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# The Making of a Chinese Bronze Mirror

By Herbert Maryon

The British Museum, London

THE GREAT majority of the Chinese mirrors to be found in our museums and private collections, though varying almost infinitely in detail, have this much in common. They are of cast bronze, and their surfaces have undergone comparatively little retouching since they left the moulds. From them we learn that their makers generally preferred to leave them "as cast," without much scraping or other surface finishing. In this they differed widely from their brother craftsmen, the Italian mediaeval medallists, whose cast work often provides evidence that they relied ultimately upon the use of hand-held punches (chasing tools) for the production of their most delicate effects.

A fine mirror in the Freer Gallery of Art, Washington, No. II-108, gives us most valuable evidence as to the aims and the skillful technical methods of a Chinese craftsman, working in the Han period (*Fig. 1, 2*).

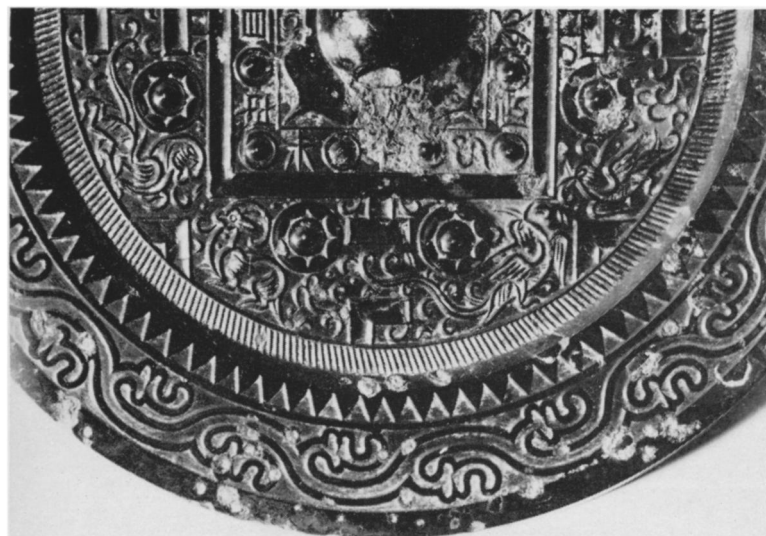
The general form of this mirror seems to have been produced by turning it from a block of wood or plaster. This work would include formation of (1) the bevelled edge, (2) the sunken "field," (3) the boss, (4) the raised circle which touches the points of the teeth, and (5) that raised circle which forms the inner support for the inclined "radial" pattern. At the rim, the turned surface is that surface which forms the background to the "cloud" pattern, and it runs beneath that pattern. It may be seen also between the teeth in the next circle of ornament. The turned surface of the field of the mirror extended, on a quite unbroken level, from the edge of the boss to the bottom of the slope which forms the boundary of the sunken field. It passes beneath the square, the TVL devices, the inclined radial pattern, the site of the nipples and beneath the animals and other decorative devices. And concentric traces of the turning may be observed on that background. A "setting-out" line may be seen beneath the "L," part of whose form is visible at the extreme right-hand side of the illustration when it is held with the boss above. The line runs from below the L in the direction of the outer edge of the "seat" of the large nipple near it. There are 20 nipples

in all upon the mirror. Those parts of them which are in high relief were probably formed in the mould by suitably-shaped drills or burrs. Their lower parts, and the "seats" on which they rest, may have been formed by modelling them on the turned surface of the disc. But the actual height of the nipples is difficult to judge from an illustration. It is clear however, that the material of which they were formed was not left standing up above the general level of the field when the turning was completed, for that would have entailed a good deal of carving away of the material between adjacent nipples, and there is no trace that any such operation was performed. The turned surface ran under all the modelled devices.

