The Great Northern Paper Company, Chapter 02: Better and Cheaper

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CHAPTER II
BETTER AND CHEAPER

It is said that there are at least seven thousand different uses for paper, and it is made in almost as many forms; all the way from unbelievably thin sheets like condenser paper to sturdy container board; in every conceivable color and finish, with special characteristics for special requirements.

Modern newsprint, the paper on which newspapers are printed, and with which a large part of our story is concerned, is the head of a family of papers which are made principally from "groundwood" or mechanical pulp; that is, wood which has been reduced to fibre by the action of a grindstone or a refiner, without chemical assistance. A sheet of standard newsprint is approximately .032" thick mostly white or nearly white in color, and 500 pieces of it, 2 feet by 3 feet in size, weigh about 32 pounds. It is made of a mixture of mechanical and longer-fibred chemical wood pulp, with a little coloring material and sometimes a bit of china clay filler. In North America, it is manufactured in mills all the way from Newfoundland to Texas and from Maine to British Columbia, on some of the largest paper-making machines ever built, and in the year 1973 over ten and one-half million tons of it went through the presses of United States newspapers alone.

It is generally conceded that the process of making paper was developed in China about the year 105 A.D. (1) Papyrus, which had been used by the Egyptians for at least a thousand
years prior to that date, was not true paper, although it has given its name to the product with which we are familiar.

The use of paper, made at first from the inner bark of certain trees; cotton, flax, hemp, and at a very early date from previously processed fibre such as old linen rags and fish-nets, spread gradually westward from China, but it was not until the beginning of the 8th century that it became known to the Western world.

The subjugation of Samarkand, the principal city of Turkestan in southern Asiatic Russia, by Arab peoples, was accomplished between 705 and 751 A.D. The Arabs found paper being made in that city by Chinese. They continued and encouraged the industry, and the horsemen of Islam spread the knowledge of it throughout their empire. Faced with the problem of raw materials, the Arabs turned to cotton and linen rags, and discovered the advantages of these materials over raw fibre. (2) As the use of paper increased, the Arab manufacturers came up against the problem of making it "better and cheaper", the goal of the paper-maker of today, and they developed and improved the process.

Paper was brought into Europe by the Moors, the Arab Moslems who invaded and conquered Spain in the 8th century. It appears to have been early in the 11th century, however, that the first paper was actually made in that country. (3) The industry flourished in Valencia and Toledo, both of which were manufacturing centers, until the Moors were driven from Spain in the 13th century.
While the first Crusaders, who went to Palestine from Europe, became acquainted with paper, and learned how to make it, they were apparently not much interested in it, and it was not until after the Third Crusade that the paper-making industry was established independently in Christian Europe. (4) The first mill of record appears to have been at Hainault, in France, in the year 1189. (5) Shortly thereafter, paper manufacturing began in Holland.

During the 12th century, improvements in the paper-making process were made at a rapid rate in France. The paper trade there grew tremendously, as it did also in Holland, and these countries were soon exporting much of their product. For a long time, French and Dutch papers were the best in Europe and held most of the market. (6) Italy began making paper after the fall of Moorish power and the decline of paper-making in Spain, and in the 14th century mills at Padua, Florence, Milan and Venice supplied most of the paper used in southern Europe.

So important did paper-making become to these countries that not only did individual manufacturers go to great lengths to prevent their improvements from being copied by others, but the various governments adopted highly protective policies. However, Italian workmen were induced to aid in establishing the industry in Germany, and a number of mills were in operation near Cologne and Mainz as early as 1320. (7) In the year 1390, a mill was built at Nuremberg, where the workmen were required to take an oath that they would not teach others the art of paper making, or go into business for themselves. (8) As late
as the 16th century the Dutch endeavored to protect their industry by making the exportation of paper-making equipment an offense punishable by death. (9) At the beginning of the 19th century, a Federal census of manufacturing in the United States got no cooperation from the papermakers, who were reluctant to divulge any information about their industry. (10) In 1828, the one-man crew of a cylinder machine in Franklin, New Hampshire, was under written bond to make no disclosure about the process, and the mechanic who repaired the machine was allowed to see only the part requiring attention. Nearly 150 years later one occasionally still finds a mill which discourages visitors and inquiries into its operations.

Paper was not made in England for a long time after the industry was well established on the continent. The first record of a paper mill in the British Isles is in 1495, but there does not appear to have been a permanent paper industry there until late in the 17th century, when new life was given to manufacturing in general by the immigration of Huguenot refugees from France. (11) In 1689, paper was so scarce and expensive in England that all printing was practically at a standstill. (12) At this point, the law of supply and demand brought about an expansion of the industry, and at just about the same time the first paper mill in America was built near Philadelphia by William Rittenhouse (Ruddinghuysen), a papermaker from Holland, and William Bradford, a printer. This was in the year 1690.

