

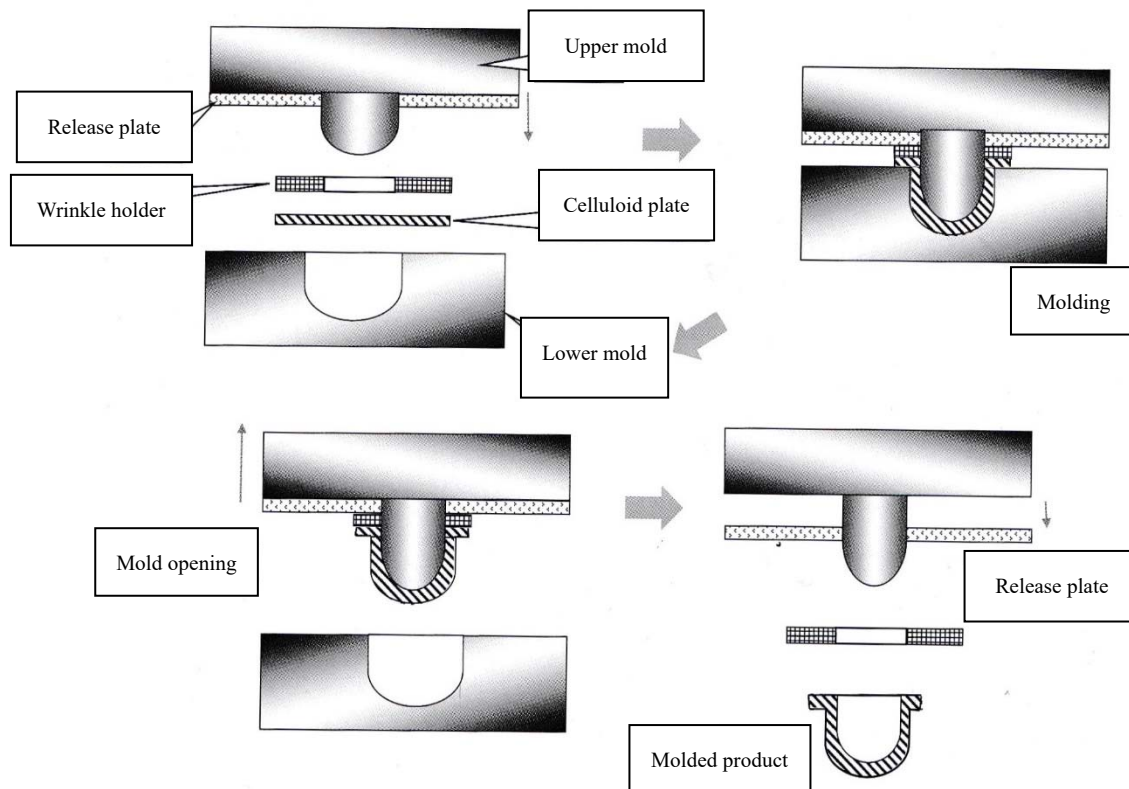
1. Introduction

The celluloid house also contains a number of molds used for celluloid molding. Of these molds, the preparation and listing of the molds for clamping mold has been completed and this will be the summary report.

2. Clamping molding method ⁽¹⁾

As shown in Fig. 1, a molding method for deforming the heated softened celluloid plate in a pair of male and female molds can be molded a product having a depth such as a box or a can. When molding, a vertical press (human-powered type often called "ketobashi") in which a mold was mounted on the top and bottom was used. There are many stationery and household goods as applications.

