# JOURNAL OF THE CLASSICAL CHINESE FURNITURE SOCIETY

SUMMER 1994

# Uniting Elegance and Utility: Metal Mounts on Chinese Furniture

*Curtis Evarts*

In ancient and medieval China, wood and bamboo were the materials most widely used for the construction of mechanical implements. Only essential parts requiring superior tensile strength or abrasive resistance were made of bronze or iron. Early Chinese furniture, too, was made of wood and fitted with metal mounts where these characteristic strengths could be best employed to maximize service and utility. Extant examples display the long established Chinese aesthetic of blending function with beauty, and prefigure the sentiments of the great English furniture designer, George Hepplewhite, who was clearly influenced by the eighteenth-century vogue for things Chinese: "To unite elegance and utility, and blend the useful with the agreeable has ever been considered a difficult, but an honorable task." In the following pages we will trace the history, examine the materials, and determine the various functions of the metal mounts that lent practicality and elegance to hardwood Chinese furniture of the Golden Age.

The use of metal mounts on Chinese furniture can be considered to have begun in the transitional Eastern Zhou period, generally divided into the Spring and Autumn (770-476 B.C.) and the Warring States (476-221 B.C.) periods. The latter period, in which competing states strove for military superiority, was one of the richest periods of technological invention in Chinese history. Metalworking technology, in particular, flourished, with advances leading to the greater reliability and durability of weaponry and the more efficient harnessing of horses. Like the rapid electronic advances made in the twentieth century during the Cold War, advances in metalworking trickled down in various forms to enhance the daily lives of individuals. The emergence of the double-acting piston bellows provided a continuous flow of air to fuel blast furnaces, and facilitated the development of cast iron, which requires considerably higher temperatures than does bronze casting. The ability to cast iron led to the mass production of farm implements, which in turn increased taxable yields. The heightened energies of the time contributed to prosperous economies, with large-scale commercial mining and casting industries supporting the rising merchant class (Gernet 67).

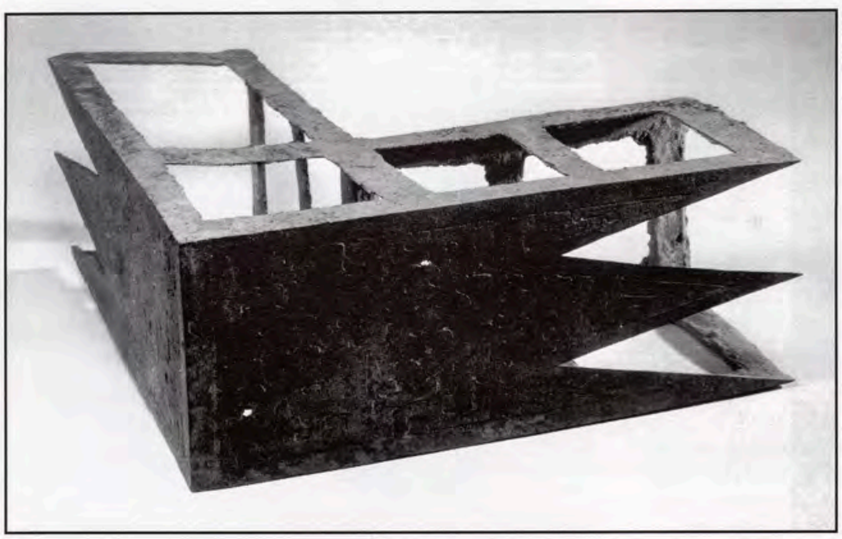
*Fig. 1. Portable bookcase, late sixteenth/early seventeenth century. One of a pair.* Huanghuali *and* paktong*; width 59 cm, depth 35 cm, height 69. 5 cm. Museum of Classical Chinese Furniture, Renaissance, California.*

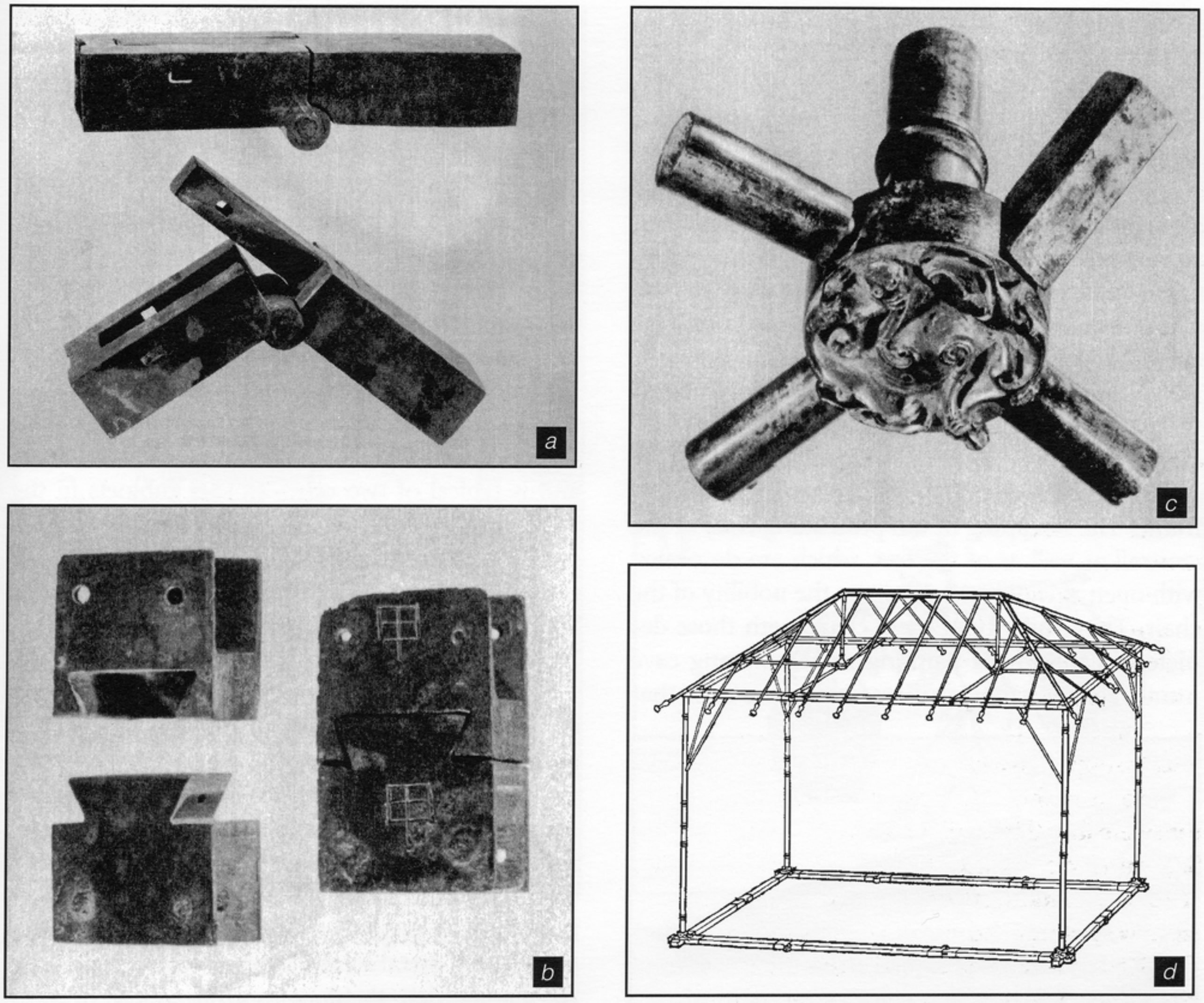
Out of this economic climate, metal casting began to appear on household furnishings for functional as well as decorative purposes. This combination is illustrated by a group of decorated bronze structural connectors excavated in Fengxiang county, Shaanxi province, from the ruins of the ancient Jin capital of the Spring and Autumn period. Sixty-eight various structural connectors were discovered, including splice connectors (used to join the two ends of timbers), and right-angle brackets (fig. 2) (Zhang Shengfu 182-3). Their surfaces are covered with fine patterns of coiled hornless dragons (*panhui*), which would have enhanced the interiors of the open timberframe construction characteristic of traditional Chinese architecture. Similar metal connectors are used today in woodframe house construction for earthquake and hurricane reinforcement. A heavily cast bronze corner bracket with similar surface decoration was excavated from another mid-Eastern Zhou tomb. Found with a single bronze bell, it is thought to have been one of the corner connectors for the beam of a bell stand that originally supported a complete set of bells (Hubei 34).

Some of the earliest examples of Chinese furniture were found in the Chu tombs from the Warring States period excavated at Xinyang in Hebei province (Lou 54), including the often cited lacquer bed with bamboo railings and bronze corner mounts (Handler 1992, 4). Also excavated from the same tomb was a lacquer table with bronze corner mounts. Two bronze rings with animal mask escutcheons were attached along each of the two long sides, and were presumably used to lift the table. Four hoof-shaped bronze legs tenon into the underside of the table, and were probably removed for transport (Lou 42). (For a similar table, see figure 15, p. 52, this issue.)

In ancient times, small bronze pulls and escutcheons were soldered to the sides of bronze vessels. Similar small and large pulls are commonly found in early tomb excavations, and were once attached to doors or to the sides of coffins. The escutcheons are often finely wrought, in the form of a creature holding a bronze ring in his mouth (*pushouxian huan*). According to Chinese legend, the animal-mask pull is a watchful door-god in disguise, which can protect the master of the house or the spirit residing in a tomb. A coffin hold found in the tomb of Prince Liu Sheng (d. 113 B.C.) at Xinyang, Hebei province, has a magnificent escutcheon sculpted with two masks and a pair of dragons writhing upward at either side (fig. 3). The pull is held in the beak of an owl-like mask, and the bottom is twisted outward like a rope (Mancheng 34).

