Papermaking at Oxford

Oxford Paper Company
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Sixty-three Years In The Manufacture Of Fine Quality Book, Business, And Specialty Papers At Rumford, Maine. Other Mills In Lawrence, Massachusetts, and West Carrollton, Ohio.
OUR COVER PICTURE

The picture on the front cover shows Oxford's North Star Coater. This machine is used to put a quality coating on plain papers. It is 130 feet long and operates at speeds ranging from 200 to 2,000 feet a minute.

Built in 1958, the North Star Coater is one of the most modern coating machines to be found in the paper industry. It produces such famous grades of letterpress and offset printing papers as Polar Superfine Enamel, Mainefold Enamel, Polar Offset Enamel, and Mainellex Offset Enamel.

It has been described as "one of the greatest advances in the manufacture of fine quality papers in more than twenty years." Its "trailing blade" coating features have made it possible for Oxford to produce printing papers with a levelness of surface unequalled by conventional coating methods. The machine, with auxiliary equipment, represents an investment of more than $6,500,000.
Papermaking is one of the oldest skills known to mankind. The ancient Egyptians made a crude paper from the stems of papyrus plants growing along the Nile River and it is from their word "papyrus" that our word "paper" is derived.

The Egyptians were not the only ancient papermakers. A good quality paper was made by the Chinese about 2,000 years ago and it was from China that the secret of papermaking spread westward across Asia and eventually into Europe and America. By the year 1150 papermaking was being practiced in Spain, by 1189 in France, by 1320 in Germany, and by 1494 in England. In 1690 the first paper mill was built in America. It was established by William Rittenhouse outside the city of Philadelphia.
In the early days of papermaking, both in Europe and in our own country, stock or fibres for making paper was made from rags. This stock, mixed with water, was poured on a wire screen. When the water drained off, the layer of fibres remaining on the screen was removed and then rolled and pressed into a fairly smooth sheet of paper. Since each sheet had to be made by hand the method was slow and laborious. As a result, paper was scarce and expensive.

It was not until the introduction of the Fourdrinier papermaking machine, shortly after 1800, that papermaking began to grow into a large-scale industry. The Fourdrinier machine enabled papermakers to run a continuous sheet of paper in rolls.

Another important development, in the second half of the Nineteenth Century, was the development of methods of making pulp from wood. The invention of the Fourdrinier machine combined with low-cost pulp from wood were probably the major factors in contributing to the rise of our modern pulp and paper industry. Today, pulp and paper is the fifth largest industry in the United States.

The first paper manufactured in Rumford, Maine, was produced by the Rumford Falls Paper Company in 1893. During the following seven years the International Paper Company and the Continental Paper and Bag Company established mills in Rumford for the production of newsprint, wrapping paper, and paper bags.

In 1899 the Oxford Paper Company was organized by Hugh J. Chisholm and in 1901 began producing book paper at the rate of 44 tons a day. In later years the Rumford properties of the Rumford Falls Paper Company, the International Paper Company, and the Continental Paper and Bag Company were acquired by Oxford and added to its facilities for the production of fine quality book and specialty papers.
Wood For Pulp

Every day at Oxford, about 900 cords of wood are converted into chips to be used for making pulp. This is at the rate of approximately 330,000 cords a year.

Both hardwoods and softwoods are used for making pulp at Oxford. In four-foot lengths the sticks arrive at our wood yards by railroad and truck from the woodlands of Maine and New Brunswick. Then, from the storage piles in the wood yards the sticks are moved on conveyors into the wood rooms for processing.

All sticks are washed to remove sand and grit and, where necessary, bark and knots are removed. After this handling, they are fed into powerful chippers that can reduce a stick of wood into small chips in a few seconds. These chips are then screened to be of fairly uniform size and are conveyed to storage bins built above our digester system.
The Digesters

Our digesters for cooking hardwood chips to make pulp are six large steel vessels 42 feet high and 10 feet in diameter. A digester is filled with about 12 cords of chips which are then cooked in an alkaline liquid under steam pressure for a period of three hours. The purpose of this cooking is to remove resins and gums and to dissolve the lignin which holds together the desired cellulose fibers in the wood. These six digesters produce more than 350 tons of hardwood kraft pulp per day.

When a cook is completed, the digester is "blown." That is, the softened chips, almost entirely cellulose fibers, and the cooking liquor are forced from the bottom of the digester into a blow tank from which they are pumped over brown-stock washers which wash out the cooking liquor and the other substances cooked out of the wood. This leaves a mass of dark brown pulp.

Softwood chips are cooked in what is known as a "continuous flow" digester system for the manufacture of softwood kraft pulp. In this system the chips are pre-heated and then picked
up by an alkaline cooking liquor and carried into a Kamyr digester. This digester is 90 feet high and is 11 feet in diameter at the top and 12 feet at the bottom. “Black,” or used cooking liquor is taken out of the digester and heated to provide the required pressure and temperature. This digester produces 175 tons or more of softwood kraft pulp per day.

This chemically processed pulp is still in an impure state and must be subjected to a long process of washing, screening, and bleaching before it is ready for use in the beaters and on our paper-making machines.

All these are large scale operations. For example, Oxford’s modern Hardwood Kraft Bleach Plant is housed in a brick and glass-block building 132 feet long, 45 feet wide, and 105 feet high. The building contains a modern four-stage bleaching system with the most modern instruments for the control of bleaching operations. This plant has a capacity of 300 tons of pulp per day.

In addition to producing chemically processed pulp, Oxford also manufactures about 75 tons of ground-wood pulp a day. This type of pulp has very short fibres and is used as a filler with the chemically processed pulps to make a wide variety of quality book papers.
Refining Pulp

Before pulp is used on our paper machines it is refined in machines called Jordans. A Jordan is a cone-shaped steel shell with length-wise steel blades on the inner surface. Inside this revolves another cone with more steel blades along its surface. These two cone-shaped cylinders can be adjusted to very close tolerances. By forcing pulp to pass between them, a beating or refining action can be performed on the pulp fibres. In this way the tiny pulp fibres can be cut or gently brushed. This refining of pulp is essential in the making of quality paper.

Before the pulp passes through the Jordans, dyes, fillers, and sizing agents such as clay, alum, and resin (which give paper such characteristics as body, strength, color, and opacity) are mixed with the pulp.
By varying the quantities and qualities of different pulps, the severity of the beating action in the Jordans, and the amounts of sizing and filling agents added, a wide variety of combinations can be produced to make the many grades of fine paper produced at the mill.

Some refining of pulp is also done in beaters. A beater is an oval shaped tub about 20 feet long, three feet deep, and has a partition in the center. The wet pulp is caused to circulate around this vat by the action of a heavy drum faced with steel cutting bars. This drum, called a beater roll, rotates against the top of a bed plate also faced with steel bars.

All pulp circulating in the beater must pass through the narrow space between the beater roll and the bed plate. By raising or lowering the beater roll the tiny pulp fibres can be cut or gently brushed and thus prepared for the paper machines.

After beating the pulp is “dumped” into beater chests where it is kept agitated and ready for use on the paper machines.

A JORDAN FOR REFINING PULP
The Papermaking Machines

As already mentioned, the first papermaking machines were developed by the Fourdrinier brothers of England early in the nineteenth century. Since that time they have been developed to a high state of perfection. Today, some of the modern machines at Oxford produce fine quality book paper in a strip 12 feet wide at speeds of 1,200 feet a minute.

However, with all the new developments, the original principle of making a continuous strip of paper on a moving wire screen remains the same.

From the beater chests and Jordans, processed pulp is pumped through a fine screen into a "head-box" at the "wet end" of the machine. The purpose of the screen is to remove tangled fibres which would mar the perfection of the finished paper. The "head-box" does exactly what its name implies; it builds

THE "WIRE" OR "WET END" OF A PAPERMAKING MACHINE
up a volume of watery pulp similar to the manner in which a dam across a river builds up a head of water.

From the head-box the pulp passes in an even flow through regulating gates called "slices" and runs over a rubber apron to a finely meshed, endless wire screen, generally called "the wire," which runs the full width of the machine.

Deckle rules fastened along both sides of the wire keep the watery pulp in place as it flows. At the same time the wire vibrates from side to side and interlaces or mats the fibres together. Much of the water in the pulp flows down through the meshes in the wire and, further along, more of it is removed by suction boxes placed across the under side of the wire.

Above and between the suction boxes is a wire-covered roll called a "dandy" which impresses the rapidly forming sheet of pulp fibres. This dandy roll is also used to impress watermarks into the forming paper.
After passing under the “dandy” and over the suction boxes, the web of pulp passes over about one-third of the surface of a “couch roll.” This is a cylindrical suction unit which extracts much of the remaining water in the web of pulp. The paper is now formed and is passed along to an endless belt of moist felt while the wire passes under the “couch roll” and moves back to the head-box to bring along more pulp.

The paper, now carried along on the damp felt, passes between a series of cylindrical rolls called “press rolls.” These squeeze out more water and smooth the surfaces of the paper.

From the press rolls the paper, still retaining about 65% moisture, starts through the drying cylinders. These rotating cylinders of polished cast-iron are about four feet in diameter and run the full width of the machine. They are steam heated and at all times the temperature is closely controlled to provide a uniform moisture content in the paper produced. The number of drying cylinders on a book paper machine may vary from 25 to 50 depending on the character and weight of the paper being produced.

When the drying operation is completed, the paper is passed through the heavy rolls of a calender stack which impart a smooth surface to the paper. From the stack the paper goes to a windup reel at the end of the machine.

On several of Oxford’s modern papermaking machines, some of them as big as a battleship, the paper is passed through a roll press section which applies a coating made from such materials as clay, starch and pigments. This is known as machine-coated paper and has an unusually high gloss and finish. The application of coating materials to paper while the paper is moving through the papermaking machine is a modern innovation that was introduced in recent years.
Supercalendering

In ancient times, when paper was laboriously made by hand, it was calendered or given a smooth surface by burnishing each sheet with polished stones. The purpose of this burnishing was to press down any loose fibres, close the pores in the sheet, and thus make it more suitable for printing or for the use of pen and ink.
Today, high speed supercalenders do the work of reducing the bulk or thickness of the paper and at the same time give it the smooth and glossy surface so desired by printers and publishers.

A supercalender is an upright stack of alternate steel and resilient rolls. The resilient rolls are generally made of pressed cotton fibre. From the top of the calender, hydraulic pressure is applied so that the steel rolls press into the resilient rolls. This alternating of hard and resilient rolls performs a burnishing action on the paper passing through the stack and imparts an unusually high gloss to the sheet.

In Oxford today, both machine stacks and supercalenders are used to give quality book paper the various degrees of smoothness and polish required for a wide variety of different printing purposes.

Our big supercalenders, driven by electric motors, and with top speed of 1,800 feet a minute, can run 8 miles of 148 inch wide paper in about 20 minutes. Each day, more than 500,000 pounds of machine coated paper is processed on the supercalenders. This is equivalent of a strip more than 500 miles long and 148 inches wide.

The first mechanical machine for imparting a gloss to paper was invented in Europe in the Sixteenth Century and was called a pressing or glazing hammer. The sheet of paper was laid on a smooth surface and a heavy hammer was made to fall upon the sheet thus smoothing both sides in the same operation.

Later the pressing hammers were replaced by plate calenders. The sheets of paper were placed between highly polished plates of copper or zinc until thirty or forty sheets were in the pile or pack. The pile was then passed between two iron rollers and a great amount of pressure was applied.

Perhaps the first modern type supercalender was developed by the Dutch when they made a machine equipped with a series of wooden rolls that could be pressed together.
Finishing And Shipping

After rolls of paper are supercalendered, they are sent along to the rewinders where they are wound into tight, evenly-balanced rolls. Also, sharp disks on the rewinders can cut big rolls into small rolls and trim off the outer or deckle edge of the web of paper.

