

**EXAMINATION OF  
PHOTOCOPIES &  
PRINT OUTS**



# What is a photocopy????

- It is a copy of usually written or printed material made with a process in which an image is formed by the action of light usually on an electrically charged surface.

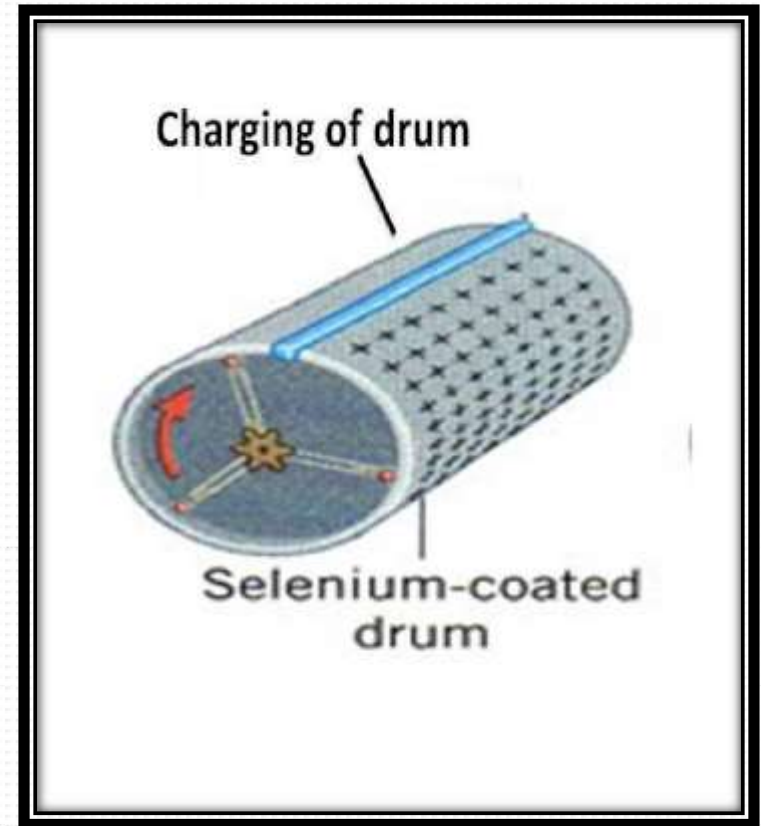


## Contd....

- It is also called xerography, which was derived from two Greek words “**xeros**” , meaning *dry* and “**graphos**” , meaning writing.
- Xerography was invented in the late 1930s by an American patent lawyer named Chester Carlson. It is a printing and photocopying technique that works on the basis of electrostatic charges.

