tioning the many difficulties and hardships of the papermakers' craft Father Imberdis has this to say: "Heaven does not permit such a divine art to be made easy for mortals here below."

After the sizing operation was completed, the paper was again dried and taken to a room called the "saul" or "salle." In England the finishing room of a paper mill has been known by this name for several hundred years. The term may have come originally from the German word Saal, and it is reasonable to surmise that it was first used in England by John Spilman, the German who established a mill in Kent in 1558. The "salle" was that part of the mill where the paper was surfaced and packed for transportation. The earliest method of producing a smooth surface on the paper was to burnish each sheet by hand by the use of an agate or other glossy stone (Figures 174, 175, 176). The Orientals gave their paper a glass-like surface by this procedure. One side of the sheet only was burnished, but as the reverse side was laid against a smooth slab of wood it also took on a certain amount of finish. Even when the Asiatic scribes made use of European paper, they subjected it to a polishing with an agate or stone burnisher, which gave the paper an Oriental appearance. This action also closed the pores of the sheets and rendered them more suited for writing upon with ink. A mechanical method of imparting a surface to paper was brought into use in Europe in the early seventeenth century. This consisted of a pressing-hammer of huge construction, operated by water-power (Figure 179). The idea for the apparatus was borrowed by the papermakers from the bookbinders, as these craftsmen had employed this mechanism for polishing the backs of books for many years before the papermakers adopted it. This machine gave the paper a more uniform surface than had been possible by the hand rubbing method. The results achieved by the use of the glazing-hammer were soon spread to the different mills by travelling workers, and it was not long before this machine was used universally. The hand burnishers looked upon the introduction of the hammer none too kindly, for when it came into use they had to seek other employment. In Germany the intro-
trovery became so heated that the government threatened to confiscate the tools used in hand burnishing, and recommended that the mills adopt the new pressing- or glazing-hammers. In spite of this ruling, however, the mill-owners continued to polish or finish their paper in the manner they desired. Polishing by hand always gave the paper a streaked and uneven appearance owing to the narrowness of the glazing-stone, while the huge hammers imparted an almost uniform surface over the entire sheet. In old Oriental and Occidental papers these slight variations are traceable and afford somewhat of a clue as to the origin of the paper. About 1720 the pressing-hammers gave way to wooden glazing-rolls for giving the paper a smooth surface. These were a Dutch invention and consisted of two large rollers, cut from the solid trunk of a tree, between which the paper was pressed. The finish which this machine imparted was as superior to that of the pressing-hammer as that had been to the original hand burnishing by stone.

After the paper was finished it was packed for transportation by wrapping in heavy coarse paper of a brown or grey colour; this wrapping paper was made from the dregs of the vat, which could not have been used for moulding book or writing paper. While there are no paper-package labels from the fifteenth century extant, there have been a good many preserved from later centuries (Figures 180, 181, 182, 183).

The methods used at present in making handmade paper differ but little from those described. Several improvements in the construction of the vats have been made, the chief of which was the "knotter," which eliminated foreign substances and knotted fibres from the paper stock before it ran into the vat. This appliance, an American invention, came into general use about 1819; before

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* The earliest United States patent in the Paper Museum covering the glazing-roll, or plater, is dated February 27, 1827, and was issued to Ira White and Leonard Gale of Newbury, Orange County, Vermont. The patent describes a machine "for the useful improvement in the art of finishing paper, to render its surface smooth without injuring its strength ... and to improve it in durability and firmness." The original patent, on parchment, is signed by J. Q. Adams, President.

† The earliest United States patent in the Paper Museum covering the knitter is dated March 12, 1851, and was issued to Solomon Stimpson of Newbury, Orange County, Vermont. The patent describes "a new and useful improvement in the art of papermaking for separating the knots, knobs,
its introduction it was necessary to scrape out from the sheets the knots made by twisted fibres or by bits of broken buttons, pieces of stone, wood, metal, or earthy matter. These could not be removed without considerable injury to the paper, often causing holes in it. The knotter or strainer was greatly improved in 1832 by a Kentish papermaker, and it is this form of the appliance that is still in use in handmade-paper mills. Another improvement was the use of a steam pipe for the heating of the stock in the vat in place of the old pistolet, while the primitive stirring- pole was substituted, from the pulp before the sheet is formed, and also for graduating the quality of pulp necessary to form the sheet, etc. The original patent, on parchment, is signed by Andrew Jackson, President. The first English patent covering a knotter for the cleansing of paper pulp before it entered the vat was granted to Richard Ibotson on July 29, 1830. Previous to 1830—5 much of the paper was embossed with knotted and unbeaten fibres. In the best mills these imperfections were removed with knives before the paper was sold.

perseded by an agitator that revolved in the bottom of the vat, keeping the liquid material in constant motion. The heavy wooden screw press may still be seen in several of the older handmade-paper mills in Europe, but the hydrostatic press is now used by all well-equipped vat mills. This was invented in 1790, but was not adopted until long after that date, although Joseph Bramah, the originator, recommended it for use in paper mills.*