Up until this time, the preparation of fibre for the manu-
facture of paper had not changed greatly in principle from the procedure used by the Chinese. Soaking in water; fermenting, in the case of linen rags, and pounding in a mortar with hammers, at first by hand and later by machinery driven by water wheels or windmills, constituted the process. Starch sizing, to allow the paper to be written upon with ink, was known to the Chinese and was used by the Arabs. This art was lost during the Middle Ages and was not regained until the 19th century, animal glue being used as size meanwhile. (13)

Natural plant fibres were at a very early time supplanted by reworked rags of cotton, linen and even woolen cloth. By the 13th century, rags had become the principal papermaking material throughout the Western world. An Arabian traveler, who visited Egypt in the year 1200, informs us that "the cloth found in the catacombs, and used to envelope the mummies, was made into garments or sold to the scribes to make paper for shopkeepers". (14) This was linen cloth. The art of preparing raw fibre for the making of paper was gradually lost.

The invention of printing from movable type, in the middle of the 15th century, greatly increased the demand for printing paper and for the rags from which to make it. The scarcity of materials led to Government control. In 1588, for example, Queen Elizabeth of England granted to Sir John Spielman, a German, a license for "the sole gathering for ten years of all rags, etc., necessary for the making of paper". (15)

The date of the invention of the first major improvement
in paper making equipment, the Hollander, or "beater" as it came to be called, is unknown. Some authorities place it as late as 1759. However, other sources indicate that it was in use in Holland previous to 1697, where "there are windmills with cutting and grinding engines which do more in two hours than the others do in twelve." (16) The beater employed the principle of rubbing or brushing out the fibres instead of developing them by pounding. This same principle is used, with many variations, in the machinery used to refine pulp in our modern mills. This invention not only resulted in better paper, but facilities for preparing the pulp far outstripped the crude methods for making the sheet of paper which had been in use ever since paper-making began. This put pressure on the development of machinery to make the sheet itself, but a successful paper machine was not to be forthcoming for over a century.

For nearly seventeen hundred years, paper had been made in relatively small sheets, by dipping a mold, made up of a rectangular frame with a bottom of woven reed, horsehair or wire, and a removable raised edge frame--the "deckle"--, into a vat of pulp; throwing off the excess stock so that just the right amount remained in the mold, shaking the mold with a peculiar rotary motion to distribute the fibres evenly and mat them together; allowing the free water to drain off through the woven bottom and removing the sheet thus formed. This was then pressed between woolen cloths to remove more of the water, and was dried in the air or on heated metal plates. In later developments, a finish was imparted to the paper by pressing it between smooth metal surfaces or by rubbing it with a polished stone.
It required years of training for the papermaker to perfect himself in the technique of manipulating the mold so as to form a "level" sheet and he was a highly skilled workman. His productivity, however, was very low. The Spielman mill, operating in England in 1588, which produced only a few pounds of paper a day, is said to have employed six hundred men. (17) More than one hundred years later, a day's work for a crew of three men was about 4½ reams of the paper used for printing newspapers, 20" x 30" in size. (18) At the end of another hundred years the process was substantially unchanged.

In January, 1799, N.L. Robert, a machinist in a paper mill in Essones, France, was granted a patent on a machine to make big sheets of paper -- as large as twelve feet wide and fifty feet long. This was revolutionary, but the working model, was not satisfactory, and the experiments necessary to perfect the machine were expensive. Robert sold his patent to Leger Didot, the owner of the mill in which he worked, and Didot, with an Englishman, John Gamble, took the model to England, where there seemed to be more favorable conditions for development. There they secured the services of Bryan Donkin, a man of considerable mechanical skill, and between them they perfected the machine. In 1801 and 1803, British patents were granted to Gamble for improvements. In that same year, the first machine for making paper mechanically was put into operation at Frogmore, in England. A second machine was installed at Two Waters, in England, in 1804.

In that year, the Messrs. Henry and Sealy Fourdrinier,
wholesale stationers, of London, bought the improved Robert patent from Didot and Gamble, and proceeded to make further improvements, on which they obtained patents. In spite of its great potential, the fourdrinier machine, as it came to be called, brought little financial return to the people who made it a success. Donkin, on the other hand, formed a company to manufacture the machines, and made a great deal of money. (19)

In these primitive paper machines a controlled amount of prepared stock was run onto an endless moving woven mesh belt -- the "wire" -- from which the formed sheet was removed by a "couch roll" and was transferred to a "press part", where other rolls squeezed out some of the remaining water. The paper, however, was wound off wet, was immediately unwound, and was hung up on wooden poles to dry in the air. As time went on, the poles were made to travel, picking up the paper from the presses in loops, and drying became continuous. This was the "loft dryer". The machines were gradually further improved. Cylindrical metal dryers, heated at first by burning charcoal in suspended baskets, later by steam, replaced the loft dryer, although this remained in use for some types of papers for a very long time. At some point suction boxes were invented, and the "calender stack", a set of smooth, heavy, heated rolls, which put a finish on the surface of the sheet, was added. A reel for winding off the paper continuously was developed, and at that point all the basic functions of forming, drying, finishing and winding could be performed by one machine. Our modern high-speed multi-million dollar monsters retain all the principles of the original Fourdrinier machine. The part that
forms the sheet is still known as the "fourdrinier", and it, along with the rest of the machine, is still being improved. Indeed, in the writer's experience, no new paper machine was ever installed without "improvements" being made in the process, and no new machine has ever been in operation for more than fifteen minutes without the addition of further "improvements" by the machine crew in the form of canvas, bits of wood and pieces of baling wire -- some of which improvements later become permanent, some are discarded, and some seem to remain in use for the life of the machine as canvas, bits of wood and pieces of baling wire.