Every day, about 340 tons of our paper is shipped to our customers in rolls for use on high-speed rotary printing presses. Approximately another 260 tons is cut into sheets on high-speed cutters. Sheet paper is generally cut and trimmed to the customer’s specifications and after careful inspection and sorting in our finishing rooms is shipped on skids, in cases, and in cartons.

A HIGH-SPEED SHEET CUTTER IN THE FINISHING DEPARTMENT
More than 600 tons of our fine quality paper, in 21 to 23 railroad cars, leaves Rumford every day for delivery to publishers, paper distributors, and printers across the nation. Later, this paper can be found in magazines such as TV Guide, Better Homes and Gardens, House Beautiful, Vogue, Cosmopolitan, House and Garden, Reader’s Digest Books, and many other publications having a national circulation. Our paper also appears in the books of the best publishers, in smart advertising brochures, and catalogues. Our specialty papers also appear in the form of envelopes, wrappers for fine books, labels for cans and bottles, and in soap wrappers. Some of the pulp we produce is used by other companies for the manufacture of paper plates and drinking cups.

Wherever you go in the United States, you will find Oxford’s fine quality book and specialty papers serving the nation.
Oxford’s Other Mills

In addition to its large plant in Rumford, Maine, the Oxford Paper Company has two other mills. One is located at Lawrence, Massachusetts, (below), the other at West Carrollton, Ohio, (above). The mill at Lawrence has 700 employees, two papermaking machines, five coaters, and a soda mill for making pulp. It specializes in the manufacture of fine quality coated papers. The mill at West Carrollton has 400 employees, four papermaking machines, and produces some of the finest offset printing papers manufactured in the United States. Production for these two mills is approximately 300 tons a day.
The Oxford Story

Note: This brief history of pulp and papermaking in Rumford and the origins of the Oxford Paper Company is from the book, "As I Live And Dream" by Gertrude M. Cote of East Rumford, Maine. Published in 1955.

The transformation of Rumford from a small farming community to one of the great papermaking towns of New England began in 1882. At first the transformation was only a dream in a young man's eyes. This young man was Hugh Joseph Chisholm who for some years had been a resident of Portland. In the winter of 1882 he got off the Grand Trunk Railroad at Bethel, Maine, and with Waldo Pettengill drove twenty-four miles by horse and sleigh to where the Androscoggin River thunders over the Rumford Falls.

FIRST POWER STATION AT RUMFORD FALLS - 1892
Few outsiders had ever seen this magnificent stretch of the Androscoggin River. Only hunters, Indians, and the few farmers who had settled in the locality had looked on the great falls where the waters of the Androscoggin roared down more than 162 feet in a distance of about one mile. To these, the falls meant little more than a great volume of roaring, turbulent water.

But young Hugh J. Chisholm, standing near the falls with the spray falling on his face, saw more than rushing water. With his vivid imagination and practical mind he saw the possibility of low-cost water power — power that could be used to drive machines, and machines that could be used to make pulp and paper from the forest of trees that grew along the hills and valleys near the falls. From the time he was thirteen years old he had been associated with paper and pulp products. His story in the paper industry is a typical American saga of "from rags to riches."
This young man, who was to change Rumford from a sleepy farming community into a booming industrial town, was born in Chippewa, Ontario, in 1847. He was the fifth of ten children whose parents, Alexander and Mary Phelan Chisholm, had migrated from Strathglass Glen, Scotland. At the age of thirteen, when his father was accidentally drowned, Hugh J. had to abandon grammar school and go to work.

The first job Hugh ever had was digging potatoes at twenty-five cents a day. Quickly realizing that he was not cut out to be a farmer he secured a job selling papers and magazines on the old-time trains that ran between Detroit and Toronto. Another boy, about the same age, by the name of Thomas A. Edison, had the same job on the alternate run and the two became lifelong friends. Both were destined to rise in the rapidly developing industries of electric power and papermaking.

