

*how paper is made*

*at*





# Foreword

This booklet is written primarily for guests who have just gone through our mills at Parchment. Such a trip is apt to be a bit bewildering. The machines are so large, some of them are so noisy, and there are so many kinds of them that it is sometimes difficult to remember just what happened at some particular spot.

The information given here, therefore, is to give you, in the quietness of your home, a chance to sort out the high spots of the tour so that you can arrange them in orderly fashion and leisurely review your day's experiences.

Kalamazoo Vegetable Parchment Company  
Parchment, Michigan



## How Paper Is Made at KVP

### THE FIRST PAPERMAKERS

The first papermaker, still doing business as he did it in the Garden of Eden, was the papermaking wasp. The hornet is the most spectacular member of the family. He makes his paper from wood, an art man was not to learn until less than 100 years ago. He waterproofs it (the human papermaker calls it "sizing") and makes it into an apartment house.

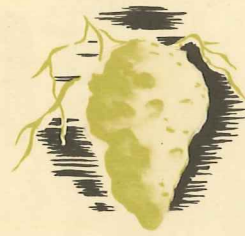
### THE CHINESE

About the year 105 A.D. a Chinese by the name of Ts'ai Lun is thought to have formed the first man-made paper, though others may have done so as much as 200 years earlier. Men had first written on skins, stones, bark, and on the walls of caves. The Chinese had long used silk for a writing material.

Ts'ai Lun hit upon the idea of pounding vegetable fibres into pulp, fibres like those in bamboo and mulberry bark, and grasses. Mixing this pulp with water, he poured it into a rectangular mould or sieve with a cloth bottom. The water drained through the cloth. The matted fibres stayed on top. When taken off the mould and dried over ropes or pasted against a smooth wall in the sun, the result was a sheet of paper. Later, they learned to dip the mould into a vat of pulp. Paper is still made in this primitive manner in thousands of tiny family "paper mills" in China, Japan, India, and other Oriental countries.

### PAPER COMES TO EUROPE

The art spread very slowly across the trade routes to the west, and was not general in Europe until the 14th and 15th centuries. The invention of movable type by Gutenberg greatly increased the demand for paper and hundreds of mills came into existence.



Hornet's Nest



Papyrus



Medieval Beater



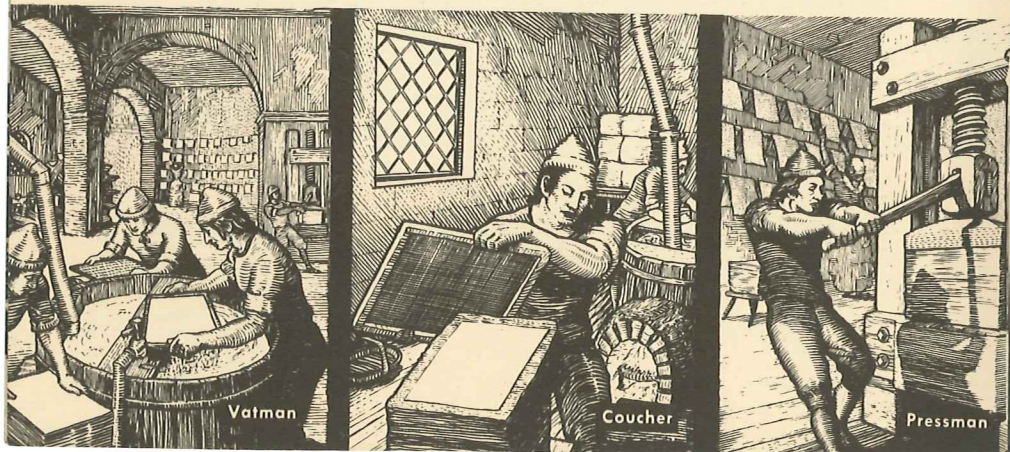
The basic method remained unchanged, but cotton and flax fibres came into use. Old rags were the chief source of material. Power beaters were invented to make the pulping process easier, wire screens replaced the cloth in the moulds, and a screw press was used to squeeze out the water to speed up drying. It was a wonderful paper whose quality has never been excelled by the most modern machines. A typical size sheet, made one at a time, might be one 28 x 23 inches. Today, a papermaker produces from one to two thousand times as much paper in 8 hours as his counterpart in the days of hand moulds produced in a 12 to 14 hour day.

Our English word *paper* comes from the Egyptian word *papyrus*. The Egyptians had long made a paper-like writing material from a water plant called papyrus. It was probably the bulrushes in which the baby Moses was hidden. It was not a true paper, but real paper looked like the papyrus product, and took its name.