Complex castings of bronze hub connectors used to join canopy structures were also unearthed in the Warring States excavations at Xinyang. Those found in the extravagant second-century tomb furnishings of Prince Liu Sheng not only demonstrate the high level of bronze casting attained at that time, but also illustrate the early Chinese mastery of collapsibility. Among the thousands of entombed articles were the bronze remains of two small portable canopies, including hinged sockets, splice connectors, and hub connectors, which originally joined short wood or bamboo poles into a lightweight canopy frame (figs. 4a-d). Draped with fabric and






furnished with mats, tables, and attendants, this ingenious frame could be transformed into a small portable palace (*Mancheng* 173). Remains of the earliest known folding table were also found in this tomb. At the top of each bronze leg is a hinge, one leaf of which was originally attached to a lacquered plank fitted with bronze corner mounts. The legs, when folded open, were held in place with a small swivel latch, and could be folded against the bottom of the plank for storage or travel (*Mancheng* 145).

Bronze and gilt-bronze fittings are frequently excavated from tombs of the Han periods (207 B.C.-A.D. 220). During the Tang (A.D. 618-906) dynasty, the technique of hammering and chasing objects with gold and silver was introduced from Persia. Metal spring-locks also must have developed during this period, as excavations from Tang tombs have unearthed numerous examples, and there is little, if any, evidence of their earlier appearance. An exquisite silver-gilt lock unearthed from Hejia village in the southern suburb of Xian reflects the high level of metalworking achieved during this period (fig. 5). Both lock and key have finely chased lozenge patterns that were parcel-gilt (Zheng 138). Miniature *sancai*-glazed pottery coffers from the Tang period are often modeled with locks; surprisingly, an example at the

*Fig. 2, facing page, left. Decorated bronze structural connector excavated in Fengxiang county, Shaanxi province. Spring and Autumn period (770-476 B.C.). Shaanxi Provincial Museum, Xian.*

*Fig. 3, facing page, right. Coffin handle with animal-mask escutcheon excavated in Mancheng, Xinyang, Hebei province, from the tomb of Prince Liu Sheng (d. 113 B.C.). Gilt bronze. Length 12.2 cm, width 7.3 cm.*

*Figs. 4a-d, above. Bronze canopy fittings excavated in Mancheng, Hebei province, from the tomb of Prince Liu Sheng (d. 113 B.C.). (a) Hinged socket, (b) Dovetail splice connectors, (c) Hub connector, (d) Drawing of reconstructed canopy structure.*

Rietberg Museum in Zurich is fitted with an actual gilt-bronze lock (Ellsworth 48).

Japan was heavily influenced by the radiating Tang culture. The capitals at Nara and, later, Kyoto, imitated the plan of Changan, the Tang capital; and almost every other imaginable area—language, religion, politics, technology—was affected as well. The artifacts stored at the Shōsōin in Nara thus strongly reflect fashionable Chinese taste of that time. Several pieces of furniture are fitted with metal mounts, including perhaps the earliest extant Chinese-style armchair (fig. 6). It is made of zelkova wood, finished with sappanwood extract and lacquer, and fitted with chased gilt-bronze mounts that band junctures at the crestrail, the armrests, and the four corners of the seat frame. The wrapping of the protruding ends of the crestrail as well as of the feet, which are decorated with open *ruyi* designs, enhances the nobility of the chair. The similarity of these chairs with those depicted in the mural paintings in Dunhuang cave number 196 further confirms a Chinese style that

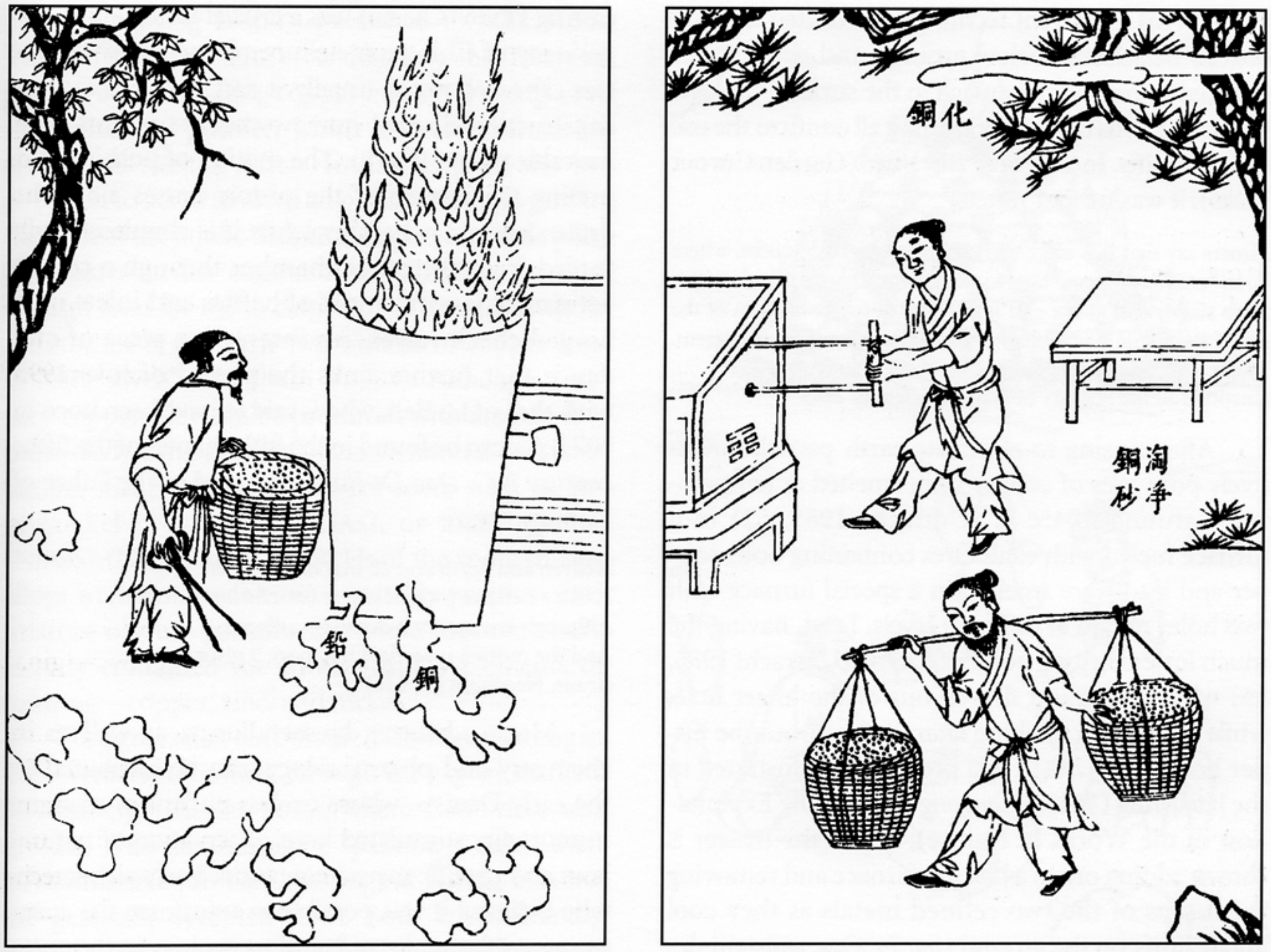
can be dated to the Tang period (Dunhuang 184).

The use of nails and reinforcements on the chests and cabinets in the Shōsōin indicates that the sophisticated Chinese joinery characteristic of Ming furniture had not yet evolved. Although the sides of chests are joined with interlocking tenons (box-joint construction), these simple interlocks relied heavily on iron nails pinned through every tenon. A beautifully figured zelkova cabinet was listed in the initial inventory of objects placed in the Shōsōin after the death of Emperor Shomu in A.D. 756 (Handler 1993, 10). Its construction, too, relies on neatly spaced nails with large boss-heads to join the corners of the solid vertical panels as well as to attach the internal shelves, and is typical of two other smaller cabinets in the Shōsōin. The solid-panel doors swing on hinges whose opposing *ruyi* outlines resemble animal masks. The doors are also fitted with lock receptacles with escutcheons of a six-petal design. The original lock and hardware are all of gilt bronze.*

During the Song dynasty, *Yingzao fashi* (Treatise on Architectural Methods) was published (1100), with details of sophisticated joinery for timber framing (*da muzuo*) as well as fine woodworking (*xiao muzuo*). Its widespread effect on construction techniques undoubtedly influenced furniture makers, who established many of the forms of what was later to be known as Ming-style furniture. Although the necessity of metal reinforcements may have diminished somewhat, the deep-rooted tradition of using metal mounts continued. Hardwood and lacquer furniture from the Ming and early Qing dynasties are frequently fit with mountings cast from a copper-nickel-zinc alloy, known primarily in the West as "paktong," and, somewhat less frequently, with iron or yellow brass mounts.

An examination of the history of mining and metallurgical practices in China can yield a better understanding of the materials used in metal mounts. Copper is the main component in the gilt-bronze, paktong, and brass fittings found on Chinese furniture. Bronze has a secondary element of tin, and brass, of zinc. More than four hundred copper-producing areas were listed in possibly the earliest known geological treatise, *Shanhai jing* (The Classic

** Fittings that were missing or had deteriorated on the cabinets and chair have since been faithfully replaced without any attempt to conceal the restoration* (Kimura 57).




of Mountains and Rivers), thought to have been compiled sometime between the sixth and fourth centuries B.C. It also contains the earliest known references to geo-botanical prospecting—the connection between the surface vegetation and the types of minerals in the subsoil. For instance, the presence of the wild pansy (*Viola Calminaria*) or pennycress (*Thlaspi*) were both strong indicators of zinc-rich ores, and alyssum (*Alyssum Bertonlonii*) of nickel ores. Soils bearing elegant plants with yellow stalks were likely to contain copper, as were those where the Indian sorrel (*Oxalis Corniculta*) grew, which was known to accumulate copper (Needham III 678).

