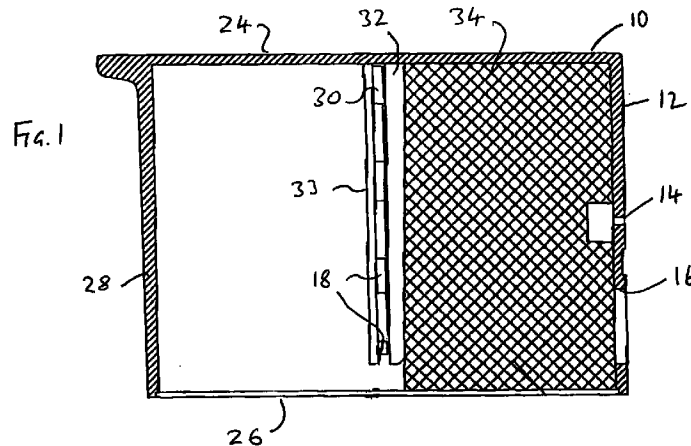
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(54) **An ink cartridge**

(57) An ink cartridge 10 for a printer includes a body 34 of foam material which bridges a breather hole 14 and a delivery aperture 16 of the cartridge 10. A holding member 30;40 held by ribs 32,33 holds the body 34 in place to leave an ink storage volume behind it while per-

mitting air to pass through the body 34 into the storage volume. The foam body 34 is spaced from the cartridge 10 by a holding wall 12 around the breather hole 14 to define a void between the wall 12 and the foam material 34.



Description

The invention relates to an ink cartridge for a printer.

If a simple box filled with ink is used as an ink cartridge, ink will escape in handling through the delivery aperture in the cartridge and possibly also through the breather hole. The cartridge will also leak if the ambient atmospheric pressure drops.

One known cartridge attempts to remove those problems by providing a body of low capillary force sponge or foam material which is saturated with ink and fills the entire cartridge. This does mean however that the volume of ink that the cartridge can hold is significantly reduced.

Another known ink cartridge is currently sold by Canon K.K. and is disclosed in GB-A-2268911. The cartridge has two compartments separated by a solid wall which reaches almost to the floor of the cartridge. The front compartment to one side of the wall includes a breather hole above a larger delivery aperture.

The front compartment is filled with a body of low capillary action foam. The wall includes ribs extending into the first compartment and leading to the lower edge of the wall. As ink is withdrawn through the delivery aperture, air enters through the breather hole. The cartridge achieves negative pressure by the fact that ambient air has to pass through the opening between the two compartments which is at the bottom of the cartridge when it is installed on the machine. The ribs on the dividing wall allow the air to pass by the foam in the first compartment to go under the wall and into the second compartment. The ink in the foam in the first compartment would effectively impede the passage of air, were the ribs not there.

According to one aspect of the invention, there is provided an ink cartridge for a printer, the cartridge including a body of capillary material therein and bridging a breather hole in the cartridge and a body of capillary material therein and bridging a delivery aperture of the cartridge, and means for holding the bodies in place to leave a storage volume behind them while permitting air to pass through the bodies into the storage volume.

The cartridge can thus consist of a single, undivided compartment and preferably has that configuration. Negative pressure is achieved by the fact that ambient air has to pass from the breather hole, and through the ink saturated material in order to replace used ink in the cartridge. Each body has a sufficiently high capillary force to result in a negative pressure within the cartridge sufficient preferably to prevent any leakage of ink from the cartridge during handling and in operation.

The means for holding the bodies in place may take any suitable form and may comprise at least one projection, such as a rib, preferably a pair of oppositely disposed ribs. The holding means may comprise at least one strut across the cartridge. Preferably the holding

means covers less than three quarters of the body to permit ready flow of air. Unlike the cartridge of GB-A-2268911 the holding means may be apertured at the top or centrally or may define a regular or irregular array of apertures evenly or unevenly distributed. The holding means may thus form a perforated barrier.