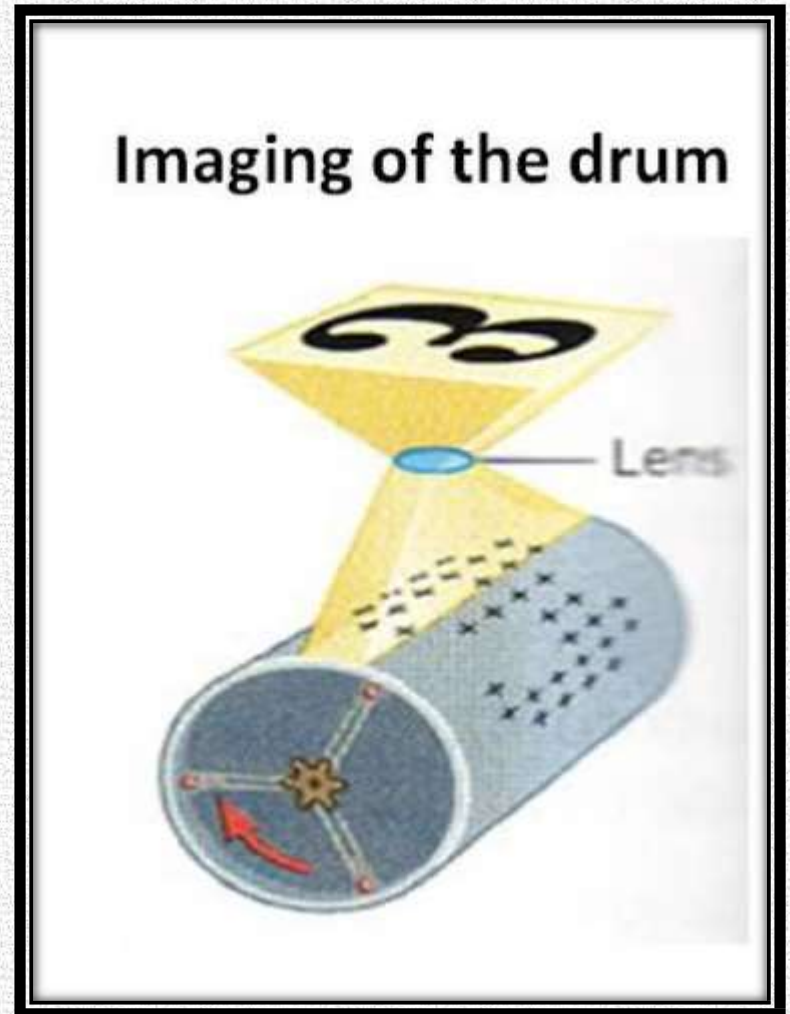
# How does photocopier machine works???

- To produce photocopies of an original document, the photocopy machine first makes a temporary image, a sort of negative of the original.
- Inside the machine is cylinder or drum made of a highly conductive metal, usually aluminum, coated with a photoconductive, often selenium.



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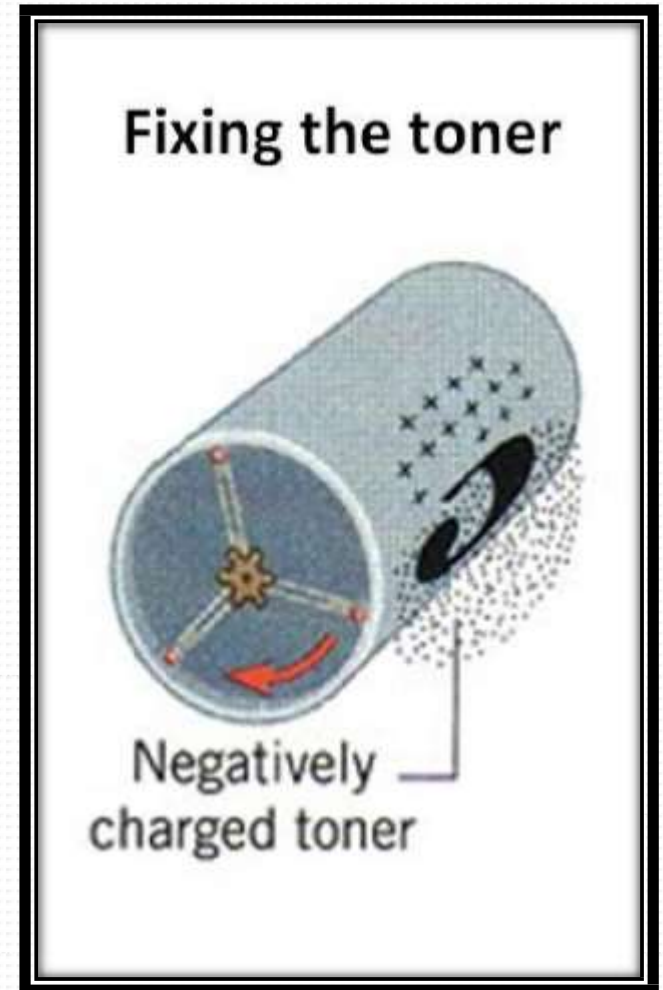
- The surface of the drum is then charged using LED or laser light source.
- The printed area of the original document will form positive charge on the drum, forming a latent image of the printed matter.