The first part of the modelling to be executed was probably the formation of the squares and the TVL devices. They would be outlined by waxed threads of suitable thickness, and several thinner threads or strips of wax would be employed to build up their hollowed form. They would be trued-up with a modelling tool. The four petals on the seat of the boss would probably be cut from a layer of wax painted on to the turned surface at that spot. And the inscribed characters would be provisionally set out in wax thread work: their later treatment will be described below. The animals, birds and other ornamental devices in the field would be formed initially from gummed threads, stretched and dried, then bent to shape while lying on the



*Fig. 1. Bronze mirror, Han Dynasty.  
Freer Gallery of Art, Washington, no. 11-108.*



*Fig. 2. Detail of lower section.*

drawing, before being lifted with tweezers, dipped into molten wax, and arranged in place on the turned slab. For the inclined radial pattern a ring would be required, formed of any firm material, about one-quarter inch wide and perhaps one-quarter inch deep, with a hole through its centre of the same diameter as the boss. When this ring was slipped over the boss, a ruler held against it and reaching to any part of the circle would indicate the correct inclination for a ray at that spot. About 350 pieces of stiffened thread, each nearly one-quarter inch long would be required for this band. The decoration of the central parts of the mirror probably would have been advanced considerably before the ornament on the rim was taken in hand. The whole of the flat turned surface of the rim would be given a coating of wax, perhaps one-sixteenth inch deep. It might be scraped smooth down to the level of the top of the turned ridge left between the teeth and the cloud patterns. A triangular-faced punch of the exact size of the gaps between the teeth, with its base resting against the turned circle, would be employed to squeeze out the wax from the spaces between the teeth. The displaced material would rise as a little wave all round the depression, and pile itself up on the teeth and the turned circle. It would be scraped away during the subsequent tidying-up of the pattern.

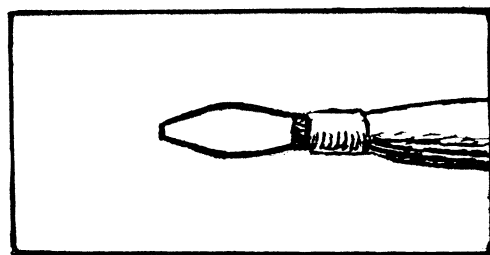
The cloud pattern on the rim would be drawn or traced on the wax coating of the central part of the flat rim surface. Then, with a "wire-tool," the wax which covered the background of the pattern would be removed. The wire tool (Fig. 3) is just a loop of thin but stiff wire, fastened at the end of a wooden handle. The tool employed on this occasion would be one with a flattened end of a convenient width. All the wax which originally filled the background of the pattern would be removed in small curls by this convenient tool. A slight burr might be left all along the outline of the pattern, dragged up by the tool as it cut its way through the wax and lifted it from its bed upon the ground. The burr would be scraped away. The wire tool is a well-known tool, employed by sculptors to trim away a layer of the clay or wax in which they were modelling their figure or ornamental work. It is a tool which could hardly escape the notice of any craftsman who wished to cut away some of the plastic material in which he was modelling his work. The Chinese, or any other practical

craftsman, would almost certainly have discovered the usefulness of a stiff loop of wire to facilitate this. By the use of the wire tool the background of the cloud pattern could be scraped clean, and many little traces of the turning technique, by means of which the wood or plaster disc was originally produced, might become visible. Any little burrs or other small lumps of wax which happened to adhere to the upper surface of the cloud or tooth patterns would do no harm. For they would be cut away in the wax or filed, or ground away when all the ornament on the rim of the mirror was smoothed up, by file or hone, in finishing the bronze casting.

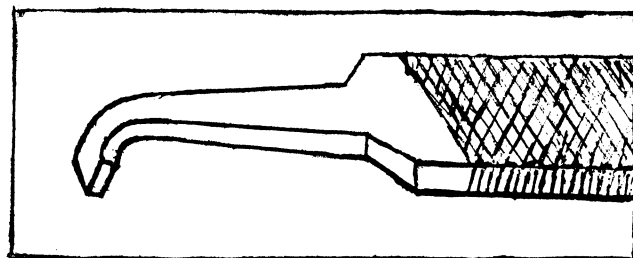
The modelling of the "pattern" for the mirror being now completed, the preparation of the clay mould, into which the molten bronze would be poured, would next be taken in hand. The mould would consist of two slabs of specially prepared clay, enclosing a hollow of the exact shape of the proposed mirror. The modelled "pattern" would be laid upon a board, or on a slab, perhaps of plaster, measuring about two inches larger all round than the modelled pattern. The little gap between the outer edge of the pattern and the board would be carefully filled in with plaster, so that when, later on, the mould was to be lifted off the pattern, there should be no "undercut" or other irregularity, to prevent its removal.

