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# PAPER

BY FRANK DICKERSON, JR.

**H**ow long a time as you have been in Ohio State University, have you ever paused to think or to ask yourself, "What is the most important material thing or article in your college life?" Of course education and culture are the most important but they are not material, but mental. Supposing you should stop some people on the campus, and put that question to them. One would probably answer, "Our football team," or "Our faculty," or "Our student body," or "Our campus," or "Our books," or any number of such answers. In all probability no one would give you the correct answer. The fellow who says "Books," comes the nearest to it. Now what is this so important article that is practically the life of the university? It is no other than the common, every day necessity, much used and little thought of article — paper.

What would college be without paper? There would be no text books, note books, mid term or final papers, and no checks or paper money. Just think of carrying a slate and slate pencil to class to make notes on. Supposing you had a long report to hand in; you would have to hire a truck to carry all your slates, with your report on them, to class.

Of course printing, ink, pencils, erasers and so forth come in for an important part of our education, but they, in turn, depend directly on paper. To me the discovery or invention of paper was one of man's greatest achievements towards civilization.

The following is a rough outline of the bigger steps in making our undervalued paper.

## The Origin.

Paper, that indispensable substance for which modern civilization finds so many uses, had its origin in the papyrus plant from which it derives its name. The early Egyptians split the stalk and peeled off the pellicle in layers. These they joined together with an adhesive forming long sheets or leaves.

Modern paper consists of a prepared fiber mixed with other substances which acts as filler, binder, coloring matter, etc. It goes through many processes and when finished is one of the greatest of commercial products.

## The Fiber.

Tear a piece of paper and hold the torn edge up to the light, the feathery edge that is seen is called the fiber. This is the part of the paper that gives it strength; the longer the fiber the stronger the paper.

The fiber is of only one origin, that is vegetable matter. Of our native fibers linen makes the best paper; cotton ranks second. Other substances from which paper is made are wood, manila and straw. The above are generally used although any substance which will yield fibers can be used in making paper. Paper made from old rags is stronger than that made from wood. The two are often combined.

The bulk of paper, however, is made from wood pulp. The greatest amount of wood used for paper-making comes from Norway.

## Pulp.

The first step in paper-making is to reduce the fibrous substance to a pulp. If rags are used they are sorted, dusted and then cooked in an alkaline solution with steam, after which they are washed and bleached. They are then ready to be sent to the beater.

The wood pulp is made by grinding the wood mechanically or by treating it chemically. Paper used by newspaper establishments is mechanically made wood pulp. The wood, cut in lengths is dropped into hoppers held against grindstones and ground into small particles. A stream of water is played on the grindstone to keep the wood from igniting and also to carry away the small wood particles. The ground wood is sent through a sieve and the particles which are too large are excluded. Mechanically made wood pulp soon deteriorates and turns color on continued exposure to light.

In chemically made wood pulp all the extraneous substances are removed by chemicals, leaving only the fiber of the wood. There are two chemical processes that can be used, the soda process and the sulfite process. The former is used because of its cheapness, but the latter makes the stronger fiber. In either case, the wood is first cut into small chips. In the soda process, the chips of wood are put into large metal containers, caustic soda is added and this combination is subjected to a pressure of eighty pounds of steam. After eight hours the container is opened and the liquid, which is drawn off, is evaporated into a syrup and burned. Lime is then added and soda is reclaimed. It is due to this reclaiming of soda that this process is used. The wood pulp is thoroughly washed.

## The Beater.

The fibrous substance, after being ground into pulp, must be converted into still smaller particles and is sent through a machine called a beater. In this machine the pulp passes between a stone or steel bed plate and rollers. The distance between the plate and rollers is regulated so that the pulp in passing through is torn, dragged or teased out to produce the feathery edge. This also causes the fibers to mat together forming the web of the paper which gives it its strength.

## The Refining Machine.

The fibrous substance, after leaving the beater, is called stuff. The stuff is sent to a Jordon, the name of the refining engine which in appearance and action is like a great coffee mill except that it is carefully encased. In this machine the stuff receives its final grinding or refining and is then ready for the paper-making machine.

## The Paper-Making Machine.

The stuff, after leaving the Jordon, passes through a sand trap where it is mixed with a great quantity of water. The excess of water causes the heavy particles such as sand, iron and other foreign matter to sink to the bottom where it is caught in ripples. The stuff continues on its way passing through a fine screen to the regulat-

ing box, on out under a gate and continues along on a moving screen.

The gate is so regulated that only a certain amount of stuff passes out in a given time. The weight of the paper can be regulated by the speed of the machine; the faster the machine works the thinner the paper. The output of a machine in tons is fairly constant but varies a little according to the size of the paper produced.

As the stuff leaves the regulating box, it flows out upon a small meshed copper screen which is in the form of an endless belt. As the screen moves along at a uniform rate it takes an even layer of stuff. A side-way motion of the screen near the regulating box causes the fibers to point in all directions and to mat together.

As the screen travels along the greatest amount of water passes through the screen by gravity, the rest is removed when the screen passes over suction boxes. The stuff is prevented from flowing off of the sides of the screen by a belt of rubber called a deckle, which moves along with the screen. The shaking of the screen causes part of the stuff to work its way under the deckle thus producing the much desired deckle edge. In case the deckle edge is not desired it is cut off by a jet of water while on the screen.

If the paper is to be watermarked by a name or trade mark it is done at this stage. The stuff is passed beneath a dandy-roll made of wire gauze on which the design is worked in thin wire. The weight of the cylinder presses the design into the plastic mass of paper, the wires of the trade mark push aside some of the material leaving the mark. The reason a water-mark can be seen on a sheet of paper is because it is thinner in that place.

After the paper leaves the wire screen it passes between brass rolls and rolls covered with blankets or felt. These rollers compress the paper and also absorb most of the water which remains in the paper.

The paper, after leaving the felts as the covered rolls are called, goes to the drying rolls or drums, which are heated with steam from which the paper emerges thoroughly dry. The paper is then sent through a calender which gives it a finish. It is then cut or rolled into large rolls according to the finish to be given it.

#### **Hand-Made Paper.**

If a machine-made piece of paper is torn it tears more easily in one direction than at right angles to that direction. This is due to what is called the grain of the paper which all machine-made paper has.

When paper is made by hand a wooden frame covered with a copper screen is used. On this wooden frame another frame is fitted which acts as a deckle. Both frames are dipped into a tub containing the stuff. The frame is drawn up and an even deposit of stuff obtained. As the frame is drawn out of the stuff it is given a circular motion which causes the fibers to point in all angles preventing a grain. After the water is drained off it is placed between sheets of felt and compressed in a screw-frame. The paper is then hung up in lofts to dry. Hand-made paper is very much stronger than machine-made paper.