*Fig. 5, facing page, center. Spring lock, Tang dynasty (A.D. 618-906). Excavated in Hejia village, Shaanxi province. Gilt silver; length 18.3 cm. Shaanxi Historical Museum, Xian.*

*Fig. 6, facing page, below. Armchair, Tang dynasty (A.D. 618-906). Lacquered zelkova with gilt bronze mounts; depth 68.5 cm, width 78.5 cm, height 91.0 cm. Shōsōin Treasury, Nara, Japan.*

*Fig. 7, above, left and right. Smelting mixed ores of copper and lead. Woodblock print illustration to* Tiangong Kaiwu *(The Exploitation of the Works of Nature), 1637.*

In 1974, a strip-mining operation in the Tanglu Mountains of Hubei province exposed two ancient copper mines dated to the Spring and Autumn period. Their unique construction—a series of vertical shafts from which horizontal galleries radiate—demonstrates an evolved mining process that did not significantly change until the modern era. The mines still contained rich deposits of malachite, copper brilla, and cuprite, easily recognized by their bright green, orange, and red colors. One mine had five deep vertical shafts with diameters of 110-130 cm, all within an area of 120 square meters. Ten descending levels of horizontal tunnels radiating from the vertical shafts were found. Each was large enough for one man to crawl through, and was propped with small timbers. The bottom level was found at a depth of fifty meters, where excavated material revealed that the actual mining for ores had begun. Working from the bottom up allowed waste materials and inferior ores to be used to fill the previously excavated voids below. This intelligent technique permitted the best ores to be selected below ground, and significantly reduced unnecessary haulage to the surface. The few written records on copper mining all confirm the use of deep shafts. In the Song *Tan Yuan* (Garden Corner Talks), it was further noted:

Miners say that it is risky working at such great depths, where lurks "cold smoky gas" fatal to man. A long bamboo pole with a lamp suspended at the end is first thrust to the bottom of the pit. If the flame turns blue, it shows that toxic gas is present. Those who flee it are saved.
(Institute of the History of Natural Sciences 264)

After rinsing to eliminate earth particles, relatively pure ores of copper were smelted at temperatures around 1045° C (Untracht 1985, 52) in a furnace fueled with coal. Ores containing both copper and lead were smelted in a special furnace with two holes placed at different levels. Lead, having the much lower melting point of 325° C (Untracht 1985, 55) melted first and flowed out of the lower hole, while the copper, melting later, flowed from the upper hole (Sung 244). This process was illustrated in the late Ming (1637) *Tiangong Kaiwu* (The Exploitation of the Works of Nature), where the master is shown adding ore to a blazing furnace and removing the lumps of the two refined metals as they cool and solidify on the ground (fig. 7). One assistant delivers the ore in wicker baskets while another pumps the double-acting bellows to supplement the coal in the blazing furnace with a continuous flow of oxygen.

At this point in the process, the demi-god of craftsmen, Lu Ban, appears as the inventor of the ingenious, yet relatively simple, double-acting bellows. The continuous flow of oxygen to the blast furnace provided the significantly higher temperatures that were necessary for the development of iron casting (1536° C), and was a crucial factor in the superiority of Chinese metallurgy for so many centuries. The bellows is usually a rectangular, box-like construction divided into two compartments by a movable piston (fig. 8). The motion of pushing and pulling the handle of the piston causes air to be drawn into one chamber while it is simultaneously forced from the other chamber through a clever, yet simple, arrangement of baffles and inlets with hinged check valves. An interesting piece of evidence that further links the period of invention with that of Lu Ban, who is said to have been born in 507 B.C., can be found in the fifth chapter of the fifth-century B.C. *Dao De Jing*, attributed to the father of Daoism, Laozi:

Heaven and Earth and all that lies between,
Is like a bellows with its tuyère [nozzle for the blast];
Although it is empty it does not collapse,
And the more it is worked the more it gives forth.
(trans. Needham IV, 136)

Many advances in metallurgy, as well as in chemistry and pharmacology, can be attributed to the early Daoists, whose tireless pursuit of material immortality stimulated keen observation of natural laws and prolific experimentation. Early alchemists, who believed it was possible to transform the common into the sublime, found an analogy in the combination and transformation of base metals into gold and silver. As the knowledge of the individuality of atoms in an alloy was lacking, the transformed substance was considered to be indistinguishable from, if not better than, the natural substance, so long as the desired characteristics of weight, ductility, malleability and, most important, color, were realized. In the case of paktong, which is slow to tarnish, the claim of superiority to silver could well have been justified. Maoying, the great Daoist scholar of the Western Han (207 B.C.-A.D. 25) reputedly transformed silver into gold, and iron into silver in order to purchase grain for thousands who were starving during a famine at Tanyang. These methods later became known as the "Tanyang techniques" (Needham V, 234).

The earliest account of making a paktong-type alloy is found in *Chun Zhu Ji Wen* (Records of Things

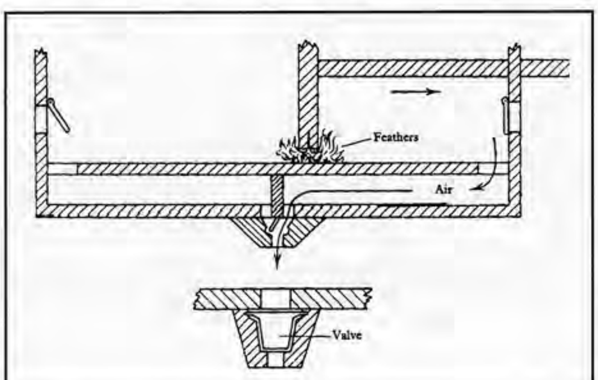



*Fig. 8, left. Drawing of a section through the double-acting bellows. After Needham IV, fig. 427c, d.*

*Fig. 9, facing page. Workers smelting zinc. Woodblock print illustration to* Tiangong Kaiwu *(The Exploitation of the Works of Nature), 1637.*

Heard at Spring Island), published in A.D. 1095. There the author, Ho Wei, describes the Tanyang process of transmuting copper into silver using a refined arsenical powder, which he learned from an alchemical master. After Ho had received the instruction to add a tenth of an ounce of this reagent to the flesh of the jujube date and shape it into little pills, the master further commented: "This is as good as enough food for me to cultivate the Dao for a whole month, for it can turn two ounces of copper into brilliant silver" (Needham V, 233). Although a silvery copper alloy can be produced with arsenic, it is more likely that commonly known natural ores containing nickel and arsenic were used, such as cupronickel or niccolite (NiAs), or nickel glance (NiAsS) (Needham V, 232). Until the modern age, alloys were not made from a suitably proportioned mixture of pure constituents; some ores may have already contained the three primary elements of paktong—copper, zinc, and nickel.

Foreigners first encountered Chinese paktong in the seventeenth century through the export markets in southern Chinese ports, where Cantonese was spoken. Thus the Cantonese "paktong," rather than its Mandarin equivalent, *baitong* (白 銅), has become the generally accepted term. Both terms literally mean "white brass." Some Chinese today, however, still refer to this silver alloy as *saiyin* (賽銀), meaning "in competition with silver," which may reflect its alchemical origins. The Western terms "nickel silver," "German silver," and "cupronickel" are also more or less synonymous with paktong.

Scholars generally date the beginning of paktong production sometime after the subjection of Yunnan by Han Wudi (c. 131 B.C.) because of the rich deposits of arsenical nickel known to have existed there. The *Huayang Guo Zhi* of A.D. 347 records that *baitong* was produced in the mountains of Tanglan county in Yunnan.*

More than a century earlier, Chang Yi's *Guang Ya* (Literary Expositor) dictionary (A.D. 230) notes that *baitong* is *wu* (鋈), a term that Needham has traced back to the eighth-century B.C. *Shijing* (Book of Odes), where it was used to describe fittings on a war chariot; its composition remains obscure.

**Needham also noted an area not far from the Tanglan Mountains in Sichuan, adjacent to Yunnan, recently known to produce a copper-nickel ore that, after processing, was sent out to other provinces in the form of round cakes (Needham V 232).*

Paktong coins dated to the later Xia dynasty (A.D. 419-425) are the earliest Chinese artifacts made of this alloy (Needham V 232). The discovery of a few Greek cupronickel coins dating from 180-160 B.C., however, has led scholars to postulate a source that produced paktong in ingots, which traveled westward along trade routes (Needham V 237). Curiously, there is no further evidence of paktong in the West until the late sixteenth to early seventeenth century, when ingots and objects began to be exported from southern Chinese ports, and only after the element of nickel was isolated almost two centuries later did Westerners discover the mystery of its composition.

The addition of zinc to copper produces a golden-yellow brass that is harder and stronger than copper while retaining the malleable and ductile qualities that enable it to be easily hammered into sheets and elongated without fracture. According to the late Ming *Tiangong Kaiwu*, one hundred cakes of a "self-bellowing coal" (*zifeng meitan*), were sufficient to melt ten catties of copper together with six catties of zinc. This fuel, which did not require the bellows, was made of a finely powdered coal mixed into cakes with a clay binder (Sung 247). This ratio of elements varies only slightly from the modern standard for a good cold-working yellow brass of 65% copper and 35% zinc (Untracht 1985, 53).

Zinc began to be isolated in the ninth to tenth century A.D. (Needham V 219); the process is explained in *Tiangong Kaiwu:*

> Zinc (*woqian*) is extracted from smithsonite, and produced primarily in the T'ai-hang Mountains of Shansi, followed by Ching-chou [in Hubei] and Heng-chou [in Hunan]. Fill each earthen jar [retort] with ten catties of smithsonite (calamine), then seal tightly with mud and let it dry slowly so as to prevent cracking when heated. Then pile a number of these jars in alternate layers with coal and charcoal briquettes, with kindling on the bottom layer for starting the fire. When the jars become red-hot, the smithsonite will melt into a mass. When cooled, the jars are broken open and the substance thus obtained is zinc, with a twenty percent loss in volume.
> (Sung 247)

Although this method of smelting (fig. 9) produced a 98-99% pure zinc, the Chinese still considered zinc to be a low-grade material related to the lead family. As the color and the low melting point of zinc (410° C) were similar to lead, it was termed "poor (or Japanese) lead" (*woqian,* 倭鉛). Because of its volatile nature at higher temperatures, it is necessary when producing brass to add zinc to the molten copper right before pouring to prevent its loss through vaporization. Various qualities of brass are produced, with compositions ranging from 5 to 60% pure zinc, the latter of which is a low-grade casting metal (Untracht 1985, 53; Sung 247).