* The first use of the hydraulic press in paper manufacture was probably in the Matthias Koops mill, Mill Bank, Westminster. This mill, established in 1801, was originally equipped with old-fashioned screw presses, but from a French account of this mill we learn that at least one hydraulic press was in use. Under the title of "Sur les papeteries et fabrication de papier-paille en Angleterre" in Annales des arts et manufactures, ou Mémoires technologiques, October—November 1803, we read: "It is there that we saw for the first time the use of the hydraulic press, which pressed the water from the paper and felts from five vats. This new press has the advantage of not shaking the buildings when it is used; also, the pressure is considerably greater than that of
The method of drying handmade paper (Figure 161) remains today very much as it was in the fifteenth century, but the old sizing tub has been replaced by a machine composed of a trough and rollers, each separate sheet of paper being led through the warm size in the trough upon an endless felt. A century or more ago the heavy wooden rolls of the Dutch glazing-machine gave way to iron, but the principle of the apparatus remained about the same as in the early eighteenth-century original. Every appliance of a modern handmade paper mill can be traced to its Oriental origin, the steps of development being separated by centuries. To be able to determine the locality and period of old papers it is necessary to make a minute study of the ancient papermaking appliances, as the succession of innovations, occurring in different countries at various periods, caused changes in the character of paper throughout the ages. To the casual observer these changes are insignificant, but to the student of papermaking they are clues that, followed, lead to secrets of the craft he loves.

the old screw press and one can limit the pressure as desired by simply turning a tap; the press is disengaged in an instant. We have been astonished by the different applications of the hydraulic press we have seen in England. . . . We have remarked that the low cost of machinery in England makes it possible for the establishment of all kinds of mechanism at a reasonable figure."

VII

Paper: a Sacred Material

THE USE OF PAPER IN THE ORIENT FOR CEREMONIES AND PURPOSES UNKNOWN IN THE WESTERN WORLD

While my interest in paper in the Far East has been primarily in its actual manufacture, I have not been unmindful of the uses of paper in the Orient. In investigating handmade paper fabrication in China the wayfarer will at once be interested in the use of paper in religious rites and sacrifices, as well as for many of the practical purposes for which it is employed. Also, in Japan and Korea great quantities of paper are used in ways totally unknown in the Occident. In this chapter, therefore, an account of the development and use of Chinese ceremonial paper, and an outline of the present-day uses of paper in Japan and Korea for utilitarian purposes, will be undertaken.

Before the advent of paper, or as early as the period of the Western or Former Han Dynasty (206 B.C.-A.D. 25), wealthy Chinese placed silver and copper coins in the tombs and coffins of their deceased relatives, so that the departed might have an abundance of money for various purposes in the spirit world. The authenticity of this statement rests upon the assertion in the Chronicles of the Former Han 1 that during the reign of Emperor Wu Ti (140-86 B.C.) vandals entered the vault of one of his ancestors, Wen Ti, (179-156 B.C.) and made away with the silver coins therein. After the invention of paper by Ts'ai Lun, while Emperor Ho Ti (A.D. 89-106) ruled the country, we are informed by the Chronicles of the Later Han 2 that paper was placed in the tombs as a substitute for the metal coins of earlier years. During the dynasties of Wei and Chin, from the beginning of the Three Kingdoms (A.D. 221-420), it is recorded that "cunning knaves" cut paper into forms and offered it to the spirits in lieu of genuine silver and copper coins.
According to the numismatist work entitled *Chi'ian-pu t'ung-chih*, published in China in 1833, the first paper notes issued in the Celestial Empire made their appearance during the reign of Emperor Kao Tsung (A.D. 650–683), of the Tang Dynasty.

By the fourteenth century paper money was fairly common in China. Most of the notes of the Ming Dynasty are dark grey in colour, owing to the use of both the dark outer bark and the white inner bark of the mulberry tree in their making. Legend has it that Emperor Wu (A.D. 1385–98) tried to procure a suitable paper for the printing of money and to this end consulted with the wise men of his realm for advice. One of the learned group suggested that counterfeiting could only be prevented by mixing the macerated hearts of great literary men with the mulberry-bark pulp. The Emperor is said to have taken this suggestion under advisement, but at length he decided it would be a grave mistake to destroy the literary men of China simply for the purpose of using their hearts as ingredients for paper. In talking over the problem with the Empress she suggested that the same result could be achieved without interfering with the lives of their scholarly subjects. The Empress brought forth the thought that the heart of any true literary man was actually in his writings. Therefore, the wise Empress asked the Emperor to have collected the papers upon which the great Chinese authors and poets had set down their writings. The manuscripts were duly macerated and added to the mulberry bark and it was thought that the dark grey

tone of the money papers was due to the black ink used in the calligraphy upon the paper.