## Contd....

- The charge on the image area is used to attract the negative toner particles to make the image visible on the drum surface.
- A stronger electrical charge of the same type is given to the paper. This causes toner to transfer from drum to paper.



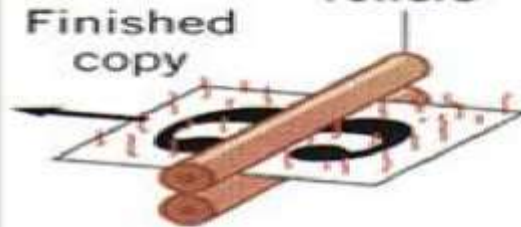
## Contd....

- The toner is adhered or fixed to the paper by heat and pressure.
- A lamp or hot roller melts the toner, which is absorbed into the paper.

Transferring of toner to the paper

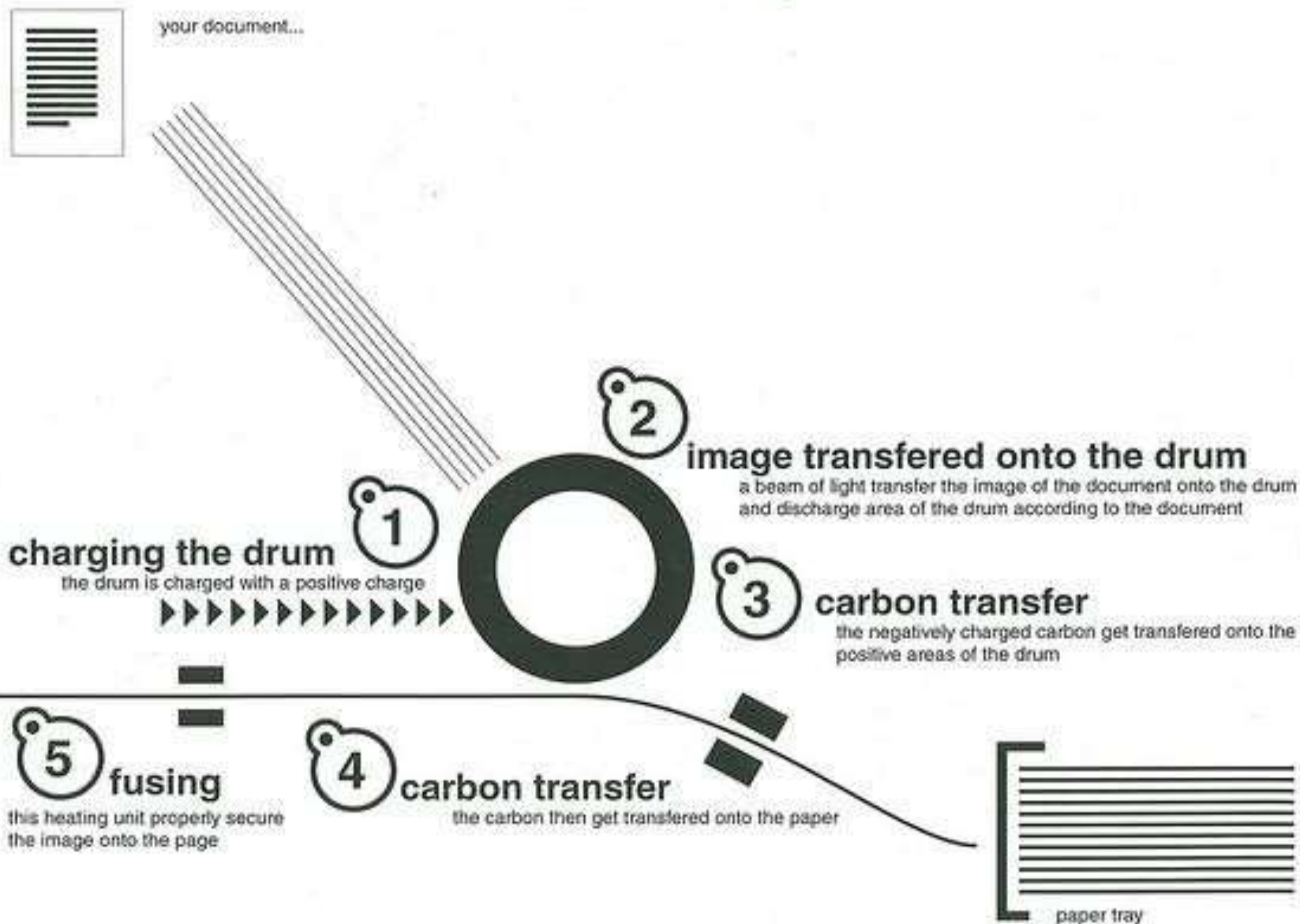


Heated pressure rollers



Melting the toner into the paper

# The working of a xerox machine





# Handling of photocopied documents

- Photocopied exhibits should be stored in paper folders not plastic. Plastic will stick to the exhibit affecting any future chemical analysis of the photocopier toner.

# Examination of photocopies

This can be done by analyzing:

1. Paper type
2. Photocopying toner
3. Machine characteristics

# Paper type

- The paper weight and dimensions will be specified by the photocopier manufactures.
- To create a charge sensitive surface the paper is coated with zinc oxide.

# Toner type

- 1. *Dry toner*** –it contains the discrete resinous particles, which can be best examined by IR spectroscopy and Pyrolysis mass spectroscopy. Dry toner has a raised, glossy appearance on the paper.