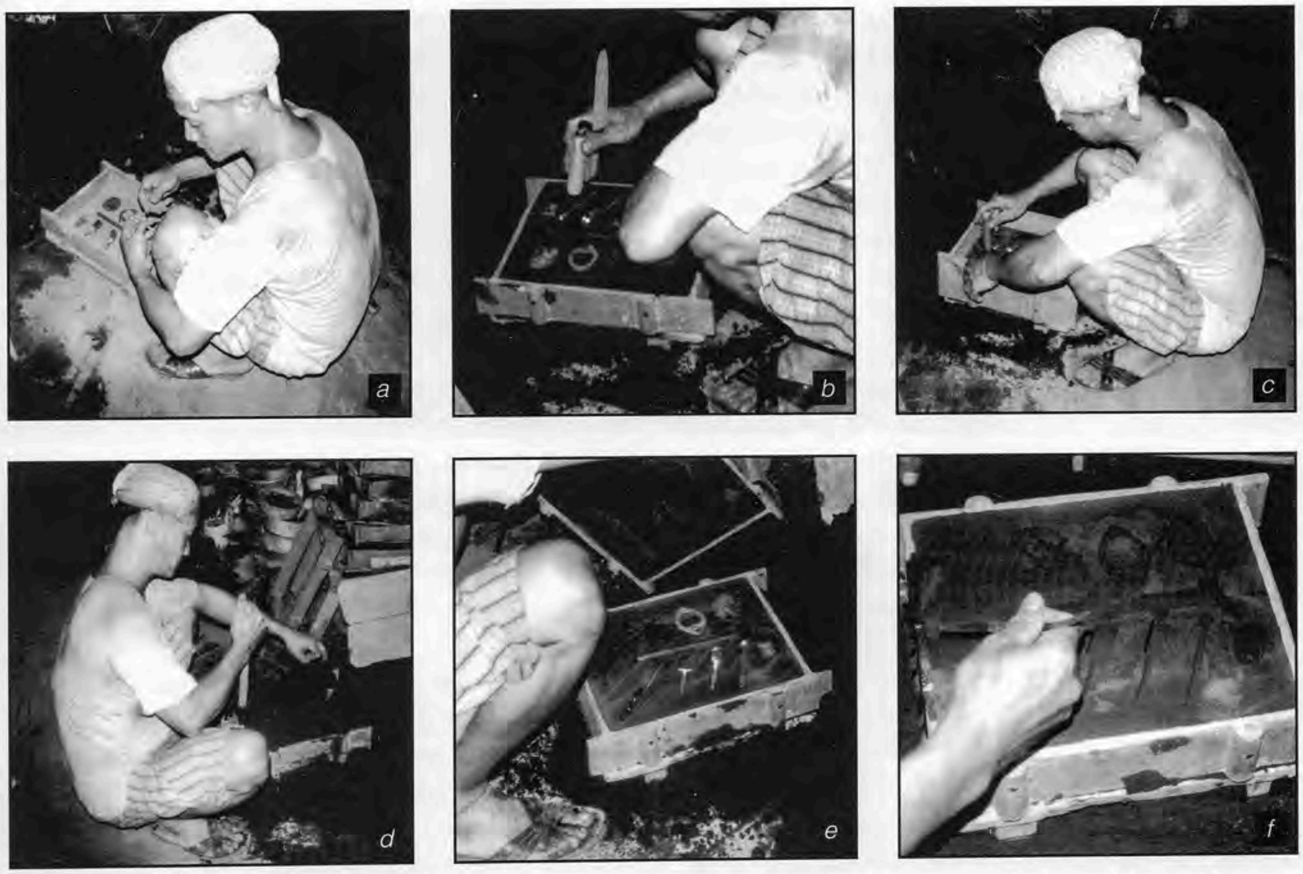
The melting point of nickel is 1453° C, thus the paktong alloy requires considerably higher temperatures to produce than brass. Nickel is a malleable and ductile metal that is capable of a high polish and combines readily with other metals. When combined with the constituents of brass, its properties of high resistance to oxidation produces a superior alloy that is slow to tarnish. Modern silvery-white to yellow-white alloys of 65% copper are produced with respective variations of 17-23% zinc and 18-12% nickel (Untracht 1985, 54). The lower percentages of nickel can also confer a quasi-golden color on the alloy. A group of Chinese paktong objects that Needham analyzed illustrates a fairly wide range of composition and, furthermore, with percentages of copper varying from 40-60%, zinc 22-45%, and nickel 6-36%, probably indicates the use of natural ores (Needham V 230). A magnet will attract nickel and can be used to test for any significant presence in a true paktong.

During the early part of this century, Rudolf Hommel traveled throughout China to record its ancient technologies before they disappeared into the shadows of looming advancements from the West. Among itinerant tradespeople, brass smiths were noted as still using paktong. Traveling from village to village for work, they often repaired or made small fittings for furniture such as hinges, pulls, hasps, and locks. The tools of their trade were carried on poles in compact portable cases; one type seen in Guling, Jiangxi province, had a built-in bellows (fig. 10). When setting up shop, bricks were used to make a small hearth adjacent to the draft-port of the bellows box. Regarding the vise-clamp mounted on its top, Hommel recorded :

> On the top of the box is the wedge-vise, which can be raised or lowered, to serve as support for things to be filed. The typical Chinese file has two tangs, one for the handle and the other for a guiding rod, which slides in the eye-bolt here seen protruding from the top of the bellows-box. The vise consists of a heavy iron staple driven part way into the top of the box, and a strip of rather hard wood which is passed through it. With a wedge inserted underneath, this strip can be fixed in various positions, holding articles tightly to the bench.
> (Hommel 39)

*Fig. 10, below. Itinerant brass smith's combination box bellows and tool box. After Hommel 38.*

*Figs. 11a-f, facing page. A metalworker in Hong Kong preparing a sandcast mold..*




He also noted the use of various other tools, including tongs, hammers, and a steel scraper, whose sharp edges were presumably used to flatten the dimpled surfaces of hammered sheets of softer metals. The pump drill was also part of the tool kit, and was an indispensible aid in making small wares.

It was traditional to cast brass and paktong into sheets. These malleable alloys were easily cut and hammered in the cold into desired shapes. A hand polish was given with the help of charcoal powder and gourdskin (Hommel 20). Today, modern restorers have the luxury of purchasing small sheets of a "nickel silver" that is manufactured in Japan and available in several thicknesses.

Sand casting was probably one of the earliest techniques of casting molten metal, and is still practiced today in Hong Kong to reproduce larger furniture fittings for restorers (figs. 11a-f). Original or wood models to be reproduced are laid out on a board and within a metal frame, flat side down, on either side of a duct tube (fig. 11a). Sand is slightly dampened, sifted into the frame, and pounded until compact. A fine red molding sand, called "Shanghai red" but actually from Guangzhuo, is used, which turns black after use. After carefully turning over the frame, the board is removed. Here, objects without a flat side, such as a lockpost or pin, are gently tapped halfway into the compacted sand (fig. 11b). A second frame is fitted onto self-aligning pins, and a vertical duct tube is placed to join the horizontal duct (fig 11c). Sand is again added and compacted to fill the second frame (fig. 11d). This second half of the mold, having received its impression, is carefully lifted off and set aside (fig. 11e). After each piece has been carefully removed, the hollowed impressions are each then joined to the horizontal duct canal by a small channel cut into the firm sand with a metal blade (fig. 11f). The two frames are then carefully rejoined with the hollowed cavities perfectly aligned. Except for the addition of a modern electric blower to blast the furnace, the metals are melted just as they were in ancient times. Today, a Vietnamese coal is added to the furnace around the crucible filled with scrap brass. If paktong is to be cast, the brass smith simply melts scrap paktong or the new sheet metal product from Japan. The molten liquid is poured into the duct tube and flows into the empty cavities. Any gases that form as the molten metal cools escape through the porous sand. The cast reproductions are then cut from the waste armature and polished.

The decorative effect of ornamental hardware on furniture varys considerably. The forthright and cultivated appearance of a pair of small chests (fig. 12) and a pair of portable bookcases (fig. 1) reflects the austere attitude of a Confucian scholar or a military official, while the paktong mounts on the compound wardrobes (see cover) radiantly pulsate to complement the flaming figure of the *huanghuali* panels. Metal mounts can be divided into four categories according to function—lockplates and hasps, pulls and handles, hinges, and reinforcing and protective mounts. These categories will be discussed below and illustrated with examples of hardwood furniture from the Museum of Classical Chinese Furniture, Renaissance, California.

**Lockplates and Hasps**

The impression of cabinets and chests is greatly enhanced by the design of the lockplate (*mianye*, 面葉). Those on the Museum's *huanghuali* wardrobes are hexagonal in design with radiating *ruyi* cloudheads (fig. 13). The verticality of a pair of *huanghuali* tapered cabinets in the Museum's collection are complemented by the placement of long, narrow paktong lockplates (*miantiao*, 面條) (fig. 15k) on an otherwise undecorated surface. Their harmonious proportions and carefully considered vertical placement impart a sense of balanced focus (see Handler 1993, 13). Large metal mounts such as these serve to protect the wood surface from the soiling that occurs from repeated usage, and to prevent wear from swinging pulls and damage from sliding the lock through the lockposts.

Segmented by the doors and the central removable stile, these large plates are attached to each member at two points—by the lockpost and by the looped pin below, which also secures the pull (fig. 13). This mounting technique explains why the removable stile usually has an otherwise unnecessary pull. The lockpost has a pin extending from the back that penetrates through the wood panel; a small, flat washer is then fit over the protruding end of the pin, and the end is hammered over the washer like a rivet head to hold the lockpost in place. The two ends of the looped pin also penetrate through the frame member and are bent over in opposite directions to fix them in place. These bent loops (*ququ*, 屈曲) are the traditional attaching system. They are fashioned from a narrow strip of brass or paktong doubled back upon itself with an eye loop formed at the bend. The two ends are slightly pointed to ease the entry into the hole. Once the eye loop is firmly seated against a backplate or escutcheon, the ends are bent over in opposite directions to hold the pull in place.