After the issuance of the first paper money it no doubt became the custom to make imitations, but not counterfeits, of these notes for burial with the dead. During the period of K'ai Yüan (A.D. 713–739), Tang Yuan Tsung, a most superstitious person, established Wang Yü as High Master of Ceremonies. This minister began the burning of mock paper money at the Imperial sacrifices, and he himself had great faith in the practice. According to the *Chronicles of the Tang Dynasty*, however, the custom was condemned by numerous Chinese scholars, who were apprehensive that the rite might become popular with the rank and file of the people; but in spite of the severe condemnation of the learned gentlemen the custom soon became prevalent among all classes and in all parts of the vast country. To the present day the rite is practised in every city and hamlet of China, as well as in all Asiatic countries where the Chinese have immigrated. There was, indeed, sound argument in favour of the imitation paper money. The practice of burying the actual silver and copper coins with the dead not only made the tombs a prey for robbers, but removed an immense amount of money from circulation, a serious matter in a land where metals were scarce. For these two reasons, no doubt, the use of genuine coins was abandoned, and in their place pieces of paper made to resemble somewhat the newly introduced paper notes were substituted. The tomb papers (Figures 184, 185) were not in any way a direct copy of the real paper money, as such an imitation would have been punishable by decapitation.

The disillusioned scholars who condemned the rite were too few to prevail against the hundreds of thousands who sanctioned and approved the ghostly practice, but their unceasing protests, and the protests of others who followed them, are recorded in old Chinese histories. Among the men who thus protested was an official named Wang Ssu Tsung, who lived during the reign of Chên Tsung (A.D. 988–1023), of the Sung Dynasty. This gentleman, who occupied the position of Prefect of the Second Order, forbade all unorthodox sacrifices and caused many of the temples of the false gods to be destroyed. On his deathbed Wang Ssu Tsung was distressed when his family burned offerings to procure his content-
baked the officials at the ceremony by saying: "The burning of spirit-money is a Buddhist practice to deliver the soul from Hades; my holy sire needs no such things."

These few instances of approval and disapproval will serve to show that in early times, as at present, there was much agitation relative to the use of paper for sacrificial offerings, and that all through the centuries there has been a never ceasing controversy as to whether or not the old rite should be continued.

Marco Polo (1254–1323), during his researches in China, was amazed at the use of great quantities of paper in native ceremonies and in his writings we find many references to this dominating practice, a use for paper entirely unknown in Europe. (It is of interest to note that the Chinese were the first to use toilet paper, for in a book published in France in 1718 it is recorded that Arabs travelling in China in the ninth century were confronted with such paper. The book giving this information is Eusebius Renaudot's Anciennes Relations des Indes et de la Chine de deux voyageurs Mohametans. The passage relating to toilet paper appears on page 17 and reads as follows: "Ils ne sont pas soigneux de la propreté et ils ne se lavent pas avec de l'eau, quand ils ont esté à leurs necessitez; mais ils s'essuyent seulement avec du papier.")

The use of ornamental paper cut to represent various objects and burned at Chinese funerals long antedates the time of Marco Polo and has continued through the centuries to this day; every year thousands of reams of paper are consumed by fire in ceremonial offerings. Objects of all kinds are constructed of paper and burned at the bier of the deceased so the departing spirit may have an abundance of the things represented by the frail paper effigies. Along certain streets in all the great cities of China, as well as in all large communities of Asia where Chinese people dwell, there may be seen open shops, usually clustered three or four together, where these ghost-like paper replicas are fashioned—highly ornate cardboard chests with shiny gold and silver paper locks, flowing robes of paper painted with golden dragons and complicated patterns, shoes, hats, and all manner of wearing apparel made of paper (Figure 186). For the relatives of the wealthy the craftsmen in paper also construct full-sized carts, horses, and even automobiles, the thought being that when these fragile representations

![Fig. 184 A wood-block for printing mantras, or charms, called wang shêng chên, denoting money for the hereafter. The paper used for these prints is usually of bamboo fibre.](image)

![Fig. 185 A wood-block for printing mantras, or charms, called wang shêng chên, denoting money for the hereafter. The paper used for these prints is usually of bamboo fibre.](image)

