Fig. 65 Two workers using the Korean mould as shown in Figure 63. Paper of this kind is used on the floors of Korean houses. Ompei, Korea.

separate parts: the frame, the laid-cover, and the two deckle sticks. While bamboo is the most common material used in making Korean “laid” moulds, there have been instances where a tall Korean grass (Miscanthus sp.) has been found suitable for the purpose. In India grass has long formed a useful material for the making of “laid” mould-covers (Figure 64).

All Korean moulds, as well as the paper made on them, may be distinguished by several marked characteristics: the “laid-lines” run the narrow way and the “chain-lines,” often narrowly spaced and irregular, run the length of the mould. In an examination of hundreds of sheets of Korean paper, dating from the sixteenth century onward, I have found that every sheet conforms to this formula. In all other Oriental (and Occidental) moulds the opposite of this arrangement may be expected. The Korean mould is of the regulation pattern and has been used in forming sheets of paper measuring 28½ by 46½ inches. This sort of paper, after a number of sheets have been beaten or pressed together and oiled, is used for the permanent covering of floors in native Korean houses, and in single thickness the paper is used in lieu of glass in the windows (Figures 65, 66).

Fig. 66 A papermaking unit in the village of Ompei, Korea, near Seoul. The Korean moulds are operated by two workers. The heavy paper in the foreground is used on the floors of Korean houses.

THE MOULDS OF JAPAN

From China, by way of Korea, the Japanese received most of their arts, and papermaking was no exception. The craft of making paper was introduced from China into Korea and in turn the Koreans, during the seventh century, established papermaking in Japan (Figures 67, 68, 69, 70). Not only did the Japanese, with their innate skill, become expert papermakers, but the moulds fabricated by them display a highly developed technique not found in the papermaking moulds of any other country, either Oriental or Occidental. While the moulds of Japan are more complex than those of any other part of Asia, the manner of their construction and their ultimate use in forming sheets of paper are practically the same as in China and Korea. The Japanese in late years have given thought to such commercial necessities as more rapid pro-
duction and the adaptability of certain styles of moulds for particular requirements.

The most common type of mould used in Japan (Figures 71, 72) is distinguishable from all others by the "deckle," or upper sugeta, being hinged to the lower sugeta, or frame (Figure 73). Moreover, this pattern of mould has two handles protruding from the hinged deckle and spaced conveniently for the worker to grasp. Moulds of this type are used in making the thinnest tissue paper, usually from the bark of the mulberry tree, called in Japan kozo. The uncut and untrimmed paper fashioned on the mould pictured (Figure 71) would measure about 22½ by 62½ inches, but these exceedingly thin papers are usually trimmed and cut into convenient sizes to suit numerous commercial uses throughout the world. The mould-cover is made for forming "wove" paper of the finest texture, and every effort has been made to eliminate any markings or impressions that the mould-cover might leave in the paper. This has been accomplished by covering the usual "laid" bamboo cover with finely woven silk textile in which the warp and woof threads run about thirty-four to the inch, the silk being lacquered as a protection against the constant moisture to which it must be subjected. The supporting framework for this "wove" mould-covering is made of soft wood with thin copper hinges and catches, the complete frame weighing but five pounds, while the silk cover, with its flexible bamboo under-support, weighs only one and one-quarter pounds. From the photograph there may be seen the thirteen ribs, or cross-bars, that support the "wove" covering during the dipping of the mould. Each of these wooden ribs is surmounted by a copper-wire bridge which holds the "wove" cover above and away from the ribs, thus eliminating any impressions or streaks in the finished paper which would be caused by the suction of the ribs if the covering were laid directly against the wooden rib supports. These slightly curved wire bridges are a recent innovation and were adopted.
Fig. 70  Papermaking in Japan, showing thevatman and the paper-drier. (From a wood-block print by Hishikawa Moronobu in the four-volume work: Wakoku Shōshoku Edzukushi, 1681.)

Fig. 71  The most common type of Japanese papermaking mould. Most of the mulberry papers exported to America and Europe are formed on moulds of this type. Paper measuring 22% by 62½ inches can be formed. From Kochi, Shikoku, Japan.