- 2. *Liquid toner*** - Liquid toner appears to dye the individual paper fibers and can be examined under stereomicroscope (10X magnification) and SEM.

# Machine characteristics

- Apart from those marks which are characteristic of a model other individual marks of the photocopier appear on a copy caused by dirt, damage or malfunction of the machine.
- Trash marks are the most significant marks formed randomly on the photocopies due to dust or damage on the machine.



## Contd...

- These trash marks may appear in group just like cluster of stars.
- The marks on platen will occur each time the document is copied.
- The marks on the drum will occur regularly but not with same frequency as copies are produced. It may show at different places on successive copies.
- Other problems can also occur due to defects in the corona wire which charges the drum and paper.

# Color photocopy

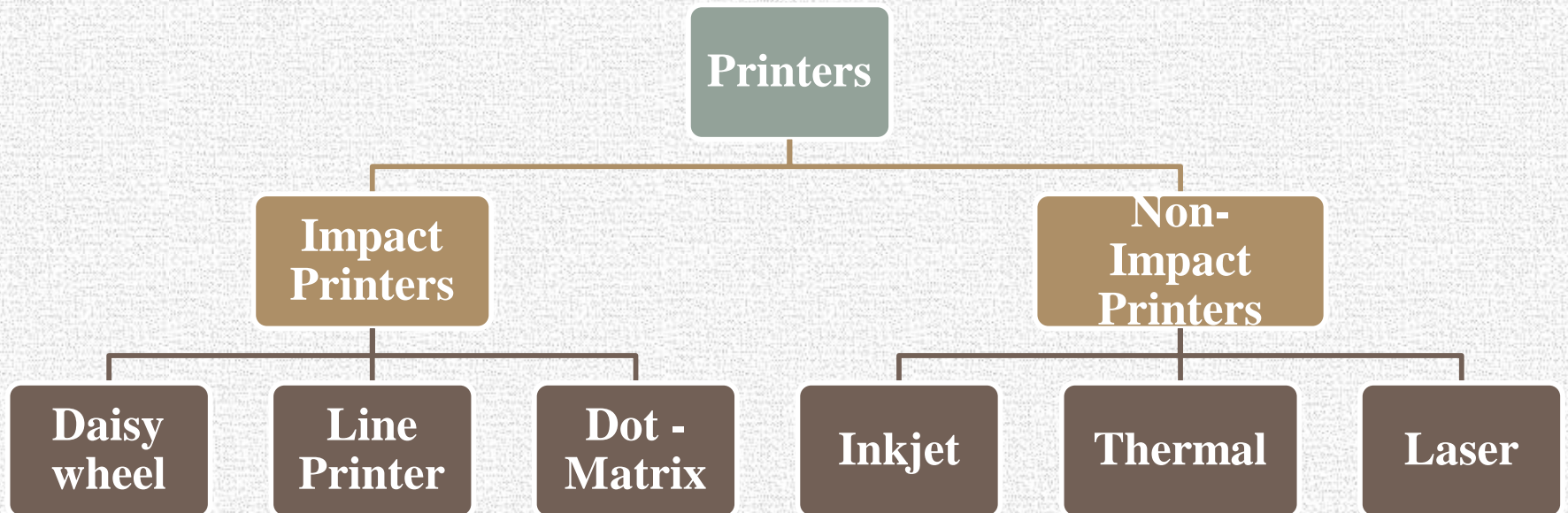
- Full color photocopy machines were first introduced in 1969.
- Color Photocopy Machine which has four color independent drums CMYK (C-CYAN, M-MAGENTA, Y-YELLOW, K-BLACK).
- It works on the principle of laser printer.