mention in the next world, and, according to the ancient records, "raised his feeble voice and cried: 'If the spirits are intelligent, how can they accept bribes?" In the reign of Hui Tsung (A.D. 1101–26), of the Sung Dynasty, there were two ministers, Kao Feng and Liao Yung Chung, who presented a petition to abolish the burning of ceremonial papers. The petition read: "The custom of burning perforated paper made to resemble money, so as to assure happiness in the spirit world, is an absurd delusion; if the spirits have intelligence the practice is an insult to them." It is likely that the sheets of perforated paper, made in the shape of round coins pierced with square holes for stringing, was the original "spirit-money," inasmuch as metal coins preceded paper notes by many centuries. With all the apparent disbelief in the rite by the scholarly gentry, the funeral of Emperor Kao Tsung (A.D. 1127–69) was a most elaborate show of the burning of ceremonial papers and mock money and of all manner of paper images set afire before his remains. The heir-apparent, Hsiao Tsung (A.D. 1163–1290), however, was contemptuous of the practice and re-
go up in smoke they will eventually assume reality in heaven and the deceased will have horses and vehicles at his disposal. I have often marveled at the skill and patience of these artisans who fashion the paper objects, as they work in their open-fronted shops along the narrow, dirty streets and courts. The facade of each shop is usually decorated with a number of gaily painted mirrors, and the interior takes on the appearance of a veritable paper museum, all kinds of funeral paraphernalia made of paper hanging from the rafters, and shelves, drawers, and cases literally overflowing with every conceivable variety of decorated and coloured paper used in the making of these weird reproductions. Quality and workmanship vary to suit both the rich and the lowly, but all alike are destined to be burned at funerals. In Bangkok, where the population is largely Chinese, I recall standing before one of these shops for hours watching the construction of the effigy of a huge dog, the frame made of thin strips of bamboo, all covered with many thicknesses of paper and finally realistically painted with water colours. Upon asking the Chinese worker for what purpose the paper dog was intended, I was told that a wealthy Chinese merchant had just died and that this was a representation of his mastiff; the imitation animal had been ordered by the dead man’s relatives and would be burned at his funeral to assure his master of having his favourite dog with him when he reached the spirit world.

Everywhere such paper animals, paper clothing, and vehicles go up in smoke at Chinese funeral ceremonies, yet the number of these objects is insignificant compared with the quantities of mock money burned every year in China and all over Asia where Chinese have made their homes. It is probably reasoned by many Chinese that if sufficient “money” is burned the deceased relative or friend will be able to purchase elaborate clothing, fine horses, and other necessities and luxuries after reaching the spirit world, making it unnecessary to burn paper images made in imitation of these things for the departed to enjoy them.

In many Chinese homes the paper is burned before the coffin of the deceased, consumed upon a stone hearth in the living-quarters. It goes without saying that numerous disastrous fires have been caused by over-zealous indulgence in burning paper images and imitation paper money. The following dispatch to American newspapers from Taiyuan, China, dated June 17, 1936, is signifi-
The performance of an ancient Chinese ritual of mourning today cost the life of the widow and son of a general one week after he had been assassinated. Buddhist monks were burning in effigy the household utensils and money of General Li Sheng-ta in front of his coffin. The flames were carried by a draught to other paper images that were near the casket in honour of the dead. A roaring fire developed in a few seconds. The widow and son rushed in to save the corpse from the burning paper replicas and both were fatally burned.

Among the numerous Chinese death ceremonies at which I have been present I especially recall the occasion when I was invited to attend the funeral of a relative of an old scholarly gentleman who asked me to meet him at a certain road-crossing so that he might guide me to the house of death. He appeared promptly at the hour agreed upon, dressed in long silk robes and padded slippers, and mounted in state upon a nickel-plated bicycle, the handle-bars of which were laden with mock money and paper images—an anachronism that afforded me much secret amusement.

In the large centres the ordinary ceremonial papers, put up in compact packages, are usually sold in special shops dealing in joss paper, candles, incense sticks, and other items used in sacrificial offerings. In the villages and outlying country districts the more common funeral papers may be had in almost any shop where groceries are sold, the bundles of paper being invariably stored on the upper shelves of the orderly stores, pungent with the aroma of spices, roots, ginger, nuts, and herbs. I have procured these sacrificial papers in the great cities of China, as well as in muddy country hamlets; in the moist, mouldy shops of Indo-China, in the stores of the Chinese section of old Manila, in the small sidewalk shops of the villages of Java and Sumatra, in the queer Chinese markets of Kuala Lumpur, Penang, Singapore, and other settlements of Malaysia, and in the paper-shops of Bangkok’s crooked lanes and winding canals (Figure 187). In the Chinese quarter of New York I have gone from store to store and from shopkeeper to shopkeeper seeking the small bales of “spirit-paper,” but I have found that most of the Chinese living in America know nothing of its use. In one cramped establishment, kept by a parchment-faced Chinese, I found a small assortment of the less pretentious ceremonial papers, along with the bamboo paper trays in which they are sometimes placed, fan-like, for burning. I was informed that the custom of consigning imitation money to the flames is seldom preserved by the Chinese after leaving Asia, and that paper is burned only by the transplanted Celestials of the older generation who insist upon following the ancient traditional rites of the homeland (Figure 188).