The cast mounts through which a lock or pin is fitted are called lockposts. When a central removable stile is employed, the third lockpost provides a fixed point to lock the doors of a cabinet. Without this uniquely Chinese device, loose tolerances and tilted positioning will cause a pair of locked doors to swing partially open. Another method of fixing a solid point to lock a pair of cabinet doors can be seen in the

pair of portable bookcases (fig. 12). The central lockpost is firmly attached to an interior shelf that is joined to the sides of the cabinet. The lockpost can vary from the universal loop-head pin (*ququ*) to a more complex decorative casting. The paktong lockposts in figure 13 are inlaid with a ring of copper or red brass and an open cross pattern of yellow brass. This refined detail is found on the hardware of a number of fine cabinets, and was perhaps once the trademark of a noted brass smith.

*Ruyi*-shaped hasps (*paizi*, 拍子) are often found on chests and boxes. An exceptional example may be seen on the Museum's small, finely carved chest (fig. 14). The cartouche-shaped backplate echoes those carved on the main panels and is segmented by the two doors and the lid (fig. 14a). The surfaces of both backplate and hasp are incised with borders and meandering vines with lotus blossoms. The pin housing of the hasp was created by making a series of angular bends at the top, and was then further worked to shape indented corners and concave surfaces. The hasp is attached to small posts with a pivot pin that was fixed in place by hammering the protruding ends to spread them into flat heads. When hinged downward, the hasp plate fits over two lockposts, one mounted on each door, through which a small lock can be placed. Hasps are more commonly found with a pin housing formed as a continuous cylinder and hinged with looped pins; a second set of looped pins serves as the lockposts (fig. 12).

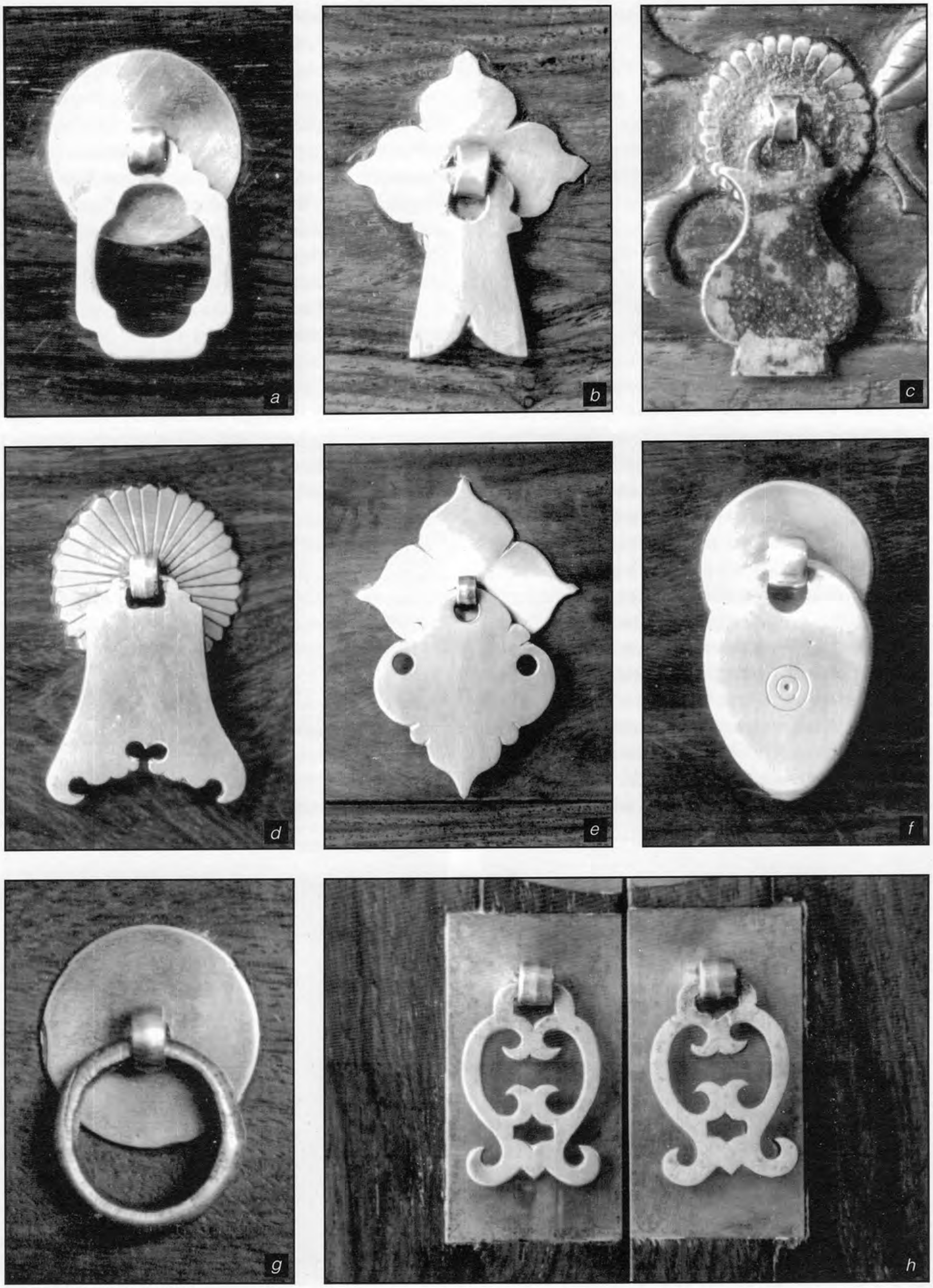
Drawers are sometimes fitted with sliding bolts that can be secured with a lock. They are commonly found on coffers and balance stands, where valuables were presumably stored. Cast bronze sliding bolts were already fairly sophisticated during the Eastern Zhou dynasty (Needham IV, pl. 136), thus it should not be surprising to find several variations in use on furniture more than two thousand years later. They are generally mounted on the outside of an escutcheon plate with a simple clasp or a decorative boss that is shaped to allow the bolt to slide up and down. The Museum's balance stand has a sliding bolt attached to the lower of two drawers (fig. 21, p. 42). In the unlocked position, shoulders shaped on its upper corners prevent the bolt from falling through the lower clasp. To secure both drawers, the slide lock is raised upward through the slightly wider clasp mounted on the horizontal rail between the drawers. At the point where the slide lock cylinder is aligned with the loops on the bottom drawers, a traditional

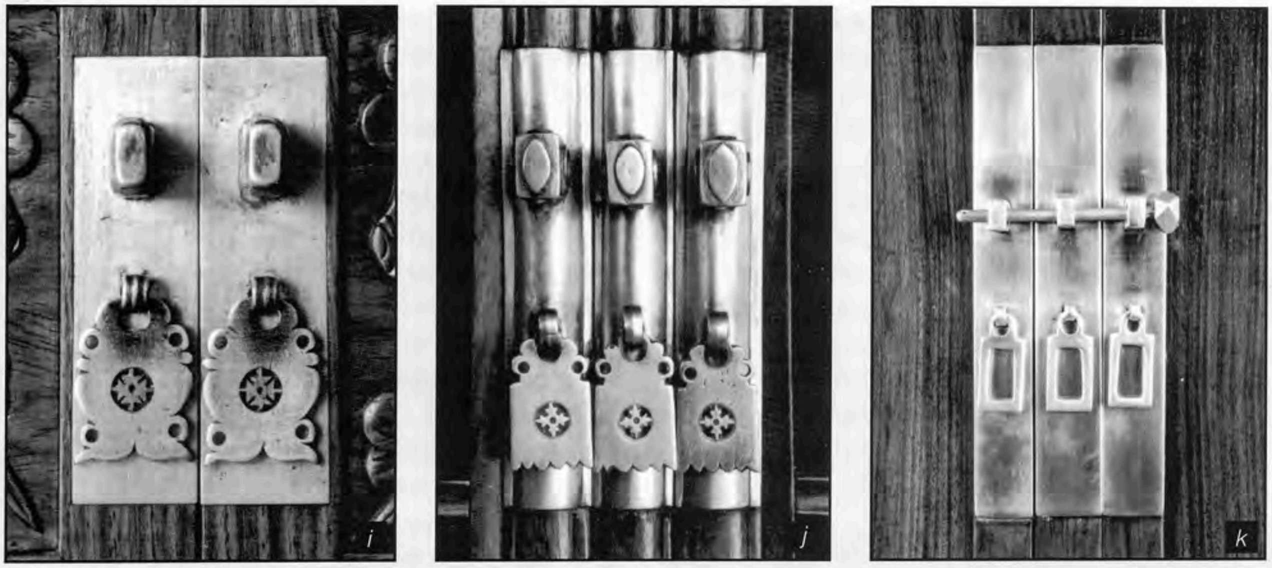
*Fig. 12, facing page, left. Chest, late sixteenth/early seventeenth century. One of a pair.* Huanghuali *and paktong; width 40.3 cm, depth 35.6 cm, height 35.7 cm. Museum of Classical Chinese Furniture, Renaissance, California.*

*Fig. 13, facing page, right. Lockplate of a* huanghuali *wardrobe. One of a pair. (See cover, this issue.) Museum of Classical Chinese Furniture, Renaissance, California.*

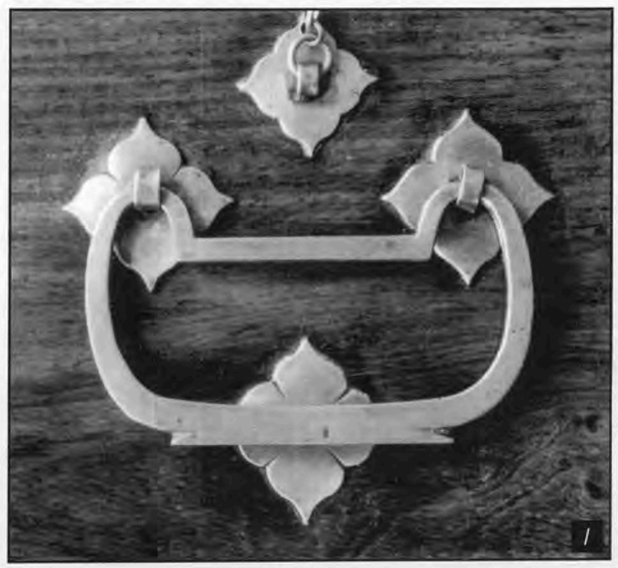
*Fig. 14, left. Chest with low relief carving, late sixteenth/early seventeenth century.* Huanghuali *and paktong; width 40 cm, depth 28.5 cm, height 35 cm. Museum of Classical Chinese Furniture, Renaissance, California.*

*Fig. 14a, right. Detail of figure 14, showing the hasp.*


a
b
c
d
e
f
g
h




Chinese lock can be inserted. To lock a drawer under a tabletop, the bolt is simply raised into a narrow mortise cut into the underside of the frame. A coffer in the Museum's collection has drawers fit with exposed slide bolts that are attached from behind the escutcheon plate—a design that complements its sleek design. Another sophisticated variation can be found on the coffer at the Metropolitan Museum of Art, New York, where the entire bolt is hidden behind the backplate (Ellsworth 76).