# Computer printer?????

A computer printer is a peripheral device that produces a hard copy of any data like graphics, images, text stored in a computer connected to it.



# Types of Printers



# Daisywheel printers

- The daisy wheel is a disk made of plastic or metal on which characters stand out in relief along the outer edge.
- To print a character, the printer rotates the disk until the desired letter is facing the paper.



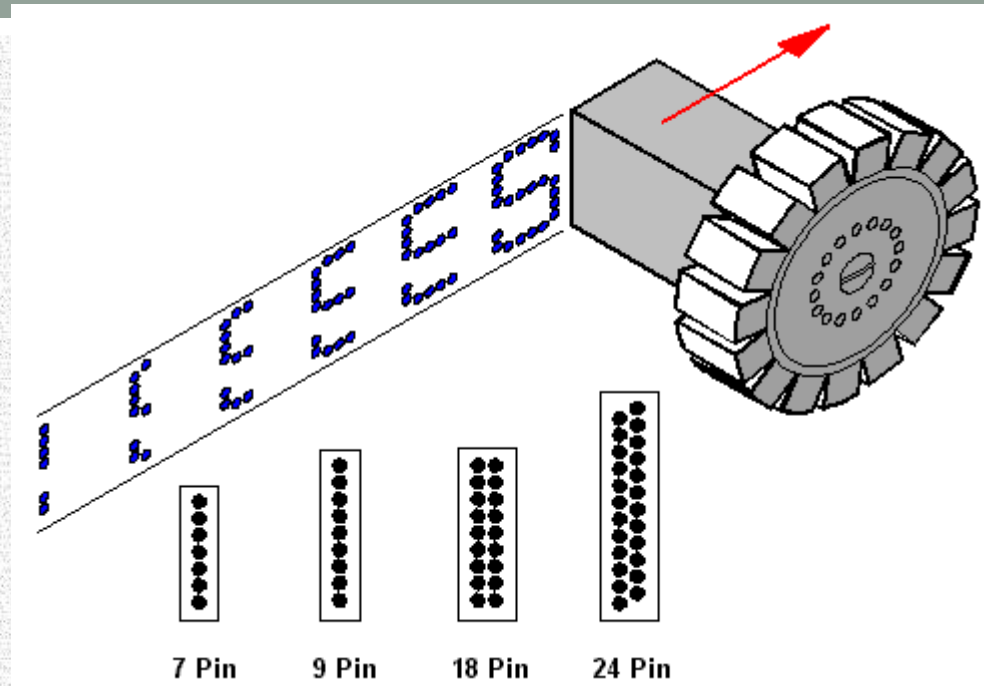


# Contd...

- Then a hammer strikes the disk, forcing the character to hit an ink ribbon, leaving an impression of the character on the paper.
- Daisy-wheel printers cannot print graphics, and in general they are noisy and slow.
- With the excessive use of laser jet and inkjet printers, daisywheel printers are becoming obsolete.