Fig. 72  The same type of mould, but smaller, as shown in Figure 71. This mould has a cover of the "laid" type, while the mould pictured in Figure 71 is covered with woven silk and forms paper of the "wove" style. Gifu Prefecture, Japan.
Fig. 73  Forming and couching sheets of paper with the type of mould shown in Figures 71, 72. Japan.

Fig. 74  A mould for making shōji, a paper used in lieu of glass in old-time Japanese houses. Two women operate a mould of this size, forming paper that measures 29 by 67 inches. The mould-cover is rolled to show construction of the mould-frame. From Okayama, Japan.

solely to remedy the streaks, which were a slight annoyance to the foreign trade in using the paper for special purposes.

The large mould shown in Figure 74 was originally used in Okayama, Japan, in making shōji (window paper), the size being 29 by 67 inches. It requires two skilled women to form paper on a mould of this giant size. As stated before, so many varieties of moulds (cf. Figure 75) are used in Japan that only the important ones have been described.

THE MOULDS OF KASHMIR, BENGAL, AND OTHER PAPERMAKING LOCALITIES OF INDIA

The moulds of Kashmir, where papermaking is thought to have been first introduced into India, show the influence of their Persian origin, and to the moulds of Kashmir the design of all other moulds of India can be directly traced. The construction of Chi-
nese papermaking moulds was reflected in those of Persia, and the moulds of India were in turn modelled after those of Persia. It is only natural, therefore, that the present-day moulds of India follow, to a great extent, the pattern of the ancient moulds of China. The Kashmir moulds in the Paper Museum are representative of those in use in modern times, but it is reasonable to believe that these moulds have undergone few changes, if any, since the intro-

Fig. 76  Papermaking mould of Kashmir, northern India. This mould is shown in use in Figures 77–80. The finely polished manuscript papers of Kashmir are formed on “laid” moulds made of grass (Andropogon microanthus) laced with horsehair. The size of the paper made in Kashmir approximates 32 by 36 inches.

duction of papermaking into northern India. Certainly the construction of the present-day moulds of Kashmir would not suggest that there has been any alteration from the time of their introduction. While the modern tool, as in the past, is simply conceived and crudely made, its construction nevertheless shows considerable scientific knowledge.

The Kashmir mould (Figure 76) consists of two distinct parts: the mould-frame and the mould-cover, the frame acting as a sup-

Fig. 77  The catman dipping the mould shown in Figure 76. Kashmir, northern India.

Fig. 78  After the paper has been formed on the mould shown in Figure 76. Kashmir, northern India.

Figs. 79, 80  In couching, or laying down, a sheet of paper in Asiatic papermaking the matting is lifted free from the framework of the mould and the wet sheet of paper deposited flat, one sheet upon another, the workman rolling up the matting, or mould-cover, from the top edge to the bottom, leaving the moist, tender sheet firm and un-wrinkled. Kashmir, India.
port for the cover. The mould-frame of Kashmir is composed of sixteen separate pieces of wood, with two extra deckle sticks used as side deckles, in the manner of the Chinese moulds. Four of the sixteen pieces represent the actual frame of the mould; the remaining twelve compose the ribs, or cross-bars, of the mould-frame. The four outer frame sections are usually cut from strips of deodar (Cedrus deodara). These four sections are mortised at the corners making a square resembling a plain picture frame, the outside measurements being 32 by 36 inches. Between the top and bottom sections of this square are placed the twelve triangular-shaped
a practical papermaking surface, but not equal to the best "laid" bamboo moulds of China or Japan. The horsehair lacing ("chain-lines") are taken from the tail of the animal and are usually black or brown in colour. The weaving of the grass mould-covers requires considerable dexterity, but perhaps not so much ingenuity as that expended upon a "laid" bamboo mould-cover. A Kashmir mould-cover to be used on a 32-by-36-inch mould-frame would need to measure about 29 by 33 inches, but after the deckle edges have been cut away, the paper formed on a mould of these dimensions would measure only about 26 by 30 inches. There are no standard sizes for Kashmir paper and there are no set rules for the distance between "chain-lines" or the number of "laid-lines" to the inch.

