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# Importance of the Paper Industry

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One of the greatest achievements of mankind that has helped not a little to bring to light the civilizations of the past was the invention of paper. All the dazzling conquests of masters of war combined could not equal paper in importance. It was first made in China at a time when the rest of the world was still in darkness and ignorance. The honor was later shared by a similar but less sensational discovery in Egypt.

In the upper Nile a plant technically known as *Cyperus Papyrus* had engrossed in no small measure the attention of primitive wanderers. It was used for many purposes the most important of which was in the manufacture of a species of paper. For this purpose the pith was cut into strips which were placed side by side on a flat surface, and over the layer thus formed was piled a second layer of strips at right angles to the first. The whole was then pressed and rolled into a sheet, to which the natural gum of the plant gave a homogeneous character. The sheet when dried was ready for use. Artificial paste was probably employed to bind together the fibres. The sheet when newly prepared was white or brownish white in color, but the element of time has converted what papyri that have reached the present day into light or dark brown sheets.

Historically speaking, the growth of ancient libraries accelerated in no small degree the development of paper manufacturing which seems to have greatly progressed under the patronage of ancient Greeks. It is only in comparatively recent times that the attention of explorers has been directed toward the Egyptian and Greek processes of paper-making. The great bulk of the enormous mass of papyri unearthed consists of official documents, nevertheless the volumes brought to light bear testimony to the progress that the Egyptians and Greeks had made along this line.

What the Egyptians had accomplished must not, however, blind us to the great achievement made in China. Her cultural contribution to the world becomes evident when one realizes that the beginnings of the paper industry may be traceable to the genuine paper made by the Chinese from times immemorial although the word "paper" owes its derivation to papyrus, a plant that grows in the Nile valley of Egypt. From the Chinese the paper-making art spread to other races and was probably brought to Europe during the twelfth century at the time of the Second Crusade. About the year 1150 a paper mill made its appearance in Italy which subsequently became the principal center of paper-making. From Italy the art spread to France and Germany. Thanks to a law of France banishing paper makers to England and America, paper mills sprang up in these countries by leaps and bounds.

Up to the beginning of the nineteenth century, though machinery was used to reduce the rags to pulp the formation of the sheet of paper was done chiefly by hand. The oldest process in vogue was the making of paper by hand from the inner bark of the so-called paper mulberry. It is of interest not only on account of its antiquity but because it represents in outline all other methods, which merely are adaptations of the earliest process. A sheet of paper is an artificially felted web of

vegetable fibre, purified of perishable materials so that the remaining fibres are more or less pure cellulose. The process may be outlined as collecting the raw materials, purging them of foreign particles by boiling, macerating them to a fine pulp, diluting with water, forming a sheet on a porous surface that the water may drain off, and drying the sheet thus formed. In Europe the original raw material was linen rags. As they are too tenacious to be reduced to pulp by hand, the early European mills had them hammered into bits. Then came the discovery of the modern beating engine or Hollander invented by the Dutch in the latter part of the seventeenth century, which revolutionized essentially the process of paper-making.

Instead of wood or rags, Chinese paper makers use rice straw, bamboo, tree barks, etc. The provinces south of the Yangtze River occupy a pre-eminent position in the paper-making industry. In fact, a saying goes: Where there is rice or bamboo, there is paper. Generally, *Hsuan* paper produced extensively in the City of Hsuan Cheng, Anhwei, may be chosen to represent the first group. The pulp consists of a mixture of rice straw and tree bark and the quality of *Hsuan* paper varies in direct proportion to the quantity of tree bark pulp added. In order to insure an inexhaustible supply of pulp, it is not uncommon for paper makers to grow trees for no other reason than to peel bark from their branches which are usually felled in winter. When subjected to boiling, the bark is quickly reduced to a paper-making pulp. Paper made from bamboo is extensively used, ranging from the finest writing material to the coarsest wrapping paper. Bamboo grows in abundance in Central China, forming beautiful groves. In April it begins to grow and must be cut by the beginning of June. The young bamboo is pruned of its branches and made into bundles before it is immersed in vats to rot. Following a process of maceration, the bamboo stalks are removed from the concrete ponds to be cut into chips. Upon the macerated stems are sprinkled solutions containing lime and alkali. And it takes two months to complete the process of rotting. When the fibrous solution is washed of its lime and salts, it is dumped into a concrete reservoir. The mass is not ready for conversion into paper until it is reduced to a pulp with rakes after vigorous heating. To add cohesive quality to the pulp so made, mucilage is poured into vessels containing the pulp. Upon the amount of this starchy liquid present, the thickness of each sheet of paper to be made largely depends. A thin layer is created by making pulp to run over the surface of a bamboo screen. To rid the semi-dried sheet of surplus water, a rolling-pin is passed over its surface, and further pressure is applied to it to complete the flattening process. As a rule the frames are brought to the drying chamber for further treatment.

There is little doubt that the equipment of the native paper mill is more than antiquated. As a matter of fact it merely is the semblance of a plant, having only a handful of articles to work with. For washing and soaking bamboo or rice straw the proprietor keeps stone-lined tank. Bamboo fibres or rice stalks are steamed in iron boilers. For pounding fibres to the fineness of pulp a stone mortar is provided. And a few concrete tanks take care of whatever raw materials that a paper mill owner may need for manufacturing purposes. Bamboo screens of all

sizes and shapes are widely employed for drying the pulpy mass as well as for straining the surplus water. The chemicals needed are placed in earthenware vessels. Taking all in all, the capital put in is ridiculously small, and the term in this sense has been much abused. Small establishments of this type are found scattered all over China.

In comparison with modern mills operated by machinery, what equipment the native mill operators may possess necessarily looks primitive. The preparation of rags is essentially the same, except that the boiling process is more intensive, varying with the substance chosen. In countries where machinery dominates in industrial processes, the tendency is to use rags for making pulp and the process may be summarized in five words, cleaning, boiling, washing, bleaching and pulp-reducing.

Rags are received at the mill in the form of bales to be graded after careful sorting. For manufacturing fine grades of paper only rags that are scrupulously dusted are used. To eliminate foreign substances from the collection, it is customary to submit rags to a further dusting by mechanical devices of various forms. Ordinarily girls are employed to do the sorting, allowing the dust to filter through a wire-screened table to a receptacle for collecting dust thus sifted. The factory hands are constantly on the alert for whatever rubber articles that may remain in the collection, for rubber is a great nuisance to paper makers in that its presence causes black and ugly spots to appear on paper besides blocking the straining screens. In America and Europe rubber in its many forms has entered so deeply into garment making that in the eyes of paper mill operators it is something of a necessary evil. The rags are chopped into bits about two inches long before they are despatched for boiling.

The machine for boiling rags is made to rotate under the pressure of steam. When ready, the rags are packed in a boiler horizontal in shape with a manhole for admitting and discharging rags and lime. In order to reduce impurities including colored and fatty substances to a negligible minimum, a solution containing lime is poured on the rags. After that, the mixture is cooked for several hours. This done, the steam and the solution are let off that the rags may be dumped out of the boiler when the manhole is released. As to impurities, either insoluble or colorless compounds are precipitated and can be readily washed out. After such a chemical treatment the rags begin to assume a brownish color. A washing or beating machine, technically known as the Hollander, is installed lest dirt should be ground into the fibres. The machine is a long metal tub into which is injected a stream of water together with the rags to be cleaned. To hold the rags in position, a wire screen is used. As the rags are lowered they gradually lose the characteristics of a fabric. The macerated rags are then automatically thinned into single fibres, clean and ready for conversion into paper-making pulp which is left behind for bleaching upon releasing the valve to let out the water.

Generally the pulp is white enough for manufacturing ordinary paper but for the finer sorts of paper a solution of bleaching powder is added to the pulp to bleach it to a creamy whiteness. Processes vary significantly in different countries. In Europe washing and bleaching are done simultaneously while in America a distinctly separate operation is

performed. After bleaching the pulp is removed from the tank and placed upon a porous floor for the surplus water and moisture to drain off. The pulp is left in the drainer to dry for a few days. And it is not infrequent to take it out of the drainers for pressing by mechanical devices.

In the final analysis, paper is really made in the beating engine. The beater is composed of a network of knives so arranged as to rapidly macerate the pulp. A sprinkling of china clay is admitted to the mixture with a view to filling possible pores on the paper. Besides adding to the weight this practice keeps the surface even and fit for printing. To bring paper up to the standard of milky whiteness, a little blue is added to the pulp under preparation. The coloring is, in fact, done at this point. As a precaution against the absorption of ink, paper makers generally resort to the art of sizing. As far as this practice is concerned, two methods are in vogue—vegetable sizing and animal-sizing. The former operation is completed at the time when the ingredients are being mixed while the latter is usually done after the pulp is converted into paper, and is in that respect an external application.