In 1798, Louis Robert, a Frenchman, invented a *moving* wire screen and the slow, costly hand mould method was doomed. The Fourdrinier brothers, Englishmen, developed it, and the wire or screen section of the modern paper machine (except for the cylinder type) bears their name to this day.

### AND THEN TO AMERICA

The first paper mill in this country was built by William Rittenhouse in Germantown, Pennsylvania, in 1690. The first American mill to install a Fourdrinier paper machine was probably the Henry Barclay mill at Saugerties, New York, in 1827. Both the hand and early machine mills used the costly rag fibres, but in the 1880's, groundwood began to be used, and the chemical pulps followed.



## Modern PAPERMAKING

### HOW PULP IS MADE

Paper can be made from nearly every known vegetable fibre. Moss, straw, bark, vines, leaves, grass, bamboo, hops, nettles, even mummy wrappings, are typical. KVP once made it from cornstalks. But by far the most paper today is made from trees for they provide the best of the economical fibres.

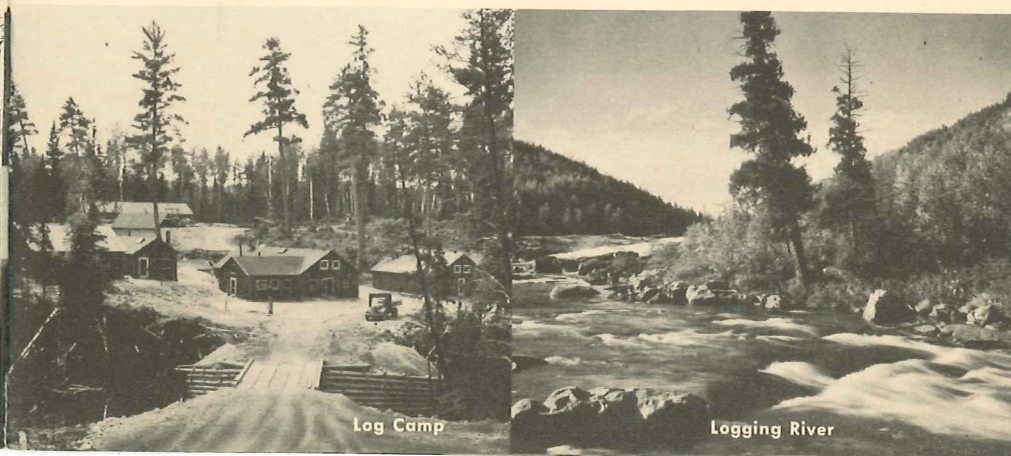
Nearly every kind of tree can be made into paper, but the cone-bearing trees are most commonly used because they are plentiful, and because their fibres have the most strength. Tree fibres vary from 1/25 to 1/5 inch in length. There are probably one or two million of them in the page you are now reading.

Four methods are commonly used to turn wood fibres into pulp suitable for papermaking. One is a *mechanical* process known as the groundwood process. As the name suggests, this is made by holding a block of wood against a grindstone until it is chewed into tiny fragments. Groundwood is the base for most newsprint paper. The other three are *chemical* processes: soda, sulphite, and sulphate. They take their names from the chemicals used to free the fibres from the lignin and other non-cellulose materials found in wood. KVP uses all four types, but chiefly, sulphate.

### THE KVP PULP MILL

Let us look at a tree growing in the Spanish river section of KVP's 6500 square mile forest limits in Canada, near Espanola, Ontario. It may be a spruce, a balsam, a jack pine, or a poplar. It will be at least 40 years old and not less than 6 inches in trunk diameter, for it takes that long to grow a tree to pulpwood size in the upper Great Lakes area.

In the winter, lumberjacks cut it down, saw it into 8 or 16 foot lengths, and put it in piles near the edge of a frozen stream. When the spring thaw comes, the corded wood is pushed into the





river and floated down to the pulp mill at Espanola. Here it is taken from the water, cut into short lengths, the bark removed, and stacked with millions of fellows in a great block pile. Other wood, cut some distance from streams, is shipped in by rail or truck.

When needed for pulp, the logs are cut into small chips which are dropped into a great steel tank known as a digester. Caustic soda and sodium sulphide are added in liquor form and the mixture is cooked by steam for a number of hours, under pressure. The cooking dissolves the chips, leaving only the cellulose fibres, and the spent liquors are drawn off. The fibres undergo a long process of washing and screening. If white paper is the ultimate end, they are bleached with chlorine.