The moulds of the Punjab (Figure 81), Central Provinces, United Provinces, Bombay Presidency, Madras, Hyderabad, and Bengal (Figures 82, 83) are all modelled, more or less, on the Kashmir pattern (Figure 84). With the exception of one province, all mould-covers of India are composed of grass (Figure 84); but in the papermaking sections of Bengal (Figure 85) bamboo is used in very much the same manner as in China, only perhaps not to the same degree of refinement as by the Chinese artisans.

THE MOULDS OF INDO-CHINA

The papers of Indo-China are formed on moulds that resemble those of China to a great degree, but in Indo-China we find no loose deckle sticks, the deckle being very much like the sugeta of Japan, only it is not hinged (Figure 86). The papermaking centre of Indo-China is in Tonkin, and the mould pictured was acquired in the connecting paper-villages of Lang-Buoi and Yên-Thai, lying along the muddy road not far from Hanoi. Here paper has been made for hundreds of years without interruption. The frame for the mould shown in the illustration is made of wood, and the "laid" cover is composed of unusually delicate bamboo splints laced with horsehair. The mould shown is capable of forming paper measuring 10 by 24 inches. The paper made by hand in Indo-China is consumed locally by the merchants for accounting and for use in religious ceremonies (Figure 87).
Fig. 86  Papermaking mould from Tonkin, northern Indo-China. This type of mould is used by women workers, and sheets of paper measuring about 10 by 24 inches are made. From the paper-village of Yén-Thai, where paper has been made continuously for more than six hundred years.

Fig. 87  In Indo-China the mould is dipped into the vat with the far side first, the opposite of the European custom. This mould is shown in Figure 86. From the Paper Village of Yén-Thai, Tonkin, Indo-China.

THE MOULDS OF SIAM, BURMA, NEPAL, BHUTAN, AND TIBET

In this category of moulds we find a somewhat different technique in the actual papermaking. As previously outlined, paper was formed either by dipping the mould into the fibrous water or pouring the macerated fibres upon the mould's surface. It is impossible to state which was the first method of making paper. In present-day papermaking in Siam, Burma, Nepal, Bhutan, and Tibet (Figures 88, 89, 90) the paper stock, or pulp, is poured upon the mould — the mould is not dipped. For this particular method of forming sheets of paper the mould is floated on a stream, or pool, of clear water, and the macerated bark fibres mixed with water in a bucket are thrown upon the cloth covering of the mould as it floats on the surface of the stream (Figures 91, 92, 93). Here we have perhaps the original method of making paper in using the "wove" type of mould and in the actual formation of the sheets.

The moulds of Siam, Burma, Nepal, Bhutan, and Tibet are all made in practically the same manner; it will suffice to describe the Siamese implement as representative. The moulds used in Siam are constructed so that the paper is long and narrow in shape, conforming to the character of Siamese books. The most common width of paper is about 16 inches, but it is not usual to find Si-
Tibetan workers forming their large sheets of paper by pouring the macerated pulp into the cloth moulds while floating on a pool of water. The pulp is whipped with sticks to assist in distributing the fibre over the entire mould in a fairly even sheet. From Gyantse, Tibet.

In Siam the paper stock is poured upon the mould as it floats in a stream. The “floating” type of mould is also used in Tibet, Burma, and Nepal. From Bangsoom, south Siam.

After the fibres have been intertained upon the mould, it is lifted from the stream and the paper allowed to dry upon the mould.

Siamese papermaking moulds made of teak and woven cotton fabric. Moulds of this type are shown in use in Figures 91 and 92. Inasmuch as the paper remains on the moulds until dry, many moulds are necessary. From the now abandoned Tym and Piung Nittongkum mill, Bangsoom, Siam.