China is a vast country, the topography of which makes intercourse between districts exceedingly difficult. It is therefore a land of many dialects and of many provinces, the comparative isolation of which tends to preserve ancient local customs and ceremonies. It has been my experience that even the educated Chinese of North China are entirely unfamiliar with the customs and practices of their countrymen living in the south; also that the people
from the coastal provinces know very little regarding the ceremonial customs of inner China. The religious ceremonies of various isolated districts do not arise entirely from Confucianism, nor are they wholly Buddhist or Taoistic; they are largely of local origin and exhibit different practices even in adjacent provinces. The one thing common to all Chinese ceremonies, especially funerals, is the desire of the relatives of the deceased to outdistance in display anything that has been attempted previously in their particular neighbourhood. This is attended by complications, the rivalry often leading ambitious families to bankruptcy, since they think little of spending five or even ten times as much money for a funeral as they actually possess. The Chinese people are noted for their love of gambling, but their desire for elaborate and costly funerals occupies almost as large a place in their hearts as their various games of chance.

It is evident that paper plays a prominent part in myriad Chinese ceremonies. The fibrous substance called paper is regarded in a vastly different light in the Orient from what it is in the Occident, for in the Far East it has a spiritual significance that overshadows its practical use, while in the Western world the purposes...

Fig. 188 A small Chinese country temple with bundles of bamboo and straw spirit-paper neatly piled in front of the building ready for burning and sacrificial offerings.

Fig. 189 A furnace for burning sacred paper. This furnace was dedicated to Emperor Ch'eng T'su (1403-25), of the Ming Dynasty. These ornamental incinerators were usually built in the temple courtyards at the loft of the main building. On sacrificial days imitation paper money and other ceremonial papers are carried to the temples, where they are reverentially consigned to flames in the furnaces.
for which paper is intended are purely practical and utilitarian. In dealing with the use of ceremonial paper in China, therefore, it is essential to realize the respect and reverence that this substance commands in the Celestial Empire and to endeavour, if possible, to attain an appreciation of the Chinese viewpoint relative to paper — a viewpoint that has been inherited by the Chinese through hundreds of years of paper symbolism and paper worship (Figure 189).

A large portion of the paper used in China for ceremonial purposes is manufactured by hand in Chekiang. In the statistics compiled in 1935 by the Minister of Industry, Nanking, the number of individual handmade-paper mills in Chekiang Province in 1933 was 24,437. These small, family mills, termed tsao hu, are found principally in Fuyang, Yiuhang, and Yungchia, with Ch’uhsien, Tunglu, Chu-chi, Hsin-teng, and Hsiao-han of lesser importance. The capital involved in the handmade-paper industry of Chekiang Province in 1933 amounted to about five million Shanghai dollars, half of this money being invested in Fuyang. The establishments where the finished paper is sold are known as chih hong or chih po chu-hang, the most important centre for selling the sacrificial papers being the city of Hangchow. In Chekiang there are almost 127,000 workers engaged in making handmade paper, the artisans varying in number in each small cottage mill according to the kind of paper fabricated. Where bamboo is used as raw material the number of workers varies from four to six for each mill, while in making pl paper from the bark of trees, or ts’iao paper from rice-straw, only three men are needed (Figures 190, 191). In Fuyang alone there are over 40,000 papermakers at work in some ten thousand individual mills. The annual production of handmade paper in Chekiang Province in 1933 was valued at more than twenty million dollars. The paper made from bamboo represents about three fourths of the total production, the bamboo used being classified as ch’ing kao, pai liao, and huang liao.

In making paper from bamboo, straw, and the bark of trees it is necessary to use a different method of preparation for each material, but the actual process of forming the fibre into sheets of paper is practically identical. In using bamboo the canes are stripped of their leaves and shoots, tied into bundles, and steeped in a pond until the green outer skin, or bark, can be removed. After splitting, the bamboos are placed in layers in a sunken pit.
lined with stones, layers of canes alternating with layers of lime (Figure 192). The pit is then filled with water and the bamboo allowed to soak thoroughly for several months. After this intense treatment in the lime solution the bamboo is taken from the pit and placed in clear water to free the material from any trace of the caustic. After a vigorous cleansing the semi-disintegrated bamboo is beaten by hand, or by water- or buffalo-power. This final process renders the fibre suitable for forming into sheets of paper by the use of the hand-mould.

In preparing the bark for making the superior pi paper, the branches of the trees are cut during the winter months, tied into bundles, and finally given a steaming in an iron cauldron for two or three hours. After this preliminary treatment the branches are removed from the cauldron and the outer bark stripped from the stalks; the bark is then dried in the sun. A second boiling in lime reduces the bark to a semi-macerated condition, after which it is bleached — a process that requires from seven to eleven weeks. The bleached bark is finally placed upon a stone slab and beaten with hand mallets until it becomes a fibrous pulp. Before this pulp can be moulded into paper a mucilaginous gum made from the leaves of deciduous trees is added to the substance.