About 250 tons of sulphate (kraft) pulp are produced in the mill daily, and a small amount of groundwood. Some of the pulp produced at Espanola is used on two large paper machines in the same mill to make paper for Canadian consumption. The chemistry and mechanics of the pulp process, including its six-stage bleaching, are much too complicated for description here. Few industrial processes require greater scientific know-how and skill, or greater capital investment. The diagram on pages 6 and 7, however, will show basic steps in the transformation of a tree into a bale of bleached pulp.

Espanola is a town almost entirely owned by KVP, located at a beautiful falls of the Spanish river on the edge of the "bush." Its entire life centers around the pulp and paper operations of The KVP Company Limited. Originally built around a newsprint mill that was closed down in 1929, it became a "ghost town" for 13 years, until KVP took it over and built the big bleached pulp and paper mill. Today it is a thriving, bustling community, a "model city" like Parchment.

### THE PAPER MILL AT PARCHMENT

The major papermaking and converting operations of KVP center in the mills at Parchment, Michigan. The business was founded in 1909. The first paper (it was genuine vegetable parch-

ment) was produced the following spring from raw stock purchased from paper mills. From a little converting plant with 15 employees, the operation has grown to a great mill employing over 2000 men and women who make many kinds of paper and transform or "convert" it into hundreds of articles in daily use in millions of American homes.

A model little city has sprung up around the mill. The good schools and churches, beautiful Kindleberger Park, and a well run city government make it one of the most desirable residential communities in the area. It borders on the city of Kalamazoo.

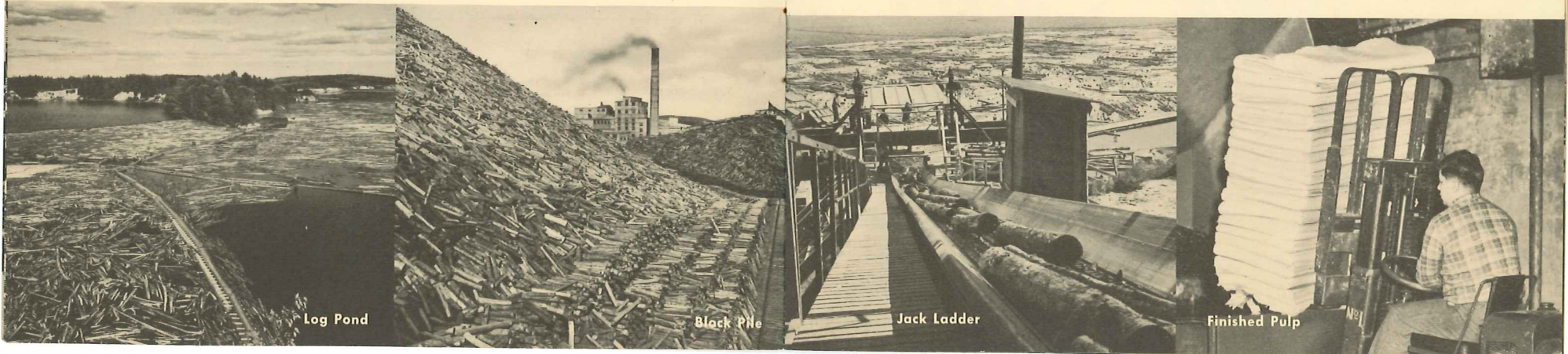
### KALAMAZOO—*The Paper City*

The Kalamazoo area produces more tons of paper than any other comparable region in the world. Pulp, power, and water are the three prime requirements for papermaking. Strangely enough, however, there has never been any wood pulp produced in southwestern Michigan. And while deep wells and the Kalamazoo river supply adequate water, there has never been any important water power development. The pulp, therefore, is all shipped in, and power is generated by steam.