The high cost of the early fourdriniers led to efforts to produce a more simple and less expensive machine. In 1809, John Dickinson, an English papermaker, patented the cylinder machine, in which the "wire" instead of being an endless belt, is the surface of a cylinder which revolves, partly submerged, in a vat of paper stock. Water draining into the interior of the cylinder leaves on its surface a mat of pulp, which is continuously removed by a woolen felt, and is passed through press rolls and dried as on a fourdrinier. This type of machine is still in use, often with a large number of cylinders, the several sheets made by the individual cylinders being combined to form heavy paper or board. A number of variations on the fourdrinier and the cylinder have been developed, together with combinations of the two, but most of these have become unimportant.

By the time of the American Revolution, there were probably about fifty paper mills in the Colonies, but the amount
of paper they made, due to the scarcity of rags as raw material, was an inconsiderable part of market requirements. (20) Rags became so scarce that at the beginning of the war not more than three mills were able to remain in operation in New England. This situation was general throughout the world and serious efforts began to be made to find other kinds of raw material. Again, however, as in the case of the paper machine, it was nearly a hundred years before a satisfactory solution to the problem was found.

It does not appear that American papermakers gave much thought to the production of paper by machinery until after the War of 1812. In 1810, there were at least 185 paper mills in the United States, all making paper by hand, and in that year papermakers began to bolster local raw material supply by importing rags from Europe. (21) At that time, and for many years thereafter, the domestic industry was hampered by heavy importations from Europe and depressed financial conditions at home. By 1820, the industry was in serious difficulties. In Pennsylvania, the leading papermaking state, production had dropped to about 20% of pre-war volume. At that, the paper business was in better shape than some others. Thomas Gilpin, a textile and paper manufacturer of Philadelphia, faced with a choice, decided to suspend the manufacture of cloth, and concentrate on paper. He had interested himself in the design of the Dickinson cylinder machine, and had come to the conclusion that he could build in America a machine, which, if not quite as good, would at least make paper, and he started out to do so. His design was patented in 1816, and the following year his first
machine was started up near Philadelphia. This was the first efficient mechanical paper-making plant in America. Gilpin tried to keep the details of his machine secret, but its product was so good that competitors were forced into intensive experimentation, and many new cylinder machines were built. Gilpin's business began to decline, and eventually he failed. The mill, the machines and all the experimental data were destroyed by a flood in 1822. (22)

Between 1820 and 1830 there was no remarkable improvement in the art of paper making in the United States. In 1827, the first fourdrinier machine to be used in America was imported from England and installed at Saugerties, N.Y. About the same time another fourdrinier machine was installed at Windsor Locks, Conn. Efforts were made to interest American paper manufacturers in English machinery, but prices were so high that few orders were obtained. During this period a number of cylinder machines of domestic manufacture were put into use, but they were mostly crudely made and were used on the poorer grades of paper. (23)

From 1830 to 1840 there were still no outstanding advances in the manufacturing process, although the industry continued to expand, and its financial condition improved. Machinery came to be more widely used, almost all of the paper machines being still of the cylinder type, however. Imports of paper continued to account for a large proportion of domestic consumption.

Better - 11
In 1801, paper had been made successfully from straw by Mathias Koops, who published a book describing the process. In the same year, a man with a very similar name, Matthew Kooper, succeeded in making clean white paper from de-inked old paper, and the papermaking qualities of flax and hemp were re-discovered. About 1828, William Magaw, of Readville, Pennsylvania, developed a new method of making straw pulp, and this process was used for many years. Straw and some other fibres gradually became acceptable for newsprint and other low-grade papers, but while many materials were tried, rags continued to be the favorite papermaking material, in spite of continual shortages and rising prices.

It had long been recognized that wood had a fibrous structure, and many attempts were made in the early 1800's to separate the fibres mechanically. Charles Fenerty, of Nova Scotia, experimented with the grinding of wood, and made paper from the pulp thus produced some time prior to 1844. (24) In that year, Freidrich Keller, a German, inspired by the scientist Reaumur's comments on the "paper" made by American wasps, developed and patented a machine for grinding wood into pulp. This patent he sold to Henry and Christian Voelter, also Germans, who improved on it, patenting the improvements in France as early as 1847, and in the United States in 1858. (25) In all the processes prior to the Voelter improvements, the wood had been ground on end, producing fibres of no practical length, nearly worthless for papermaking. The Voelter process ground the wood with the axis of the stick parallel to that of the revolving
stone. At the same time, his apparatus provided that the pulp was carried around the stone, and was crushed and rolled between the stone and the unground portion of the stick. This action resulted in the separation of the fibres into little "bundles", which were to some degree broken up by the re-grinding action, producing usable papermaking pulp.

In 1852, Charles Watt and Hugh Burgess, of Reading, England, made paper from pulp obtained by treating wood with caustic soda and a chlorine bleach. In 1855, Hugh Burgess came to America and produced pulp from poplar wood by boiling it in caustic soda at Maylandville, Pennsylvania, and in the same year built a small soda mill at Royer's Ford, Pennsylvania. (26)

While Congress had imposed duties on paper in 1816, this had not allowed the domestic industry to develop, or perhaps there was reluctance on the part of American manufacturers to adopt new ideas. At any rate, the numerous improvements which were developed in England between 1840 and 1850; the almost universal use of the more efficient fourdrinier paper machine in Europe and an importation duty on rags in 1843 all tended to check domestic production. It is questionable whether there was much increase in the quantity of paper made in the United States between 1840 and 1850 over that made in the previous decade.