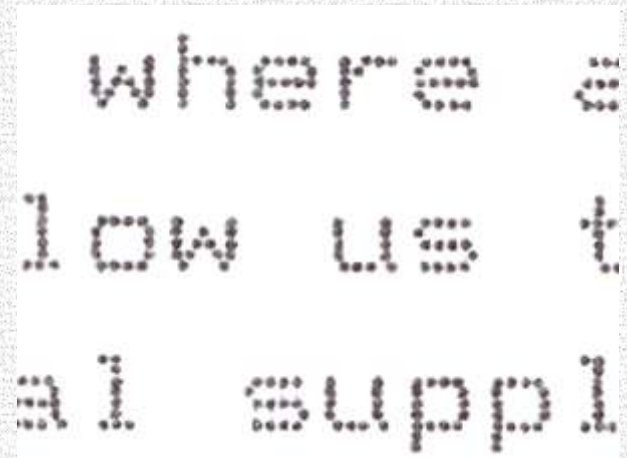
# Dot matrix printer

- Contains printing heads in form of pins, which print the character as a group of dots or matrix.
- The density of matrix depends on the print head, it may contain 9-pins or 24-pins.
- The pins are stacked vertically in the print head which are struck by hammer to give impression (solenoid action).



# Identifying character of Dot matrix printer

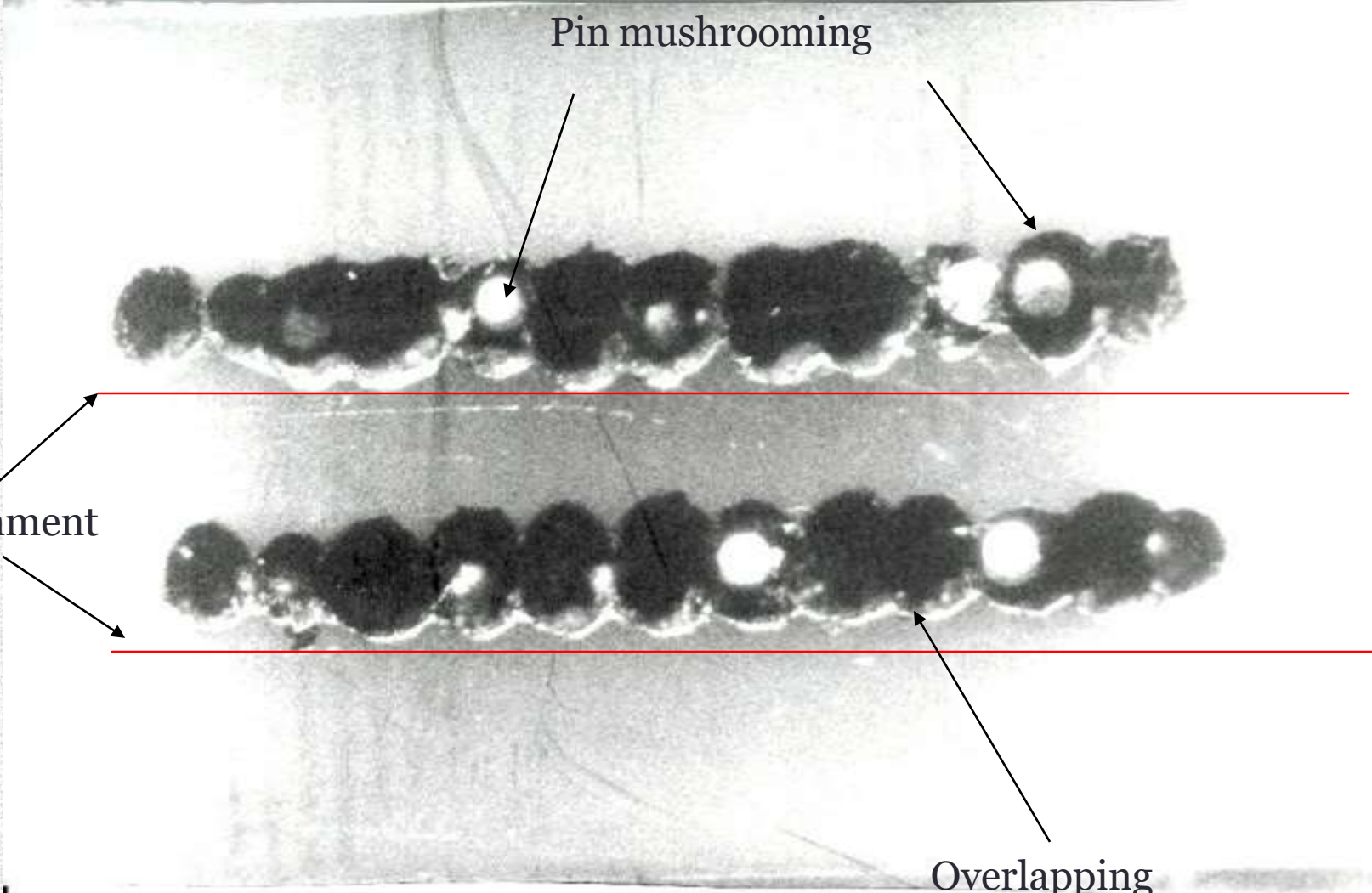
- Diameter of individual pin
- Defects in the printing heads
- Alignment defects causing disproportionate spacing between pins