A wooden pattern of the "pour" or gate, through which the molten metal would be poured into the mould, would be prepared. It would be just a funnel-shaped piece of wood, perhaps two inches long, reaching from the edge of the board to that of the modelled pattern. It would produce a conveniently-shaped opening in the mould, leading to the hollow which was to be filled by the bronze.

The principal materials required for the mould were clay, sand and vegetable fibre. The clay, used alone, unless well worked, as when "thrown" on a wheel in pottery making, might be brittle when fired. Therefore it was mixed with "sand." This would not be river-sand or sea-shore sand, for generally that has been rolled into smoothish, rounded grains. More angular material such as casting-sand, crushed stone or pottery, or powdered brick, were better. The vegetable fibre might be of long-fibred paper, tow or straw. Paper made from pulped wood,



*Fig. 3. The wire tool.*



*Fig. 4. The claw tool.*

like that used for modern newspapers, is not good for this purpose. Modern Japanese moulders use paper made from the bark of the mulberry tree, as it has long, fine fibres.

These materials were employed in three grades of fineness, corresponding with the successive layers of which the mould was usually composed. For the first layer that which came in contact with the model, the clay and sand, or powdered pottery might be passed through a sieve, with apertures of three-sixteenths of an inch. The paper was torn up and soaked or boiled in water to separate the fibres. The water in which they are floating was stirred in order to allow the fibres to distribute themselves throughout. Then the water was allowed to stand for half a minute (for the coarser matter to settle), and then poured off into another vessel, carrying with it most of the floating fibres. The powdered clay and sand particles might be added gradually, and thoroughly stirred. All solid matter was now allowed to settle and the water drawn off. When partially dry the clay and fibres were kneaded together until when a piece was pulled apart, the fibres showed as a kind of bloom, or mould, growing all over the surface. The purpose of the fibres is clear, for when the mould was fired, all vegetable matter was burnt away, leaving even the finest modelled surface porous for the escape of air through the fabric of the mould. The fibres were so fine that they leave no trace

on the cast. The fine mud which the prepared clay became when wet, was painted thinly and very carefully over all the exposed surfaces of the model, avoiding the production of bubbles or gaps. This mould would extend about two inches wider, all round the modelled pattern.

This first coat might be built up to one-thirty-second or one sixteenth of an inch in thickness. The work was set aside to dry and to become firm enough to withstand the application of the second coating. This was a mixture of clay, coarser sand or crushed pots or powdered bricks, which had been sieved through a mesh of one-sixty-fourth of an inch and mixed with short strands of tow. The third and any subsequent coatings of clay, sand and chopped straw, were applied when the last coat was dry enough to remain firm. By successive coatings this leaf of the mould was built up to the required thickness, perhaps three-quarters to one and three-sixteenths of an inch. The slab would then be trimmed all round tidily, and set aside to get thoroughly dry. Then all the linear work, the inscription, and the animal and ornamental devices in the field, would be tidied up with a claw-shaped tool, such as that shown in Fig. 4. This would sharpen up the lines in the mould, and they might result, in the cast, in work as clean as that of the single character, *wei*,<sup>1</sup> to be seen near the lower left-hand corner of the square, between two of the smaller nipples.

The strength of the lines which were employed to produce the inscription, the animals and ornament, though originally formed from waxed threads, could be deepened and emphasized, to any degree that the craftsman might desire, by the use of this tool. The little bosses which fill many of the otherwise vacant spaces could be prepared for by pressing a round-faced punch into the clay mould wherever the craftsman felt that it was needed. If the clay was too dry, a drill could be used instead.

