

Subject: Xerox Copier Principles

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By G8MNY

(New Comments Dec 04)

After working on a few old copiers & laser printers, here is a brief overview of how they do their magic.

TONER

This is the very fine black (or Cyan, Magenta & Yellow) powder "ink" that forms the image. Each particle consists of a low melting point glue centre with a dye (carbon) outside.

HAZARDS

Toner: This gets everywhere, so when working with it have a vacuum cleaner & soft brush handy to such up spills, never blow it clean! Wear a mask if no vacuum cleaner handy.

Voltages: Very high voltage is used in this process, so never override safety interlocks etc. they are there for your safety!

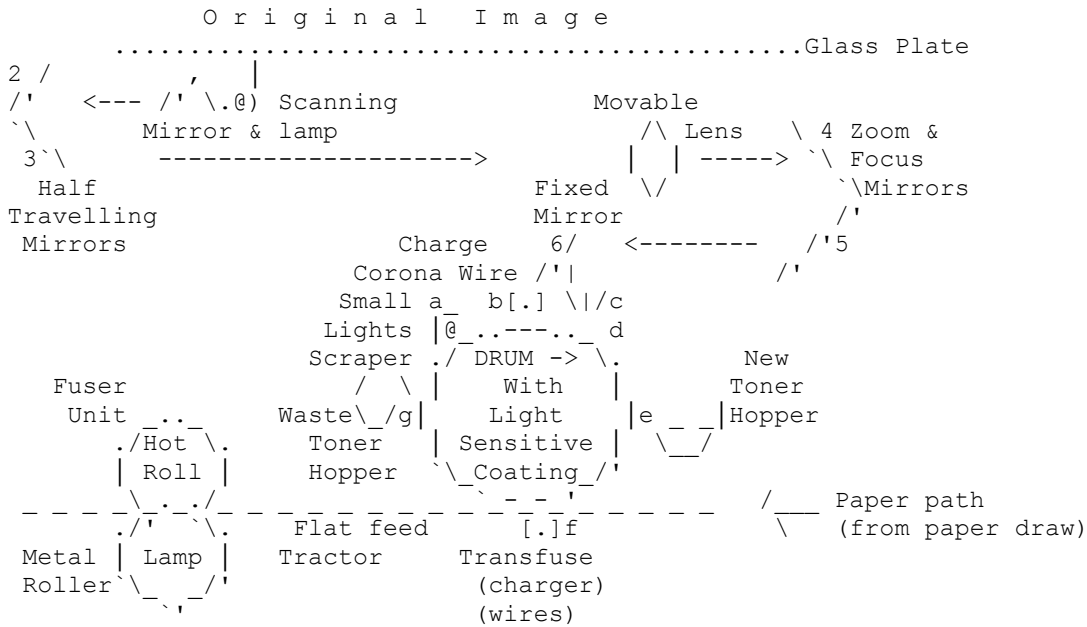
Weight: The larger machines can be very heavy, so use help to move, & watch out for heavy top decks when propped open!

OPTICS

This is cleaver, all done with 6 mirrors. They convey the image from (1) a moving light (300W) scanning mirror, that moves over the entire image, to a half moving pair (2 & 3) of mirrors that maintain a constant distance from the original image to the lens. The lens position & the next pair of mirrors (4&5) form the Zoom feature of most copiers as well as keeping the final image focused. The last mirror (6) is fixed & presents the image to top of the drum. For cleaning note all the mirrors are surface silvered & are easily damaged, only use the lightest of cleaning pressure!

When double side printing it is worth noting as there is a lens involved & the scanning is from underneath th original & printing is on top of the paper, the image is always reversed. eg. top is bottom, but the starting edge is the start edge. This my not be the same with digital copiers!

The optics are normally maintained clear of misting when the copier is apparently powered off by a permanent heater (30W).



THE DRUM

This is an aluminium tube with a fairly long wearing photo sensitive Selenium coating. It is a very good insulator & can store strong static charges but when light falls on it, it quickly leaks away the charge. (if drum is removed avoid scratching & finger prints etc, & don't leave drum exposed to bright light [sun]).

DRUM PROCESS

- a/ The drum is electrostaticly discharged with a row of small lights.
- b/ Then it is "charged up" with static from the nearby corona wire (10kV?).
- c/ The well focused & in step light image falls on the rotating drum.
- d/ The static is discharged where the light falls producing an electrostatic drum image.
- e/ This passes very close to the toner hopper where the black particles are picked up on the charged areas to make a toner image.
- f/ When the drum & image reaches the paper another static charge under the paper encourages the drum to drop the toner image.
- g/ The drum then passes a soft rubber scraper to remove surplus toner.

Depending on its diameter, the drum may rotate several times for a single sheet of paper. The initial static charge, & image light level both affect the contrast & are normally varied to get the exposure correct.

Electrostatic fields actually get stronger with finer images, so fine detail (other than focus, unmatched speeds, toner particle size & paper grain) is not a problem for the Xerox process, compared to some digital copiers.

PAPER HANDLING

Movable rubber pickup rollers in the paper box as well as & paper switch gates for manual feeds all need sensors to make sure the paper is in the right place before the copy process can start.

The flat feed tractor sometimes use fan suction to gently handle the paper & loose toner image into the fuser unit.

As all these are very mechanical & liable to paper dust they do give trouble, so clean them as needed with damp cloth/alcohol (meths).

FUSER UNIT

This is the last part of the process 8/, it has a heated roller tube normally with a 1KW lamp inside. It is maintained around 100°C, THAT IS HOT & it is reaching the running temperature that takes up the initial warm up time. A seconds rubber pressure roller makes sure the outgoing toner image is fully fused to the paper.

Often an economy mode is used to reduce the fuser temperature, but then it will takes a minute or so to be ready to copy. The temperature of the fuser unit & feed speed, determine what type of clear acetate OHP material that can be used.

LASER PRINTERS

These work much the same as copiers, except a laser & mirror scanning system erase the charged drum with the image to form the white areas.

Comments from Harry M1BYT @ GB7CFR...

Over time and usage the pickup rollers can become hardened and glazed by the passage of the paper. If simple cleaning does not help and they retain the glaze indicated by paper misfeeds, then they are quite cheap to replace though often difficult to get at inside the works. One solution which has worked several times for me, is to clean the rollers with 'sticky stuff remover'. This solution seems to both dissolve the glaze and soften up the rubber to make it as good as new, often without a great deal of dismantling.

Horizontal lines across the width of the paper and similar regular defects, can be diagnosed by measuring how far apart they repeat. The repeating rate will exactly match the diameter of one of the rollers, the drum, or the heated roller in the paper path.

There is a school of thought which suggests the fine toner particles will pass straight through a vacuum cleaner dust bag, so the use of a domestic vacuum cleaner might not be advisable. Cold water on a cloth is the recommended method of cleaning up spillages.... Not hot, as this melts the toner fixing it and you will then never get it off. The same applies to clothes which has had toner spilled on them, wash them well in cold water first, never hot.

The fuser rollers often prove to contain nothing more than a simple tubular tungsten halogen lamp as the source of heat in the middle of the roller. Often these can be bought much more cheaply as sold for there original purpose at an electrical dealer, a T/H lamp as used for lighting up your drive.

Grades of toner can vary from machine to machine, but it is often possible to refill a £60 original toner cartridge combined with drum several times at a cost of £15 per fill. The process typically involves hot cutting a hole in main hopper to refill it and cutting a second hole to drain the waste toner section to drain that. Drilling can allow small fragments of plastic to abrade the drum, so the method is to make the hole(s) with something similar to a heated apple coring implement (ask SWMBO). A metal one rather than the plastic ones which do tend to melt :-)

Once the draining (usually every 2nd refill) and the refilling is complete, the hole is covered with sticky tape or similar.

The more capable printers often contain a fan and filter to prevent toner escaping into the office atmosphere. This might need to be cleaned or replaced at regular intervals.

As regards buying and running a laser printer, the best and cheapest to run are the ex office machines. These can often be had for simply taking them

away, they are built to last and the cartridges are often 3 or 4 times the size of the home lasers and cost not much more. Larger paper capacity, probably more capable, reliable and much faster than a home model. Their sheer size need not be a problem, you can put them out of the way if they have a network card or install an after market network to parallel printer adaptor, plus run a LAN.

Mine lives in my shack in the loft, always on standby, available to any of my PC's on the LAN. Just one machine to be fed watered and maintained very occasionally.

Why Don't U send an interesting bul?

73 De John, G8MNY @ GB7CIP
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