**Pulls and Handles**

A rich variation in design is found in the pulls and handles on Chinese hardwood furniture. Flat pulls (*diaopai,* 吊牌) are generally cut from sheet metal. Flat pulls found in the Museum's collection have shapes rich in auspicious meaning—festive lanterns (figs. 15a, b, j), vases (fig. 15c), Buddha's hand fruit (fig. 15d), and bats (fig. 15e). In Qing dynasty building regulations, a reference to pulls that are shaped like duck eggs (*yadan*) (Wang I 1989, 138) can be found, which lends a possible explanation to the shape of a standard pull incised with concentric circles (fig. 15f).

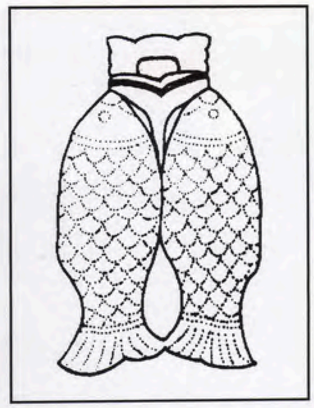
The double *chi* dragon pull is a common motif and is found in several variations on pieces in the Museum's collection (fig. 15h, i). Although somewhat abstract and at first glance resembling a "double-


*Figs. 15a-m. Details of pulls and bails: (a, b, j) Lanterns, (c) Vase, (d) Buddha's hand fruit, (e) Bat, (f) Duck egg, (g) Ring pull, (h, i) Double fish/*chi *dragon, (k) Open rectangle, (l) Ox nose bail, (m) Censor-shaped bail.*

fish" pull (a common rebus signifying "double wealth"), the etched designs on the pulls of the small carved chest (fig. 14a) clearly delineate dragons. A pair of easily recognizable double-fish pulls were found in a Liao dynasty (A.D. 990-1178) tomb, however, and suggest an earlier tradition of using pulls with auspicious forms (fig. 16) (Zhang Baizhong 58).

Simple, functional ring pulls (*diaohuan,* 吊環) are probably the most common to Chinese furniture (fig. 15g). Open, rectangular forms are also found, and harmonize with the austere presence of the tapered cabinets (fig. 15k) and the scholar's bookcases (fig. 1) in the Museum's collection.

Bail handles are also commonly found on drawers and chests. A common shape echoes that of the metal rings pierced through the nose of a domesticated ox, thus the Chinese name "ox nose ring" (*niubi huan*) (fig. 15l). Bail handles can also be shaped like a censor, such as those fitted onto the Museum's small carved chest (fig. 15m). Chests often have a small bumper plate located at the point at which the bail would otherwise mar the surface. This is traditionally a diamond, a quatrefoil, or sometimes a dome-shaped piece, and is attached with a small nail.

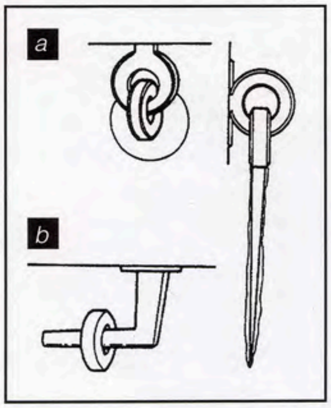


Pulls and bails are usually backed with small decorative escutcheons. Traditionally, these are round (figs. 15a, f, g, m) or incised with radials to represent the auspicious chrysanthemum (figs. 15c, d). The quatrefoil pattern that resembles a calyx (*siyedi*) (figs. 15b, e, l) is an old motif known to have been used for escutcheons since the Han period (Qinghai 19). The small escutcheon neatly finishes the somewhat rough hole through which the bent loop fits.

**Hinges**

Chinese furniture exhibits a variety of hinges. Those found on furniture from the late Ming period are relatively simple, comprised of two leaves with rolled cylinders joined with a retaining pin. Thus, three common Chinese terms can all literally be interpreted as joined leaves (*heye,* 合葉, leaf; or 合頁, leaf of book; or *heshan,* 合扇, leaf of door), differing little from the English counterpart. Hinges are found on doors, chest lids, paneled screens, and folding chairs.

Cabinet doors are traditionally fitted with a pair of two-knuckle hinges that allow the doors to be easily removed when fully open. Hinges are either surface or flush mounted. The Victoria and Albert Museum houses a magnificent pair of wardrobes with butterfly-shaped hinges chased with dragon designs and mounted with large boss-head pins (Clunas 92). Two pairs of wardrobes in the Museum's collection feature surface-mounted hinges that complement their large lockplates. On the *huanghuali* wardrobes, the hexagonal hinges ra-




diating with *ruyi* motifs are further enlivened with six boss-head pins (fig. 17). Each penetrates through the hinge plates to the back side of the frame members, where it is bent over to fix it in place. A more typical method of attachment is found on the large circular hinges on the Museum's camphorwood wardrobes (fig. 18). Small holes approximately three millimeters in diameter are drilled into the hinge plates. Into each hole, one or two narrow and slightly tapered strips of brass are wedged to protrude from the backside with enough length to penetrate through the frame member and bend over. The ancient technique of soldering is used to affix the strips to the plate, and also fills any voids left in the hole. The surplus material on the front side is cut off and filed flush with the surface of the hinge. After a little repolishing, the strips are nearly invisible except for the silvery color of the solder.

Wrap-around hinges are used on doors of small chests and medium-sized apothecary-type chests to accommodate their frameless construction (see figs. 1, 12, 14). One leaf attaches to the door frame while the other is bent at a right angle to attach to the side panel of the chest.

The lids of chests from the late Ming and early Qing periods are usually fitted with hinges whose three knuckles interlock and pivot around a retaining pin. Stages in the evolution of the hinged chest lid can be seen in a group of chests with overhanging lids stored at the Shōsōin since the Tang period. A simple link hinge was created by joining two ring-head nails (fig. 19a). The end of one ring-head nail was driven into the overhanging back edge of the lid. The end of the other was driven through the body of the chest and bent over. Another method utilized an L-shaped nail mounted under the overhanging lid that fits into a ring-nail on the body. By mounting the two L-shaped fittings in the same direction, the open lids could be easily removed (fig. 19b) (Kimura 27). The twelve panels of the large surrounding screen in the

*Fig. 16, facing page, above. Drawing of a double fish-shaped pull excavated from a Liao dynasty (A.D. 990-1178) tomb. After Zhang Baizhong 58.*

*Fig. 17, facing page, center. Detail of hinge on a* huanghuali *wardrobe. (See cover, this issue.) Museum of Classical Chinese Furniture, Renaissance, California.*

*Fig. 18, facing page, below. Detail of hinge on a camphorwood wardrobe in the Museum of Classical Chinese Furniture, Renaissance, California.*

*Figs. 19a, b, above. Drawings of hinges on chests in the Shōsōin Treasury, Nara, Japan. Tang dynasty (A.D. 618-906). After Kimura.*

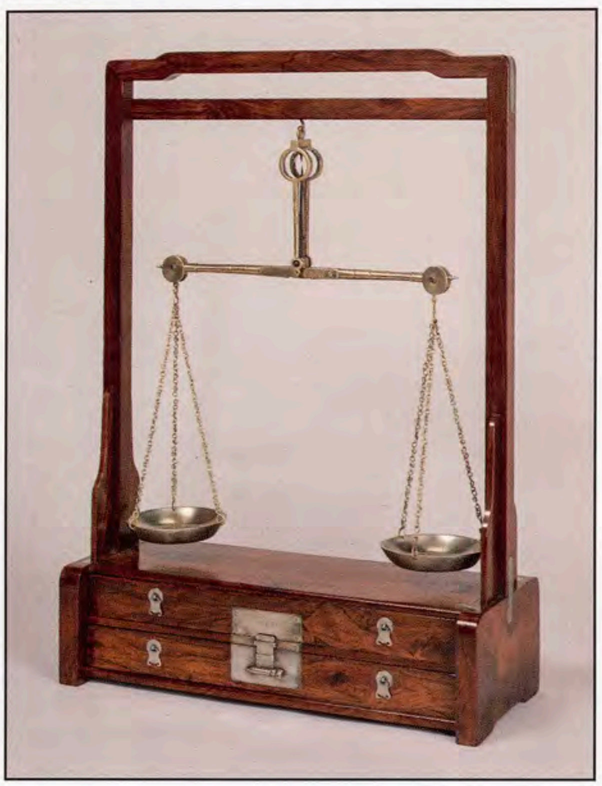
*Fig. 20, left above. Folding horseshoe-back armchair, Late sixteenth/early seventeenth century.* Huanghuali *and silver inlaid iron; width 69.2 cm, depth 45.7 cm, height 97.5 cm. Museum of Classical Chinese Furniture, Renaissance, California.*

*Fig. 20a, left below. Detail of figure 20. Footrest.*

Museum's collection are joined with a similar type of hinge, which allows one panel after another to be lifted off the adjacent panel and easily disassembled for storage or relocation.

A simple pin hinge traditionally joins the legs of folding chairs and stools. The metal pin is fitted through the pivot point of the two legs. Both ends of the pin are usually hammered to spread retaining, mushroom-like heads over decorative escutcheons. Round backing washers chased with chrysanthemum designs are common, and are often combined with long plates terminating in *ruyi* shapes. More refined and rare is the use of decorative heads to secure the pins. The remarkable iron mounts with hammered silver designs on the folding chair in the Museum's collection (fig. 20) include *ruyi*-shaped hinge plates with double-blossom backplates against which a pistil-like boss-head pin is seated.

The square-back folding chair in the Museum's collection (Wang 1992, 42) has a rather unique blind pivot hinge. X-ray photography revealed the hinge to be comprised of two rectangular metal bushings of square section fitted snugly into mortises at the pivot points of the legs. A pin fits into the bore of the bushings to join the legs. The final framing of the front and rear legs with the seat and base stretchers locks



the invisible hinge inside. This rather ingenious hinging method is more precise and sophisticated than that generally found on late Ming and early Qing furniture, and suggests a master ahead of his time or perhaps a later masterpiece that has embraced the classic style.

**Protective and Reinforcing Mounts**

In 1956, a small stone casket containing a *nanmu* box with sutras and a stem cup inside was discovered in a hidden recess between the second and third floors of the pagoda on Tiger Hill, Suzhou. The pagoda was completed in A.D. 959; thus the box is dated to the Five Dynasties period. The corners and edges of the *nanmu* box are heavily banded with protective metal chased with wave patterns and attached with closely spaced bubble-head nails (Addis 15). As the knowledge of materials increased and the art of joinery developed throughout the ensuing periods, the need for reinforcing metal mounts to secure joints diminished. The application of traditional mounts can still be found, however, on many extant late Ming and early Qing furnishings—especially portable types such as chests and folding chairs. The edges and corners of lacquer furniture were extremely fragile, and even those of dense hardwood pieces were vulnerable to the accidents and abuse common to daily use.

The corner mounts from low tables excavated from Warring States and Han tombs were likely more structural than those found on hardwood furniture; their decorative and protective functions, however, were similar. The large table in Zhou Wenju's famous tenth-century painting, "Gongyue Tu" (Palace Concert), has *ruyi*-shaped corner mounts that may represent decorative corner-frame connectors in use at that time (Wang 1991, 6). (Artistic representations of standing screen frames frequently depict similar mounts.) The tradition of *ruyi*-shaped corner mounts continued into the late Ming and early Qing period, and such mounts are occasionally found embellishing the corners of *kang* tables (Wang 1988, 118) and, more commonly, the upper corners of chests, sedan boxes, and food boxes (see figs. 12, 22).

The vertical corners of such portable containers are often wrapped with bronze (figs. 1, 12). This practical application was not only for protection, but also to conceal the otherwise exposed dovetail corner

joint construction commonly used on these pieces. Much more difficult to execute is the blind dovetail corner joint found on the individual trays of a pair of *zitan* food boxes in the Museum's collection (fig. 22), which obviates the need for concealment. The outermost corners of the carrying frames of these boxes are, however, wrapped with paktong plates to give protection during transportation by scurrying servants. The handle joints are linked with similar metal plates. Although these simple, rectangular paktong plates are themselves without decoration, their careful placement and soft luster is pleasing when set against the dark *zitan* wood.

The similar construction and use of metal reinforcements on balance stands (fig. 21) suggests that they were lifted and carried by the upper rail of the balance frame. Most balance stands have either one or two drawers, one of which is specially designed to hold the balance scales during transport. With the additional load of a standard set of balance weights, the necessity of the reinforcing plates becomes more apparent. The Museum's stand is also appropriately decorated with plates shaped like silver ingots (a common shape for balance weights), which link the top panel to the two end panels.

A *huanghuali* cosmetic case with folding mirror stand in the Museum's collection is a superb example of corner protection (fig. 23). Paktong is wrapped around the four corners of the separate folding mirror stand, which is kept in place by the raised drip-edge molding around the perimeter of the chest/table top. These four corners are also fit with protective wraps, which neatly align with those on the mirror frame above. Thus abrasion and marring along these delicate edges is reduced when removing and replacing the mirror stand to use the table surface. The convex surfaces of the four cabriole-leg shoulders and the additional molding above are also skillfully wrapped with a hanging *ruyi* form reminiscent of the Song-style furniture foot. The crowning touch is that all four vertical corners of the three *huanghuali* drawers inside are also wrapped. This indicates that they were removed and used as trays. Unconventional wood pivots were tastefully selected to hinge the doors, avoiding what would otherwise have been an excessive use of paktong .

The use of metal mounts on chairs since the Tang period has already been noted, and similar chairs fitted with ornamental mounts found in por-

*Fig. 21, facing page. Balance stand, seventeenth century.* Huanghuali *and paktong; width 61.3 cm, depth 24.5 cm, height 87.5 cm. Museum of Classical Chinese Furniture, Renaissance, California.*

*Fig. 22, above. Food boxes, seventeenth/eighteenth century.* Zitan, tielimu, *and paktong. Length 39 cm, depth 23 cm, height 26.4 cm. Museum of Classical Chinese Furniture, Renaissance, California.*

*Fig. 23, right. Cosmetic case with folding mirror stand, seventeenth century.* Huanghuali *and paktong; width 41.5 cm, depth 41.5 cm, height 28 cm. Museum of Classical Chinese Furniture, Renaissance, California.*

trait paintings suggest that this was not uncommon (fig. 24). In the Yuan painting, "Listening to a Qin Player," two scholarly figures in the audience are seated in armchairs fitted with metal mounts wrapping the joints and the feet (Evarts 1991, 4). While it is often debated whether the mounts, or traces of mounts, on a given piece of furniture are original, it should be relatively clear that a long tradition of usage existed. A stable wood chair is one of the most difficult furniture structures to create because of the various forces that it must withstand. Ideally, a four-legged, wood frame chair must sit on a level plane so that each leg equally bears the weight of the sitter. If only three legs contact the ground, the downward forces overcome any rigidity of the structure by simple leverage, and cause the framework to rack and twist. Each time this occurs the joints become looser. Linking frame members together with metal connecting plates protects the internal joint by preventing it from loosening and pulling apart.

The armrests, crestrail, and base stretchers of a pair of *huanghuali* rose chairs shaped like bamboo in the Museum's collection were once inlaid with delicate strips of paktong terminating in *ruyi*-shaped heads. Remaining nails in the footrest stretcher suggest that it, too, was once covered with paktong. The consistent and uniform placement of the carefully hollowed recesses into which they were inlaid suggests an original intention (fig. 25). Furthermore, the combination of bamboo with the *ruyi* is a rebus for one of the most traditional Chinese wishes, "May you have long life." The original mounts would have given the chairs a sprightly decorative effect not unlike that found on other types of furniture. The arbitrary insistence that most metal mounts on chairs are later additions needs to be closely examined, for it may stem from a preconceived and romantic notion that Ming-style hardwood furniture was always plain and unadorned.

Throughout history, the Chinese have demonstrated a remarkable resilience and resourcefulness. For instance, because the value of coinage varied considerably, it was sometimes advantageous to melt coins down to make household goods or weapons; when the economic pendulum swung the other direction, such articles would be re-smelted to make coins (Eberhard 72). In 1959, Chairman Mao began a program to recycle metal, and smelting ovens were erected on neighborhood street corners. Thus it is not surprising that more than half of the hardwood furniture that has come out of China in the last fifty years has been stripped of its metal hardware, or exhibits what appear to be later additions and inferior replacements.

Obviously, metal mounts were required on portable folding chairs. Often set on uneven terrain, their frames required great flexibility. Every joint of the horseshoe-back folding chair in the Museum's collection is secured with wrought-iron mounts, which ensure a solid, yet forgiving, throne-like seat (fig. 20). Their surfaces are decorated with silver wire hammered into patterns of scrolling vines with lotus heads. The technique is documented as *fanyin* (鋄銀) in the regulations for craftsmen published during the Qianlong period (Wang 1963, 20). The designs were probably initially drawn with ink or scratched onto the surface of the mount. A sharp chisel was then

*Fig. 24, above. Ancestral portrait painting of Empress Xuanzu. National Palace Museum, Taipei.*

*Fig. 25, facing page, above. Detail of the hollowed recess for a missing mount on a* huanghuali *rosechair carved like bamboo. One of a pair. Museum of Classical Chinese Furniture, Renaissance, California.*

*Fig. 26, facing page, center. Detail of brass foot covering on a demountable* huanghuali *wine table. Museum of Classical Chinese Furniture, Renaissance, California.*

used to crosshatch the surface of the areas to be decorated. This technique lifted interlocking rows of fine teeth into which the silver wire could be gently pounded as the artisan followed the remaining traces of the pattern. Cammann wrote,

> Inlaid iron produced an effect much esteemed by the seventeenth-century Manchus, and by the Mongols and Tibetans down to modern times. They admired such pieces after a soft brown rust had developed to form a patina, as this made a better contrasting background for the gold and silver inlays. (Cammann 84)

The background of the folding chair mounts is blackened, perhaps due to special techniques such as the Indian "Kuftgari process," utilizing chemicals and heat (Untracht 1975, 153-158), or lacquer (Wang 1963, 21), as well as to time.

Occasionally, the entire footrest stretcher of a chair is protected from wear with a paktong covering. That of the folding chair discussed above is covered with a decorative plate surrounding open designs of two of the Eight Treasures—a pair of crossed rhinoceros' horns flanking a coin—all of which is securely attached with thirty-six boss-head nails (fig. 20a). Carved cups of rhinoceros horn were used by high court officials because of a natural "sweating" reaction that warned of the presence of poison (Cammann 68). Thus, joined with the "eye coin" (*yanqian*) motif, a rebus is formed on the footrest to give symbolic protection from any attempt to administer poison before (*qian*) the eyes (*yan*) of the sitter, and furthermore implies the high status of the chair's owner. A triple lozenge design surrounded by *ruyi* motifs is another motif commonly found on the footrests of folding chairs and folding stools.

Metal feet coverings (*taojiao*, 套脚) prevent the feet of heavy or large pieces of furniture from splintering when slid across stone or tile floors. Lacquered cabinets and hardwood wardrobes are frequently fitted with metal feet for such protection. These coverings also inhibited the absorption of moisture from the damp or even wet conditions found along the inside of exterior walls, which led to dry rot and deterioration. Even rot-resistant tropical hardwoods were subject to damage when the very extractives that prevented decay were leached out after repeated saturation with water (Evarts 1992, 33). Feet that have deteriorated are often restored by cutting away the rotted material to solid wood, to which new material can be spliced. These splices on hardwood furniture are often wrapped with paktong to conceal the restoration. The originality of such feet coverings is a controversial subject. Many debates are quickly ended, however, when the foot covering is removed. A splice is immediately obvious. If the metal has been next to the wood for centuries, there will be some evidence of staining or oxidation on the surface of the wood. If the metal wrap is newly inlaid, the wood will look raw and smell fresh.