The Chinese paper termed tsiao is of a yellow colour and is made from rice-straw. The process of reducing this material to a pulp is much simpler than that used for either bamboo or tree barks. The straw first receives a preliminary pounding and then after saturation in a lime solution is buried in a trench. When properly disintegrated, the straw is removed and placed in porous cloth bags, which in turn are suspended in a running stream so that the fibres may be cleansed of all particles of lime. The straw fibre, being of a tender nature, requires far less beating than either bamboo or bark. The forming of the sheets of paper upon moulds is practically the same with each of the three distinct types of fibres.

From this account of the use of paper in China for ceremonial purposes it must not be surmised that the Chinese make no other use of paper. Aside from the usual requirements of native book-printing, the papers of China are used extensively in the lining of clothing and in the making of sandals and slippers; also in the fabrication of toys, firecrackers, and fireworks, so much in evi-

dence in all parts of China at festival time. Throughout China paper is always in evidence for many unusual purposes, and for the most part it is manufactured by hand from bamboo, straw, or mulberry bark or a mixture of these fibres.

JAPAN

In travelling through the more remote papermaking districts of Japan on the narrow, rough, and often dangerous roads, passing endless processions of carts, jirikshas, and pedestrians along almost continuous lanes of low-built villages, the Occidental traveller cannot but observe two dominant features — the absence of chimneys on the houses and shops, and the use of great quantities of handmade paper for everyday purposes.

The rooms of Japanese houses are heated by large, heavy earthenware bowls, known as hibachi, in each of which several pieces of charcoal burn with a red glow within a nest of sand or asbestos, the charcoal being dextrously put in place by the use of ornamental brass chopsticks. To the visitor from the Occident, accustomed to central heating supplemented by roaring wood fires within huge chimneys, the Japanese method of heating seems cheerless and inadequate, but in the elimination of complicated heating devices and chimneys the Nipponese have dispensed with one of the most expensive features of house construction. It is doubtful, however, if the native people of Japan, huddled about the small charcoal fires, are ever wholly warm during the cold, damp winter months, as they are constantly rubbing their hands above the hibachi in an effort to absorb what little heat may arise. The living-quarters of Japanese houses are fairly large, and usually one or two outside walls of each room are fitted with small oblong frames of frail wood over which paper is pasted, allowing the entrance of some light but preventing all vision from either the inside or the outside (Figure 193). Even in the north country the Japanese houses and inns have only these thin paper windows to separate the meagre indoor comfort afforded by their charcoal heaters from the drifted snowbanks and cold winds from the mountains. *

* From a scientific standpoint it has lately been proved that the use of paper in windows is more healthful than the use of glass. The paper permits the beneficial ultraviolet rays of the sun to penetrate into the room, while glass excludes these rays. Also, paper is a warm substance, as is evidenced in the use of paper in keeping the body warm; glass is extremely cold.
While Oriental houses with their fragile, although fairly practical, paper windows would not be adequate in material comfort for us, we of the Occident could doubtless learn much in economy from the Chinese and Japanese of the use of paper in ways unknown in the Western world. For instance, the burden of window-washing is eliminated with the use of paper windows, as each spring the old soiled paper is removed and fresh paper pasted to the wooden window frames. Oriental artisans have developed a wide variety of papers and adapted them to almost every conceivable use. This development in Japan is largely due to the growth of certain trees and shrubs, the bark of which, when unadulterated with European wood pulps, forms excellent paper-making fibre. With the Japanese innate ability to execute hand work and through the use of the mulberry (Broussonetia papyrifera), mitsumata (Edgeworthia papyrifera), and gampi (Wikstroemia canescens) fibres as raw materials, the handmade papers of Japan fabricated previous to the modern tendency to haste and cheapening were admirably adapted to many Occidental aesthetic and industrial uses. In late years, however, the Japanese have lessened the quality, and thereby the desirability, of their papers by the admixture of inferior foreign wood pulps. Also, they have reduced the quality of their handmade papers by the employment of mechanical drying devices and supplementing honest hand work with the introduction of power-driven beaters and other appliances for the acceleration of the process.

In Europe and America, as well as in the Orient, there are fast-running machines producing paper in continuous rolls of hundreds of feet each minute, but these short-fibred, easily torn, mechanically-made papers would not endure the ordeal to which the old Japanese handmade papers were subjected in the making of windows, lanterns, partition screens, umbrellas, rain-cloaks, bags, and tarpaulins, and for all sorts of other requirements where glass, metal, leather, rubber, and cloth are employed in the Occident. The general impression existing among Western people is that Japan has a mild climate, and therefore more delicate and fragile objects can survive. But this is not the case; both summer and winter in Japan are most severe and are trying even to an American accustomed to rigorous winters and to summers that are damp and-warm. In preindustrialized Japan it was only through the use of superior and unique papermaking materials and genuine ability in the craft of paper fabrication that the Japanese were able to make papers that gave faithful service through long periods, being used over and over again. In former times it was not uncommon to see paper umbrellas that had been in use many years, and any traveller knows that Japan could never be called a rainless country. The observant wayfarer who has sojourned in the mountainous little islands during the spring months is cognizant of the hardships the paper umbrellas had to endure, for in Japan it often rains for several days without interruption; yet no matter how wet and dank it may have been, the peasants were always to be seen walking through the rain-soaked rice fields with their stilted wooden sandals and their charmingly coloured umbrellas.

Along the country roads of Japan it was always interesting to watch the great variety of man- and beast-drawn carts laden with every kind of native commodity, each cart with its paper tarpaulin. Every little vehicle had this oiled-paper protection, impervious to water and lighter in weight and cheaper than cloth, which during sunny weather was folded and packed away in the cart. These seemingly frail paper coverings endured the trying conditions to which they were subjected from one year to another and finally wore out only through constant use, like any other supposedly more durable material. The jinrikisha men in the towns and villages during the periodical rains wore mantles of oiled paper, for this covering not only was effective in keeping them dry, but could be purchased in large pieces for a few sen. The workers in the fields, the men labouring on the roads, and the watchmen at the railway crossings depended upon coverings of paper to keep them dry.

The oiled paper of Japan could formerly be purchased in the smallest of shops, and every peasant cottage had a stock of sheets of divers sizes, which were used again and again for many household requirements. In the tea-growing districts stout oiled-paper bags were used for holding the newly picked leaves and it was not unusual to see paper sacks that had given service for half a dozen years literally covered with patches of paper where they had been repaired from time to time. Paper bags for the storing of grain were also common, for paper that had been oiled or tanned with the fermented juice of green persimmons, the method used to ren-
under the material durable, was not easily destroyed by insects. The Occidental traveller never ceased wondering at the almost unlimited use of paper by the Japanese for utilitarian purposes.

The Japanese have been making handmade paper for more than thirteen centuries, and through the ages its myriad applications to local needs have been almost without limit. The most unusual and fantastic use of the paper, however, occurred during the late war when the Japanese military undertook to dispatch bomb-laden paper balloons to the shores of the United States with the hope of inflicting death and destruction and causing untold consternation. The paper used in making these balloons, of remarkable tensile strength, was made of long, drawn-out mulberry fibre, and to render the material impervious to water it was treated in the manner long used by the Japanese in waterproofing their paper umbrellas, bags, tarpaulins, and many other useful commodities used outdoors. Specimens of the balloon paper show many small paper patches, resembling the repaired paper bags that are used from one year to another by the tea-growers of Shizuoka. It is probable that the paper used in constructing the balloons was made in a number of different isolated mills, an assumption that is evidenced by the various colours of the paper and the technique employed in its formation. In the state of Montana balloons of a brown-yellow colour as well as of an almost pure white tone were found, while in Oregon paper balloons of a pleasing light-blue shade were discovered. The paper balloons were responsible for the deaths of several persons and perhaps they were instrumental in causing a few small forest fires, but considering the magnitude of the effort the military results obtained by the Japanese were infinitesimal.

After the Japanese surrender the Staff Officers Technical Section, Japanese Headquarters, Tōkyō, revealed that they worked for two years in an attempt to perfect the paper balloons and 9,000,000 yen (more than $2,000,000) was expended on the project. Each balloon was about forty feet in diameter and all together, according to the Japanese, nine thousand of the bomb-laden balloons were launched from three different sites near Tōkyō. Japanese scientists had the course of the sky-weapons computed in detail: each balloon would spiral upward more than ten thousand yards, they estimated, then eastward winds would speed them across the Pacific at 125 to 190 miles an hour in a straight course for the United States. Timing devices were set to explode the bombs from forty to fifty hours after the balloons had been launched. While an undetermined number of the balloons did land in the United States, one as far east as Michigan, details of the outcome of the dubious experiment were kept secret in this country so the Japanese were uncertain and bewildered as to the effect the sinister paper balloons were having on their Occidental enemy. Before the close of the war the Japanese came to the conclusion that most of the balloons were going down in the Pacific Ocean, and by April 20, 1945 the entire project, which had employed thousands of women papermakers, was abandoned as a complete failure.

KOREA

While Korea for years has been dominated by Japan, this peninsula country has not been modernized to the same extent as Japan; Korea still retains many of its age-old customs and traditions. In Korean houses paper plays a part that is unique, for in place of the regularly shaped grass mats used on the floors of Japanese houses, the Koreans use thick oiled paper, a thoroughly practical material when their method of heating is considered. In Korea the rooms are kept warm, not by the picturesque but impractical hibachi of Japan, but by an oven under the floor. The smoke is emitted by way of a tile chimney running underground and finally rising within a brick wall at a considerable distance from the house; though in lowly homes the smoke escapes directly from the house foundation without the expense or bother of a tile chimney. For actual comfort the Korean house is preferable to the old-time Japanese house. In both countries the people live close to the floor, and in Korea the floors are delightfully warm; while in Japan, even though covered with the thick straw mats, the floors are usually cold and uncomfortable. In Korea, as in Japan and in some parts of China, paper is used for windows (Figure 194).