Pin mushrooming

Alignment

Overlapping





# Advantages of dot matrix over daisywheel

- It was faster than daisy wheel printers.
- It was reliable.
- It could print graphics as well as text.
- Its consumable were of low cost.
- Printer designs were miniaturized to fit on a desk.



# Line printers

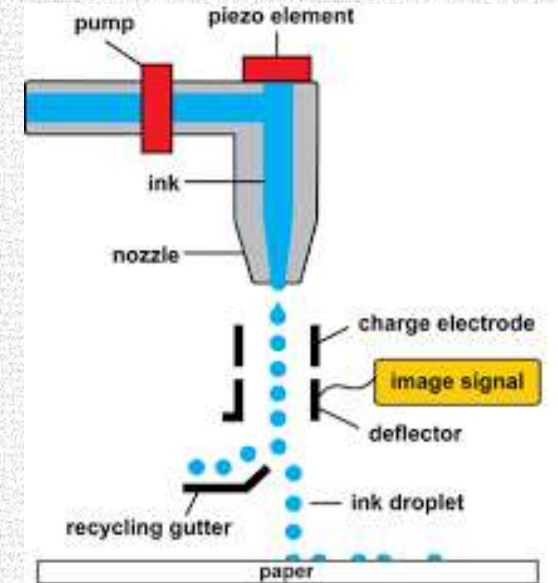
- A high-speed printer capable of printing an entire line at one time.
- A fast line printer can print as many as 3,000 lines per minute.
- The disadvantages of line printers are that they cannot print graphics, the print quality is low, and they are very noisy.



FAULT INFLUENCE TEST DATA				1.00 MM ZONE OF INFLUENCE			
CASE 1							
16.21	7.20	SAMPLE SECTION SIZE, 1 FAULTS					
MODELS 2 & 1	0	0.00000	.86836	1	.06583	.13164	
MODELS 3 & 1	0	0.00000	.86836	1	.01945	.13164	
CASE 2							
16.14	6.76	SAMPLE SECTION SIZE, 2 FAULTS					
MODELS 2 & 1	0	0.00000	.85349	1	.07318	.14651	
MODELS 3 & 1	0	0.00000	.85349	1	.02160	.14651	
CASE 3							
15.94	6.97	SAMPLE SECTION SIZE, 2 FAULTS					
MODELS 2 & 1	0	0.00000	.87369	1	.06310	.12631	
MODELS 3 & 1	0	0.00000	.87369	1	.01866	.12631	
CASE 4							
15.94	8.44	SAMPLE SECTION SIZE, 1 FAULTS					
MODELS 2 & 1	0	0.00000	.87446	1	.06275	.12554	
MODELS 3 & 1	0	0.00000	.87446	1	.01854	.12554	
CASE 5							
15.99	7.91	SAMPLE SECTION SIZE, 1 FAULTS					
MODELS 2 & 1	0	0.00000	.82134	1	.08935	.17866	
MODELS 3 & 1	0	0.00000	.82134	1	.02640	.17866	
CASE 6							
16.82	7.96	SAMPLE SECTION SIZE, 2 FAULTS					
MODELS 2 & 1	0	0.00000	.75773	1	.11448	.22786	2 .01588 .0144
MODELS 3 & 1	0	0.00000	.75773	1	.03385	.22786	2 .00407 .0144
MODEL 2							
6SAMPLE SECTIONS; NUMBER OF SECTIONS INFLUENCED BY 0, 1, 2 ETC FAULTS:							
0	6	1	6	2	1		
MODEL 3							
6SAMPLE SECTIONS; NUMBER OF SECTIONS INFLUENCED BY 0, 1, 2 ETC FAULTS:							
0	6	1	6	2	1		