Soon after this the firm of Chisholm Brothers was formed and it was not long before the firm had the sole rights to dis-
tributing papers and magazines on more than 5,000 miles of rail and steamship lines. The next step was into the publishing business and the firm began to specialize in the publication of tourist guides and souvenir books of travel.

In 1872 Hugh J. Chisholm became an American citizen and settled in Portland, Maine. Here he became interested in the pulp and papermaking industry and, after securing an early patent for making wood-fibre ware, founded the Somerset Fiber Company at Fairfield. This plant burned to the ground but, un-daunted by the set-back, he established the Umbagog Pulp Company at Livermore Falls.

It was ten years after coming to live in Portland that Hugh first saw the great falls on the Androscoggin at Rumford and started in motion the chain of events that was to make Rumford the busy and prosperous community it is today. Mr. Chisholm recognized the power possibilities of the Rumford Falls and immediately began to plan toward the acquisition of property and flowage rights along the river in Rumford.
Nothing very much seemed to happen in Rumford after Hugh J. Chisholm made his memorable visit to the falls in 1882. But then, great industries do not spring up overnight. It takes long years of planning, effort, and financing to build plants and to buy machines.

Between 1882 and 1890 Mr. Chisholm and his associates bought up hundreds of small parcels of land around the Rumford Falls and along the river. This involved the purchase of 1,400 acres which would assure them of the use of the falls and adjacent water rights. At that time land along the river was worth only a few dollars an acre. Even so, it took long and patient negotiating on the part of Waldo Pettengill to secure the required property. One farmer demanded forty dollars an acre and refused to budge from this fantastic figure. Finally, Mr. Pettengill was forced to call Hugh J. Chisholm in Portland and tell him there was a “crazy” farmer in Rumford who wanted forty dollars an acre and refused anything less. Mr. Chisholm must have felt some kinship for this Yankee farmer.
He is supposed to have said, "Give him his forty dollars an acre and congratulate him on his particular brand of insanity."

In 1890 Mr. Chisholm and his associates organized the Rumford Falls Paper Company and built the dam and hydro-electric power station which became the major source of power in the area. Also in that year, he founded the Portland and Rumford Falls Railroad which later became an important part of the Maine Central Railroad. This project was completed in 1892 and was essential to any industries that might operate in Rumford.

Of course, between 1882 and 1890, Mr. Chisholm was not idle. He was literally a human dynamo who scarcely had one project planned and started when he was off on another. Some of the old folks who knew him back at the turn of the century have told me that whenever he came to Rumford people constantly crowded around him and wanted to know what he intended to build next.

In 1887 he founded the Otis Falls Paper Company at Livermore Falls. This company was capitalized at $750,000 and Hugh J. Chisholm became its treasurer, its general manager and principal owner. At that time it was one of the largest plants of its kind in the country and later became a unit of the International Paper Company. This company, also originated and organized by Mr. Chisholm, was to become the largest of its kind in the world. Later, in 1898, Hugh Chisholm became president of International and in 1907 he became chairman of the board. It was not until 1909 that he resigned to become president of the Oxford Paper Company.

In the meantime, Rumford became a busy place. Builders and contractors and their men were digging, sawing, and hammering at the work of constructing a plant for the Rumford Falls Paper Company. A prospectus issued in 1890 showed a
projected layout for manufacturing sites, canals, a business section, railroad facilities, homes, and parks. In all, thirty mill sites were to be available in Rumford.

The first paper to be produced in Rumford came from the Rumford Falls Paper Company plant in 1893. At this time 183 men and women were employed in the plant and the weekly payroll was $3,658. There were two paper machines and two pulp mills with a capacity of 52 tons a day. Then in 1899 the International Paper Company and the Continental Paper and Bag Company moved into town. Soon more than 700 men and women were employed in the mills and the weekly payroll moved up to $15,000 a week.

It was in this year, 1899, that Hugh Chisholm founded the Oxford Paper Company, of which he was to become president in 1909. This company was another one of his dreams. The great majority of paper mills in New England were making
nothing but newsprint and a few specialty papers. He could foresee the time when there would be a tremendous demand for quality papers for the widespread publication of fine books and magazines.

This was his last great project. The Oxford Mill in Rumford, now one of the largest book paper mills in the world under one roof, remains as a living memorial to his vision in planning for the future and to his indefatigable energy in making his dreams come true.

All the other paper companies have left Rumford and their buildings have been added to the existing Oxford Mill. Today, the main plant at Oxford covers 30 acres or 1,306,800 square
feet and employs more than 3,000 men and women who reside in the Rumford-Mexico area. And every day more than 600 tons of fine quality book and specialty papers leave the mill for delivery to publishers, printers, and paper distributors.

One of the outstanding features of the mill is that its operations cover all major phases of papermaking. It has its own woodlands, makes its own hardwood and softwood pulps, produces its own power, manufactures some of its essential chemicals, and has thirteen modern paper machines for producing more than eight percent of all the fine book paper made in the United States.

And all this valuable industry of ours, which has maintained Rumford as an above-average, prosperous community, came from the vision and energy of a young man who looked on the rushing waters of the Rumford Falls back in 1882.

Hugh J. Chisholm, often referred to as "the founder," died in 1912 and was succeeded in the presidency of the Oxford Paper Company by his son, another Hugh J. Chisholm. The son carried on very ably where his father left off and continued to expand the plant. Since the end of World War II alone more than fifty million dollars have been spent in modernization and improvement projects.

And all these years the mill and the great majority of the families living in this locality have been closely associated. You can't talk about Rumford without talking about the Oxford Mill and vice versa. Economically and socially we are bound together and sometimes I think we have been fortunate in that our big local industry is an important segment of the paper trade. It has always been a relatively stable and essential industry and as long as people read and write I imagine that Rumford and Oxford will go down the years together.
People And Paper

The Management at Oxford is very proud of the modern machinery and equipment in its mills at Rumford, Maine; Lawrence, Massachusetts; and West Carrollton, Ohio, but it is still more proud of the technical skills and abilities of the more than 4,000 men and women who operate its various mill departments and offices.

Today, as in the past, Oxford means men and women skilled in the art of papermaking, working together to operate modern machinery and equipment, and working under good conditions where safety and cleanliness are a part of every operation. All this adds up to fine quality book, business, and specialty papers to serve the nation.

Over the years, people have found Oxford a good place to work. The Company now has more than 4,000 employees. Of these approximately 900 have worked with Oxford for 25 or more years.

A SKILLED WORKER OPERATING A REWINDER
Some Facts About Oxford

Founded in 1899 the Oxford Paper Company now produces about eight per cent of all the fine book paper made in the United States.

The first mill buildings for the Oxford Paper Company were built near the Androscoggin River in Rumford, Maine, in 1900 and 1901. Production on four paper machines, at the rate of 44 tons a day, began in November, 1901. By 1906, Oxford had six machines ranging from 118 to 148 inches wide and had boosted production to 125 tons a day. By 1922 the Rumford Mill was operating eight paper machines and producing 360 tons of paper a day.

Further expansion came in 1926 when Oxford acquired the mill of the Oxford Miami Paper Company, West Carrollton, Ohio. This mill, with four paper machines, produces about 150 tons of paper every day. Oxford acquired another mill in 1958
when it purchased the Champion International Company, Lawrence, Massachusetts. This mill, specializing in quality coated papers has two paper machines, five coaters, and a soda mill for the manufacture of pulp. It produces about 36,000 tons of paper annually.

In a period of 61 years the Oxford Paper Company grew from a relatively small organization producing about 20,000 tons of paper annually with 180 employees and four paper machines to an industrial complex operating mills in three states with 19 paper machines, more than 4,000 employees, and an annual production of approximately 300,000 tons of fine quality paper.

The daily output of paper at the Rumford Mill is more than 600 tons. This is the equivalent of a flow of paper 2,000 miles long and 11 feet wide, or sufficient production every 13 days to circle the world at the equator with a paper girdle 11 feet wide.

THE LIGHTS ALONG THE RIVER — OXFORD AT NIGHT