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PRINTER WITH CAPPING DEVICE**FIELD OF THE INVENTION**

The following invention relates to improvements in portable printer technology. More particularly, though not exclusively, the invention relates to a capping device for a hand-held drop-on-demand printer having a fixed printhead for ejecting droplets of ink onto a sheet of print media external to the printer.

BACKGROUND

Prior art drop-on-demand printers incorporate a supply of print media and employ a print media feed mechanism to transport the print media past the printhead or printheads to effect printing onto the print media. Our co-pending application (AP43) entitled "Manually Moveable Printer with Speed Sensor" discloses a portable, hand-held drop-on-demand inkjet printer having a fixed printhead. The printer can print an image onto a sheet external to the printer by passing the casing of the printer over and across the print media as the nozzles of the printhead eject ink.

During non-use periods of the printer, a capping device seals the printhead from the surrounding atmosphere to prevent evaporation of ink and the consequential blockage of the nozzles.

The present application is directed to specific capping arrangements for portable printers, particularly, though not exclusively, for portable printers of the type disclosed in co-pending application AP43, the contents of which are specifically incorporated herein by cross-reference.

CO-PENDING APPLICATIONS

Various methods, systems and apparatus relating to the present invention are disclosed in the following co-pending applications filed by the applicant or assignee of the present invention simultaneously with the present application:

AP39	AP43	AP44	AP46	AP47	AP48
AP49	AP50	AP51	AP52	AP53	AP55
AP58	AP60	AP61	AP62	AP63	AP64
AP65	AP66	AP67	AP68	AP69	AP70
AP71	AP77	AP78	AP79		

The disclosures of these co-pending applications are incorporated herein by cross-reference. Each application is temporarily identified by its file reference. This will be replaced by the corresponding PCT Application Number when available.

RELATED PATENT APPLICATIONS AND PATENTS

US6,227,652	US6,213,588	US6,213,589	US6,231,163
US6,247,795	US6,394,581	US6,244,691	US6,257,704
US6,416,168	US6,220,694	US6,257,705	US6,247,794
US6,234,610	US6,247,793	US6,264,306	US6,241,342
US6,247,792	US6,264,307	US6,254,220	US6,234,611

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	US6,302,528	US6,283,582	US6,239,821	US6,338,547
	US6,247,796	US09/113,122	US6,390,603	US6,362,843
	US6,293,653	US6,312,107	US6,227,653	US6,234,609
	US6,238,040	US6,188,415	US6,227,654	US6,209,989
5	US6,247,791	US6,336,710	US6,217,153	US6,416,167
	US6,243,113	US6,283,581	US6,247,790	US6,260,953
	US6,267,469	US6,273,544	US6,309,048	US6,420,196
	US6,443,558	US09/422,892	US6,378,989	US09/425,420
	US09/422,893	US09/609,140	US6,409,323	US6,281,912
10	US09/575,113	US6,318,920	US6,488,422	US09/693,644
	US6,457,810	US6,485,135	US09/112,763	US6,331,946
	US6,246,970	US6,442,525	US09/505,951	US09/505,147
	US09/505,952	US09/575,108	US09/575,109	US09/575,110
	US09/607,985	US6,398,332	US6,394,573	US09/606,999
15	US6,238,044	US6,425,661	US6,390,605	US6,322,195
	US09/504,221	US6,480,089	US6,460,778	US6,305,788
	US6,426,014	US6,364,453	US6,457,795	US09/556,219
	US09/556,218	US6,315,399	US6,338,548	US09/575,190
	US6,328,431	US6,328,425	US09/575,127	US6,383,833
20	US6,464,332	US6,390,591	US09/575,152	US6,328,417
	US6,322,194	US09/575,177	US09/575,175	US6,417,757
	US09/608,780	US6,428,139	US09/607,498	US09/693,079
	US09/693,135	US6,428,142	US09/692,813	US09/693,319
	US09/693,311	US6,439,908	US09/693,735	PCT/AU98/00550
25	PCT/AU00/00516	PCT/AU00/00517	PCT/AU00/00511	PCT/AU00/00754
	PCT/AU00/00755	PCT/AU00/00756	PCT/AU00/00757	PCT/AU00/00095
	PCT/AU00/00172	PCT/AU00/00338	PCT/AU00/00339	PCT/AU00/00340
	PCT/AU00/00341	PCT/AU00/00581	PCT/AU00/00580	PCT/AU00/00582
	PCT/AU00/00587	PCT/AU00/00588	PCT/AU00/00589	PCT/AU00/00583
30	PCT/AU00/00593	PCT/AU00/00590	PCT/AU00/00591	PCT/AU00/00592
	PCT/AU00/00584	PCT/AU00/00585	PCT/AU00/00586	PCT/AU00/00749
	PCT/AU00/00750	PCT/AU00/00751	PCT/AU00/00752	PCT/AU01/01332
	PCT/AU01/01318	PCT/AU00/01513	PCT/AU00/01514	PCT/AU00/01515
	PCT/AU00/01516	PCT/AU00/01517	PCT/AU00/01512	PCT/AU01/00502
35	PCT/AU02/01120	PCT/AU00/00333	PCT/AU01/00141	PCT/AU01/00139
	PCT/AU01/00140	PCT/AU00/00753	PCT/AU01/01321	PCT/AU01/01322
	PCT/AU01/01323	PCT/AU00/00594	PCT/AU00/00595	PCT/AU00/00596
	PCT/AU00/00597	PCT/AU00/00598	PCT/AU00/00741	PCT/AU00/00742

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DISCLOSURE OF THE INVENTION

There is disclosed herein a portable printer comprising:

a housing,

5 a printhead affixed within the housing and including a plurality of ink ejection nozzles configured to eject droplets of ink toward a sheet of print media external to the housing in a printing operational mode, and

a capping device including an arm having a capping region that covers the ink ejection nozzles when the printer is in a non-printing operational mode and moves away from the nozzles to enable ejection of ink en route to a sheet of print media in said printing operational mode.

Preferably the arm is attached by a pivot to the housing.

10 Preferably the arm includes an activation region to one side of the pivot and a leg to the other side of the pivot, the leg extending in a direction substantially normal to the activation region and including said capping region.

Preferably an elastomeric pad is attached to the capping region.

15 Alternatively the arm is formed of a resilient, elastically deformable material being affixed at an end thereof to the housing.

In this alternative the housing can include a fulcrum and said arm includes an activation region to one side of said fulcrum and a leg to the other side of the fulcrum, the leg extending in a direction substantially normal to the activation region and including said capping region.

20 Alternatively again, the housing can have mounted thereto a wheel by which the housing rides over a sheet of print media in said printing operational mode, the wheel having associated therewith a friction clutch, the friction clutch including activation means for deflecting said capping region of the arm upon rotation of said wheel in said printing operational mode.

In this alternative said activation means can comprise a peg projecting from the friction clutch.

25 In this alternative the arm can be formed from an elastically deformable material including a deviation and wherein the peg bears against the deviation.

In a further alternative the arm can be attached to the housing by an integral spring and the printer further comprises an eccentric cam upon a shaft, the eccentric cam bearing against the arm and rotatable to deflect the arm so as to move said capping region away from the nozzles to enable ejection of ink in said printing operational mode.

30 In yet a further alternative, the printer can include a solenoid within the housing disposed with respect to the arm such that upon energization of the solenoid magnetic force draws the arm thereto so as to move said capping region away from the nozzles to enable ejection of ink in said printing operational mode.

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In this alternative the arm can have attached thereto a metal plate to interact with the solenoid.

In this alternative the arm can include an integral spring interacting with the solenoid so as to bias the arm away from the solenoid.

BRIEF DESCRIPTION OF THE DRAWINGS

5 Preferred forms of the present invention will now be described by way of example only with reference to the accompanying drawings wherein:

Figure 1 is a schematic cross-sectional end elevational view of a portable printer showing a first capping device in a capped position;

10 Figure 2 is a schematic cross-sectional end elevational view of the portable printer of Figure 1 with the first capping device shown in an uncapped position;

Figure 3 is a schematic cross-sectional end elevational view of a portable printer having a second type of capping device, in a capped position;

Figure 4 is a schematic cross-sectional end elevational view of the printer of Figure 3 with the second capping device, in an uncapped position;

15 Figure 5 is a schematic cross-sectional end elevational view of a portion of another printer having a third type of capping device, in a capped position;

Figure 6 is a schematic cross-sectional elevational view of a portion of the printer of Figure 5 with the third capping device in an uncapped position;

20 Figure 7 is a schematic front elevational view of a friction clutch used in the embodiment of Figures 5 and 6;

Figure 8 is a schematic cross-sectional end elevational view of a portion of a printer having a fourth type of capping device, in a capped position;

Figure 9 is a schematic cross-sectional end elevational view of a portion of the printer of Figure 8 with the fourth capping device shown in an uncapped configuration;

25 Figure 10 is a schematic cross-sectional end elevational view of a portion of a printer having a fifth type of capping device, in a capped configuration; and

Figure 11 is a schematic cross-sectional end elevational view of the portion of the printer of Figure 10 with the fifth capping device shown in an uncapped configuration.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

30 In the accompanying drawings there are schematically depicted a number of different capping configurations for a portable printer. The portable printer is intended to eject droplets of ink onto a sheet of

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print media as the printer is held by hand and moved across the sheet of print media. A typical internal configuration of a printhead and associated hardware in a portable printer for which the capping devices disclosed herein are applicable is disclosed in co-pending application entitled "Manually Moveable Printer with Speed Sensor" (AP43) cross-referenced above.

5 In Figures 1 and 2 of the accompanying drawings there is schematically depicted in cross-section, a printer housing 10 having located therein a fixed printhead 11. The printhead 11 has a print chip 12 extending throughout its full width, that is, the width of an image to be printed. A first embodiment of a capper arm 13, which may be metallic or formed of other material such as plastics, is pivotally mounted at 14 to the printer housing 10. The capper arm 13 resides at the exterior of the housing 10 and includes a leg 28 to which there is
10 affixed an elastomeric pad 16 which seals against the chip 12 in the capped configuration depicted in Figure 1. The elastomeric pad 16 is moved away from the print chip 12 by leg 28 to enable printing in the configuration depicted in Figure 2.

The capper arm 13 includes an activating region 15 to which finger force can be applied as indicated by arrow F shown in Figure 2. The application of such finger force causes pivoting of the capper arm 13 about
15 pivot 14. A spring (not shown) can return the capper arm to the position shown in Figure 1.

A second embodiment of the capping device is depicted in Figures 3 and 4. In this embodiment, the capper arm 13 is formed of a resilient, elastically deformable material such as metal or plastics. In a particular preferred embodiment, the capper arm 13 is formed of stainless steel. The capper arm 13 is fixed at 17 to the printer housing 10 at one end thereof. A fulcrum 14 (depicted schematically) resides alongside the transition
20 of the capper arm 13 to the leg 29.

Upon the application of finger force F as indicated in Figure 4, the capper arm 13 deforms, resulting in the leg 29 moving to the position depicted in Figure 4 so as to draw the elastomeric pad 16 away from the print chip 12 for printing purposes. Upon release of the finger force F, the resilience of the capper returns it to the configuration depicted in Figure 3 wherein the elastomeric pad 16 seals against the print chip 12.

25 In the first and second embodiments of the capping device shown in Figures 1 to 4, a user grasps the printer housing 10 and in doing so, inherently applies a force F to the activation region 15 of the capper arm 13. There may be provided a switch within the printer housing and associated with the capper arm 13 such that application of finger force F depresses the switch to set the printhead 11 into a printing operational mode.

In Figures 5 to 7 of the accompanying drawings there is schematically depicted a third embodiment
30 of a capping device incorporating a friction clutch. In this embodiment, the printer housing 10 has mounted thereto one or more wheels 18, at least one of which can be associated with an optical sensor as described in the cross-referenced application AP43 entitled "Manually Moveable Printer with Speed Sensor". One of the wheels, ie. wheel 18 in this example, can have associated with it a friction clutch 19. Wheel 18 and clutch 19 can be mounted upon a common shaft 30 (Figure 7) and biased against each other such that rotation of wheel
35 18 causes rotation of clutch 19 until something stops the clutch 19 from spinning, whereupon wheel 18 continues to rotate with a dynamic frictional engagement between it and the non-rotating clutch 19. In the

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embodiment depicted, the friction clutch 19 has a peg 20 extending laterally from it. This peg 20 is received behind a deviated portion 21 of the capper arm 13. In this embodiment, the capper arm 13 is attached within the printer housing 10 such that portion 29 moves in a linear fashion, ie. it is guided to move in a straight line. Upon rotation of friction clutch 19, the peg 20 bears against the deviated portion 21 of capper arm 13 to move it in the direction indicated by arrow C (Figure 6). This, in turn, draws the elastomeric pad 16 away from the chip 12. It should be appreciated in this regard that wheel 18 is riding upon the print media 22 to effect wheel rotation in the direction indicated by arrow W in Figure 6. When the printer housing 10 is lifted away from the print media 22, rotation W ceases, whereupon resilience of the capper arm 13 pushes the peg 20 back to the position depicted at Figure 5 and at the same time returns the elastomeric pad 16 to seal the print chip 12 as shown in Figure 5.