# Inkjet printer

- An inkjet printer is any printer that places extremely small droplets of ink onto paper to create an image.
- Inks are present in the tanks of cartridge. Inks are water soluble.
- The dots are extremely small (usually between 50 and 60 microns in diameter.)
- A piezo inkjet printer is a type of inkjet printer that uses printer heads containing special crystals to which an electric current is applied. This causes the crystals to expand, forcing ink onto a substrate. When the current is removed, the crystal shrinks again, drawing up ink into the printer head.



# Identifying characters of inkjet printers

- Clogging of nozzle produce unusual form of droplets and thereby defective characters.
- Defects in cartridge (non-uniform characters).
- Non-uniform ink distribution due to improper communication between printer and computer.
- Composition of ink, determined through spectroscopic techniques.

# Laser jet printer

- It works on the same principle as digital photocopier.
- Computer generates text on selenium drum through laser beam which creates particular charge in text area.
- Toner of opposite charge adhere to the text area and fused by heat and pressure on paper.



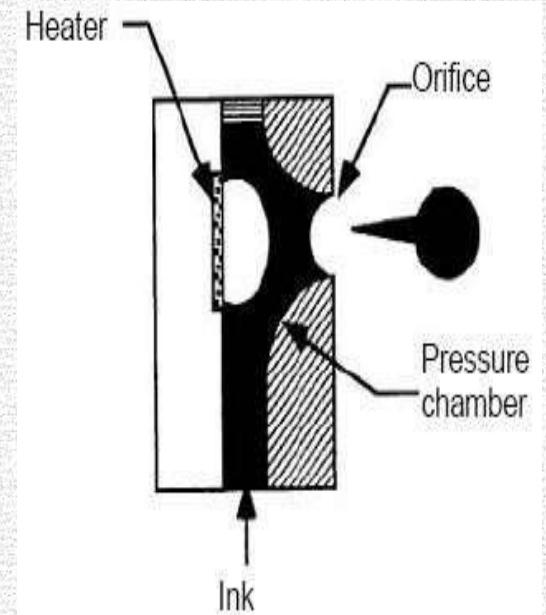
# Identifying characters

- Defects in drum(dirt, dust or scratch marks), fusion roller.
- Toner characteristics by spectroscopic methods.
- Toner is not soluble in water and printouts are sharper than that of inkjet.



# Thermal jet printer

- Thermal printing uses heat, rather than force or impact, to print characters or images onto specialized thermal paper.
- The heating pins within the printer head transfers heat to the paper, which causes the ink to transform into a visible color..



# Difference between typewriter and printer

<b>Typewriters</b>	<b>Printer</b>
Single font design	Multiple font design
Font size remains same	Variable font size
Impact printing	Impact as well as non-impact printing
Enhancement will be in form of bold and underline	Bold, underline, italics, double underline
Inconsistent top and bottom margin	Consistency in top and bottom margin
Right margin uneven	Right margin justified
Location of page number may vary	Consistency in location of page number