A census of the handmade paper industry of Japan would show between twelve and fifteen hundred individual mills, each operating from one to forty vats. In China and Japan papermaking by
hand is by no means an obsolete industry, and new uses for paper are constantly being developed. It is possible that the fabrication of paper by hand will continue for all time in the Orient, as labour costs are comparatively low and there is considerable natural papermaking material. Coupled with these two important conditions is the fact that many of the utilitarian handmade papers of the East have desirable qualities that cannot be duplicated successfully by the papermaking machine. In Japan in the year 1932 (the latest figures available) the value of paper made by hand was 14,000,000 yen, while that manufactured by machinery was 43,-000,000 yen — surely a comparison that is favourable to the ancient hand process when compared with conditions in Occidental countries. In three great papermaking districts of Japan — Gifu, Fukui, Köchi — there were in 1934 almost six thousand families who gained their support through the fabrication of handmade paper. The Japanese, however, have not been slow in adopting the papermaking machine, but there are many varieties of paper made in Japan that can be formed successfully only by the use of a hand-mould in the hands of a skilled and patient craftsman.

The papers of China, Japan, and Korea, used in the myriad ways that have been described, are for the most part made by the traditional hand methods. The chief fibres used for making Oriental papers, as previously outlined, are bamboo, rice-straw, mulberry, mitsumata, and gampi barks. These materials grow and are used in China, Japan, and Indo-China. The material used in most of the handmade papers of Siam is the native kholi bark (Streblus asper); in India jute (Corchorus olitorius) and hemp (Crotalaria juncea) and discarded papers (naddi) are largely used for papermaking. In Nepal the Daphne cannabina is the bark used in making the large sheets of paper used in this northern country, while in Burma and Tibet a species of the mulberry tree yields the papermaking fibre.

In Europe and America handmade paper is regarded as a luxury, something to be used only for the printing of expensive books, for etchings and elaborate stationery. Indeed, the greater part of the people of the Occident live their entire lives without ever even seeing any paper that has been formed by the hand method. In the more traditional Orient this condition does not exist. Every person, from peasant to plutocrat, comes in daily contact with common, useful things that have been made of handmade paper — things fabricated by artisans who regard their craftsmanship as edified through its use by workaday people for humble purposes. The makers of handmade paper in the Orient, unlike those of the Occident, do not feel that their handiwork should be restricted only to the libraries and drawing-rooms of those who have the means to indulge in finely printed books and expensive engravings. Their art is not exclusive, but inclusive, an ideal which is the result of an ancient civilization where handmade paper has always been used for making lowly objects, and where traditions and training have been handed down through countless generations of papermaking families.
The Paper and the Papermakers of Europe and America during the Early Years of Printing

The paper fabricated in the fifteenth- and sixteenth-century mills did not vary in size to the same extent as paper made in later years, owing to the limited demand for sheets of diverse dimensions and to the expense of production. For every size of paper two moulds and one deckle were required, appliances fashioned only with difficulty and considerable outlay of money. In the early years of printing, the paper was seldom cut, the sheets being printed upon in the original sizes formed in the moulds, although in many cases the deckle edges were trimmed away. In all old paper, as well as in the handmade papers of the present day, there is a considerable variation in the thickness and finish, and in single books the leaves vary noticeably in weight.

The tone of the old paper was never entirely uniform, and owing to the absence of chemicals in the manufacture, the grades of paper differed strikingly in colour. The best paper was of a creamy tint, while the poorer grades, made from old and discoloured materials, were a light coffee tone, and at times even a dark grey. The bleaching of linen and cotton rags for papermaking was not in general use until the early nineteenth century, and all paper made before that time assumed the tone of the material from which it was made; the water used in the early mills also had considerable influence upon the shade or tint of the paper. In the wintertime, especially, it was difficult to clarify the water for use in the paper

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* The use of two moulds and one deckle applies only to the making of paper in the European manner where the vatman forms the sheets and the coucher lays them down. In all Asiatic papermaking based on the Oriental principle only one mould is required for each size of paper as the same worker acts as both vatman and coucher.

mills. This muddy appearance is noticeable in many of the early American-made papers. It is interesting to note that in England very little paper except that of a coarse quality and greyish tone was produced until the late seventeenth century, about the time papermaking was introduced into the American colonies. In France blueing was often added to the paper stock to counteract the discolouration caused by muddy water.

In holding old paper to the light it is not uncommon to notice in the sheets round semi-transparent spots, somewhat smaller than a dime (Figure 195). These spots have a thinner surface than the rest of the sheet, resembling a watermark to some extent, and may be found in modern handmade paper as well as in the old. They were caused by drops of water falling from the workers’ hands upon the moist sheet just after it had been dipped; the water