The year 1850 opened with bright prospects for all industry in America. The discovery of gold on the Pacific Coast and the new foreign markets which were being opened up by exports of cotton and grain were powerful stimulants to
many branches of manufacturing, including the paper business. New mills were built and existing mills were enlarged. Many of the old cylinder machines were replaced by fourdriniers, and pulp preparing equipment was correspondingly improved. This boom lasted five years, during which time, supply could not keep up with demand, and prices rose rapidly. Then, following the pattern which has been the bane of the industry ever since, the effect of over-building became apparent; prices dropped, and by 1860 many mills had been forced to close their doors.

It is a little hard for us to visualize the paper mills of this period and to realize what miniscule units they were in comparison with our modern mills. The United States Census Bureau report for 1860 is quoted as follows:

"Some of the largest mills in the United States have turned out paper at the rate of seven tons per diem. The materials used are not only cotton and linen rags, the waste of cotton, flax and hemp mills, and of rope and cordage factories, coir and jute, hemp and other fibres, either crude, fibrilized, or in the shape of worn-out bagging, cable, rope, etc., but also straw, hay and stable refuse, various kinds of wood, particularly bass or white wood, hemlock, etc., cornhusks, mulberry leaves and bark, canes and reeds, etc., etc." (27)

This was probably the first public acknowledgement that "stable refuse" was used in making paper, although many mills, before and since, have been accused by their customers of this practice.
The outbreak of the Civil War in 1861 gave a new impetus to the paper industry. The tremendous jump in the price of cotton which followed the beginning of the war caused paper to be used for many things for which cotton had formerly been employed. Paper twine, paper collars, cuffs and shirt-fronts came into use, and many other new applications generated a huge demand. The price of paper rose by leaps and bounds. Newsprint, which sold for $166.00 a ton in New York in 1860, had gone up to $442.00 a ton by 1863, and the price of other grades had risen accordingly. (28) As the war went on, prices dropped again, and many of the smaller mills were soon in trouble. However, at the end of the war, forces came into play which changed the entire future of the paper industry, and particularly that part of it concerned with the manufacture of newsprint, with which this story will be largely involved from this point on.

These forces were many, and were acting from many directions. The tide of education was rising. More and more people could read, and were using this facility to increase their knowledge. The press was improving its technology. In 1868, the Walter rotary press was developed by the London Times; the first paper to use stereotype plates for newspaper printing. In 1870, a machine was invented for folding newspapers as they were delivered from the press, and a few years later Mergenthaler obtained his first patent on what became the Linotype. In the paper industry, there developed an awareness of the necessity of finding new ways to make it better and cheaper. The twenty
years from 1865 to 1885 saw the largest number of patents relating to pulp and paper making issued by the Government of the United States that had ever been known in the history of any country. The pressure for new sources of raw material began to take effect, and wood pulp became important as a papermaking material.

The first wood pulp to be used commercially in newsprint was mechanical pulp, the basic constituent of our present-day product. Historians generally agree that the first groundwood to be made in America was produced on two grinders imported from Germany by the Pagenstecher brothers, under license from Voelter, and installed in a mill at Curtisville, Massachusetts in 1866 or 1867. This pulp was first made into paper by the Smith Paper Company of Lee, Massachusetts.

The first important wood pulp mill in America to use the soda process developed by Hugh Burgess was built by the American Wood Paper Company at Manayunk, Pennsylvania, in 1865, (29) and a number of soda mills were built up into the late 1880's. Many improvements were made in the early processes, notably chemical recovery systems, which reduced cost sufficiently to keep the soda mills in business for a long term of years. Soda pulp was never any factor in the manufacture of newsprint, and the process is today practically obsolete.

Between 1865 and 1880, experiments were being carried out almost simultaneously in America, in England, in Sweden, in Austria and in Germany, which eventually resulted in the production of sulphite pulp. In 1866 and 1867, at the time the
first groundwood was being made commercially in America, Benjamin Tilghman, of Philadelphia, was experimenting with the cooking of wood, and was granted an English patent on a process for producing pulp by treating wood with a solution of sulphur dioxide in water, with or without the addition of the bisulphite of an alkali such as calcium or magnesium. While he made good pulp, his continuous digester, using indirect heat, was impractical, and, discouraged by a drop in the price of the already established soda pulp, he gave up his experiments, after having spent a small fortune. In Sweden, C.D. Ekman, probably unaware of Tilghman's experiments, developed a practical process for cooking wood with magnesium bisulphite in small, rotating, steam-jacketed digesters, and started up the first sulphite mill in the world at Bergvik about 1872. In Austria, about 1878, Baron Eugen Ritter and Carl Kellner developed a sulphite process using for heat steam admitted directly into the digester. This they operated secretly until 1882, when they obtained patents. In 1880, in Germany, Andrew Mitscherlich produced an excellent sulphite pulp by an indirect process similar to Tilghman's, while experimenting with the production of tannic acid. (30) There were a number of other developments and investigations in this period, many having to do with linings to protect the pressure vessel from the action of acid.

The Ekman process was brought to America by Charles Wheelright, of Providence, Rhode Island, but was never used on a large scale. The American rights to the Mitscherlich process were bought in 1885 by August Thilmany, and the first successful sulphite mill in America, built by the Fletcher
Paper Company at Alpena, Michigan, in 1887, used this process. A number of other Mitscherlich mills were constructed in the United States, some of which will be mentioned in another chapter. Due to the long cooking time involved, and resulting high cost, this process did not remain competitive, and is now also obsolete. The Ritter-Kellner process was introduced in America by Governor Russell and Charles Riordan, who built the first mill of this type at Merritton, Ontario, in 1885. (31) This direct-cook, or quick-cook, system was adopted by the newsprint industry, and has been universally used to produce the chemical pulp constituent of newsprint until quite recent years.

A third chemical method, the sulphate, or kraft process, producing a very strong pulp, was invented by Dahl, in Germany, in 1884, but was not used in America until 1907, when sulphite pulp was made by the Brompton Pulp & Paper Company, of East Angus, P.Q. (32) This process, while of the utmost importance to the paper industry, was used only in a very small way by newsprint mills up until the expansion in the southern United States in the 1950's. Semi-bleached kraft was used by the Southland Paper Company, which made the first commercial newsprint from southern pine groundwood in 1937. The kraft process has been used to produce chemical pulp requirements of all the southern newsprint mills built since that time, and in recent years other North American plants have found increasing use for this fibre in newsprint and other groundwood papers.

Another pulping method, developed in the 1940's and 1950's, is partly mechanical and partly chemical. In this method, the
material bonding the fibres of the wood is softened by chemical cooking, and the wood is then reduced to pulp by mechanical means. The pulp thus produced is generically semi-chemical, but has other names, and the wood is chipped, cooked and pulped in some type of mechanical refiner. This type of pulp has many useful applications, and has been employed to some extent in newsprint. In the 1940's, a semi-chemical process which involved cooking the whole stick of pulpwood and then grinding it in the conventional manner was developed for the purpose of producing news grade groundwood from hardwoods. The Great Northern Paper Company was the first to use this process commercially, but it was not successful. We will tell about it in another place.

All of the pulping processes have undergone many changes since the basic principles for them were established and the first crude plants were built. In the early chemical mills, for example, the wood, barked by hand, was sawed into thin discs which were packed into the digester. Mechanical means of barking, and guillotine-type equipment for making chips by slicing across the grain were devised, the latter being replaced by rotating knife chippers. The original pulp grinder evolved into many forms; the natural sandstones at first used (some say that cast iron "stones" were tried at one period) disappeared in favor of artificial pulp-stones, designed expressly for grinding wood, and the grinder itself is on the way to being replaced by the refiner.

Digressing from wood pulp, one other development deserves mention, as the bridge between rags and wood as the raw material for newsprint. Charles T. Davis, in his "Manufacture of Paper"
comments: "From 1870 to 1885 there remains but little to notice, excepting the introduction of wood pulp into papermaking and the enormous consumption of straw, etc. for newspaper". It has been noted that pulp was made from straw as early as 1801. According to the United States Census Bureau, white paper was first made from straw by the Messrs. Ames of Springfield, Massachusetts, in 1849, and several newspapers, including the Philadelphia Public Ledger had used paper containing straw for several years prior to 1860. The Bureau of Standards, in Washington, differs a little from this, as the result of a study made in 1934 of newspapers printed between 1830 and 1900. It states that the first departure from all-rag paper for newsprint was in 1868, when some straw was found in one of the papers. The latest paper using straw was dated 1885, after which time practically all newsprint was found to be a mixture of groundwood and chemical wood pulp in varying proportions. (33)

Returning now to wood pulp, the Bulletin of the New York Public Library of October, 1929, reports on a study of the newspapers in its files to determine the first use of wood pulp as a substitute for rags. The following paragraphs are from that report:

"The New Yorker Staats-Zeitung may claim whatever reward or blame may belong to the pioneer in this field, as it started to use wood stock in January, 1868. The New York World followed on June 22, 1870; and on April 5, 1871 the Providence Journal printed an issue on wood paper; the Brooklyn Daily Eagle followed by using wood
stock for the issue of July 28, 1871.

The change from rag to all wood was neither sudden nor uniform. In the case of the Brooklyn Daily Eagle and the New York World, it was spread over a period of ten and eleven years respectively, while the Staats-Zeitung commenced using wood paper on January 7, 1868 and continued at short intervals during the remainder of the year, some issues being on paper of a poor mixture. In 1869, many issues were on wood paper, and in 1870 all wood was used entirely, and this before most of the other papers had started to use wood."

In 1870, the price of newsprint was $270.00 a ton. "Wood", as the word is used above, means groundwood pulp, the earliest use of chemical wood pulp in newsprint apparently not being until 1872.

The change from rags to wood pulp was not only "neither sudden nor uniform", but was full of grief for the paper maker. It is said that the groundwood first used in newsprint by the Smith Paper Company was hauled to the mill by night, to avoid publicity, as there were those who thought that the company would be ruined by its use. However, as soon as the publishers had got over their distrust of it, the advantages of paper made from this pulp, for newspaper printing purposes, became obvious. These advantages remain to this day.

Charles T. Davis tells this story of an experience which probably was repeated many times as mills shifted to the new pulp.
"Pearson T. Chenney, ex-Governor of New Hampshire, has described the difficulty of introducing paper made from wood. In his testimony before the Senate Committee on Education and Labor, Mr. Chenney said:

'When Mr. Russell built his mill at Franklin, those of us who were engaged in the manufacture of paper and had no knowledge of what could be done with wood supposed that his enterprise would ruin him. We supposed that his material would be more like sawdust or clay. Mr. Russell completed his mill at Franklin, but after manufacturing the pulp he could not find a manufacturer who would buy a pound of his wood pulp, because they did not believe in it -- they had no faith in it, and he was compelled to buy a paper mill in order to make a good test of it, which he did in Franklin, right beside his pulp mill, and made the test, and a successful test, and showed very good paper. After the test was made he found great difficulty in selling it. The printers felt that they could not use it; they were afraid to use paper made from raw wood; they were afraid it would injure their type or ruin it, and they declined to use it.

His selling agents were the firm of Rice & Kendall, in Boston. They resorted to all sorts of devices to get this paper used, but they were finally obliged to resort to something that did not appear on the surface, but seemed necessary in order to secure the introduction of the paper into use. They had an order from, I think, the Boston Herald, for about 500 reams of paper. They were
supplying that journal regularly from month to month, and, without saying anything as to the nature of the paper, they sent paper made from this wood; the paper passed, and was used, and when the next order came and they delivered the regular paper which they had been in the habit of sending before, the Herald people came to Mr. Rice in some displeasure and asked why he could not send paper such as he had sent the month previous. He told them that he could do so if they preferred it and they said they did. They said it worked very well -- very much better than the other. So he told them that the next order they gave him he would send some of that paper. The next month he again delivered 500 reams of the wood paper and that was used and gave great satisfaction. But I think they were using it for six months before they knew that is was wood paper. That established the use of that class of paper, and there was no trouble after that in selling it. The fact is that it absorbs ink better and works much better for printing than other paper does, and works particularly well in rapid presses.

This Mr. Russell was William A. Russell, afterwards first President of the International Paper Company. According to the Merrimac Journal of February 23, 1872, he established his pulp mill in Franklin in 1868 or 1869. A number of other mills to produce groundwood pulp were built about the same time in New England.

Early paper mills were located close to centers of population, where a supply of rags for pulp was most likely to be
available. When paper machines were installed, more power was necessary. This, at that time, meant water power, and the mills moved out along the rivers to larger sources of power. With the advent of groundwood pulp, power in great amounts became requisite. Early in the groundwood game, poplar was the favorite wood, because of its bright color and easy grinding characteristics. It was soon learned, however, that spruce made stronger pulp, and as the demand for newsprint generated new mills, the combination of spruce forest and abundant water power was found in northern New York and New England, and a little later in the Lake States and eastern Canada, and the mills multiplied in these areas.

Royal S. Kellogg, of the Newsprint Service Bureau, estimated that in 1869, when wood pulp was first used in quantity in newsprint, the total production of this grade of paper was about 100,000 tons. During the 1870's, wood pulp gradually became the major raw material for newsprint, and production of this grade was increasing about 5% per year, to 149,000 tons in 1879. By that time the manufacturers were in serious difficulty again because of over-production. In August, 1878, they had met at Saratoga Springs, N.Y., formed the American Paper Makers' Association (later the American Paper and Pulp Association and still later the American Paper Institute) and attempted to set up a plan to control production to match demand. This failed, because all of the mills were not willing to cooperate. (35) The New York price for newsprint had dropped at this time to between $120.00 and $130.00 a ton. (36) By the next year, however, the gloom which followed the panic of 1873 began to
be dispelled, and the new decade began with excellent prospects for the publishing industry and consequently for the newsprint manufacturers. At this point began the unfortunate struggle between the newsprint manufacturing industry and the newspaper publishing industry -- of which the former is unavoidably an extension -- arising out of opinions, which have generally been of wide variance, as to what constitutes a fair price to the consumer and a fair return to the producer. In this conflict of interest, the Great Northern Paper Company has often held a unique position, as will be seen.

The short but active boom which started in 1879 touched off a new round of mill construction and expansion. The price of newsprint rose to $200.00 a ton early in 1880, but this rise was short-lived, the average price in 1880 being about $138.00. (37) The swift reaction of the strongly-organized publishing industry to this brief price flurry illustrated its new awareness of the development of situations unfavorable to it, and its willingness to use any weapon in its defense. Its action took the form of a number of bills introduced in Congress in 1879 and 1880, calling for the removal of import duties on pulp, newsprint and the raw materials thereof. These were defeated, partly because of the arguments of the manufacturers and partly because they became part of a general wrangle over tariff protection. In 1883 there was a moderate reduction in the duty on pulp and newsprint, and in 1888 another bill calling for further reduction of duties was introduced. This died between the House and the Senate. In the atmosphere of falling prices and overproduction the publishers were not particularly interested, and the manufacturers had little to say, for fear of
offending the publishers. (38)

Conditions in the industry during the latter part of the 1880's became chaotic. In 1886, Charles T. Davis wrote:

"Under the enormous output from the many large mills in this country, it is becoming a very serious question whether even mills of moderate capacity can afford to manufacture paper on a small margin of profit which produces a meagre but satisfactory dividend to the wealthy owners of the capital stock in the larger mills."

This was written of the paper industry in general, and in the newsprint business even the larger mills and their wealthy stockholders were not making "a meagre but satisfactory dividend." A report to the News Division of the American Paper Makers' Association in August, 1889, stated:

Each manufacturer seems to think he is as wise as his neighbor, and proposes to seek his fortune in his own way, regardless of consequences to others. Ruinously low prices and over-production are the reports from all quarters...." (39)

According to the Newsprint Service Bureau, there were in the United States at this time 130 companies with 132 mills, and in Canada 13 companies with 14 mills, making newsprint. Of the United States mills, nearly half were in New York State and New England. Only about one-third of all these mills made as much as ten tons of paper a day. In 1889, while pulp made from wood had been in use for about 20 years, all kinds of wood pulp accounted for only about 20% of the pulp used in making all
grades of paper; straw pulp was about another 20% of the total and the remaining 60% was made from rags, old rope, waste paper and the like. As far as newsprint was concerned, however, all of the 196,053 tons produced in that year was made from wood pulp. (40) The industry being concentrated in the northeastern and lake states, where the continued heavy cutting of spruce for lumber was causing concern as to the duration of supply, the mills had begun to bring in wood and pulp from Canada. This made the threat of the removal of tariff protection on newsprint a matter of the greatest importance. While no newsprint was being imported at the time, it was proposed to remove the duty on it. The manufacturers were well aware of the danger to them of the combination of wood supply and water power in Canada, the hostile attitude of their powerful customers, and the growing feeling in Canada that its forest resources should be used in home industry.

At this time, while awake to the problem, the manufacturers seemed to be unable to arrive at any conclusion as to what should be done about it. Their association was ineffective; they were hedged around by the anti-trust laws and were handicapped by public suspicion of "big business". In 1894, there had been a general revision of the tariff laws which had made no significant change as regards wood pulp or newsprint. There was a little burst of prosperity in the opening years of the last decade of the century, followed by the panic of 1893. There appears to have been an effort to form a trust some time in the early 1890's, in spite of the laws, and in 1896 an attempt to combine a large tonnage under one sales agency was unsuccessful. (41)
In the effort to compete, the producers continued to build new and bigger mills and to thereby add to their difficulties in other directions. It was every man for himself.

This brings us up to the year 1897. The manufacture of paper was well established in the State of Maine in 1897, although most of the mills had been built after the Civil War. The first paper mill in the state was established by General Samuel Waldo on the Presumpscot River in Falmouth (Portland) in 1731. Paper was of course made in this mill by hand. It was destroyed by fire in a short time, as were many small mills started up in the next 100 years, fire being a great hazard in these early plants. It has been found difficult to make a complete list of the pulp and paper mills actually in operation in Maine in 1897, as there were at different times a number of small operations, mostly groundwood mills, which were short-lived, and of which nothing but memory remains. For instance, there was a little groundwood mill at East Dover, on the Piscataquis River, and another on Dudley Brook, near Smyrna Mills, the dates of which are uncertain. However, a fairly complete tabulation has been made up from information supplied by the Maine Department of Labor & Industry, the Bangor Public Library and other sources, as follows:
<table>
<thead>
<tr>
<th>NAME</th>
<th>LOCATION</th>
<th>BUILT</th>
<th>TYPE PULP</th>
<th>NO. PAPER MGHS.</th>
<th>PRODUCT</th>
<th>PROD. TONS '24 HRS.</th>
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<td>ANDROSCOGGIN Pulp Co.</td>
<td>BRUNSWICK</td>
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<td>AUBURN LEATHERBOARD SUPPLY Co.</td>
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<td>1</td>
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<td>BANGOR PULP &amp; PAPER Co.</td>
<td>BASIN MILLS</td>
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<td>GROUNDWOOD</td>
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<td>G.W. PULP</td>
<td>?</td>
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<td>BISCO FALLS PULP Mills</td>
<td>PARIS</td>
<td>?</td>
<td>GROUNDWOOD</td>
<td></td>
<td>G.W. PULP</td>
<td>?</td>
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<td>1868</td>
<td>?</td>
<td>4</td>
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<td>35</td>
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<td>CUSHNOC PAPER Co.</td>
<td>AUGUSTA</td>
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<td>EASTERN MFG. Co.</td>
<td>SOUTH BREWER</td>
<td>1889</td>
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<td>FOREST PAPER Co.</td>
<td>YARMOUTHVILLE</td>
<td>1872</td>
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<td>GARDINER</td>
<td>1866</td>
<td>?</td>
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<td>MANILA</td>
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<td>JAY PAPER CO. *</td>
<td>JAY</td>
<td>1881</td>
<td>GROUNDWOOD</td>
<td>4</td>
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<td>KATAHDIN PULP &amp; PAPER CO.</td>
<td>LINCOLN</td>
<td>1889</td>
<td>SULPHITE</td>
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<td>KENNEBEC FIBRE Co.</td>
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<td>GROUNDWOOD</td>
<td>2</td>
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<td>LISBON FALLS</td>
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<td>SULPHITE</td>
<td>2</td>
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<td>MANUFACTURING INVESTMENT Co.</td>
<td>MADISON</td>
<td>1891</td>
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<td>KENNEBUNK</td>
<td>1875</td>
<td>-</td>
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<td>SULPHITE</td>
<td>2</td>
<td>MANILA</td>
<td>15</td>
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<td>OTIS FALLS PULP &amp; PAPER Co. *</td>
<td>JAY (O'ISHOLM)</td>
<td>1888</td>
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<td>NEWSPRINT</td>
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<td>JAY (RILEY)</td>
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<td>G.W. PULP</td>
<td>100</td>
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<td>TOPSHAM</td>
<td>1868</td>
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<td>NEWSPRINT</td>
<td>65</td>
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<td>1882</td>
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<td>Montague (Enfield)</td>
<td>1888</td>
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<td>Record, A.*</td>
<td>Livermore falls</td>
<td>1877</td>
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<td>South Gardiner</td>
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<td>1893</td>
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<td>1854</td>
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<td>11</td>
<td>Book</td>
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<td>Webster paper co.*</td>
<td>Orono</td>
<td>1890</td>
<td>Sulphite</td>
<td>2</td>
<td>Newsprint</td>
<td>30</td>
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<tr>
<td>Webster &amp; Ring</td>
<td>Orono</td>
<td>1895</td>
<td>Groundwood</td>
<td>-</td>
<td>G.W. Pulp</td>
<td></td>
</tr>
</tbody>
</table>