The length of Siamese moulds varies from 60 to 80 inches. The papers made in the southern Shan States of Burma are usually fabricated from the inner bark of the paper mulberry. The heaviest paper made in Burma measures 32 by 66 inches; a lighter-weight paper, admired by Western artists for the printing of wood-blocks and etchings, measures 25 by 26½ inches. The coloured papers made in the Shan States in blue, red, yellow, green, and pink and used in the manufacture of umbrellas are made in a size approximating 22 by 29 inches.

In Nepal the bark of the Nepal paper plant (Daphne cannabina or Daphne papyracea) forms the material from which paper is made. The paper is said to be immune from the ravages of insects. The usual sizes of Nepal paper are 30 by 62 and 28 by 64 inches. The paper of Bhutan is usually square, measuring about 23 by 24 inches.

In making paper in Tibet the inner bark is peeled from the stalk of the shrub by women, who boil the material for two days before it is finally beaten to a fibre by hand. The macerated fibre is next mixed with water in tea-churns, where it is thoroughly agitated. The stock, or watery pulp, is then poured upon “wove” cotton moulds in the Siamese and Burmese manner.
frames of the moulds are usually made of teak (Tectona grandis, Linn. f.) of the family Verbenaceae, and are held together by teak pins and wedges. The four outside strips measure about three quarters of an inch in thickness and one and one-half inches in breadth. The cloth upon which the paper is actually formed is woven by hand, the material being pure cotton (Gossypium herbaceum). The woven cloth has from 12 to 22 threads to the inch, and the common width in which the cloth is woven is approximately 17 inches, a sufficient width for fully two thirds of the moulds used in Siam (Figure 93). As with all cloth moulds of this type, each sheet of paper must dry upon the mould, and therefore if much paper is to be formed, a good many moulds are required, as the process of drying a sheet of paper of this large size would require fully three quarters of an hour, even in the hot sun of the tropics.

EUROPEAN MOULDS

When papermaking was introduced into Spain about the year 1150, it is probable that the European workmen at first made use of the bamboo moulds that had been invented in China a thousand years previously. It was not long, however, before the European artisans had substituted metal wires in place of the bamboo and horsehair, since bamboo was not a commodity readily obtainable in the Occident. Also, in place of the Oriental flexible "laid" mould-cover (Figure 54) which was removable from the mould-frame (Figure 53), the European papermakers adopted the rigid mould (Figures 94, 95) as more suited to the formation of rag fibres into sheets of paper. The Europeans used a fence, or "deckle," to keep the newly formed paper within bounds, just as had been the practice in the East. In transplanting the "laid" type of mould from Asia to Europe, as previously explained, the same

Each sheet is dried upon its individual mould as shown in the Tibetan photograph, Figure 151. The citizens of Shari Dzong, a great Tibetan papermaking centre, pay their taxes in paper and every year 12,000 sheets, each sheet measuring 12 square feet, are sent to Lhassa, where its ultimate sale constitutes a considerable source of revenue for the lama. In other papermaking centres of Tibet the sizes of the paper are: Tsöna, 23 by 25 inches; Nyemo paper, made near Toling Tsepokphuk, 27 by 53 inches; Kungchu, 27 by 42 inches; Takpo, 31 by 30 inches; Gyantse, 31 by 72 inches.

type of mould-cover was retained. But the papers of the West were impressed with the "laid-and-chain" marks of metal wires (Figures 96, 97), while the papers of the East had been impressed with the "laid-and-chain" pattern of the bamboo or grass reeds stitched together with animal hair, cotton, or silk. In both the Orient and the Occident there is a vast difference in the number of "laid-lines" to the inch; also there is no uniformity as to the distance between the "chain," or stitched, lines.

In the paper used in printing the Gutenberg Bible (1450-5), there are about 28 "laid-lines" to the inch, while some of the paper used by Gutenberg's successor, Peter Schöffer, has 24 lines to the inch. Moulds that had 32 wires to the inch were in use at the John Tate mill, the first to be established in England, in 1495.*

* In so far as is known, the first paper mill in England was set up by John Tate in Hertford near the close of the fifteenth century. Tate's paper was used by the well-known printer Wynkyn de Worde for his first English edition of Bartholomeus: De proprietatibus rerum, as appears from these three lines in the volume: