PTO Form 1960 (Rev 9/2007)
OMB No. 0651-0050 (Exp. 07/31/2017)

Request for Reconsideration after Final Action

The table below presents the data as entered.

Input Field	Entered
SERIAL NUMBER	79139127
LAW OFFICE ASSIGNED	LAW OFFICE 104
MARK SECTION	
MARK	http://tmng-al.uspto.gov/resting2/api/img/79139127/large
LITERAL ELEMENT	SWISSQPRINT
STANDARD CHARACTERS	YES
USPTO-GENERATED IMAGE	YES
MARK STATEMENT	The mark consists of standard characters, without claim to any particular font style, size or color.
ARGUMENT(S)	

The Examining Attorney has continued the refusal based on a likelihood of confusion with Registration No. 2,411,048 for QPRINT for “toner cartridges for copiers and printers.”

In responding, Applicant will address the Examining Attorney’s arguments in turn and incorporates by reference its previous July 7, 2014 response.

The Marks Are No Similar

Applicant respectfully disagrees with the Examining Attorney’s finding the QPRINT is the dominant features of both marks. Applicant submits that the dominant feature in its mark is the prefix “SWISS” and the mark as a whole creates a distinct commercial impression from QPRINT.

The Goods Are Not Related

Applicant’s goods are high end flatbed printers used by professionals in the printing trade to produce large format advertising. Applicant’s machines typically cost at least $300,000. These are high performance and sophisticated machines. See Applicant’s catalog attached as Exhibit A and

Exhibits B, D and F. In order to produce the high-quality printing required for larger format advertising, flat bed printers only use ink. See Exhibits D and F. Applicant notes that its prior response caused the Examining Attorney to believe Applicant was arguing that its machines do not use ink. That is not the case.

Applicant submits that the Registrant's toner cartridges have absolutely no relationship to high end printers. Toner cartridges do not contain ink, but are made up of toner powder which is different in kind from the ink used in Applicant's flatbed printers. See Exhibit E. There is absolutely no relationship between toner cartridges that are, by their nature, used in copiers and printers for high speed, lower quality printing. See Exhibits D, E and F.

To the extent that the Examining Attorney is relying on its evidence of third party applications and registrations, Applicant submits that it is not dispositive in this case because none of the citations that Applicant located showed use of marks with toner cartridges and flatbed printers. Therefore, Applicant respectfully disagrees that the evidence shows that toner cartridges and emanate from a single source.

Applicant further acknowledges the Examining attorney's argument that Applicant's and Registrant's goods do not contain any limitation in their trade channels. However, Applicant submits that the nature of the goods creates an implicit limitation in the trade channels. Registrant's goods are low cost (less than $20) toner cartridges which are bought through online retailers like Amazon or office supply stores. See Exhibit C. By contrast, Applicant's goods costs hundreds of thousands of dollars. See Exhibit F, pg. 12. Therefore, by definition, those goods are not purchased online or at retail stores. Instead they are purchased through trade shows and sales visits. See generally Exhibit A, B and F.

Sophistication of Purchasers

As noted above, the average cost of Applicant's goods is $300,000 and the price ranges for flatbed printers can range from $35,000 to $2 million. See Exhibit F at pg. 12. Clearly, any person or company that expends such large sums to purchase equipment is sophisticated and would not be confused by Applicant's mark for flatbed printers and Registrant's toner cartridges.

Conclusion

For the foregoing reasons, reconsideration and passage to publication are respectfully requested.

EVIDENCE SECTION	
EVIDENCE FILE NAME(S)	
ORIGINAL PDF FILE	evi_389824798-20150910214904662124_._SwissQ.pdf
CONVERTED PDF FILE(S)	\\TICRS\EXPORT16\IMAGEOUT16\791\391\79139127\xml13\RFR0002.JPG

(47 pages)	
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DESCRIPTION OF EVIDENCE FILE	Applicant's catalog, onlien articles and printouts from Amazon.com showing sales of Registrant's goods
SIGNATURE SECTION	
RESPONSE SIGNATURE	/John J. O'Malley/
SIGNATORY'S NAME	John J. O'Malley
SIGNATORY'S POSITION	Attorney of Record, PA Bar Member
SIGNATORY'S PHONE NUMBER	215-568-6400
DATE SIGNED	09/10/2015
AUTHORIZED SIGNATORY	YES
CONCURRENT APPEAL NOTICE FILED	YES

FILING INFORMATION SECTION	
SUBMIT DATE	Thu Sep 10 21:56:59 EDT 2015
TEAS STAMP	USPTO/RFR-38.98.247.98-20150910215659200780-79139127-540f7cd6c2d79abeeffbb4125db2c37e7f776c2e981179dc4c277538890e9bf31a0-N/A-N/A-20150910214904662124

PTO Form 1960 (Rev 9/2007)
OMB No. 0651-0050 (Exp. 07/31/2017)

Request for Reconsideration after Final Action
To the Commissioner for Trademarks:

Application serial no. **79139127** SWISSQPRINT(Standard Characters, see http://tmng-al.uspto.gov/resting2/api/img/79139127/large) has been amended as follows:

ARGUMENT(S)
In response to the substantive refusal(s), please note the following:

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EVIDENCE
Evidence in the nature of Applicant's catalog, onlien articles and printouts from Amazon.com showing sales of Registrant's goods has been attached.
Original PDF file:
evi_389824798-20150910214904662124_._SwissQ.pdf
Converted PDF file(s) (47 pages)
Evidence-1
Evidence-2
Evidence-3

Evidence-4
Evidence-5
Evidence-6
Evidence-7
Evidence-8
Evidence-9
Evidence-10
Evidence-11
Evidence-12
Evidence-13
Evidence-14
Evidence-15
Evidence-16
Evidence-17
Evidence-18
Evidence-19
Evidence-20
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Evidence-31
Evidence-32
Evidence-33
Evidence-34
Evidence-35
Evidence-36
Evidence-37
Evidence-38
Evidence-39
Evidence-40
Evidence-41
Evidence-42
Evidence-43
Evidence-44
Evidence-45
Evidence-46
Evidence-47

SIGNATURE(S)
Request for Reconsideration Signature

Signature: /John J. O'Malley/ Date: 09/10/2015
Signatory's Name: John J. O'Malley
Signatory's Position: Attorney of Record, PA Bar Member

Signatory's Phone Number: 215-568-6400

The signatory has confirmed that he/she is an attorney who is a member in good standing of the bar of the highest court of a U.S. state, which includes the District of Columbia, Puerto Rico, and other federal territories and possessions; and he/she is currently the owner's/holder's attorney or an associate thereof; and to the best of his/her knowledge, if prior to his/her appointment another U.S. attorney or a Canadian attorney/agent not currently associated with his/her company/firm previously represented the owner/holder in this matter: (1) the owner/holder has filed or is concurrently filing a signed revocation of or substitute power of attorney with the USPTO; (2) the USPTO has granted the request of the prior representative to withdraw; (3) the owner/holder has filed a power of attorney appointing him/her in this matter; or (4) the owner's/holder's appointed U.S. attorney or Canadian attorney/agent has filed a power of attorney appointing him/her as an associate attorney in this matter.

The applicant is filing a Notice of Appeal in conjunction with this Request for Reconsideration.

Serial Number: 79139127
Internet Transmission Date: Thu Sep 10 21:56:59 EDT 2015
TEAS Stamp: USPTO/RFR-38.98.247.98-20150910215659200
780-79139127-540f7cd6c2d79abeeffbb4125db
2c37e7f776c2e981179dc4c277538890e9bf31a0
-N/A-N/A-20150910214904662124

EXHIBIT A

One for all – all for one.

Developed and manufactured in Switzerland, ruggedly designed with attention to detail. Such qualities and modular expandability are common among all swissQprint inkjet systems. Depending on the configuration, they can print anything from the smallest panels through roll material to oversize media of any kind. And always with accurate precision.

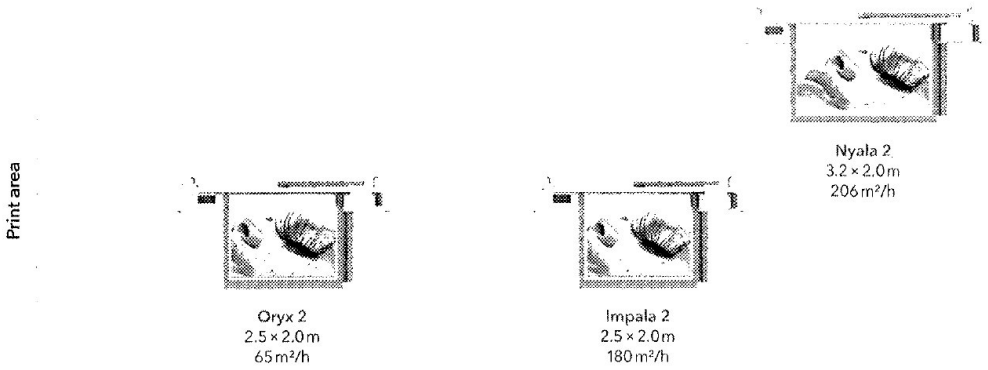
Productivity

Print mode	Oryx 2	Impala 2	Nyala 2
Draft	65 m²/h	–	–
Speed	40 m²/h	180 m²/h	206 m²/h
Production	20 m²/h	90 m²/h	103 m²/h
Quality	18 m²/h	48 m²/h	54 m²/h
Fine art	9 m²/h	28 m²/h	32 m²/h

Productivity with 2 × CMYK configuration (Impala 2 / Nyala 2)
Approx. 10% less with roll to roll

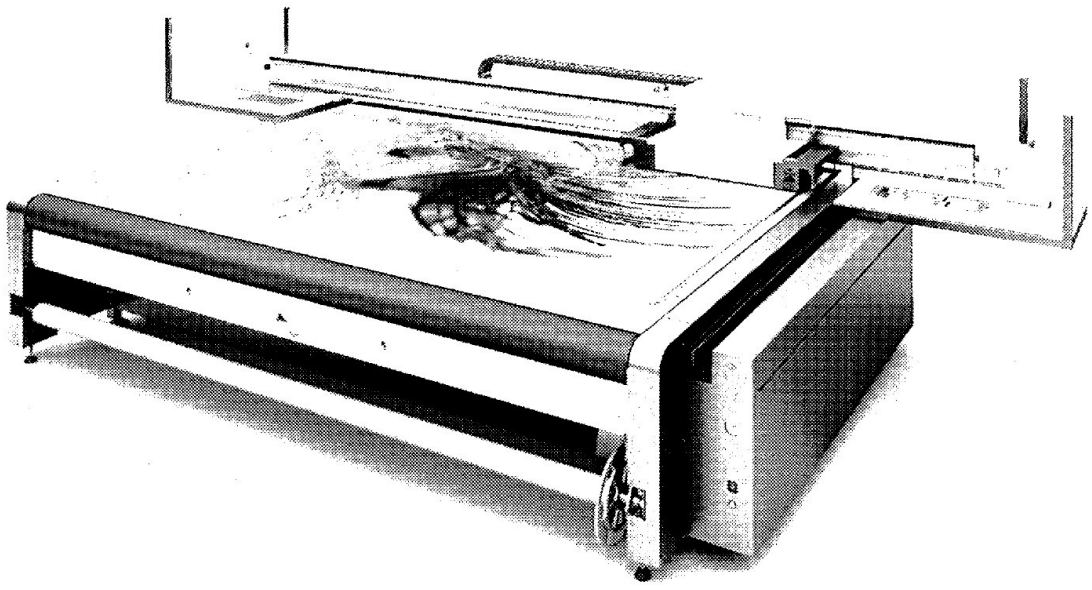
In scale with requirements

The machines are the centrepieces of small print providers, the secret weapons of successful advertising and signage producers, and links in value chains at industrial corporations. There is an ideal flatbed machine for every production volume, with retrofit options always at the ready to extend their capabilities.