The actual process of paper-making commences with the forcing of pulp through a machine containing screens on which myriads of slits are cut for the finest pulp to pass through at the same time functioning as a device for throwing out lumps or impurities. The pulp thus refined is made to pass over the surface of extremely fine network of wire placed above tanks into which the surplus water trickles. The pulp is automatically caught on the wire. To regulate the widths of paper to be made, adjustable rubber bands are placed around the wire net. Attached to the tanks are suction devices for exhausting water therefrom. Any required design may be clapped on a roller for impressing watermarks in the paper. The damp fibre is again consolidated when the wire returns for further pressure. Now the paper is practically finished except that it must be dried. A series of steamheated cylinders are erected in such a manner that the wet paper may be made to pass through them. Another machine technically known as the calenders does the smoothing part by application of its weight and pressure on rolls passing under it. As the paper is issued from this machine it is rapidly wound on a reel. When it travels through the so-called slitting machine it is trimmed of its rough edges. When rewound it is virtually ready for packing and delivery.

Papers go by a host of names. So when we come to the classification of paper we are largely interested in the various processes by which different grades of paper are manufactured. For making the finest grade of writing papers the practice is to dip them in a gelatinous solution. Upon completion of this operation, the paper is subjected to additional pressing and consolidating. Modern methods call for the installation of such drying devices as hollow drums equipped with electricity-driven fans inside. A great variety of substances have been used to coat paper, and the application is usually done by rapid-moving brushes. This operation completed, the paper is shuffled on to the drying chambers. If a highly glossy surface is desired, the paper must be glazed in the calender, and by mixing designated pigments with clay any desired color may be had. To make colored paper still more lustrous all the paper maker needs to

do is to add a little bee's wax to the coating preparation. As to wall or fancy paper, the deciding factor is nothing more than the securing of the right kind of coating and embossing. When paper is steeped in a vat of molten wax or paraffin we get the so-called paraffin paper. Newsprints, blotting paper, wrapping paper, strawboard, cardboard, etc., are merely a host of names given to the ever-increasing number of ways of paper-making.

In connection with the import of paper, the Customs statistics available show that the demand for mechanical wood pulp in China market has made a notable increase. It is imported into this country in either dry or wet form. The significance of an analysis of this raw material will be readily brought home when we realize how extensively it is used in the manufacture of newspaper. The whole process is a simple one. Blocks of wood are pressed against rapidly moving grindstones, and the stuff so ground is carried off along with water let in for facilitating the operation. Wood is fed into the machine from pockets which help bring logs of wood in contact with the grindstones. Whatever impurities may remain in the pulp are caught in a screen specially provided for that purpose. In China the amount of ground pulp imported in moist form is not as significant as that imported in dry form. It is principally consumed in the manufacture of cheap newsprints. If a strong pulp is desired then a chemical pulp must be used. The manufacture of tough board or wrapping paper requires very strong fibres. A significant point that I may mention in passing is that in America and Europe mechanical invention has attained perfection to such an extent that much of the saw-mill waste can be turned into chemical pulp after adequate treatment. Experiments have been perpetuated aiming at the discovery of new methods. Corn stalk has been used very extensively for turning out a new brand of paper. The devastating influence of relying on wood pulp for paper-making is more and more definitely manifested in the deforestation going on in places where paper mills are operated.

In endeavoring to place the native method of making paper in comparison with the modern mechanical processes of pulp preparing, I aim at the introduction of modern methods to put our paper mills on a scientific footing. This must not, however, blind us to the fact that a number of mills in China, although appearing insignificant when compared with gigantic mills in foreign countries, are run on modern lines. Hence the significance of an analysis of some of the outstanding paper mills in China.

Reasons for their establishment are not far to seek. The development of modern printing has created a marked demand for foreign paper. And this demand largely accounts for the heavy import of paper and wood pulp. Paper made from rice stalks or bamboo is too fragile to stand vigorous printing by modern machinery, so a number of paper mills have sprung up with the object of meeting this demand for machine-made paper.

Of the pioneering paper mills in China, the Tien Chang Paper Mill Co. is the oldest, if not the best. This plant first came into existence about 40 years ago, and was then known by the name Lun Chang Paper Mill Co., which was subsequently altered to Pao Yuan Paper Mill before

it gets its present name. In 1924 reorganization came, and the capitalization was definitely fixed at \$400,000. Two plants were in operation at Yangtzepoo Road, Shanghai, and Luchiatsui, Pootung. The Pootung mill was partly razed by fire and partly reduced to financial ruin by a series of strikes. As a consequence it was closed down in 1927. The mill now in operation is equipped with one paper-making machine, one calendering machine, one slitter, two spherical boilers and several beaters and breakers. The motive power consists of both electricity and steam. The breaker and the pump are run by a steam engine while the boilers and slitters are operated by a separate machine with lower power. A filtration system consisting of four big reservoirs for storing purified water was installed. As the plant is located alongside the Whangpoo River the question of water supply is negligible. The plant is indeed rather out of date in point of equipment but its output commands a fairly good market.

Chronologically arranged, the next important mill to be studied is the Lung Chang Paper Manufacturing Co. It began in 1906 and was capitalized at half-a-million Mexican dollars. At first, the technical phase of the management was left to a Japanese engineer. He was the operating technician. Contrary to the expectations of the share-holders the plant was never a paying proposition. Reorganization plans were then mapped out following the removal of the Japanese engineer from office. And the mill has paid handsome dividends ever since. The control of the mill is vested in a Board of Directors who are responsible for the appointment of a manager under whose direction are three distinct divisions, namely, the Treasury, the General Affairs, and the Works Department. The present manager holds concurrently the position of engineer. In the Works Department a number of foremen have been appointed by the Management to act as gang-masters. In the event of any dispute arising between laborers and foremen, the right to arbitrate is vested in the Manager. Ordinarily labor disturbances here are not a serious question.

The mill is located at Hwai Jih Hwei Jiao in a southern suburb of Shanghai. It had 10 Hollanders, two revolving boilers, one packing machine, two machine-controlled beaters and two paper-making machines including a number of drying devices. The rags are sorted out by machines. Steam power is extensively applied in the various stages of paper-making. A reservoir with a carrying capacity of one million gallons was constructed for storing filtered water. Chemically pure water, it must be borne in mind, has a vital bearing on the quality and color of paper to be made. The volume of output from this mill runs in the neighborhood of 30,000 pounds a day if the mill is operated on a full schedule of 24 hours daily. Figured at 10 cents a pound, the annual production reaches a value of over \$1,000,000.

In 1924, the Ching Cheng Paper Manufacturing Co. made its appearance. Two mills are in operation at Shanghai and in Tientsin, respectively. For the first time in the history of paper-making in China an endeavor may be said to have been made in the direction of establishing a system of chain factories. The Shanghai Mill is located at 82, Chengtu Road, with 787 Tungfoo Road functioning as its town office.

The Tientsin mill has its town office in the British Concession. As regards the Shanghai plant, the following equipment may be mentioned: one cardboard making machine, one calender, eight Hollanders, 10 drying rolls, three revolving boilers, one paper-making machine, etc. For the treatment of rags and other raw materials, steam power is used. It is worthy to note that this plant specializes in the production of cardboard and wrapping paper. Here division of labor exists on a small scale. It is premature to say that specialization in China has advanced so far to make the production of pulp and the manufacture of paper two distinct operations done at different mills.

In point of time of establishment, the Kiang Nan Paper Manufacturing Co. ranks third, but in point of productivity and modernness of machinery it has attained quite a predominant status among Chinese paper mills despite its recent organization. It was organized in 1925, capitalized at \$400,000, divided into 20,000 shares of \$20 each. The mill is located at Zauchiadoo, with a sales office at 32 Avenue Edward VII. The Board of Directors is headed by Mr. Woo Yao-ding. Important personages, including Messrs. S. U. Zau, Y. C. Yu, etc., have been invited to serve as advisers, and a number of industrial magnates have also pledged their support for the development of this gigantic undertaking. The regulations governing the subscription of shares state that any shareholder having in his possession 200 shares may be elected to the office of director. For the post of supervisor the candidate must fulfill the minimum requirement of 100 shares.

The present equipment consists of four Hollanders, one beater, one bleaching machine, two spherical boilers, and two paper-making machines. With a view to bringing about further expansion of plant activities, the shareholders at the Company's third regular meeting endorsed public subscription of new shares to the amount of \$600,000 for installation of new machinery. The present shareholders have already raised a third of the sum advertised for. With this addition the Company expects to so increase its output as to adequately meet the increasing demand of Chinese publishing companies for papers made in China.

The Kiang-Nan Paper Manufacturing Co. has to its credit the invention of a new pulp to be made from reeds that grow in great luxuriance in marshy places. The reed pulp has proved its worth in paper-making, and this innovation will significantly cheapen the process of production, placing the Company at a premium in competition with the products of any other paper mill in China. The path is far from being trodden as China annually imports paper to the amount of 50 million dollars. Much may be done in the way of filling the gap. In anticipation of significant development, the Board of Directors have authorized the establishment of a mill in the vicinity of Kaotse Station along the Shanghai-Nanking Line. The district called Tsung Koo Chow will serve as a site for a mill solely devoted to the manufacture of reed pulp. In addition to this reed pulp mill, the officers of the Company have arranged for the purchase of 4,000 *mow* of land for the cultivation of reeds.

As to its organization, a new departure has been made in that the company is formed under a corporation plan with separate divisions to



take care of the growth of raw material, the conversion of reeds into pulp, and the ultimate process of paper-making, thus revolutionizing the existing system in China. As modernization of business becomes more and more established industrial specialization is bound to set in. Preparation is now well under way for the formation of a large paper manufacturing company dedicated principally to the manufacture of newsprint.

A new landmark will decidedly be reached if the Wenchow Newspaper Manufacturing Co., now under organization, becomes a fact. For years and years China has had to look to foreign mills for her supply of newsprint because of the lack of similar plants here. There is little reason for China to rely on foreign producers for things so vitally related to the cultural development of a country. And this absurdity increases when we realize that the raw material needed for the production of newsprints grows in great abundance in China. Poplar, sulphur, lime and what not are one and all within our reach. It may be recalled that in 1911 the Newspaper Association endorsed the founding of a newspaper manufacturing plant which for some reason or other failed to materialize. Encouraging news came when last year the Chekiang Government took the matter up and authorized Mr. King Han, a paper expert, to make a systematic investigation into the suitability and profitability of launching on an enterprise of this nature. The result of his finding is extremely satisfactory, for Wenchow and Chuchow are noted for their poplar growth. Not only that but suitable quarters may be had, utilizing fully available water supply for plant operation. Assured of this support from the Ministry of Industry, Commerce, and Labor and the Provincial Government of Chekiang, the promoters managed the convocation of a meeting which was held at 80 Tibet Road. It was attended by industrial leaders as well as capitalists including Messrs. S. U. Zau, Y. C. Yu, S. S. Feng, L. T. Sze, etc. Inasmuch as the establishment of a newspaper manufacturing mill is an adventure hitherto unattempted, the members present all agreed that the time has come for such an undertaking to be launched. Thirty-one articles governing the subscription of shares were drawn up following heated discussion over the advisability of establishing such a mill in China. The proposed plant will be capitalized at \$3,000,000, divided into 30,000 shares of \$100 each. The members of the Organization Committee have been entrusted with the safe custody of funds collected. Should business prosper, the dividends will be parcelled out into 20 units, 10 units being reserved as the shareholders' quota. The promoters will get two units in recognition of their effort while the allotment for the superintendents and directors will amount to two additional units. The company is placed on a profit-sharing plan in that 5 units will be reserved for distribution among staff members. An interesting point is that one unit will be set apart for the cause of charity and philanthropy. Upon expiration of a 10-year limit, the promoters' bounty will be rescinded in favor of shareholders.

In making this analysis, I am not attempted to do the impossible. Paper mills have existed in China by hundreds and no exhaustive list could possibly be given. Also, at present they are working on very limited scales and their outputs are negligibly small, so insignificant that they

do not merit an intensive study. With regard to the products turned out by such mills, no standardization is possible. Different names are given for the same product in different localities, and the terms are so misleading that any attempt at classification would prove a boomerang.

As to conditions of labor, we are vis-a-vis with the same deplorable situation that exists throughout China. Labor is a cheap commodity and is subject to systematic exploitation. An average workman in a paper mill gets something between 40 cents and a dollar and 20 cents a day, the rate being dependent upon individual skill. Women and children receive still lower wages, ranging from 15 cents to 40 cents a day.

In many mills labor is organized, for the employes have instituted what is known as the Paper Trade Employes' Union for safeguarding their interests. Between employers and employes the relation is fairly wholesome. Any disputes that may arise over remuneration of labor can be readily settled by a Board of Arbitration composed of representatives of both employers and employes.

In conclusion, let me again stress the importance of developing this industry in China. At present the importation of foreign-made paper has increased to alarming proportions. It is rather encouraging to note that our paper-making industry is rapidly engaging the attention of Chinese industrial spokesmen as exemplified in development plans recently mapped out. My conviction is that increasing stress will be laid in that direction.