The insides of a photocopier

James Watt, the celebrated inventor of the steam engine also invented the first document copying machine says S.Ananthanarayanan

The early design, which was in use till the 1920s, used pressure to transfer a mirror copy of writing from a sheet of paper to a sheet of translucent, chemically coated paper.

Light and electricity

The modern photocopier uses electric charges to capture the image. Most of us would be familiar with static electricity. If we draw a comb through our hair and then hold it just above little bits of paper, the paper is attracted to the comb. This is because the comb gets charged with electricity when it rubs against our hair. When it is brought near the bits of paper, the side if the paper nearest the comb develop the opposite charge and the like charge in the paper is repelled to the far side. The opposite charges on the nearer side are attracted more forcefully and the paper rises.

In the photocopier, the main component is a drum, made of a semiconductor material. This is like the material found in light meters and it gives off electrons, or negatively charged particles, when light falls upon it. This drum is first given a positive charge, all over. When light falls on any part of the drum, electrons are given off and these neutralize the positive charge on that part of the drum.

Bright light and toner

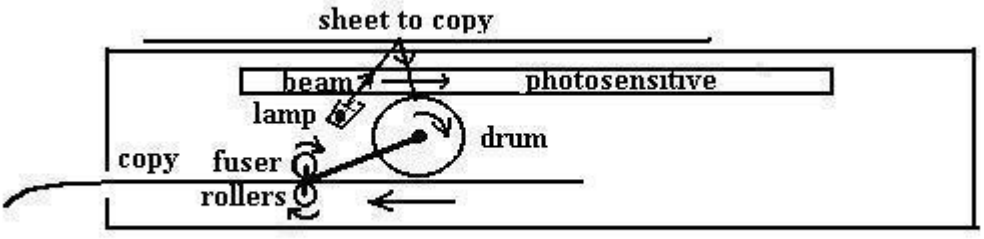
When the picture or writing to be copied is placed in the copier, it is lit by a bright light as the drum rolls across. Wherever the image is white, the light reflects and falls on the drum, rendering that part neutral. The parts where the image is dark reflect no light and the drum stays charged in those places.

A black pigment, called the toner, which fixes to paper when heated, is then given a negative charge and spread over the drum. The toner sticks to the parts that are positively charged, which

are the parts that correspond to the dark part of the image. The parts corresponding to the light parts of the image are neutral and there the toner does not stick.

Printing on paper

The drum now rolls over a sheet of paper that has been given a positive charge. The positive charge on the paper picks the toner off the drum at the parts where the copy needs to be dark. The paper is then pressed through a pair of heated rollers and the toner gets fixed to the paper.



One may imagine that to copy a large sheet or printed matter, say 24 inches long, one would need a drum with a circumference of 24 inches. This would make the copier quite large. What is done in practice is that the drum is used many times over while copying the same picture. As one part, a strip, picks up an image, the image is transferred to the paper that moves, in the opposite direction, in 'lock-step' with the drum. That strip of the drum is then again positively charged, to be reused with another part of the image.