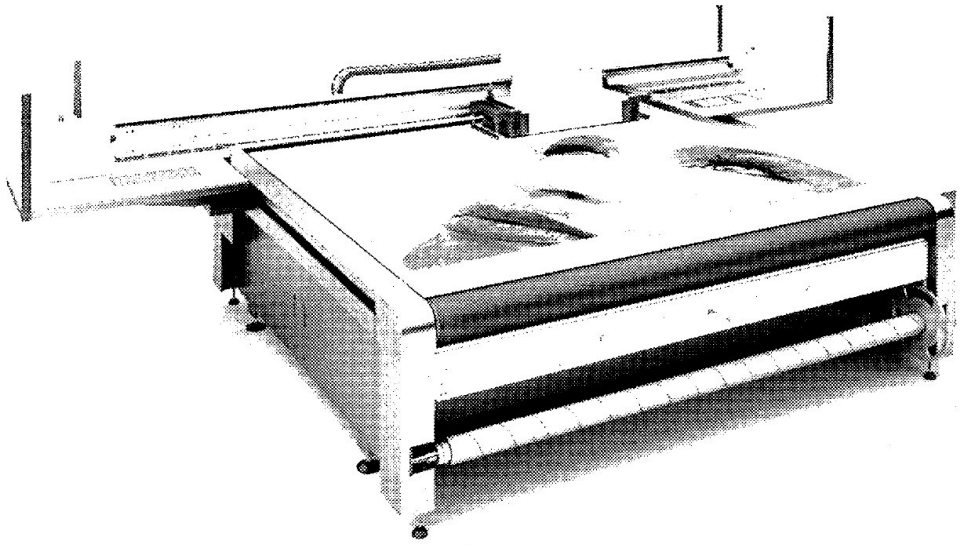


Nyala 2

The high performance model with the highest return on investment. When optimally utilised and operating through three shifts, no other large format printer is capable of such efficient and high-quality production. Firstly, it is a dependable system. And secondly, the 6.5 square metre printing table offers freedom for all formats. Watching the Nyala 2 at work is an impressive sight indeed.



Max. productivity 206 m²/h
Channels 4 - 9
Print area 3.2 × 2.0 m



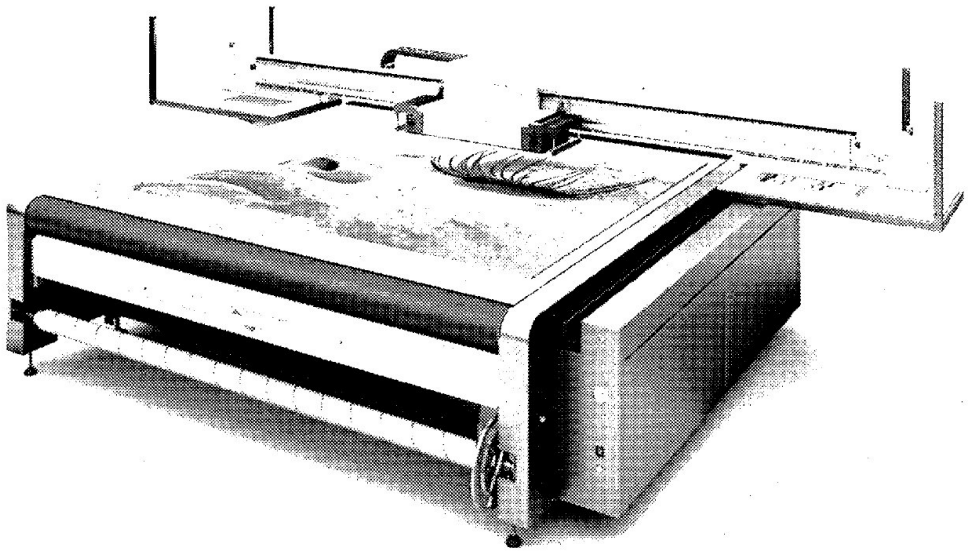
Max. productivity 180 m²/h
Channels 4–9
Print area 2.5×2.0 m

Impala 2

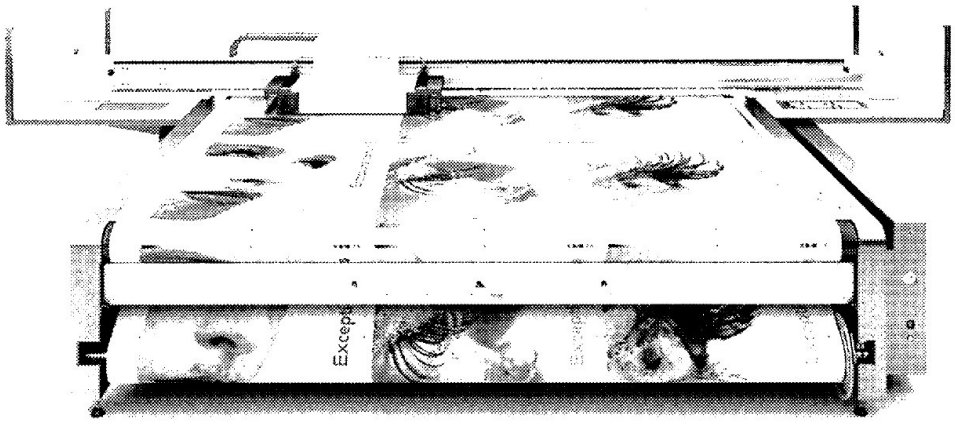
The compact model with a penchant for growth. This printer is so upgradeable that it can end up doing the work of two while occupying the space of just one.
Its performance can be effectively doubled, both in terms of printing speed and format size. It is exciting to max out all the possibilities of the Impala 2.

Oryx 2

The extra-capable entry level model. Outstanding print quality is its speciality, versatility its virtue. This large format printer is freely configurable like its siblings: with nine colour channels, roll to roll option for continuous media, and a board option for oversized panels. It is astonishing just how much the Oryx 2 can do.



Max. productivity 65 m²/h
Channels 4–9
Print area 2.5 × 2.0 m

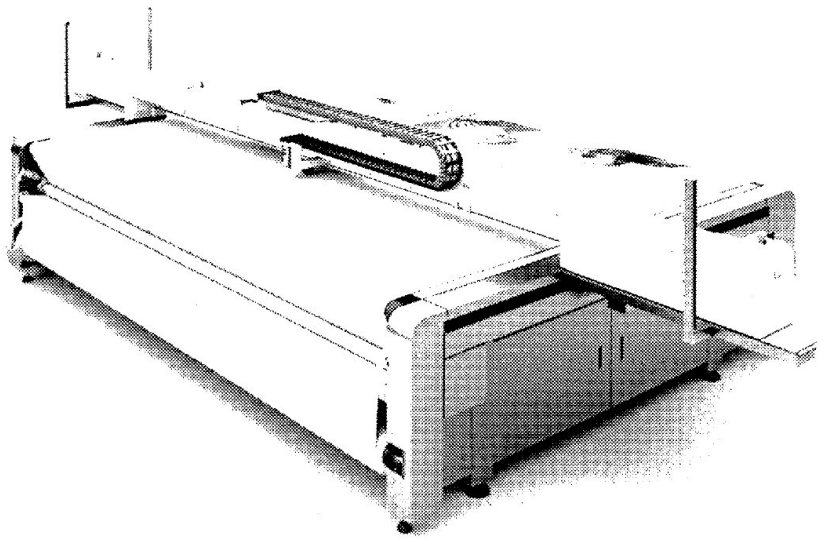


Roll to Roll option

Whether vinyl, tarpaulin, mesh or other roll stock, swissQprint systems can handle them all. And that across the full printing width of 2.5 metres (Oryx 2 / Impala 2) or 3.2 metres (Nyala 2). Setting up and changing rolls is easy, and once the job is started the machine continues working without supervision.

A well-designed, stable roller system conveys the material across the printing table and winds it up cleanly on the other side. An integrated control system regulates the tension and guarantees a perfect print image every time. When necessary, multiple colour layers can be applied in one pass and are absolutely register-true as a result.

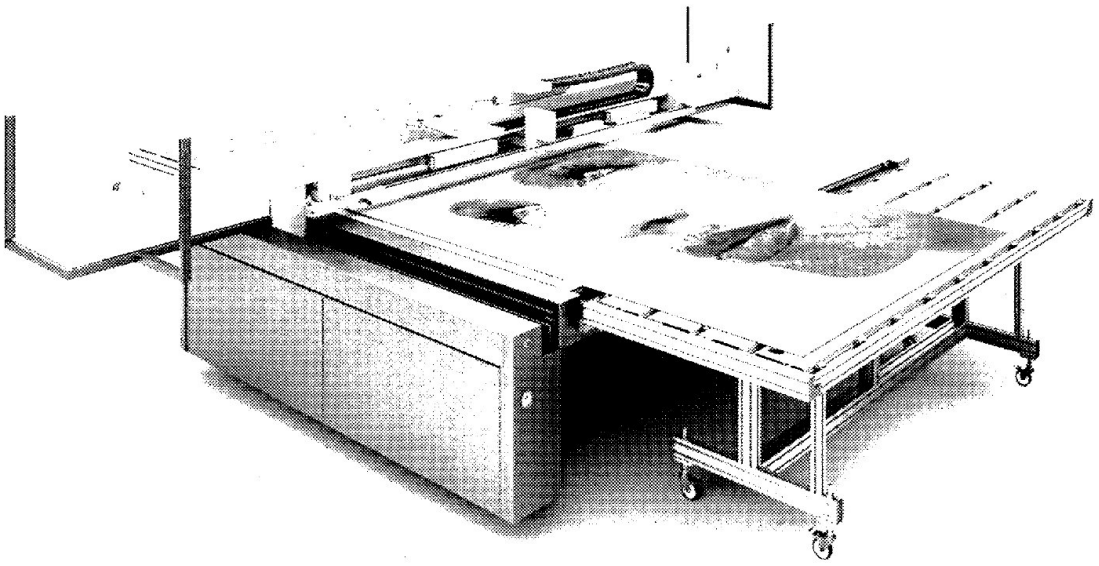
In addition, roll stock can be used as a conveyor for oversized rigid sheets of up to 4 metres in length. Roller tables dock on as extensions to the printing table for extra length. The control system ensures an accurate and steady feed even when printing heavy panels.



Board option

swissQprint systems equipped with the ingenious board option hold oversized panels and difficult roll media firmly in place under full-power vacuum during the printing process. When the printing beam reaches the end of the table, a sophisticated feed system takes over and advances the substrate automatically. Printing continues seamlessly as soon as the substrate is positioned exactly at the new zero origin.

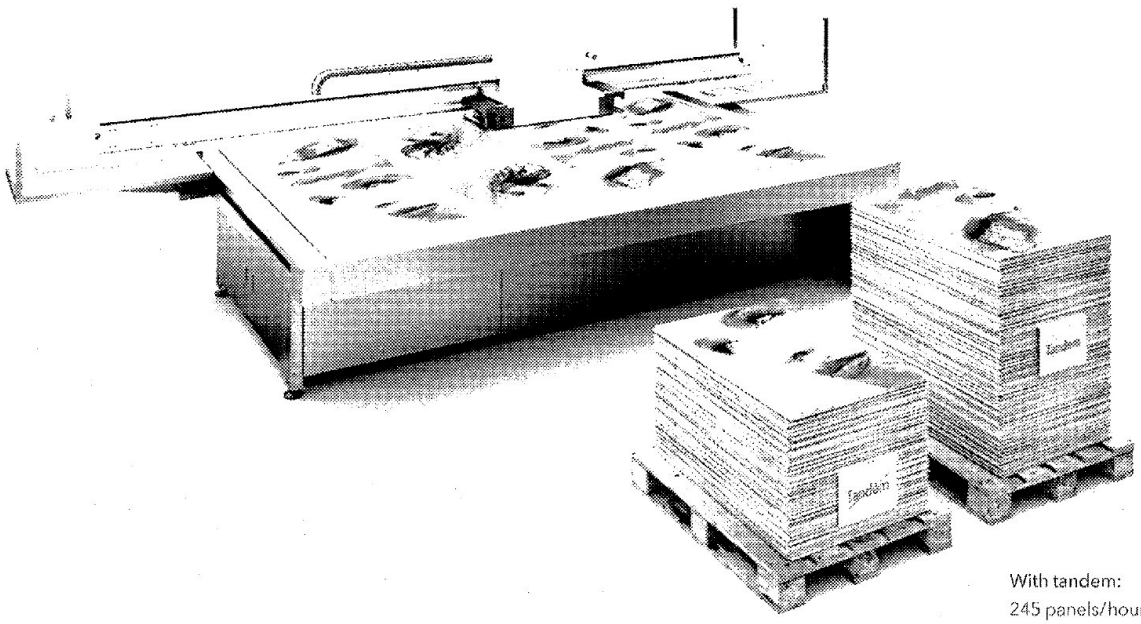
The appeal of this process lies in a combination of absolute precision and high efficiency. Flawless end-to-end printing on rigid media up to 4 metres long is a standard routine. The system really comes into its own when handling stretchy, heat-sensitive or very slippery substrates. Materials weighing up to 100 kg literally float across the table on an air cushion generated by reversing the vacuum system. Heavyweight substrates are thus effortlessly positioned.



Tandem

In tandem operation, machine and operator join forces for continuous, non-stop action: maximum productivity by the system, fitness training for personnel. The principle is straightforward: media can be loaded onto the printing table from both the front and rear. While printing is underway on one side, the operator loads the other side, and vice versa – so work continues without interruption.

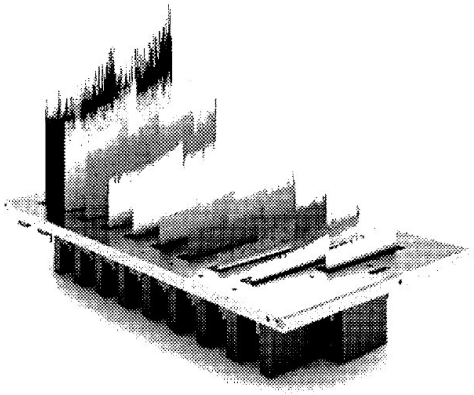
The vacuum table has front and rear sections, both with the usual continuous adjustment. A side benefit is that vacuum to the rear section can be shut off when normal jobs are being printed on the front section only – no masking needed.



With tandem:
245 panels/hour

Without tandem:
143 panels/hour

Practical test
Producing 700 × 1000 mm panels on a Nyala 2 in speed mode.
Result: 71 % higher productivity with tandem.

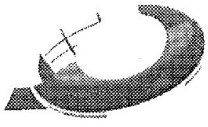


Colours

Inkjet printing is as colourful as the world around us. The systems' CMYK standard is expandable to nine colours: they include light colours for reproducing natural skin tones and fine shading, as well as white, special effects varnish and even primer for printing on glass. Special colours such as orange, violet and green expand the colour space further still for even more Pantone colour tones.

All of the UV-curing inks are VOC free. They bond on acrylic, aluminium composite panels, wood, tarpaulins, polyester, polycarbonate, polystyrene, (rigid foam) PVC, vinyl films, flexible foam panels, and numerous other media. Suitable materials may be stretched after printing without any signs of stress whitening in the colour, thanks to the adequately flexible ink.

Multilayer
Worth seeing from both sides. Apply an image, then a white coating followed by a blockout layer; recap the white coating and apply another image.



droptix
The eye-catcher par excellence. Lenses printed on transparent media work like a magnifying glass to produce optical 3D effects.

Effect varnish
A stunning 3D effect that is otherwise only accomplishable with screen printing. Apply effect varnish through one of the nine colour channels for visual and tactile enhancement.

Portfolio at a glance

Inkjet machines from swissQprint are built on modular lines. The flatbed construction provides a stable foundation for every model, from economy to top-of-the-line. Options can be added as required. That includes the continuous addition of newly developed features. Whichever machine is purchased, it will be a future-proof investment.

	Oryx 2	Impala 2	Nyala 2
Flatbed, full bleed	2500 × 2030 mm[1]		3200 × 2030 mm[1]
Clearance	maximum 50 mm		
Substrate weight	maximum 100 kg/m²		
Roll width	2500 mm		3200 mm
Roll weight	maximum 180 kg		
Roll diameter	maximum 360 mm		
Equipment/Options			
Tandem function	Standard		
Print area, Tandem each zone	2500 × 1015 mm[1]		3200 × 1015 mm[1]
Vacuum pump standard or strong[2]	2 pcs integrated		
Roll option[3]	2500 mm × endless		3200 mm × endless
Board option with extension tables	2500 × 4000 mm		3200 × 4000 mm
Colours			
Colour channels	4–9		
Print heads	maximum 9	maximum 18	
Print heads per channel	1	1 or 2	
Light Cyan, light Magenta, light Black	✓		
White	✓		
Varnish	✓		
Primer	✓		
Orange, Green, Violet, Spot (Pantone®)	✓		
Software			
Kea/droptix[4]	✓		
Step and Repeat/Shadow files	✓		
Multilayer	✓		
Material and Quality database	✓		
Statistics/ink consumption	✓		

[1] In most print modes
[2] external pumps in optional sound absorber boxes
[3] with a conveyor belt and extension tables boards up to 2500/3200 × 4000 mm can be printed
[4] if varnish channel is configured

Features

Media diversity

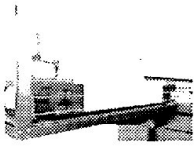
UV-curing inks adhere to acrylic, aluminium composite panels, wood, tarpaulins, polyester, polycarbonate, polystyrene, (high-density) PVC foam sheet, vinyl films, flexible foam panels, and with primer even on glass, anodised aluminium and stainless steel.

Homogenous white

White ink has a well-known tendency for sedimentation. swissQprint systems keep it agitated and circulated right down the print nozzles. Reliable print results are always assured, regardless of how often white is actually used.

First-level safety

Should something or someone breach the light curtain surrounding the beam, the print head carriage will slow down to warn as well as protect the operator. Meanwhile, printing continues and there are no rejects.



Targeted suction power

The vacuum system is steplessly adjustable along the width of the print bed. Masking is largely unnecessary. A higher-powered vacuum option is available for industrial applications and the Tandem function.

Second-level safety

Crash Sensor Technology prevents damage, for instance if the material thickness was entered incorrectly or corners on the medium are sticking out. The print head carriage is stopped immediately.

Vacuum inversion

The Quick Release button neutralises the vacuum in no time at all – and the substrate can be removed immediately. Thrust reversal creates an air cushion for effortless handling of heavy media.

Multiple points of origin

The simple, quickly set registration pins are a unique feature. In addition to defining the zero-origin, they also provide additional mechanical attachment points: format-independent, with as many as required to make efficient use of the printing table area.

Swiss Made

swissQprint systems are developed and manufactured in Switzerland and are characterised by precision, long service life, and robust quality down to the very last detail.

Technical specifications

Resolution	Oryx 2	Impala 2	Nyala 2
Variable drop size	9 - 42 picolitre		
Addressable resolution	360 dpi - 1080 dpi		
Visual resolution	up to 2160 dpi		
Print technology			
Piezoelectric inkjet technology (DOD)	✓		
Binary or greyscale	✓		
Software / RIP			
Output software on integrated PC	✓		
Caldera RIP server (Linux or OSX) Other RIPs available	✓		
Interface (data)	Fast Ethernet 1000Base-T		
Inks			
Integrated ink supply	colours in 5 litre containers, white, varnish and primer in 1 litre containers		
White feed and maintenance system	fully automated		
Low-odour UV-curable inks	✓		
Optimized for flexible & rigid media	✓		
Indoor and outdoor applications	✓		
Solvent-free (no VOCs)	✓		
Dimensions and weight			
Dimensions (L × W × H)	2.35 × 5.04 × 1.42 m		2.51 × 5.72 × 1.42 m
Weight[1]	1300-1600 kg		1400-1800 kg
Safety standards	meets or exceeds industry standards		
Installation environment			
Power supply	3 × 380-400V, 3L+N+PE 50/60 Hz, 16A (CEE16) / 32A (CEE 32) / 3 × 480V, 3L+N+PE 60 Hz / 3 × 208V, 3L+PE 50/60 Hz		
Power consumption	approx. 9.6-18.5 kVA	approx. 11.3-20.5 kVA	
Temperature range	+15°C to +30°C		
Relative humidity	35 % to 80 % non-condensing		

[1] depending on configuration

swissqprint

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EXHIBIT B

Me & my: SwissQprint Nyala

Wednesday 19 June 2013

Be the first to comment

"I'm a tight Yorkshireman, I don't part with money easily at all." So says James Dixon, managing director of Halifax-based display and merchandising specialist Retail Services Group.

Dixon: Weve worked this machine really hard

It might be expected, then, that in adding a new printing arm to the wet painting and powder coating, metal sheet manufacturing, design and retail display supply companies already in the group, Dixon would perhaps start off fairly conservatively. But this, explains Dixon, would not have been such a shrewd move.

When shopping for kit to set up a new in-house print arm, Dixon didn't want to do things by halves. He was keen to bring in-house as many of the display jobs the company outsourced before this as possible, and so was after the most productive and versatile machine he could lay his hands on. This he decided, after six months of research, was the SwissQprint Impala flatbed printer.

"It's a premium machine," says Dixon. "It is a bit more expensive than some of the others we looked at. But the way I view it, it's actually a more cost-effective machine. On production mode it produces at twice the rate of some of the others, but it's not twice the price."

Dixon looked at a whole range of other machines when researching the new print venture. Also in the running were flatbed printers from Fujifilm and Océ, and hybrid printers such as the machines in the EFI Vutek ranges. "Primarily where the other machines fell down is speed," reiterates Dixon. "We can run at 130sqm/hr in draft mode, 67sqm/hr in speed mode, 34sqm/hr in production mode and 23sqm/hr in quality mode, where the other machines were running at literally half that. That's a real boost to our output; it really helps us get through the volume of work."

Also clinching it for the Impala was quality. Again, not one to do things by halves, and keen to get his money's worth, Dixon really put all the machines he was looking at through their paces. "In selecting the machines we gave control images out to all the manufacturers and then our design director from All4Design did a blind image test," he reports. "He immediately selected all the Impala images."

Dixon puts this impressive quality down to the printhead quality, which allows the machine to achieve 1,350dpi in slow, high-quality mode he reports. Also important, is the light cyan and light magenta tones achievable. "Because we're running six colours, all the photo work is really of a different quality," he says. "Running the light cyan and light magenta inks means all the skin tones come out really well, as do the more subtle tones. We can also produce the really bright colours when we post process in RGB."

Clear channels

Also helping the company to process display and signage work stunning enough to grab the attention of fickle high-street shoppers is the option to have a clear gloss and white ink stream permanently in use. Whereas other machines' refresh systems don't always allow for these inks to be left in the machine on a permanent basis, the Impala's does, explains Dixon. "Some people can run six colours but can't then run a spot gloss, or they can't run a white as well as they don't have enough channels or they can't leave it in because the refresh system doesn't work in the same way. We can leave all channels in all the time," he says, explaining that this allows the company to be truly versatile in responding to its customer base's varying needs.

What Retail Print found it couldn't be quite as versatile as it wanted to be on, however, was the size of the banners, POS displays, textile signage and other wide-format materials they were printing. Happy as the company was with the productivity, quality and indeed reliability, of the machine, it felt something larger than the 2.5m size of the Impala was needed. So, even though the Impala was only installed last June, nine months later, Dixon upgraded it to its larger sibling, the Drupa-launched 3.2m-wide Nyala. Benefiting from the same technology, quality and speed – with the added bonus of a bigger format.

This again certainly wasn't the cheap option, and cost a "considerable" amount. But Dixon is thrilled with the results. "Now we can deal with the really large projects that other people can't address," he says. "Because we're in a bespoke industry, we don't know what tomorrow's challenge is going to be. But now we're able to handle rigid panels up 3.2m wide, 4m long, 50mm thick and 400kg in weight. The challenges we've had have been printing really wide perforated banner material for advertising, really long Dibond panels for signage and printing directly onto really large glass panels, with very intricate designs that couldn't be done in vinyl. We print onto structured cardboard panels for lightweight display work for some very well-known brands; these are very thick sections but we can still put them under the heads."

"Then we have a roll to roll system on it," continues Dixon. "So we could quite easily be producing textile materials or perforated materials on rolls up to 80kg, 3.2m wide again. We're doing those very large projects day in day out now."

Another bonus of making the upgrade has been gaining a dual-bed machine, adds Dixon. This further boosts the SwissQprint's already impressive productivity. "The Nyala has a tandem function that allows you to set up the front and the back of the bed separately, so while you're printing the work you have tiled on the front you can be tiling a job up on the back ready to print, then get ready to unload the front and so on," says Dixon, quipping: "That keeps the print operator really busy because he has to keep up with the machine."

He adds: "We literally ticked every box on the options list when we took both machines and anything I could have wished for on the Impala, we got by way of the release of the Nyala."

With two installations and bedding-in periods of course, comes a potentially doubled chance of service issues and teething problems. But this has not proved the case, reports Dixon. "We had the Impala installed and set up within a week. With the Nyala we were producing within three days; we were literally going straight into using the machine," he says, putting this down to the quality of set-up and training delivered by UK supplier Spandex.

Dixon can't comment on the quality of service support offered by Spandex, however. Not because this is a contentious matter, but because, with both machines proving highly reliable, this is not something Dixon has ever had cause to test out.

This is particularly impressive considering how hard Retail Print work the new Nyala, reports Dixon. "We've worked these machines really hard, probably harder than any other SwissQprint client so far, and they've proved themselves to be totally reliable," he says. "We're now running this printer 24 hours a day on three shifts."

Which of course provides more than a bit of a clue to how successful entering into a partnership with SwissQprint and Spandex has been in setting up an in-house print facility at Retail Services. "We've certainly got more than 12 new large clients and a good number of smaller clients as a direct result of having the print, which is significant turnover," reports Dixon. This means, he explains, that as well as boosting Retail Service's bottom line by saving money on outsourcing print work to other firms, the print arm is actually adding extra revenue to this too.

Group development

And having print expertise in-house is boosting the success of group in other ways than just financially. The product, merchandising, display and print design arm of Retail Services, All4Design, has been enhanced by having closer contact with those actually printing the displays being designed. Dixon says: "Thanks to the print facility our designs have been driven forward as well because we can do more, we've got a better understanding of the technical abilities of the machinery we've invested in. It's developed the group as a whole."

With the first 12 months of this new printing venture so successful, Dixon is keen to start expanding, The company is currently looking at purchasing further printing and cutting equipment but declined to reveal from which vendors. While Retail Print will continue to focus on digital print and cutting, a new Retail Signage venture, being launched this year will complement the design, metal-working, painting and installation companies already in the group, says Dixon.

"That's the big thing on the agenda for us in 2013," he reveals, "and having the print company helps us do that."

SPECIFICATIONS

Max print area standard model: 3.2x1.6m; with oversized roll to roll or board option: 3.2x4m

Max substrate thickness 50 mm

Max substrate weight 400kg

Roll width 3.2m

Max roll weight 80kg

Max roll diameter 360mm

Inks 4-9

Max number of printheads 18

Price from £175,000

Contact Spandex 01454 616444 www.spandex.com

COMPANY PROFILE

Retail Print was established in June last year as part of display and merchandising suppliers Retail Services Group. The print arm works in conjunction with the All4Design arm of the group which creates bespoke displays for high-street retailers. Clients include Morrisons, Home Retail Group and Arcadia.

Why it was bought...

The SwissQprint Impala was purchased last June along with a Kongsberg iXP44 cutting table and other peripheral finishing equipment such as laminators, to establish Retail Print. The company upgraded to a wider format Nyala in March this year to increase the range of work it could process, and to boost productivity.

How it has performed...

The company's reasons for choosing this brand over the other flatbed and hybrid options they looked at have held true, reports group managing director James Dixon. The printers have both delivered high-quality print at high speeds, he says, and have proved very reliable.

EXHIBIT C

Office Products › Office & School Supplies › Printer Ink & Toner › Inkjet Printer Ink

Q-Imaging Q-Print New Replacement Toner Cartridge for HP C4092A, Canon EP-22 (Q-92A)

by Q-Imaging

1 customer review

List Price: ~~$45.95~~
Price: $15.18& **FREE Shipping**
You Save: $30.77 (67%)

In Stock.
Ships from and sold by ECOMax.

Estimated Delivery Date: Sept. 16 - 21 when you choose Standard at checkout.

Package Quantity: **1**

Share

Qty: 1

$15.18 + Free Shipping
In Stock. Sold by **ECOMax**

Sell on Amazon Add to Cart

Turn on 1-Click ordering for this browser

Ship to:
PA 19082

Style Name: **Black**

- Manufactured for top quality replacement performance of HP 1100 series, Canon LBP 800, EP-22, manufacturer's reference #C4092A
- Black toner cartridge
- 100% brand new, not used, recycled or re-manufactured.
- Quality and performance tested to be on par with original manufacturer replacement cartridges.
- ISO9001 Quality System certified. 2 year manufacturer's warranty.

11 new from $12.98

Have one to sell?

Special Offers and Product Promotions

Package Quantity: 1 | Style Name: Black

- Your cost could be **$0.00 instead of $15.18**! Get a **$30.00 gift card instantly** upon approval for the **Amazon.com Rewards Visa Card**. Apply now.

Product Description

Package Quantity:1 | Style Name:Black

You do have a choice! And you don't have to compromise on quality. Q-Brand cartridges are 100% NEW. Nothing in our products is ever used or recycled or otherwise re-manufactured. Q-Brand cartridges have been independently tested and have been shown to be on par in terms of quality and performance with the original equipment manufacturer's replacement cartridges. Q-Brand cartridges are made under strict manufacturing standards and are guaranteed to work with the printers and business machines specified, without infringing on manufacturers' patents or affecting printer manufacturers' warranties. ISO9001 Quality System certified. Q-Brand, the Original Alternative.

Product Details

Package Quantity: 1 | Style Name: Black

Shipping Weight: 2.4 pounds (View shipping rates and policies)

Domestic Shipping: Item can be shipped within U.S.

International Shipping: This item is not eligible for international shipping. Learn More

ASIN: B000CCDCNS

Item model number: Q-92A

Average Customer Review: ☆☆☆☆☆ (1 customer review)

Amazon Best Sellers Rank:

#20084In Electronics > Accessories & Supplies > Computer Accessories > Printer Ink & Toner > **Inkjet Printer Ink**

#23613in Electronics > Accessories & Supplies > Computer Accessories > Printer Ink & Toner > **Laser Printer Drums & Toner**

#54617in Electronics > Accessories & Supplies > **Office Electronics Accessories**

Would you like to **update product info, give feedback on images**, or **tell us about a lower price**?

Customer Questions & Answers

Typical questions asked about products:

- Is the item durable?
- Is this item easy to use?
- What are the dimensions of this item?

Customer Reviews

1

4.0 out of 5 stars

5 star	0%	Share your thoughts with other customers
4 star	100%	
3 star	0%	Write a customer review
2 star	0%	
1 star	0%	

See the customer review

Most Helpful Customer Reviews

2 of 2 people found the following review helpful

A good drop-in replacement cartridge

By mr_creosote on January 22, 2012

Style Name: Black Item Package Quantity: 1 Verified Purchase

Search Customer Reviews

Definitely rates four stars as a quality replacement toner cartridge for my older HP-1100. Office Depot sells one for $70, not counting tax. Delivery was quick, and no hassle to remove/replace. No ink streaks, blank stipes, or ink blobs. Try this, you'll like it.

Comment Was this review helpful to you? Yes No

See the customer review

Write a customer review

Want to discover more products?Check out this page to see more: laser printers

EXHIBIT D

Flatbed digital printer

From Wikipedia, the free encyclopedia

Flatbed Digital printing is the reproduction of digital images using inkjet printing, typically on plastic or paperboard, although a wide variety of materials can be printed (common, photographic paper, film, cloth, plastic, etc.). Flatbed digital printers use inks made of acrylic monomers that are then exposed to strong UV-light to cure, or polymerize them. This process allows for printing on a wide variety of surfaces such as wood or metal, carpet, tile, and even glass. The adjustable printing bed makes it possible to print on surfaces ranging in thickness from a sheet of paper often up to as much as several inches. Typically used for commercial applications (retail and event signage), flatbed printing is often a substitute for screen-printing. Since no printing plates or silkscreens must be produced, digital printing technology allows shorter runs of signs to be produced economically. Environmentally, flatbed digital printing is based on a more sustainable system than its commercial predecessor of solvent printing as it produces fewer waste cartridges and less indoor air pollution.