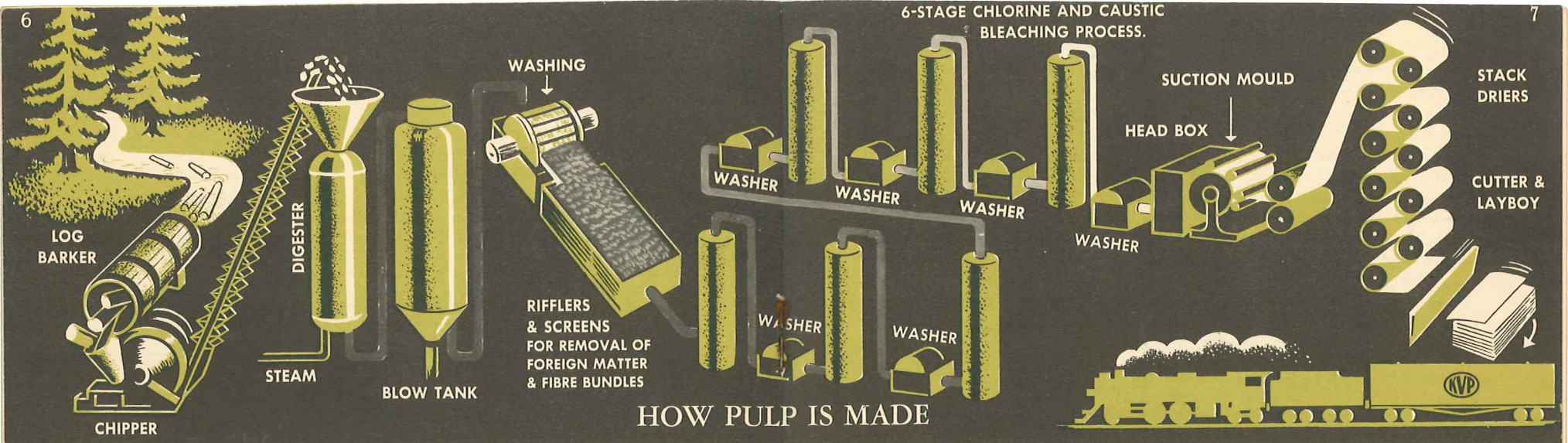
There was, however, a market for the products of the first mill to operate here, and that market grew with the Middle West. Soon other mills were started by employees of the first ones, and a pool of capital and labor which knew the paper business became the nucleus for many more. It was in this same manner that Detroit became an automobile city, rubber made Akron, and Chicago became a meat packing center.

### HOW PAPER IS MADE—*Beating*

Now let us see what becomes of a bale of pulp when it arrives in Parchment from the pulp mill at Espanola. The first operation in converting pulp into paper is known as beating, and the pulp bales are thrown into huge tanks or vats called beaters. A great deal of water is added. The function of the beater is two-fold. First, it separates the fibres until they are floating



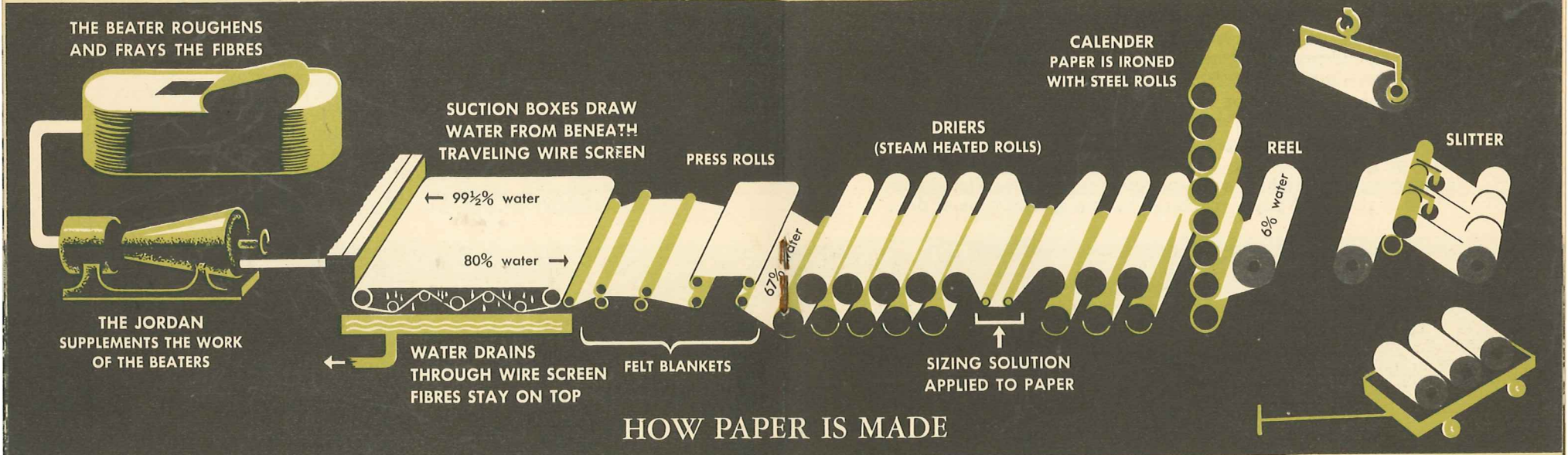




### HOW PULP IS MADE

Here, in very rough diagram, is what happens to a tree when KVP harvests it for pulp. About half the log is usable fibre. It is the task of the pulp mill to separate, by mechanical and chemical processes, the fibres from the non-fibre elements of the wood. It then bleaches them to varying degrees of

whiteness, and collects them into sheets. It is a very complex operation requiring large and costly equipment. The diagram shows only the major steps. There is no attempt to picture equipment as it actually looks, or to show relative size.