The body of capillary material bridging the delivery aperture may lie in contact with the part of the cartridge wall defining the delivery aperture. The body of capillary material bridging the breather hole may be spaced from the part of the cartridge defining the breather hole so that there is a void defined between the body and the part of the cartridge defining the breather hole. Indeed, according to another aspect of the invention there is provided an ink cartridge for a printer, the cartridge including a body of capillary material bridging a breather hole of the cartridge, the body being spaced from the part of the cartridge defining the breather hole so that there is a void defined between the body and the part of the cartridge defining the breather hole.

The body of capillary material bridging the breather hole may be integral with the body of capillary material bridging the delivery aperture. The bodies of capillary material may fill less than half of the cartridge to improve the volume of ink which can be held by the cartridge. Preferably the body or bodies are large enough to provide the required negative pressure while providing the largest volume for ink storage in the cartridge.

The cartridge may be relatively slim and flat, and may be substantially rectangular. The cartridge may include at least one strengthening member between the two largest faces of the cartridge. This will prevent possible ink leakage as a result of squeezing of the cartridge. The cartridge may comprise a zig-zag array of strengthening members but in other embodiments the or each strengthening member may take any suitable form and where a plurality of strengthening members are provided they may be in any convenient arrangement. At least one strengthening member may lie perpendicularly to the largest faces of the cartridge. At least one strengthening member may lie centrally of the cartridge.

Embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which:

Fig. 1 is a side elevation in cross-section of the cartridge of the first embodiment of the invention;

Fig. 2 is a plan view in cross-section of the cartridge of Fig. 1;

Fig. 3 is a front elevation of a part of the cartridge of Fig. 1;

Fig. 4 is a front elevation of a part of the cartridge in a second embodiment.

The cartridge 10 of the embodiment is generally rectangular being deeper than it is tall and taller than it is wide. The front wall 12 of the cartridge includes a

smaller breather hole 14 above a larger delivery aperture 16. A zig-zag arrangement of struts 18 extends across the container 10 between the side walls 20,22 from the top wall 24 to the bottom wall 26 of the container 10, substantially parallel to the front wall 12 and mid-way between the front and rear walls 12,28. The struts 18 form a unitary member 30 in the shape of a plurality of "Z"'s one on top of the other. The strut member 30 is held in position within the cartridge 10 by means of four ribs 32,33, two on each side of the cartridge 10 which define channels facing one another to receive the edges of the strut member 30. A high density body of foam 34 is provided and fills the front of the cartridge 10 abutting the walls of the cartridge 10 at the front of the cartridge except for the area of the front wall 12 around the breather hole 14, where there is a cylindrical recess to provide a void behind the breather hole 14. The body of foam 34 extends rearwardly almost as far as the strut member 30 being held in place by the front two ribs 32 and strut member 30. The cartridge 10 is supplied to a user full of ink and with a seal over the breather hole 14 and delivery aperture 16. The initial conditions necessary to ensure negative pressure when the seal is pulled from the cartridge, are achieved by sealing the cartridge with a partial vacuum inside as it leaves the filling machine.

In use, ink will not leak out of the breather hole 14 or delivery aperture 16 of the cartridge 10 while being handled by a user because of the negative pressure in the cartridge and the capillary force of the foam body 34. The cartridge 10 can be jolted or dropped but the capillary force will ensure that ink does not escape. Squeezing of the cartridge 10 which might otherwise cause leakage is resisted by the struts 18 which act as reinforcement in view of the relatively flat slim shape of the cartridge 10. The void behind the breather hole 12 will fill with air as the ink within the cartridge is removed through the delivery aperture 16 providing further security against leakage. The density of the foam will ensure that as ink is withdrawn in use through the delivery aperture 16 negative pressure is maintained in the cartridge due to the resistance to entry of ambient air presented by the ink saturated foam bridging the breather hole 14. The ribs 32,33 and struts 18 provide little or no barrier to movement of air into the storage volume at the rear half of the cartridge 10.

Fig. 4 shows an alternative to the strut member 30. The holding member 40 in this case is in the form of a rectangular sheet 42 having semi-circular cut-outs 44,46. There is one cut-out 44 at each end and a series of pairs of oppositely disposed cut-outs 46 along the sides of the sheet 42. The sheet 42 in place again forms a perforated barrier to hold the foam body 34 and allow air to pass readily through.