Contents

The advantage of flatbed digital printing

The biggest advantage that you can get from flatbed digital printing is the versatility that they offer. No matter what material, what shape, and what size of the material you want to print on, as long as it has a flat surface and does not exceed the maximum size of printable area of the flatbed, you can print on it. The resolution of prints produced by these devices is also very high and they can print in quick speed. The ink consumption of the device is also very efficient and you are able to use the ink as optimally as possible.

See also

- Digital printing
- Variable Data Printing
- Digital image acquisition
- Digital image processing
- Digital image display
- Graphical output device

References

External links

- Flatbed Printing Solutions (http://www.lavaprint.com)
- Flatbed Printing inks (http://www.artisink.com)
- Small Flatbed Printing system (http://www.brotherjet.com)
- direct to garment printer (http://www.dtgjet.com)
- The Evolution of UV Flatbed Technology (http://digitaloutput.net/content/ContentCT.asp?P=2474)

EXHIBIT E

Toner cartridge

From Wikipedia, the free encyclopedia

A **toner cartridge**, also called **laser toner**, is the consumable component of a laser printer. Toner cartridges contain toner powder, a fine, dry mixture of plastic particles, carbon, and black or other coloring agents that make the actual image on the paper. The toner is transferred to paper via an electrostatically charged drum unit, and fused onto the paper by heated rollers during the printing process.

Contents

Variants

Low-end to mid-range laser printers typically contain two consumable parts: the toner cartridge itself (which has a typical life of 2,000 pages) and the drum unit (a typical life of 40,000 pages). Some toner cartridges incorporate the drum unit in the design and therefore replacing the toner means replacing the drum unit every single time, although some consider this type unessential and therefore not cost-effective. Toner Cartridges are similar to ink cartridges, which are used in Inkjet printing.

Price

Toner cartridges can be expensive, sometimes exceeding the cost of cheaper laser printers. As a result some people dispose of the printer when it is out of toner (thereby negating any "green" or "eco friendly" claims made by the manufactures) and replace the entire machine. Ironically, new machines generally come with toners that are only ⅓ full. Consumers also can opt to buy generic brand laser toners, manufactured by companies other than the printer manufacturer. These toners are widely available at a fraction of the price of the genuine brand replacement. Toner refill kits are also an option, allowing the consumer to simply refill an empty cartridge.

Cartridge types

Genuine - Also known as "Original Equipment Manufacturer" or "OEM"[1]

> These are manufactured by printer manufacturers. Manufacturers offer certain guarantees when you use genuine brand toner in your printer and makes certain threats if you don't, voiding warranty is a typical accusation made, although in many countries this is illegal (Chapter 50 › § 2302› Literal C of Magnuson-Moss Warranty Improvement Act. makes this illegal in U.S.[2]) . Genuine cartridges are more expensive than refills, compatibles or re-manufactured cartridges, however you can reduce the difference in price dramatically by purchasing cartridges from a specialist retailer.

Compatible - Also known as "Generic" or "Alternative Brand"

> These cartridges are manufactured from scratch, they are not used cartridges that have been refilled or re-manufactured. They are produced by a third party companies and sold under different brand names. Often compatible cartridges may vary slightly in look, design and page yield to their genuine counterparts due to certain patents that restrict the exact copying of designs. Although some might say these generic cartridges are less reliable, they are undoubtedly a cost-effective alternative to the genuine article and many have exceeded the quality of the OEM. They can also be manufactured to contain more ink than the OEM versions, depending on the design of the cartridge itself (and cost aspects as well).

Re-manufactured

> A process by which the OEM or other compatible cartridge is dismantled after the first use. Any worn or defective parts are replaced and the cartridge is cleaned then it is refilled with toner. The re-manufacturing process differs from one factory to another, as well as the quality of toner that the cartridge is filled with. These are important factors to take into account when purchasing re-manufactured toner cartridges because they can ultimately lead to leaking, printer malfunction, or even damaging the printer altogether.

Availability

Remanufactured, compatible, OEM and refilled toner cartridges are available from a variety of sources. While compatible and OEM cartridges are typically items that can be purchased off-the-shelf, companies that offer remanufactured cartridges typically require the customer to provide an empty cartridge, which is then remanufactured and provided back to the customer.

Although the remanufacturing process relies on there being an empty cartridge available, some companies (a handful of larger chain stores) are able to offer remanufactured cartridges off-the-shelf in the same manner that OEM and compatible cartridges are purchased. This is a factor of their size and volume which allows cartridges to be remanufactured centrally in bulk and later inventoried at store level to be picked up as an off-the-shelf item by the consumer. Worldwide, not many companies make empty cartridges. They buy the used cartridges from users through the scrap dealers, refurbish them and keep them ready for sale.

Sustainability

Each brand new toner cartridge requires the burning of over 2 quarts of petroleum in the manufacturing process. In North America alone, more than 200 million litres of petroleum are used to sustain the production of new toner cartridges with the majority of these cartridges ending up in the worlds landfills once empty. Manufactures have responded by developing recycling programs for their used cartridges. On August 1, 2011 Hewlett Packard issued a press release showing their recycling process involves a partnership with an Asian firm that reuses plastic collected from the empty cartridges.

Advocates[3][4] of more environmentally friendly processes claim that using refilled and remanufactured toner cartridges are much more environmentally friendly than using brand name new cartridges. Refilled and remanufactured cartridges reduce the dependency on petroleum that otherwise would have been used in the manufacture process of the new cartridge. Advocates also claim that the recycling programs devised by manufacturers are not always as environmentally friendly as consumers might think or in comparison to other options that may be available.

HP's recycling program involves the recycling of cartridges in partnership with a company in Asia. The process uses significant amounts of petroleum in the collection of empty cartridges on one continent and in transporting them half way around the world to be recycled. In this example, walking to your local remanufacturer is certainly more sustainable than the aforementioned process.

Lexmark also has a similar program which they claim is in place to assure that as many empties as possible are collected and reused.[5] The program is called the "Prebate return program". In their prebate model the toner cartridges are always owned by Lexmark and consumers purchase the right to use the cartridge until empty. Once empty, Lexmark requires that the cartridges are returned to Lexmark. Since the prebate program cartridges are much more inexpensive to purchase from Lexmark, consumers are pushed into choosing those cartridges over the non prebate program cartridges.

Advocates claim that since empty prebate cartridges are "owned" by Lexmark; and since Lexmark expressly forbids the remanufacturing or recycling of the cartridge by anyone other than themselves; and since third party remanufacturers cannot therefore remanufacture the empty cartridges; and since the majority of cartridges are never returned to Lexmark, the result is that the prebate program actually ensures fewer cartridges are recycled and customers are more often required to purchase brand name OEM cartridges.

See also

- Ink cartridge

- Compatible ink
- Toner refill
- Inkjet printing

References

1. ^ "HP BLACK/WHITE Remanufactured Toners" (http://www.monoprice.com/products/product.asp?c_id=107&cp_id=10705&cs_id=1070501&p_id=9033&seq=1&format=2). Monoprice. Retrieved 26 August 2013.
2. ^ "Magnuson-Moss Warranty Improvement Act." (http://www.law.cornell.edu/uscode/text/15/2302). Cornell University Law School. Retrieved 21 April 2014.
3. ^ Remanufactured Toner Cartridges: High Quality Standards (http://www.lasercycleusa.com/toner-cartridges/remanufactured-cartridges/)
4. ^ [1] (http://www.stopwaste.org/docs/toner.pdf)
5. ^ Judge, Tricia (2004). *What is the Lexmark Prebate return program?* (http://WWW.I-ITC.ORG).

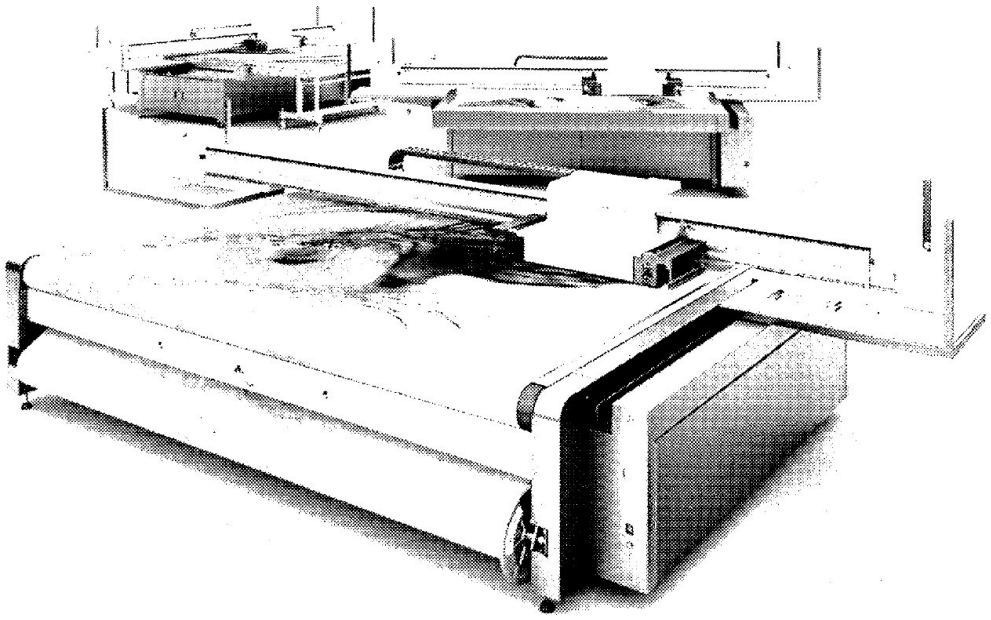
External links

- How Laser Printers Work (http://computer.howstuffworks.com/laser-printer.htm) - HowStuffWorks
- International Imaging Technology Council (http://www.i-itc.org/)

Retrieved from "http://en.wikipedia.org/w/index.php?title=Toner_cartridge&oldid=605159508"
Categories: Computer printers | Office equipment

Product Portfolio

High-End UV Inkjet Systems



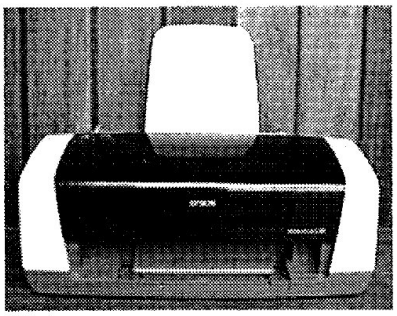
swissqprint

EXHIBIT F

Inkjet printing

From Wikipedia, the free encyclopedia

Inkjet printing is a type of computer printing that recreates a digital image by propelling droplets of ink onto paper, plastic, or other substrates.[1] Inkjet printers are the most commonly used type of printer,[2] and range from small inexpensive consumer models to expensive professional machines



An Epson inkjet printer

The concept of inkjet printing originated in the 19th century, and the technology was first extensively developed in the early 1950s. Starting in the late 1970s inkjet printers that could reproduce digital images generated by computers were developed, mainly by Epson, Hewlett-Packard (HP), and Canon. In the worldwide consumer market, four manufacturers account for the majority of inkjet printer sales: Canon, HP, Epson, and Lexmark, a 1991 spin-off from IBM.[3]

The emerging ink jet material deposition market also uses inkjet technologies, typically printheads using piezoelectric crystals, to deposit materials directly on substrates.

There are two main technologies in use in contemporary inkjet printers: continuous (CIJ) and Drop-on-demand (DOD).

Contents

Continuous inkjet

The continuous inkjet (CIJ) method is used commercially for marking and coding of products and packages. In 1867 Lord Kelvin patented the syphon recorder, which recorded telegraph signals as a continuous trace on paper using an ink jet nozzle deflected by a magnetic coil. The first commercial devices (medical strip chart recorders) were introduced in 1951 by Siemens.[4]

In CIJ technology, a high-pressure pump directs liquid ink from a reservoir through a gunbody and a microscopic nozzle, creating a continuous stream of ink droplets via the Plateau-Rayleigh instability. A piezoelectric crystal creates an acoustic wave as it vibrates within the gunbody and causes the stream of liquid to break into droplets at regular intervals: 64,000 to 165,000 droplets per second may be achieved. The ink droplets are subjected to an electrostatic field created by a charging electrode as they form; the field varies according to the degree of drop deflection desired. This results in a controlled, variable electrostatic charge on each droplet. Charged droplets are separated by one or more uncharged "guard droplets" to minimize electrostatic repulsion between neighbouring droplets.

The charged droplets pass through another electrostatic field and are directed (deflected) by electrostatic deflection plates to print on the receptor material (substrate), or allowed to continue on undeflected to a collection gutter for re-use. The more highly charged droplets are deflected to a greater degree. Only a small fraction of the droplets is used to print, the majority being recycled.

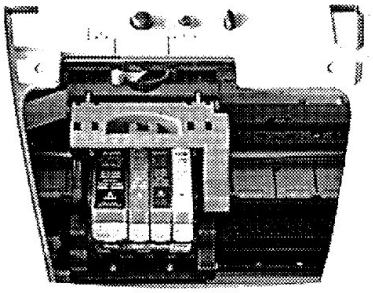
CIJ is one of the oldest ink jet technologies in use and is fairly mature. The major advantages are the very high velocity (~50 m/s) of the ink droplets, which allows for a relatively long distance between print head and substrate, and the very high drop ejection frequency, allowing for very high speed printing. Another advantage is freedom from nozzle clogging as the jet is always in use, therefore allowing volatile solvents such as ketones and alcohols to be employed, giving the ink the ability to "bite" into the substrate and dry quickly.

The ink system requires active solvent regulation to counter solvent evaporation during the time of flight (time between nozzle ejection and gutter recycling), and from the venting process whereby air that is drawn into the gutter along with the unused drops is vented from the reservoir. Viscosity is monitored and a solvent (or solvent blend) is added to counteract solvent loss.

Drop-on-demand

Drop-on-demand (DOD) is divided into thermal DOD and piezoelectric DOD.

Thermal DOD

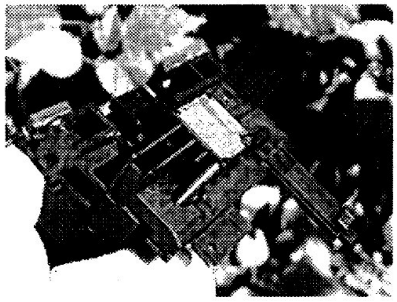


A Canon inkjet with CMYK cartridges

Most consumer inkjet printers, including those from Canon, Hewlett-Packard, and Lexmark, use the thermal inkjet process. The idea of using thermal excitation to move tiny drops of ink was developed independently by two groups at roughly the same time: John Vaught and a team at Hewlett-Packard's Corvallis Division, and Canon engineer Ichiro Endo. Initially, in 1977, Endo's team was trying to use the piezoelectric effect to move ink out of the nozzle but noticed that ink shot out of a syringe when it was accidentally heated with a soldering iron. Vaught's work started in late 1978 with a project to develop fast, low-cost printing. The team at HP found that thin-film resistors could produce enough heat to fire an ink droplet. Two years later the HP and Canon teams found out about each other's work.[5][6]

In the thermal inkjet process, the print cartridges consist of a series of tiny chambers, each containing a heater, all of which are constructed by photolithography. To eject a droplet from each chamber, a pulse of current is passed through the heating element causing a rapid vaporization of the ink in the chamber and forming a bubble, which causes a large pressure increase, propelling a droplet of ink onto the paper (hence Canon's trade name of *Bubble Jet*). The ink's surface tension, as well as the condensation and resultant contraction of the vapor bubble, pulls a further charge of ink into the chamber through a narrow channel attached to an ink reservoir. The inks involved are usually water-based and use either pigments or dyes as the colorant. The inks must have a volatile component to form the vapor bubble; otherwise droplet ejection cannot occur. As no special materials are required, the print head is generally cheaper to produce than in other inkjet technologies.

Piezoelectric DOD



Piezoelectric printing nozzle of an EPSON C20 printer.

Most commercial and industrial inkjet printers and some consumer printers (those produced by Epson and Brother Industries) use a piezoelectric material in an ink-filled chamber behind each nozzle instead of a heating element. When a voltage is applied, the piezoelectric material changes shape, generating a pressure pulse in the fluid, which forces a droplet of ink from the nozzle. Piezoelectric (also called Piezo) inkjet allows a wider variety of inks than thermal inkjet as there is no requirement for a volatile component, and no issue with kogation (buildup of ink residue), but the print heads are more expensive to manufacture due to the use of piezoelectric material (usually PZT, lead zirconium titanate).

A DOD process uses software that directs the heads to apply between zero to eight droplets of ink per dot, only where needed. Piezo inkjet technology is often used on production lines to mark products. For instance, the "use-before" date is often applied to products with this technique; in this application the head is stationary and the product moves past. Requirements of this application are high speed, a long service life, a relatively large gap between the print head and the substrate, and low operating cost.

Ink formulations

The basic problem with inkjet inks is the conflicting requirements for a coloring agent that will stay on the surface vs. rapid dispersement of the carrier fluid.

Desktop inkjet printers, as used in offices or at home, tend to use aqueous inks based on a mixture of water, glycol and dyes or pigments. These inks are inexpensive to manufacture, but are difficult to control on the surface of media, often requiring specially coated media. HP inks contain sulfonated polyazo black dye (commonly used for dying leather), nitrates and other compounds. Aqueous inks are mainly used in printers with thermal inkjet heads, as these heads require water to perform.

While aqueous inks often provide the broadest color gamut and most vivid color, most are not waterproof without specialized coating or lamination after printing. Most Dye-based inks, while usually the least expensive, are subject to rapid fading when exposed to light or ozone. Pigment-based aqueous inks are typically more costly but provide much better long-term durability and ultraviolet resistance. Inks marketed as "Archival Quality" are usually pigment-based.

Some professional wide format printers use aqueous inks, but the majority in professional use today employ a much wider range of inks, most of which require piezo inkjet heads and extensive maintenance:

Solvent inks

the main ingredient of these inks are volatile organic compounds (VOCs), organic chemical compounds that have high vapor pressures. Color is achieved with pigments rather than dyes for excellent fade-resistance. The chief advantage of solvent inks is that they are comparatively inexpensive and enable printing on flexible, uncoated vinyl substrates, which are used to produce vehicle graphics, billboards, banners and adhesive decals. Disadvantages include the vapour produced by the solvent and the need to dispose of used solvent. Unlike most aqueous inks, prints made using solvent-based inks are generally waterproof and ultraviolet-resistant (for outdoor use) without special over-coatings. The high print speed of many solvent printers demands special drying equipment, usually a combination of heaters and blowers. The substrate is usually heated immediately before and after the print heads apply ink. Solvent inks are divided into two sub-categories: *hard solvent* ink offers the greatest durability without specialized over-coatings but requires specialized ventilation of the printing area to avoid exposure to hazardous fumes, while *Mild or "Eco" solvent* inks, while still not as safe as aqueous inks, are intended for use in enclosed spaces without specialized ventilation of the printing area. Mild solvent inks have rapidly gained popularity in recent years as their color quality and durability have increased while ink cost has dropped significantly.

UV-curable inks

these inks consist mainly of acrylic monomers with an initiator package. After printing, the ink is cured by exposure to strong UV-light. Ink is exposed to UV radiation where a chemical reaction takes place where the photo-initiators cause the ink components to cross-link into a solid. Typically a shuttered mercury-vapor lamp or UV LED is used for the curing process. Curing processes with high power for short periods of times (microseconds) allow curing inks on thermally sensitive substrates. UV inks do not evaporate, but rather cure or set as a result from this chemical reaction. No material is evaporated or removed, which means about 100% of the delivered volume is used to provide coloration. This reaction happens very quickly, which leads to

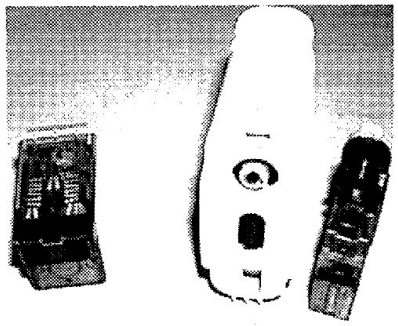
instant drying that results in a completely cured graphic in a matter of seconds. This also allows for a very fast print process. As a result of this instant chemical reaction no solvents penetrate the substrate once it comes off the printer, which allows for high quality prints.[7][8] The advantage of UV-curable inks is that they "dry" as soon as they are cured, they can be applied to a wide range of uncoated substrates, and they produce a very robust image. Disadvantages are that they are expensive, require expensive curing modules in the printer, and the cured ink has a significant volume and so gives a slight relief on the surface. Though improvements are being made in the technology, UV-curable inks, because of their volume, are somewhat susceptible to cracking if applied to a flexible substrate. As such, they are often used in large "flatbed" printers, which print directly to rigid substrates such as plastic, wood or aluminium where flexibility is not a concern.

Dye sublimation inks

these inks contain special sublimation dyes and are used to print directly or indirectly on to fabrics which consist of a high percentage of polyester fibres. A heating step causes the dyes to sublimate into the fibers and create an image with strong color and good durability.

Head design

There are two main design philosophies in inkjet head design: *fixed-head* and *disposable head*. Each has its own strengths and weaknesses.



Inkjet heads: disposable head (left) and fixed head (right) with ink cartridge (middle)

Fixed head

The *fixed-head* philosophy provides an inbuilt print head (often referred to as a *gaiter- head*) that is designed to last for the life of the printer. The idea is that because the head need not be replaced every time the ink runs out, consumable costs can be made lower and the head itself can be more precise than a cheap disposable one, typically requiring no calibration. On the other hand, if a fixed head is damaged, obtaining a replacement head can become expensive, if removing and replacing the head is even possible. If the printer's head cannot be removed, the printer itself will then need to be replaced.

Fixed head designs are available in consumer products, but are more likely to be found on industrial high-end printers and large format plotters. In the consumer space, fixed-head printers are manufactured primarily by Epson and Canon. Hewlett-Packard also offers a few fixed-head models, such as the HP OfficeJet Pro X576dw.[9] Industrial fixed-head print heads are manufactured by these companies: Kodak Versamark, Trident, Xaar, Spectra (Dimatix), Hitachi / Ricoh, HP Scitex, Brother, Konica Minolta, Seiko Epson, and ToshibaTec (a licensee of Xaar).[10]

Disposable head

The *disposable head* philosophy uses a print head which is supplied as a part of a replaceable ink cartridge. Every time a cartridge is exhausted, the entire cartridge and print head are replaced with a new one. This adds to the cost of consumables and makes it more difficult to manufacture a high-precision

head at a reasonable cost, but also means that a damaged or clogged print head is only a minor problem: the user can simply buy a new cartridge. Hewlett-Packard has traditionally favoured the disposable print head, as did Canon in its early models. This type of construction can also be seen as an effort by printer manufacturers to stem third party ink cartridge assembly replacements, as these would-be suppliers don't have the ability to manufacture specialized print heads.

An intermediate method does exist: a disposable ink tank connected to a disposable head, which is replaced infrequently (perhaps every tenth ink tank or so). Most high-volume Hewlett-Packard inkjet printers use this setup, with the disposable print heads used on lower volume models. A similar approach is used by Kodak, where the printhead intended for permanent use is nevertheless inexpensive and can be replaced by the user. Canon now uses (in most models) replaceable print heads which are designed to last the life of the printer, but can be replaced by the user should they become clogged.

Cleaning mechanisms

The primary cause of inkjet printing problems is due to ink drying on the printhead's nozzles, causing the pigments and dyes to dry out and form a solid block of hardened mass that plugs the microscopic ink passageways. Most printers attempt to prevent this drying from occurring by covering the printhead nozzles with a rubber cap when the printer is not in use. Abrupt power losses, or unplugging the printer before it has capped the printhead, can cause the printhead to be left in an uncapped state. Even when the head is capped, this seal is not perfect, and over a period of several weeks the moisture (or other solvent) can still seep out, causing the ink to dry and harden. Once ink begins to collect and harden, the drop volume can be affected, drop trajectory can change, or the nozzle can completely fail to jet ink.

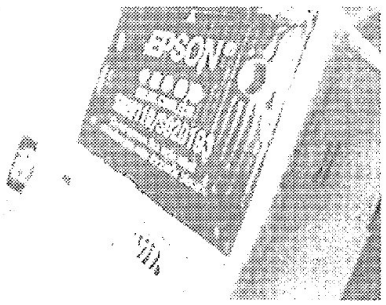
To combat this drying, nearly all inkjet printers include a mechanism to reapply moisture to the printhead. Typically there is no separate supply of pure ink-free solvent available to do this job, and so instead the ink itself is used to remoisten the printhead. The printer attempts to fire all nozzles at once, and as the ink sprays out, some of it wicks across the printhead to the dry channels and partially softens the hardened ink. After spraying, a rubber wiper blade is swept across the printhead to spread the moisture evenly across the printhead, and the jets are again all fired to dislodge any ink clumps blocking the channels.

Some printers use a supplemental air-suction pump, utilizing the rubber capping station to suck ink through a severely clogged cartridge. The suction pump mechanism is frequently driven by the page feed stepper motor: it is connected to the end of the shaft. The pump only engages when the shaft turns backwards, hence the rollers reversing while head cleaning. Due to the built-in head design, the suction pump is also needed to prime the ink channels inside a new printer, and to reprime the channels between ink tank changes.

Professional solvent- and UV-curable ink wide-format inkjet printers generally include a "manual clean" mode that allows the operator to manually clean the print heads and capping mechanism and to replace the wiper blades and other parts used in the automated cleaning processes. The volume of ink used in these printers often leads to "overspray" and therefore buildup of dried ink in many places that automated processes are not capable of cleaning.

The ink consumed in the cleaning process needs to be collected to prevent ink from leaking in the printer. The collection area is called the spittoon, and in Hewlett Packard printers this is an open plastic tray underneath the cleaning/wiping station. In Epson printers, there is typically a large absorption pad in a pan underneath the paper feed platen. For printers several years old, it is common for the dried ink in the spittoon to form a pile that can stack up and touch the printheads, jamming the printer. Some larger professional printers using solvent inks may employ a replaceable plastic receptacle to contain waste ink and solvent which must be emptied or replaced when full.

There is a second type of ink drying that most printers are unable to prevent. For ink to spray from the cartridge, air must enter to displace the removed ink. The air enters via an extremely long, thin labyrinth tube, up to 10 cm long, wrapping back and forth across the ink tank. The channel is long and narrow to reduce moisture evaporation through the vent tube, but some evaporation still occurs and eventually the ink cartridge dries up from the inside out. To combat this problem, which is especially acute with professional fast-drying solvent inks, many wide-format printer cartridge designs contain the ink in an airtight, collapsible bag that requires no vent. The bag merely shrinks until the cartridge is empty.



Labyrinth air vent tubes on the top of an Epson Stylus Photo 5-color ink tank. The long air channels are molded into the top of the tank and the blue label seals the channels into long tubes. The yellow label is removed prior to installation, and opens the tube ends to the atmosphere so that ink can be sprayed onto the paper. Removing the blue label would destroy the tubes and cause the moisture to quickly evaporate

The frequent cleaning conducted by some printers can consume quite a bit of ink and has a great impact on cost-per-page determinations.

Clogged nozzles can be detected by printing a standard test pattern on the page. Some software workaround methods are known for re-routing printing information from a clogged nozzle to a working nozzle.[11]

Advantages

Compared to earlier consumer-oriented color printers, inkjets have a number of advantages. They are quieter in operation than impact dot matrix or daisywheel printers. They can print finer, smoother details through higher printhead resolution, and many consumer inkjets with photographic-quality printing are widely available.

In comparison to more expensive technologies like thermal wax, dye sublimation, and laser printing, inkjets have the advantage of practically no warm up time, and lower cost per page. However, low-cost laser printers can have lower per-page costs, at least for black-and-white printing, and possibly for color.

For some inkjet printers, monochrome ink sets are available either from the printer manufacturer or from third-party suppliers. These allow the inkjet printer to compete with the silver-based photographic papers traditionally used in black-and-white photography, and provide the same range of tones: neutral, "warm" or "cold". When switching between full-color and monochrome ink sets, it is necessary to flush out the old ink from the print head with a cleaning cartridge. Special software or at least a modified device driver are usually required, to deal with the different color mapping.

Some types of inkjet printers are capable of very high speed printing. One commercial high speed ink jet printer can print on 30-inch (76 cm) wide web at 200 metres (660 ft) per minute.[12]

Disadvantages

Many "intelligent" ink cartridges contain a microchip that communicates the estimated ink level to the printer; this may cause the printer to display an error message, or incorrectly inform the user that the ink cartridge is empty. In some cases, these messages can be ignored, but some inkjet printers will refuse to print with a cartridge that declares itself empty, to prevent consumers from refilling cartridges. For example, Epson embeds a chip which prevents printing when the chip claims the cartridge is empty, although a researcher who over-rode the system found that in one case he could print up to 38% more good quality pages, even though the chip stated that the cartridge was empty.[13] Third-party ink suppliers sell ink cartridges at significant discounts (at least 10–30% off OEM cartridge prices, sometimes up to 95%), and also bulk ink and cartridge self-refill kits at even lower prices. Many vendors' "intelligent" ink cartridges have been reverse-engineered. It is now possible to buy inexpensive devices to reliably reset such cartridges to report themselves as full, so that they may be refilled many times.

Long-term durability of early inkjet prints was quite poor, though improved ink formulations have greatly improved this attribute. See the section on durability for more information.

The very narrow inkjet nozzles are prone to clogging. The ink consumed cleaning them—either during cleaning invoked by the user, or in many cases, performed automatically by the printer on a routine schedule—can account for a significant proportion of the ink used in the machine. Inkjet printing head nozzles can be cleaned using specialized solvents; or by soaking in warm distilled water for short periods of time, for water-soluble inks.

Third-party ink and cartridges

The high cost of OEM ink cartridges and the intentional obstacles to refilling them have been addressed by the growth of third-party ink suppliers. Many printer manufacturers discourage customers from using third-party inks, stating that they can damage the print heads due to not being the same formulation as the OEM inks, cause leaks, and produce inferior-quality output (e.g. of incorrect color gamut). *Consumer Reports* has noted that some third-party cartridges may contain less ink than OEM cartridges, and thus yield no cost savings,[14] while Wilhelm Imaging Research claims that with third-party inks the lifetime of prints may be considerably reduced.[15] However, an April 2007 review showed that, in a double-blind test, reviewers generally *preferred* the output produced using third-party ink over OEM ink.[16] In general, OEM inks have undergone significant system reliability testing with the cartridge and print-head materials, whereas R&D efforts on third-party ink material compatibility is likely to be significantly less. Some inkjet manufacturers have tried to prevent cartridges being refilled using various schemes including fitting chips to the cartridges that logs how much the cartridge has printed and prevent the operation of a refilled cartridge.

The warranty on a printer may not apply if the printer is damaged by the use of non-approved supplies. In the US the Magnuson–Moss Warranty Act is a federal law which states that warrantors cannot require that only brand name parts and supplies be used with their products, as some printer manufacturers imply. However, this would not apply if non-approved items cause damage. In the UK, a printer manufacturer cannot lawfully impose such conditions as part of its warranty (Regina Vs Ford Motor Company refers) although many attempt to do so illegally. As long as the product used was sold as being for the printer it was used in then the sale of goods act applies - anything so sold must be "of merchandisable quality and fit for purpose" in any case under UK law the retailer not the manufacturer is legally liable for 2 years on electrically operated items and is therefore where one must seek redress. [17]

Durability

Inkjet documents can have poor to excellent archival durability, depending on the quality of the inks and paper used. If low-quality paper is used, it can yellow and degrade due to residual acid in the untreated pulp; in the worst case, old prints can literally crumble into small particles when handled. High-quality inkjet prints on acid-free paper can last as long as typewritten or handwritten documents on the same paper.

Because the ink used in many low-cost consumer inkjets is water-soluble, care must be taken with inkjet -printed documents to avoid even the smallest drop of moisture, which can cause severe "blurring" or "running". In extreme cases, even sweaty fingertips during hot humid weather could cause low-quality inks to smear. Similarly, water-based highlighter markers can blur inkjet-printed documents and discolor the highlighter's tip. The lifetime of inkjet prints produced using aqueous inks is generally shorter (although UV-resistant inks are available) than those produced with solvent-based inkjets; however, so-called "archival inks" have been produced for use in aqueous-based machines which offer extended life.

In addition to smearing, gradual fading of many inks can be a problem over time. Print lifetime is highly dependent on the quality and formulation of the ink. The earliest inkjet printers, intended for home and small office applications, used dye-based inks. Even the best dye-based inks are not as durable as pigment-based inks, which are now available for many inkjet printers. Many inkjet printers now utilize pigment based inks which are highly water resistant: at least the black ink is often pigment-based. Resin or silicone protected photopaper is widely available at low cost, introducing complete water and mechanical rub resistance for dye and pigment inks. The photopaper itself must be designed for pigment or for dye inks, as pigment particles are too large to be able to penetrate through dye-only photopaper protection layer.

The highest-quality inkjet prints are often called "giclée" prints, to distinguish them from less-durable and lower-cost prints. However, the use of the term is no guarantee of quality, and the inks and paper used must be carefully investigated before an archivist can rely on their long-term durability.

Operating cost tradeoffs

Inkjets use solvent-based inks which have much shorter expiration dates compared to laser toner, which has an indefinite shelf life. Inkjet printers tend to clog if not used regularly, whereas laser printers are much more tolerant of intermittent use. Inkjet printers require periodical head cleaning, which consumes a considerable amount of ink, and will drive printing costs higher especially if the printer is unused for long periods.

If an inkjet head becomes clogged, third-party ink solvents/head cleaners and replacement heads are available in some cases. The cost of such items may be less expensive compared to a transfer unit for a laser printer, but the laser printer unit has a much longer lifetime between required maintenance. Many inkjet printer models now have permanently installed heads, which cannot be economically replaced if they become irreversibly clogged, resulting in scrapping of the entire printer. On the other hand, inkjet printer designs which use a disposable printhead usually cost significantly more per page than printers using permanent heads. By contrast, laser printers do not have printheads to clog or replace frequently, and usually can produce many more pages between maintenance intervals.

Inkjet printers have traditionally produced better quality output than color laser printers when printing photographic material. Both technologies have improved dramatically over time, although the best quality giclee prints favored by artists use what is essentially a high-quality specialized type of inkjet printer.

Business model

A common business model for inkjet printers involves selling the actual printer at or below production cost, while dramatically marking up the price of the (proprietary) ink cartridges (a profit model called "Freebie marketing"). Most current inkjet printers attempt to enforce this product tying by anticompetitive measures such as microchips in the cartridges to hinder the use of third-party or refilled ink cartridges. The microchips monitor usage and report the ink remaining to the printer. Some manufacturers also impose "expiration dates". When the chip reports that the cartridge is empty (or out of date) the printer stops printing. Even if the cartridge is refilled, the microchip will indicate to the printer that the cartridge is depleted. For many models (especially from Canon), the 'empty' status can be overridden by entering a 'service code' (or sometimes simply by pressing the 'start' button again).[18] For some printers, special circuit "flashers" are available that reset the quantity of remaining ink to the maximum.[19][20][21][22]

Microchips from Epson ink cartridges. These are tiny printed circuit boards; a deposit of black epoxy covers the chip itself

Some manufacturers, most notably Epson and Hewlett Packard, have been accused of indicating that a cartridge is depleted while a substantial amount of ink remains.[23][24] A 2007 study found that most printers waste a significant quantity of ink when they declare a cartridge to be empty. Single-ink cartridges were found to have on average 20% of their ink remaining, though actual figures range from 9% to 64% of the cartridge's total ink capacity, depending on the brand and model of printer.[25][26] This problem is further compounded with the use of one-piece multi-ink cartridges, which are declared empty

as soon as one color runs low. Of great annoyance to many users are those printers that will refuse to print documents requiring only black ink, just because one or more of the color ink cartridges is depleted.

In recent years, many consumers have begun to challenge the business practices of printer manufacturers, such as charging up to US$8,000 per gallon (US$2,100 per liter) for printer ink.[27] Alternatives for consumers are cheaper copies of cartridges, produced by third parties, and the refilling of cartridges, using refill kits. Due to the large differences in price caused by OEM markups, there are many companies selling third-party ink cartridges. Most printer manufacturers discourage refilling disposable cartridges or using aftermarket copy cartridges, and say that use of incorrect inks may cause poor image quality due to differences in viscosity, which can affect the amount of ink ejected in a drop, and color consistency, and can damage the printhead. Nonetheless, the use of alternative cartridges and inks has been gaining in popularity, threatening the business model of printer manufacturers. Printer companies such as HP, Lexmark, and Epson have used patents and the DMCA to launch lawsuits against third-party vendors.[28][29] An anti-trust class-action lawsuit was launched in the US against HP and office supply chain Staples Inc, alleging that HP paid Staples $100 million to keep inexpensive third -party ink cartridges off the shelves.[30][31]

In Lexmark Int'l v. Static Control Components, the United States Court of Appeals for the Sixth Circuit ruled that circumvention of this technique does not violate the Digital Millennium Copyright Act.[32] The European Commission also ruled this practice anticompetitive: it will disappear in newer models sold in the European Union. [33] While the DMCA case dealt with copyright protection, companies also rely on patent protection to prevent copying and refilling of cartridges. For example, if a company devises all of the ways in which their microchips can be manipulated and cartridges can be refilled and patents these methods, they can prevent anyone else from refilling their cartridges. Patents protecting the structure of their cartridges prevent the sale of cheaper copies of the cartridges. For some printer models (notably those from Canon) the manufacturer's own microchip can be removed and fitted to a compatible cartridge thereby avoiding the need to replicate the microchip (and risk prosecution). Other manufacturers embed their microchips deep within the cartridge in an effort to prevent this approach.

In 2007 Eastman Kodak entered the inkjet market with its own line of All-In-One printers based on a marketing model that differed from the prevailing practice of selling the printer at a loss while making large profits on replacement ink cartridges. Kodak claimed that consumers could save up to 50 percent on printing by using its lower cost cartridges filled with the company's proprietary pigmented colorants while avoiding the potential problems associated with off-brand inks.[34] This strategy proved unsuccessful and Kodak exited the consumer inkjet printer business in 2012.

Professional inkjet printers

In addition to the widely used small inkjet printers for home and office, there are professional inkjet printers, some for "page-width" format printing and many for wide format printing. *Page-width format* means that the print width ranges from about 8.5" to 37" (about 20 cm to 100 cm). "Wide format" means print width ranging from 24" up to 15' (about 75 cm to 5 m). The most common application of page-width printers is in printing high-volume business communications that do not need high-quality layout and color. Particularly with the addition of variable data technologies, the page-width printers are

important in billing, tagging, and individualized catalogs and newspapers. The application of most wide format printers is in printing advertising graphics; a lower-volume application is printing of design documents by architects or engineers. But nowadays there are inkjet printers for digital textile printing up to 64" wide with good High Definition image 1440x720 dpi.[35][36]

Another specialty application for inkjets is producing prepress color proofs for printing jobs created digitally. Such printers are designed to give accurate color rendition of how the final image will look (a "proof") when the job is finally produced on a large volume press such as a four-colour offset lithography press. An example is an Iris printer, whose output is what the French term Giclée was coined for.

The largest-volume supplier is Hewlett-Packard, which supply over 90 percent of the market for printers for printing technical drawings. The major products in their Designjet series are the Designjet 500/800, the Designjet T Printer series (including the T1100 and T610), the Designjet 1050 and the Designjet 4000/4500. They also have the HP Designjet 5500, a six-color printer that is used especially for printing graphics as well as the new Designjet Z6100 which sits at the top of the HP Designjet range and features an eight colour pigment ink system.

Epson, Kodak, and Canon also manufacture wide-format printers, sold in much smaller numbers than standard printers. Epson has a group of 3 Japanese companies around it that predominantly use Epson piezo printheads and inks: Mimaki, Roland, and Mutoh.

Scitex Digital Printing developed high-speed, variable-data, inkjet printers for production printing, but sold its profitable assets associated with the technology to Kodak in 2005 who now market the printers as Kodak Versamark™ VJ1000, VT3000, and VX5000 printing systems. These roll-fed printers can print at up to 1000 feet per minute.

Professional high-volume inkjet printers are made by a range of companies. These printers can range in price from US$35,000 to $2 million. Carriage widths on these units can range from 54" to 192" (about 1.4 to 5 m), and ink technologies have tended toward solvent, eco-solvent, and UV-curing with a more recent focus toward water-based (aqueous) ink sets. Major applications where these printers are used are for outdoor settings for billboards, truck sides and truck curtains, building graphics and banners, while indoor displays include point-of-sales displays, backlit displays, exhibition graphics, and museum graphics.

The major suppliers for professional wide- and grand-format printers include: EFI,[37] LexJet, Grapo, Inca, Durst, Océ, NUR (now part of Hewlett-Packard), Lüscher, VUTEk, Scitex Vision (now part of Hewlett-Packard), Mutoh, Mimaki, Roland DG, Seiko I Infotech, IQDEMY,[38] Leggett and Platt, Agfa, Raster Printers, DGI and MacDermid ColorSpan (now part of Hewlett-Packard), swissqprint.

Professional inkjet photo printers

Inkjet printers for professional photo printing use up to 10 different inks (photo magenta, photo cyan, yellow, magenta, red, cyan, photo black, matte black, gray and one chroma optimiser for black density and uniform glossiness), with 4800x2400 dpi. They can print an image of 36 megapixels on A3

borderless photo paper with 444 ppi, and can also print to CD/DVD discs.[39] Other professional photo printers have twelve different tanks (the ten colors above plus Light Gray and Dark Gray for monchrome or low-light photos).[40]

Printing of functional materials

- Three-dimensional printing constructs a prototype by "printing" appreciably thick cross-sections of material on top of one another.
- U.S. Patent 6,319,530 describes a "Method of photocopying an image onto an edible web for decorating iced baked goods". In other words, this invention enables one to inkjet print a food-grade color photograph on a birthday cake's surface. Many bakeries now carry these types of decorations, which are printable using edible inks and dedicated inkjet printers. Edible ink printing can be done using normal home use inkjet printers like Canon Bubble Jet printers with edible ink cartridges installed, and using rice paper or frosting sheets.[41]
- Inkjet printers and similar technologies are used in the production of many microscopic items. See Microelectromechanical systems.
- Inkjet printers are used to form conductive traces for circuits, and color filters in LCD and plasma displays.
- Inkjet printers, especially models produced by Dimatix (now part of Fujifilm), Xennia Technology and Pixdro, are in fairly common use in many labs around the world for developing alternative deposition methods that reduce consumption of expensive, rare, or problematic materials. These printers have been used in the printing of polymer, macromolecular, quantum dot, metallic nanoparticles, carbon nanotubes etc. The applications of such printing methods include organic thin-film transistors, organic light emitting diodes, organic solar cells, sensors, etc.[42]
- Inkjet technology is used in the emerging field of bioprinting.

Alternative trade names

Images produced on inkjet printers are sometime sold under other names since the term is associated with words like "digital", "computers", and "everyday printing", which can have negative connotations in some contexts.[43] These trade names or coined terms are usually used in the fine arts reproduction field. They include Digigraph, Iris prints (or Giclée), and Cromalin.

See also

- Additive manufacturing
- Batch coding machine
- Cardboard engineering
- Digital printing
- Edgeline printing
- Inkjet paper
- Inkjet refill kit
- Inkjet transfer
- Intelligent Interweaving technology
- ISO Standards for colour ink jet printers
- IS&T

- Laser printing
- Memjet printing
- Microfluidics
- Photo printing
- Society for Imaging Science and Technology
- Thermal printing
- Tonejet
- Water-jet printer

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External links

- Inkjet Printing of Ceramic Tiles (http://digitalfire.com/4sight/education/inkjet_decoration_of_ceramic_tiles_344.html)
- Inkjet printing (http://www.youtube.com/watch?v=tagP1XhWPI8), information video from the University of Sheffield