*LATER INTERNATIONAL PAPER COMPANY

The Bangor Pulp & Paper Company mill was owned by Orono Pulp & Paper Company, but was leased to Bangor interests. The Webster & Ring mill was owned by E. & J. Webster and E. E. Ring, and the pulp it produced was pumped to the Webster Paper Company mill a quarter of a mile away.

The earliest of these mills, those of the S. D. Warren Company (originally Day & Lyon at Westbrook and the Great Falls

Better - 30
Company at Gardiner) were nearly 50 years old at this time. The only other mills antedating the end of the Civil War were the Mechanic Falls mill of the Poland Paper Company and the mill of the Androscoggin Pulp Company at Brunswick, the first to make wood pulp in the State of Maine. Almost all of the others were built in the late 1880's and early 1890's, under conditions which we have described, following the introduction of the sulphite process into America, the acceptance of ground-wood pulp as a papermaking material and the decline of the importance of the Maine lumbering industry, the paper mills taking the place of the moribund sawmills, from the Presumpscot to the Penobscot. Only a few of these mills -- Bowdoin, Jay, Lisbon Falls, Otis, Pejepscot, Rumford Falls and Webster -- made newsprint, but they were the larger mills and their combined capacity was between 400 and 500 tons a day.

Against this background, in the year 1897, the Northern Development Company was chartered by the Maine legislature, with Charles W. Mullen and a group of Bangor timberland owners as incorporators, for the purpose of developing the water power on the Penobscot River at Millinocket. In that same year, John Norris, representing the newspaper publishing business in New York City, emerged as the leader of a campaign which resulted in the removal of the protective tariff on newsprint, changing the entire course of the industry and opening a breach between the producers and their customers which has never been entirely closed. In that year also, Hugh J. Chisholm, A.N. Burbank and William A. Russell successfully brought together some twenty
pulp and paper mills in New England and New York, nearly all newsprint mills, with total capacity of some 390,000 tons per year, about two-thirds of total newsprint production at that time, and on January 31, 1898 merged them into the International Paper Company in an effort to control competition. Within a few months after this event, Garret Schenck, a rugged individualist, whose Rumford Falls mill had gone into the new International Paper Company, and who had been negotiating quietly with Charles Mullen, severed his connection with International, associated himself with the Northern Development Company, and in November, 1900, presided over the opening ceremonies at the Millinocket mill of the Great Northern Paper Company, the biggest mill in the world, in an open declaration that competition would remain a fact of life in the newsprint industry.
APPENDIX I
NOTES -- CHAPTER II

(1) Sindall
(2) Ibid
(3) Chandler
(4) Sindall
(5) Davis
(6) Ibid
(7) Ibid
(8) Sindall
(9) Ibid
(10) Paper Trade Journal
(11) Sindall
(12) Davis
(13) Sindall
(14) Davis
(15) Sindall
(16) Ibid
(17) Chandler
(18) Kellogg
(19) Sindall
(20) Davis
(21) Ibid
(22) Ibid
(23) Ibid
(24) Daniell
(25) Davis
(26) Paper Trade Journal
(27) Kellogg
(28) Ibid
(29) Paper Trade Journal
(30) Johnsen
(31) Ibid
(32) Ibid
(33) Kellogg
(34) Ibid
(35) Ellis
(36) Kellogg
(37) Ibid
(38) Ellis
(39) Ibid
(40) Kellogg
(41) Ellis
APPENDIX II

REFERENCE BIBLIOGRAPHY -- CHAPTER II