Claims

1. An ink cartridge for a printer, the cartridge including

a body of capillary material therein and bridging a breather hole in the cartridge and a body of capillary material therein and bridging a delivery aperture of the cartridge, and means for holding the bodies in place to leave a storage volume behind them while permitting air to pass through the bodies into the storage volume.

2. A cartridge as claimed in claim 1, wherein the means for holding the bodies in place comprises at least one projection.
3. A cartridge as claimed in claim 2, wherein the holding means comprises a pair of oppositely disposed ribs.
4. A cartridge as claimed in any of claims 1, 2 and 3, wherein the holding means comprises at least one strut across the cartridge.
5. A cartridge as claimed in any preceding claim, wherein the holding means covers less than three quarters of the body.
6. A cartridge as claimed in any preceding claim, wherein the holding means defines an array of apertures.
7. A cartridge as claimed in any preceding claim, wherein the body of capillary material bridging the breather hole is spaced from the part of the cartridge defining the breather hole so that there is a void defined between the body and the part of the cartridge defining the breather hole.
8. A cartridge as claimed in any preceding claim, wherein the bodies of capillary material may fill less than half of the cartridge to improve the volume of ink which can be held by the cartridge.
9. A cartridge as claimed in any preceding claim, wherein the body of capillary material bridging the breather hole is integral with the body of capillary material bridging the delivery aperture.
10. A cartridge as claimed in any preceding claim, wherein the cartridge is relatively slim and flat and includes at least one strengthening member between the two largest faces of the cartridge.
11. A cartridge as claimed in claim 10, wherein at least one strengthening member lies perpendicularly to the largest faces of the cartridge.
12. A cartridge as claimed in claim 10 or claim 11, wherein at least one strengthening member lies centrally of the cartridge.

13. A cartridge as claimed in claim 10, 11 or 12, wherein the cartridge comprises a zig-zag array of strengthening members.

14. An ink cartridge for a printer, the cartridge including a body of capillary material bridging a breather hole of the cartridge, the body being spaced from the part of the cartridge defining the breather hole so that there is a void defined between the body and the part of the cartridge defining the breather hole. 5
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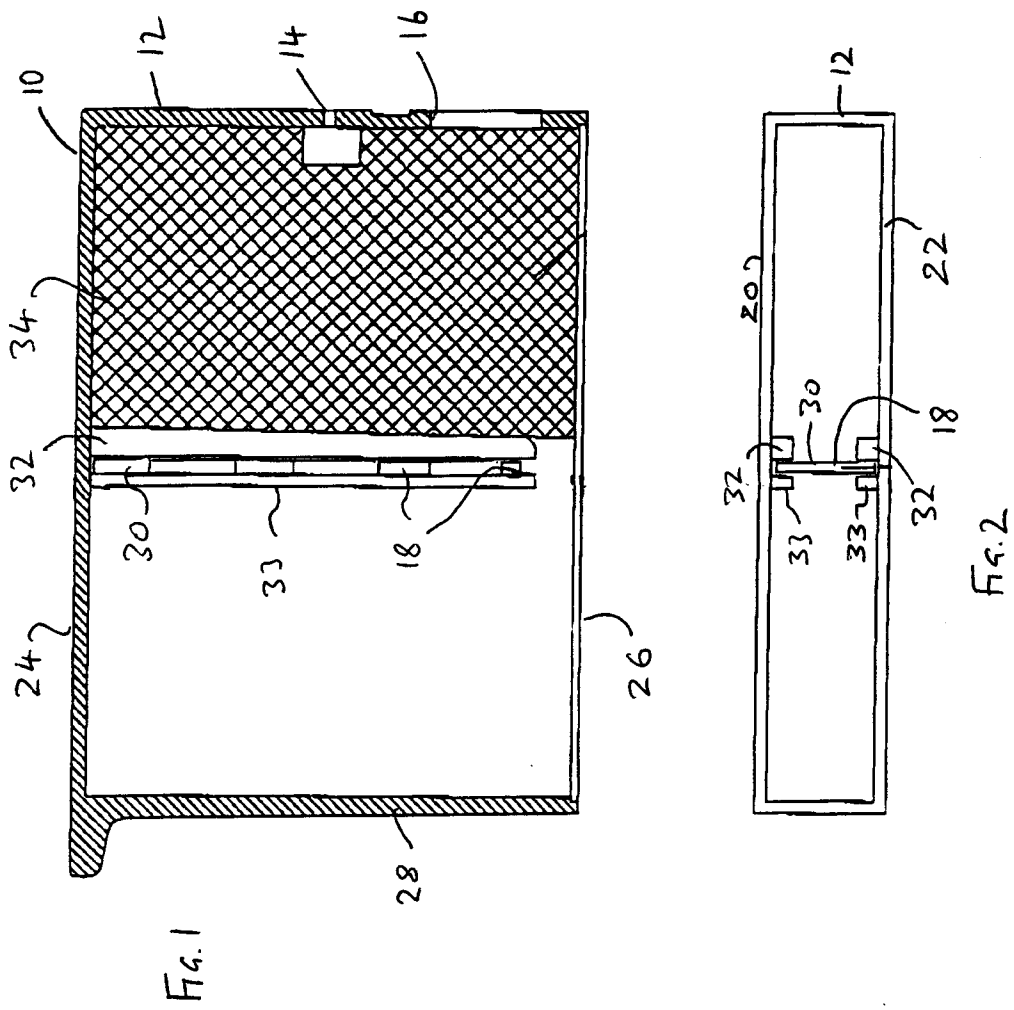
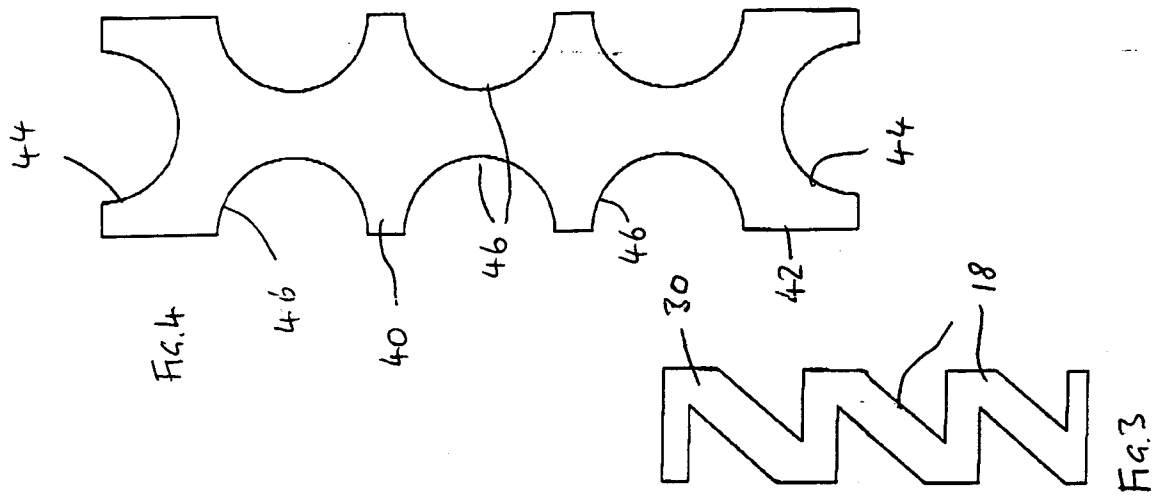
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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 30 8077

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	GB-A-2 268 911 (CANON) * page 2, line 14 - page 21, line 6; figure 2 * * page 28, line 3 - page 31, line 6; figure 3 * * page 39, line 5 - line 20; figure 6 * ---	1,2, 5-10,12, 14	B41J2/175
A	EP-A-0 488 829 (CANON) * column 4, line 58 - column 9, line 53; figures 1-3 * ---	1,2, 5-10,12, 14	
A	EP-A-0 711 667 (FULLMARK INTERNATIONAL) -----		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B41J
Place of search	Date of completion of the search	Examiner	
THE HAGUE	5 February 1997	Adam, E	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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