Register marks might now be cut in the border of the mould to ensure the correct registration of the two "leaves" of which the complete clay mould would eventually consist. The marks might be just two or three conical hollows, cut with a knife or drilled in the raised border of the mould, which had been formed over and round the modelled pattern. When the first leaf

of the mould had been fired, parts of the clay slab, of which the second leaf of the mould would be formed, would be pressed into these hollows and ensure the correct alignment of the two parts of the mould. In some Chinese mirror moulds the registration mechanism consisted not of conical projections, fitting into hollows, but of large holes drilled right through the two leaves of the mould, and fitted with plugs of fired clay, or perhaps of stone, which prevented any lateral movement.

When every part of the surface of the first leaf of the mould had been tidily finished, the clay was allowed to dry thoroughly, and, like any brick or tile, was then burnt hard in a kiln.

In the course of drying this leaf of the mould would have shrunk so much that the modelled "pattern," without injury to itself, probably could not be replaced in the fired clay mould. So a disc of wood of the exact diameter of the recess in the mould would be prepared to replace it. Its outer surface would be left flat, or shaped to the curve desired by its maker. All exposed parts of the clay mould and its background, with the disc, and the model of the pour, before being placed in position, would be "stopped" by a coating of lacquer, or otherwise treated, to prevent any adhesion of the clay slab, which itself would become the second leaf of the mould. It would be a slab of well-worked clay, perhaps one and three-sixteenths inches thick, and as large as the first leaf. By hand and finger pressure every part of the slab would be firmly pressed into contact with the wooden disc, the rim of the mould and its surrounding slab. The careful use of a mallet might be considered as an aid to finger pressure.

The exposed surface of the slab would be levelled and its outline trimmed to match that of the first leaf. When the craftsman felt assured about its satisfactory contact he would set the work aside to dry. He might place a few weights round the edges to ensure the stability of the parts about the registration marks. When dry the slab would be fired, like the first.

The second leaf of a mirror mould, being without ornament, in all probability would be overlooked by the surreptitious digger in a foundry mound.

When the bronze had been poured and the mould removed, the bevelled edge and the flat surface of the cloud and the toothed patterns would be filed or honed smooth. Sometimes the square or the TVL devices were scraped or otherwise cleaned up with powdered abrasives, which have smoothed over any uneven surfaces. Occasionally traces of convex-profiled scraping tools may be noted, when they have left longitudinal, parallel scratches along the channels. Or they may have made themselves visible at the meeting place of two channels, where they have overshot the junction and have worn away the opposite bank.

The hole through the base of the boss, through which would pass the silken cord by which the mirror was usually handled, was provided for in the following manner. In the mould for the back of the mirror the central boss would be represented by a hemispherical depression in the centre of the field. Across the base of this depression would be laid a bar of dry clay,  $\frac{1}{4}$  to  $\frac{1}{8}$  inch in diameter and long enough to bridge the hollow at its widest part, at the edge of the recess. The bar would be fastened in position by painting it with liquid clay at its ends, to join it to the main body of the mould before it was fired.

It will be realized that when the bronze had been poured into the mould the casting could not be removed from it until the bar of clay had been broken away. This operation would usually entail some damage to and the possible destruction of the mould itself.

Mr. A. G. Wenley, Freer Gallery of Art, Washington, has very kindly written the following note on the inscription upon the mirror, and has given permission for its publication.

"While the inscription around the square in the center of the mirror is not all clear because it is covered partly with corrosion, it is quite easy to see that it is one of the regular formulae common to such mirrors. It consists of the twelve horary characters which are a part of the sexagenary cycle. Also each one of these characters symbolizes a direction and it should be noted that in the combination shown, of each three characters on the four sides, the middle one represents the main direction: north, south, east or west. The others simply indicate compass points to one side or the other of the main direction. The character *wei*<sup>1</sup> mentioned above, which shows up so distinctly, stands for south-south-west, three-quarters west.

"These characters also are symbols for the various constellations; thus, the character *wei* represents Scorpio. Further these twelve characters represent the years such as the year of the dragon, the year of the snake, the year of the horse, etc.; and the *wei* character represents the year of the sheep. So what you have are the twelve signs of the Zodiac. This sort of thing is not uncommon in Chinese mirrors, particularly of the Han type."

#### NOTE

1. *Wei*: Giles, 12,606.