In a fourth embodiment of the capping device shown in Figures 8 and 9, there is provided an internally driven camshaft 24 including an eccentric cam 23. Camshaft 24 might be selectively rotated by means of an electric motor for example. In this embodiment, the capper arm 13 is mounted to a pivot 14 and is biased by an integral spring 25 against the eccentric cam 23. That is, the integral spring 25 biases the leg portion 28 of the capper arm 13 to the position depicted in Figure 8 whereat the elastomeric pad 16 seals over chip 12. When the camshaft 24 is rotated such that the eccentric cam rotates into the position depicted in Figure 9, the capper arm 13 deforms integral spring 25 while the elastomeric pad 16 moves away from the print chip 12.

In Figures 10 and 11 of the accompanying drawings, there is depicted a fifth embodiment of the capping device wherein the capper arm 13 is activated by an internal solenoid 26. In this embodiment, the capper arm 13 slides linearly between the positions depicted in Figures 10 and 11. The capper arm 13 includes an integral spring 25 that bears against solenoid 26. As an alternative, the spring 25 could bear against some other fixed internal structure of the printer housing 10. Attached to the capper arm 13 is a metallic plate 27 to be attracted to the solenoid 26 by magnetic interaction therewith. Application of electric current to the solenoid 26 creates a magnetic field drawing the metal plate 27 thereto. This in turn draws the capper 13 to the uncapped position where the elastomeric pad 16 has moved away from the print chip 12 to enable printing to commence.

When the solenoid is no longer receiving electric current, its magnetic field diminishes or ceases enabling the spring 28 to return the capper arm 13 to the capped position depicted in Figure 10.

It should be appreciated that modifications and alterations obvious to those skilled in the art are not to be considered as beyond the scope of the present invention. For example, the elastomeric pad need not be affixed to the capper arm itself. Instead, it might be attached to the printhead 11 so as to surround the print chip 12 and come into sealing contact with a smooth surface of leg 28 of capper arm 13.

WE CLAIM:

1. A portable printer comprising:
 - a housing adapted to be held by hand and moved manually across a sheet of print media,
 - a printhead affixed within the housing and including a plurality of ink ejection nozzles configured to eject droplets of ink toward the sheet of print media external to the housing in a printing operational mode, and
 - a hand-activated capping device including an arm having a capping region that covers the ink ejection nozzles when the printer is in a non-printing operational mode and moves away from the nozzles to enable ejection of ink en route to a sheet of print media in said printing operational mode.
2. The printer of claim 1 wherein the arm is attached by a pivot to the housing.
3. The printer of claim 2 wherein the arm includes an activation region to one side of the pivot and a leg to the other side of the pivot, the leg extending in a direction substantially normal to the activation region and including said capping region.
4. The printer of claim 3 wherein an elastomeric pad is attached to the capping region.
5. The printer of claim 1 wherein the arm is formed of a resilient, elastically deformable material being affixed at an end thereof to the housing.
6. The printer of claim 5 wherein the housing includes a fulcrum and said arm includes an activation region to one side of said fulcrum and a leg to the other side of the fulcrum, the leg extending in a direction substantially normal to the activation region and including said capping region.
7. The printer of claim 5 wherein an elastomeric pad is attached to the capping region.

8. The printer of claim 1 wherein the housing has mounted thereto a wheel by which the housing rides over a sheet of print media in said printing operational mode, the wheel having associated therewith a friction clutch, the friction clutch including activation means for deflecting said capping region of the arm upon rotation of said wheel in said printing operational mode.

9. The printer of claim 8 wherein said activation means comprises a peg projecting from the friction clutch.

10. The printer of claim 9 wherein the arm is formed from an elastically deformable material including a deviation and wherein the peg bears against the deviation.

11. The printer of claim 1 wherein the arm is attached to the housing by an integral spring and the printer further comprises an eccentric cam upon a shaft, the eccentric cam bearing against the arm and rotatable to deflect the arm so as to move said capping region away from the nozzles to enable ejection of ink in said printing operational mode.

12. The printer of claim 1 including a solenoid within the housing disposed with respect to the arm such that upon energization of the solenoid magnetic force draws the arm thereto so as to move said capping region away from the nozzles to enable ejection of ink in said printing operational mode.

13. The printer of claim 12 wherein the arm has attached thereto a metal plate to interact with the solenoid.

14. The printer of claim 13 wherein the arm includes an integral spring interacting with the solenoid so as to bias the arm away from the solenoid.