Six pieces in the Museum's collection have metal feet, which are considered to be original on three of the pieces. Those of the *huanghuali* wardrobes are open at the bottom and pierced with a chrysanthemum design (see cover) nearly identical to those found on the large wardrobes in the Astor Court at the Metropolitan Museum of Art, New York. The feet of the Museum's twelve-panel screen are also wrapped with a thin brass alloy that follows the profile of the molding and is attached with small brads. A number of similar screen panels with the same type of foot wrap are known to have survived. A portable wine table in the Museum's collection also has brass feet that are inlaid flush to the surface of the alternating lobed and fluted legs. Caps are soldered to the bottom to give additional moisture protection (fig. 26).

The originality of the paktong feet on the large *huanghuali* yokeback armchair in the Museum's collection was debated for some time until they were finally removed. Each leg had been carefully spliced in a rather clever way. Approximately two centimeters of the bottom of each old and somewhat deteriorated foot had been cut off and saved. A length was spliced onto each leg to restore it to its assumed original height minus two centimeters. Paktong wraps were then made for each leg, into which the cut-off sections were fitted, with the decayed surfaces once again exposed at the bottom. These were then tightly fitted over the spliced legs to give the appearance of an original foot on the bottom.

A *huanghuali* bookcase is also fitted with capped feet coverings to conceal the loss of height and subsequent splicing to the back legs. Another simple method of height restoration was developed by the restoration staff of the Museum in its approach to a round-leg *huanghuali chuang*. One of its back legs had lost nearly four centimeters in height compared to the longest front leg. Capped foot coverings of paktong were made to slip over each leg, and height-adjusting blocks were inserted into each one, thus alleviating any need to alter the original leg.

Nails were used sparingly by furniture makers, who, preferring to work within their own medium, accomplished the same ends with mortise-and-tenon joinery, or with wood dowels or bamboo pins. Small brass or paktong nails or brads, however, were commonly used to attach metal fittings. Their malleable heads are most often carefully driven flush with the surface and polished smooth so that they are barely visible. A lively decorative effect can, however, be achieved with bubble-head nails (*paoding*, 泡釘), such as those found on a small carved seal chest (fig. 14). The attachment of hardware with threaded fasteners probably began no earlier than the eighteenth or nineteenth century (Needham IV 119).

Few records remain of the furniture-making craftsmen other than the pieces they produced. From a detailed examination of metal mounts and an understanding of furniture construction, it can be surmised that relatively distinct boundaries of responsibility existed between the woodworking furniture maker and the metalsmith who produced and perhaps also installed the hardware. This theory is supported by the Ming carpenter's manual, *Lu Ban Jing*, which contains numerous references to specific wood parts and the construction of many types of traditional furniture, yet omits any references to metal hardware mounts (excluding nails). Secondly, the fact that surface-mounted hardware is often rather crudely fastened leads one to believe that it was installed by someone other than a woodworker, who specialized in producing carefully fitted joints and smooth surfaces. Thirdly, there are many lacquered cabinets that show little collaboration between the decorative design and the placement of hardware (cf. Dupont, pls. 6, 7, 8). A division of labor is also suggested by the construction process itself, whose sequence allows the completed woodwork to be passed on to a metalsmith or hardware installer in compliance with a traditional, and exclusive, guild system.

Nevertheless, the finest pieces reflect close collaboration in design and technique, such as when hinges and mounts were inset flush to the surface. The proportional diminution of the size of the paktong lockplates and hinges on the Museum's *huanghuali* wardrobes also suggests an artistic mind supervising the overall design (see cover).

In summary, the use of ornamental metal mounts on Ming and early Qing furniture followed a tradition that had been firmly established during the preceding two millennia. In their pursuit of immortality, early alchemists produced a variety of golden and silvery alloys from natural ores, which artisans and craftsmen later came to know and employ for their characteristic strengths and decorative qualities. By the Ming period, malleable paktong had become a favorite material for metal mounts, complementing both hardwood and lacquer furniture with a soft golden-silvery luster that was slow to tarnish. Later designs are both austere and playful, reflecting the neo-Confucian spirit that arose from the debauchery of the late Ming period as well as the rich traditions and folk-lore of ancient Chinese culture. Unlike woods, metals are not a renewable resource, yet they are unique in that they may be renewed through transformation. Thus, throughout the historical cycles of both East and West, metal ornaments have been recycled for some well-justified cause (one example is the legendary bronze frieze of the Pantheon). The fact that metal mounts have been replaced on a piece of furniture does not diminish its value so much as add a record to an untold story of survival. Furniture with original mounts, however, leaves us with a more exacting record, and reaffirms China's artistic tradition of uniting elegance and utility, and blending the useful with the agreeable.

**WORKS CITED**


Addis, J. M. *Chinese ceramics from datable tombs.* London and New York: Sotheby Parke Bernet, 1978.

Cammann, Schuyler. *Substance and Symbol in Chinese Toggles, Chinese Belt Toggles from the C. F. Bieber Collection.* Philadelphia: University of Pennsylvania Press, 1962.

Clunas, Craig. *Chinese Furniture.* London: Bamboo Publishing Ltd., 1988.

Dunhuang Wenwu Yanjiu (Dunhuang Research Institute). *Zhongguo shiku Dunhuang Mogao ku* (Chinese Cave Temples Series: The Mogao Caves at Dunhuang). 5 vols. Beijing: Wenwu Press, 1982-87.

Dupont, Maurice. *Les Meubles de la Chine.* Paris: Libraire des Arts Decoratifs, 1959.

Eberhard, Wolfram. *A Dictionary of Chinese Symbols, Hidden Symbols in Chinese Life and Thought.* London and New York: Routledge, 1986.

Ellsworth, Robert H. *Chinese Furniture: Hardwood Examples of the Ming and Early Ch'ing Dynasties.* New York: Random House, 1970.

Evarts, Curtis. 1991. "A Pair of Zitan Southern Official's Hat Armchairs." *Journal of the Classical Chinese Furniture Society,* rev. ed., 1:4 (Autumn 1991), 4-9.

———. 1992. "The Nature and Characteristics of Wood and Related Observations of Chinese Hardwood Furniture." *Journal of the Classical Chinese Furniture Society* 2:2 (Spring 1992), 28-41.

Gernet, Jacques. *A History of Chinese Civilization.* New York: Cambridge University Press, 1993.

Handler, Sarah. 1992. "A Little World Made Cunningly: The Chinese Canopy Bed." *Journal of the Classical Chinese Furniture Society* 2:2 (Spring 1992), 4-27.

———. 1993. "Cabinets and Shelves Containing All Things in China." *Journal of the Classical Chinese Furniture Society* 2:2 (Winter 1993), 4-27.

Hommel, Rudolf P. *China At Work.* Cambridge and London: The M.I.T. Press, 1969.

Hubei sheng bowuguan. "Danyang Jijiahu Chushi yizhi." *Wenwu* 1980:10, 31-39.

Institute of the History of Natural Sciences, Chinese Academy of Sciences, comp. *Ancient China's Technology and Science.* Beijing: Foreign Languages Press, 1983.

Kimura Norimitsu. *The Treasures of the Shōsōin: Furniture and Interior Furnishings.* Kyoto: Shikosha, 1992.

Lou Yudong, ed. *Xinyang Chumu.* Beijing: Wenwu Press, 1986.

*Mancheng Hanmu fajue baogu* (Excavation Report of a Han Tomb at Mancheng). 2 vols. Beijing: Wenwu Press, 1980.

Needham, Joseph. III. *Science and Civilisation in China.* Vol. III: *Mathematics and the Sciences of the Heavens and the Earth.* Taipei: Caves Books, Ltd., 1986.

———. IV. *Science and Civilisation in China.* Volume IV: *Physics and Physical Technology, Part 2: Mechanical Engineering.* Taipei: Caves Books, Ltd., 1986.

———. V. *Science and Civilisation in China.* Volume V: *Chemistry and Chemical Technology, Part 2: Spagyrical Discovery and Invention: Magisteries of Gold and Immortality.* Taipei: Caves Books, Ltd., 1985.

Qinghai sheng wenwu gugong zuodui. "Qinghai Datong xian shang sun jiashai 115 hao Hanmu." *Wenwu* 1981:2, 16-21.

Sung, Ying-Hsing. *T'ien-Kung K'ai-Wu: Chinese Technology in the Seventeenth Century.* Trans. by E-tu Sun and Shiou-chuan. University Park and London: The Pennsylvania State University Press, 1966.

Untracht, Oppi. 1975. *Metal Techniques for Craftsmen: A Basic Manual for Craftsmen on the Methods of Forming and Decorating Metals.* New York: Doubleday.

———. 1985. *Jewelry: Concepts and Technology.* New York: Doubleday.

Wang Shixiang. 1963. "Tan Qingdai de jiangzuo zeli" (A Discussion of Qing Dynasty Regulations for Craftsmen). *Wenwu* 1963:7, 19-23.

———. 1988. *Classic Chinese Furniture: Ming and Early Qing Dynasties.* Trans. by Sarah Handler and the Author. Hong Kong: Joint Publishing (H.K.) Co., Ltd.

———. 1989. *Mingshi jiaju yanjiu.* 2 vols. Hong Kong: Joint Publishing (H.K.) Co., Ltd.

———. 1991. "A Jichimu Platform-Type Daybed." *Journal of the Classical Chinese Furniture Society* 2:2 (Spring 1991), 4-13.

Zhang Baizhong. "Neimengu Tongliao xian er linchang Liao mu." *Wenwu* 1985:3, 56-62.

Zhang Shengfu, ed. *Shaanxi shen bowuguan.* Beijing: Wenwu Press, 1983.

Zheng Yakun. *Treasures of Chang'an, Capital of the Silk Road.* Hong Kong: Hong Kong Urban Council, 1993.