### HOW PAPER IS MADE

This diagram, also very rough, shows what the KVP visitor sees when he goes through the mill at Parchment. The finished product of the pulp mill has now become the raw stock of the paper mill. The beaters and Jordans prepare the fibres for the type of paper desired. The actual forming of the sheet of paper

takes place on the traveling wire screen, or "Fourdrinier." At the start (the "wet end") it may be as much as 99 1/2% water, only 1/2 of 1% fibre. By gravity, suction, pressure, and evaporation, in less than one minute it loses all but about 6% of the moisture and becomes finished paper, ready for "conversion."



free. Then it flattens them, and frays them at the ends, so that they will interlock to make strong paper.

Beating time varies according to the type of paper needed. Other kinds of pulp are sometimes added, as many papers are blends of different types of fibres. Color, size (waterproofing, so the paper will take ink), and various fillers (china clay, titanium dioxide, starch, etc.) are usually added in the beaters if the kind of paper being made requires them. The pulp used to make a kind of paper known as waterleaf (which in turn is converted into genuine vegetable parchment) has nothing added, not even color, and remains 100% pure vegetable fibre.

After beating, the stock passes through high speed, cone-shaped machines called Jordans, for final refining. Then, further mixed with water until it is 99½% water and only ½ of 1% fibre, it is ready for the paper machine.

## THE PAPER MACHINE

Essentially, even the great block-long paper machines are like Ts'ai Lun's hand mould in that they consist primarily of a fine-meshed screen on which the "liquid paper" is poured. The water drains through the screen, the fibres stay on top, and become paper.

The chief difference, however, is that Ts'ai Lun's cloth-bottomed screen has now become a moving endless wire belt. The wire is made of bronze, with about 65 meshes to the square inch. The six machines at KVP form webs of paper on these belts, each about 13 feet wide, at a rate of up to 1000 feet a minute. In addition to its forward movement, the screen shakes from side to side to help interlock the fibres.

The paper is still about 80% water when it leaves the wire to pass through the press rolls, which squeeze it between heavy wool blankets like a wringer. When their job is done, the paper is still 65% to 70% water. This is removed by evaporation, the paper passing over a long series of steam-filled rolls called driers.

Two of the KVP paper machines have a special type of drier

called a Yankee. Much larger and hotter than the standard rolls, they take out surplus water very fast. They also add a sheen to one side of the paper, very desirable for some types of printing.

After the driers, certain papers are passed through sets of highly polished steel rolls called calenders to give them a hard, smooth surface. The paper that started out 99½% water a minute or two ago is now about 6% water, the normal moisture content of dry paper. It is in a giant roll that weighs about 3000 pounds.

## DAILY OUTPUT

If all six machines at KVP were to make the same grade of paper at the same time, their daily output would be a ribbon of paper 13 feet wide and 1200 miles long. This would be equal to a road on which two cars could pass, between Kalamazoo and Miami, Florida; from Kalamazoo to San Antonio, Texas, or to Denver, Colorado. All this every 24 hours.

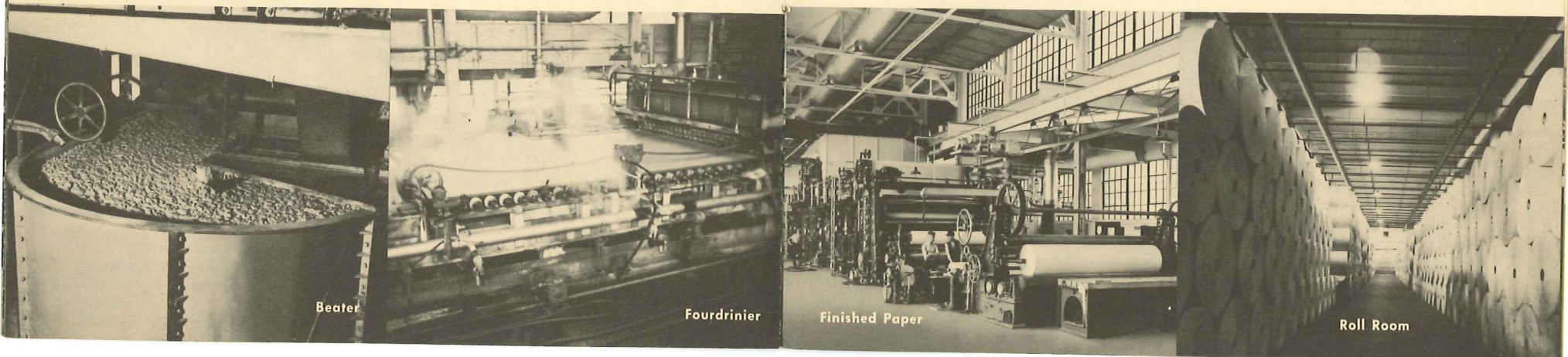
Obviously, a great deal of heat and power is needed to do this work. This is produced in a central power house which uses about 250 tons of coal daily. Roughly, it takes a pound of coal to make a pound of paper.

## CONVERTING THE PAPERS

The huge "jumbo" rolls are taken from the paper machine and cut into smaller ones on a machine known as a "rewinder." These rolls are called "mill rolls" and from this point on, the processes the paper goes through are known as "converting." Probably 70% of the KVP employees at Parchment are engaged in the converting operations.

## GENUINE VEGETABLE PARCHMENT

The original KVP converting was that of changing the paper known as waterleaf into genuine vegetable parchment. It is still a major KVP activity. It is done by quickly passing the soft,



Beater

Fourdrinier

Finished Paper

Roll Room



highly absorbent waterleaf through a bath of sulphuric acid, then washing off the acid before it can destroy the sheet. The acid dissolves the fibres to form a jelly-like substance called an amyloid. This fills up the pores and interstices of the paper. Now, instead of the original porous sheet that would go to pieces instantly in water, it has become the most astonishing paper in the world. It is completely insoluble in water, can even be boiled in it, is stronger wet than dry. Nor will it go to pieces in fat, or grease, or oil, or even in mild acids and alkalis.

Genuine vegetable parchment is therefore indispensable for the protection of butter, certain meat products, lard, margarine, and many other food (and non-food) products which present a moisture or grease problem.

Mill guides are often asked, "From what vegetables do you make genuine vegetable parchment?" When this remarkable paper was first discovered, all paper was then being made from cotton and linen rags. The paper *looked* like animal skin parchment which had been the costly writing material of ancient and medieval times. Cotton and flax belong to the vegetable kingdom. So the inventor called his product *parchment*, but he gave it the prefix *vegetable* to avoid confusion with the animal skin product. So KVP does not, as some people actually think, use Kalamazoo's famous celery as a raw material. Now that most paper is made from wood fibre, the name still holds true, for trees belong to the vegetable kingdom.

### PRINTING

A second major KVP converting process is printing. Nearly all KVP papers take printing beautifully, and nearly 50 printing presses of many sizes and types are used for this purpose. All three printing processes are employed: letterpress, offset, gravure. Most of the presses are capable of high speeds and range from one to five color impressions at a time. The quality of KVP printing is of such recognized excellence that hundreds of the nation's most famous companies look to us as their source of supply for printed wrappers.

A large staff of artists create the art work designs that finally become the printed wrappers. Most of the inks used in printing are made by KVP.

### WAXING

Waxing is the third major converting operation at KVP. We are probably the country's largest producer of waxed papers. Waxing is done by unwinding a roll of paper through a tank of melted paraffin, then through a tank of chilled water to harden the wax. Printing must be done before waxing. Bread wrappers, carton sealing papers, and soap wrappers account for the largest tonnage of KVP printed waxed papers. Meat packers, cereal companies, the frozen food locker industry, and the housewife take the greatest amount of plain waxed.

### SPECIAL TREATED

Special treated papers comprise the fourth major conversion at KVP. These include treatments to make paper water and bloodproof for the retail meat market; special papers, often laminated, for the soap industry; transparent papers; oiled, crinkled, die-cut, interfolded, embossed papers; and many, many more.

### THE KVP COMPANIES

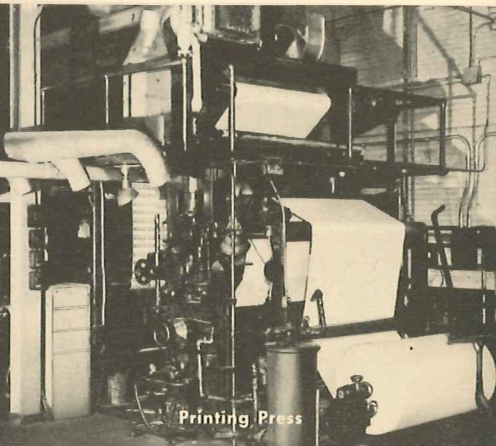
In addition to the pulp and papermaking operations at Espanola, and the papermaking and converting operations at Parchment, KVP has five other plants, and numerous salesmen and sales offices.

One plant is at Devon, Pennsylvania, just outside of Philadelphia. This plant prints and waxes. It was established in 1939.

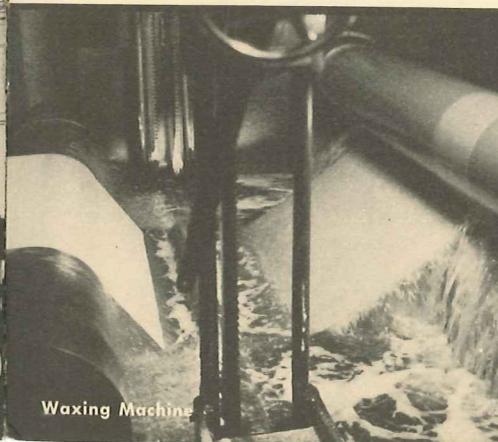
A similar converting operation is located at Houston, Texas. It is known as The KVP Company of Texas. In addition to printing and waxing, it warehouses other KVP papers for the South and Southwest trade. It began operations in 1938.



Art Department



Printing Press



Waxing Machine



Plant at Devon, Penna.



KVP Company of Texas



In 1943 KVP purchased the Harvey Paper Products Company at Sturgis, Michigan. They are large producers of paper cups and pan liners for the baking industry, and of place mats and table accessories for hotels and restaurants.

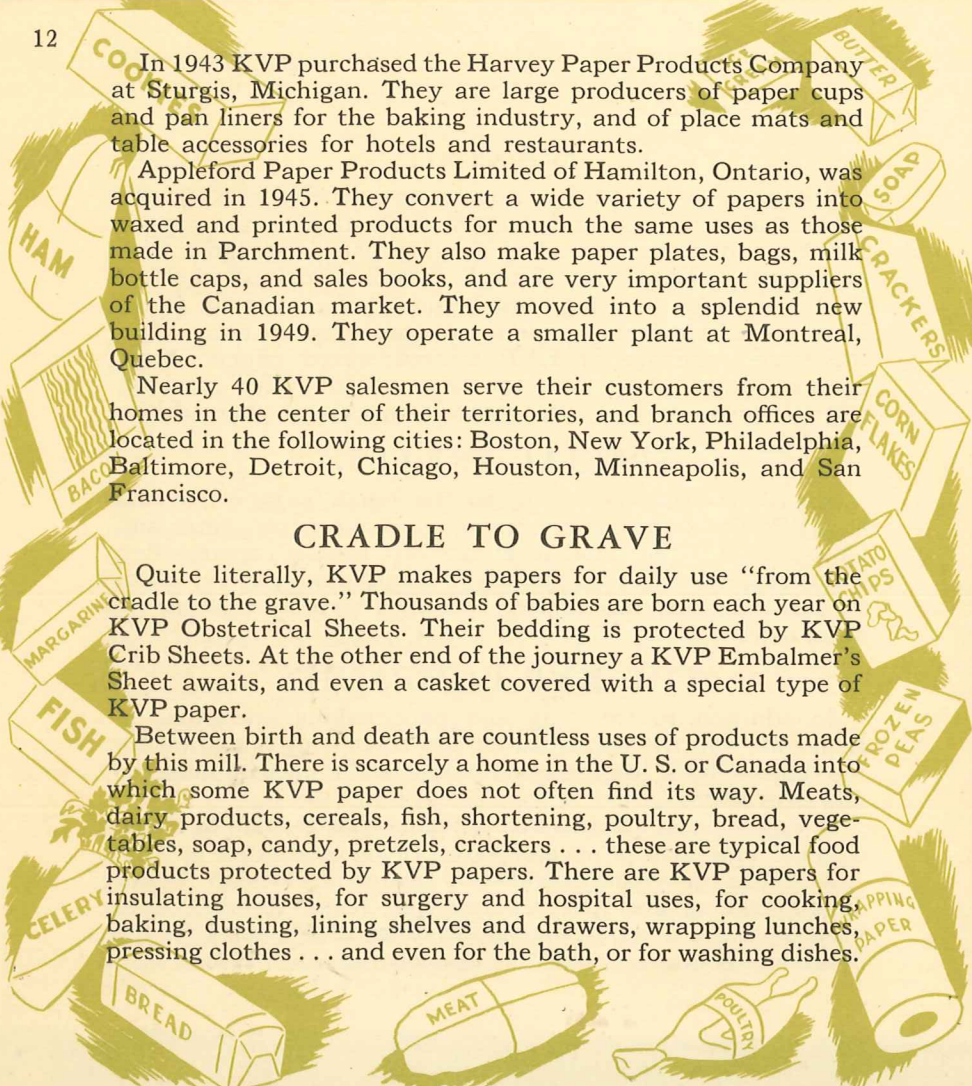
Appleford Paper Products Limited of Hamilton, Ontario, was acquired in 1945. They convert a wide variety of papers into waxed and printed products for much the same uses as those made in Parchment. They also make paper plates, bags, milk bottle caps, and sales books, and are very important suppliers of the Canadian market. They moved into a splendid new building in 1949. They operate a smaller plant at Montreal, Quebec.

Nearly 40 KVP salesmen serve their customers from their homes in the center of their territories, and branch offices are located in the following cities: Boston, New York, Philadelphia, Baltimore, Detroit, Chicago, Houston, Minneapolis, and San Francisco.

### CRADLE TO GRAVE

Quite literally, KVP makes papers for daily use "from the cradle to the grave." Thousands of babies are born each year on KVP Obstetrical Sheets. Their bedding is protected by KVP Crib Sheets. At the other end of the journey a KVP Embalmer's Sheet awaits, and even a casket covered with a special type of KVP paper.

Between birth and death are countless uses of products made by this mill. There is scarcely a home in the U. S. or Canada into which some KVP paper does not often find its way. Meats, dairy products, cereals, fish, shortening, poultry, bread, vegetables, soap, candy, pretzels, crackers . . . these are typical food products protected by KVP papers. There are KVP papers for insulating houses, for surgery and hospital uses, for cooking, baking, dusting, lining shelves and drawers, wrapping lunches, pressing clothes . . . and even for the bath, or for washing dishes.



Harvey Paper Products Company  
Sturgis, Michigan



Appleford Paper Products Limited  
Hamilton, Ontario

### FOR YOUR HOME

Unless you are connected with the many industries for whom KVP makes special papers, you are seldom aware that the paper around your meat, your bread, your soap, your butter, and hundreds of similar commodities is quite possibly from this mill. These papers come into your homes many times in the course of a year, but you quite naturally take them for granted, for you are more interested in what they contain.

There is, however, a large family of KVP papers for home use. They are to be found in department stores, food markets, hardware, and variety stores. These "KVP Paper Maids" make housekeeping easier, better, and more gracious. When you buy them, we hope they will remind you of your pleasant and instructive trip through the mill.

Come again!

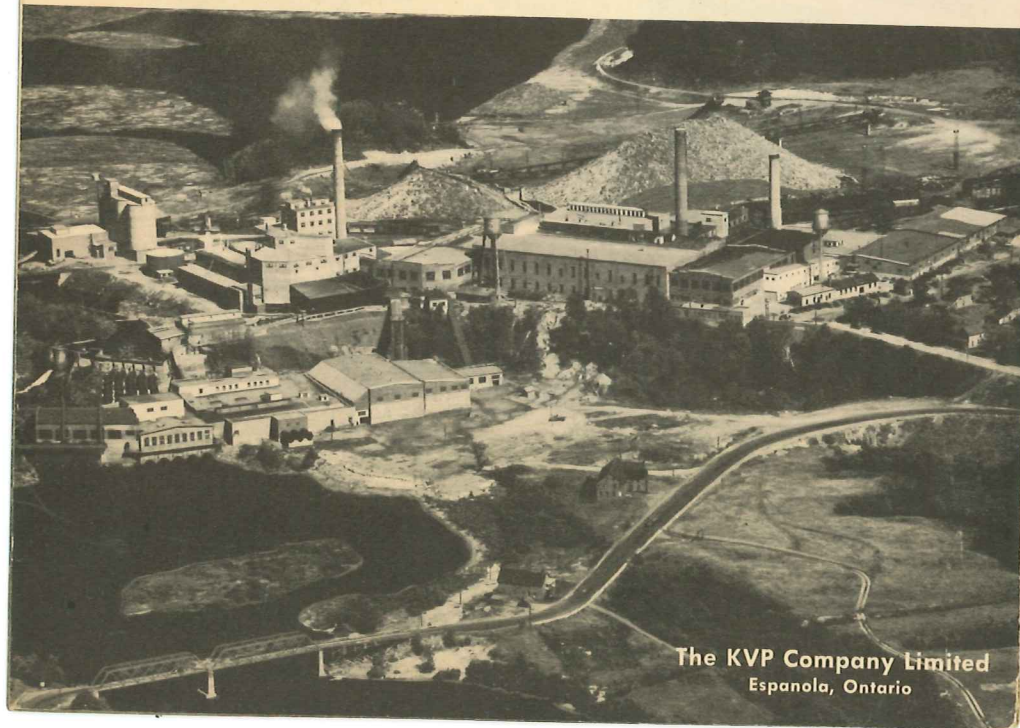


KALAMAZOO VEGETABLE PARCHMENT COMPANY  
PARCHMENT • MICHIGAN





“The World’s Model Paper Mill”



The KVP Company Limited  
Espanola, Ontario