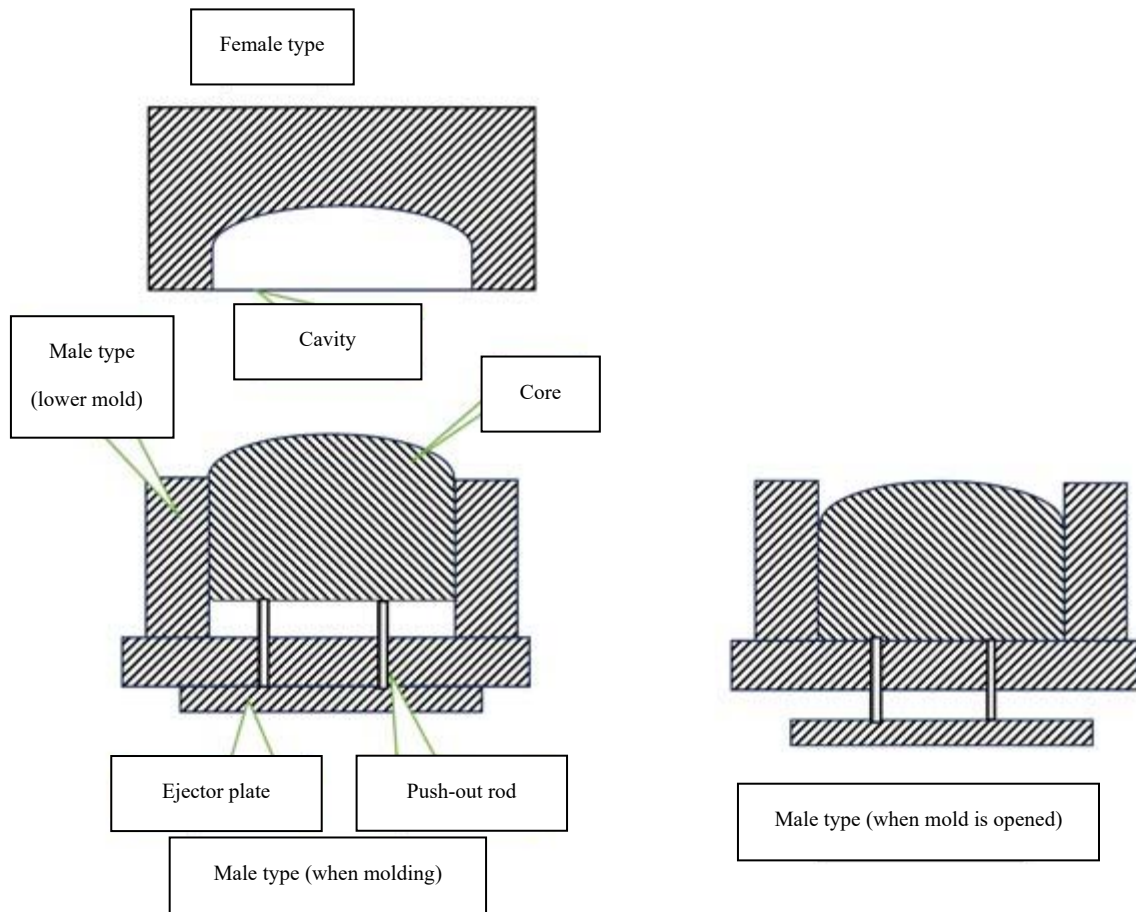
Fig. 1: Clamping process



3. Mechanism of mold clamp and behavior during molding

The mold is made of iron and consists of machined parts. The structure of a typical mold is shown in Fig. 2. The mold of the Celluloid House is upside down and the combination of male and female is opposite to the mold shown in Fig. 1, and the female mold is attached to the upper side of the press. The male mold is mounted on the press plate. The lower mold (male) has a core insertion/removal mechanism as shown in Fig. 2.

Fig. 2: Outline of mold clamping



When the mold is opened, the core is lowered (right side of Fig. 2), and the heated celluloid plate can be placed on the top of male mold. After the plate is mounted, the mold is closed and the core push outs (left side of Fig. 2). The celluloid plate is sandwiched between the cavity and the core and deforms to fit the shape of the mold. It is leaved and cooled in this condition.

After solidification, the core is retracted before opening the mold to remove the mold from the core. The celluloid molded product shrinks by cooling and solidification, and the core is tightened and adhered. A large force is required to release the product. Before opening the mold, the entire surface of the molded product is constrained by the upper and lower molds, and it is possible to mold release with a stronger force by retracting only the core. After this procedure, the mold is opened and the product is removed.

The mold does not have a cooling device such as a water tube. Natural cooling by the outside air was enough because the celluloid plate was thin (thick type was about 1mm), and because it took a long time for mold opening and closing, mounting of the plate, removal of molded products, etc.

4. Features of Celluloid House collection

At the time of storage, all types were core and cavities and they were separated. So it was combined to restore in a condition when using (pairing), and a list was created in this condition. As the result, there were about 70 types. The task of finding a combination is

still ongoing.

The most common product is the pen box. And there are many other daily necessities such as sewing boxes and soap boxes. These are composed of a combination of the main body and the lid. However, this combination may reveal an overall picture of the product, and we would like to consider this in the future.

Some small articles are presumed to be toothbrushes. Large articles are washbasins of about 30cm in diameter. We found out that the washbasin differ from other products in the molding method ⁽²⁾ .

5. Actual conditions of mold clamping method reviewed by mold survey

(1) Mold mounting method

We attempt to attach a mold for Ketobashi (manual vertical press).

It is shown in Fig. 3. The upper mold (female) attachment rod could be attached to the upper side of the press with a set screw.

Since the lower mold (male) was fixed by screws on the press plate, it is presumed that this condition was formed when molding.

Fig. 3: Condition when mold is attached to the press



(2) Molding operation

The condition of the molding will be described sequentially by Fig. 4.

① Celluloid plate insertion

Open the mold and position the celluloid plate heated to about 100°C with the core lowered on the lower mold. The periphery of the celluloid plate contacts the mold, but the center part with large deformation does not contact the mold, so the temperature drop is little.

② Mold closure

When the mold is closed, the upper mold contacts on the celluloid plate, and the upper and lower molds hold the celluloid plate and prevent it from moving. In tin sheet metal, this operation is called "wrinkle suppression" to prevent scratching and wrinkling of the plate.

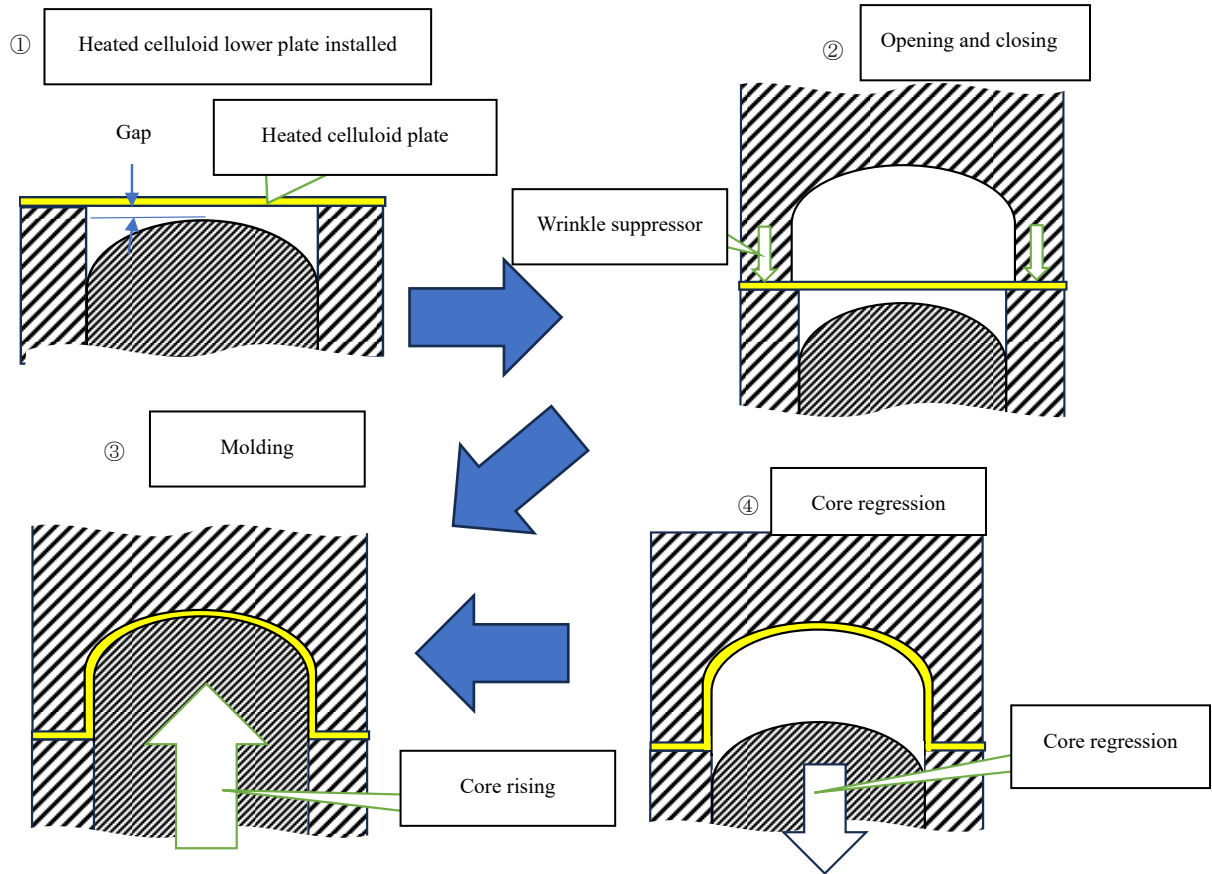
③ Molding

The core is then raised to a predetermined position to deform the celluloid plate. Since the core is low temperature, the molded product is cooled and solidified.

④ Core retraction

By solidification, the celluloid article shrinks and tightens the core. Therefore, if the mold is opened without moving the core, the mold is difficult to remove. Therefore, the core is lowered with the mold closed, and the core is released first before opening the mold. An extra part (which was said to be "Chiri") remains on the outer circumference of the molded product, but this part is removed in a later step (Chiri cut).

Fig. 4: Forming process



6. Molding for washbasins ⁽²⁾

(1) Overview

There are only four large washbasin molds in the mold clamping mold collection. As shown in Fig. 5, it is machined after being cast with gun metal. In order to investigate the combination of males and females, mold operation during molding, and etc., all-mold sketching was carried out, and the mold composition were examined.

As a result,

- ① It is divided into two molds. One is a mold, the other is a (curling) mold that entangles the end.
- ② The celluloid plate which was cut in the circular shape beforehand was used as a raw material.
- ③ The mold for curling had a heater and had a heating ability.
- ④ Deburring (trimming) work was not necessary by pre-cutting and curling of the raw material sheet.

It was proven as above that the molding process was different from the other mold.

Fig. 4: Washbasin mold

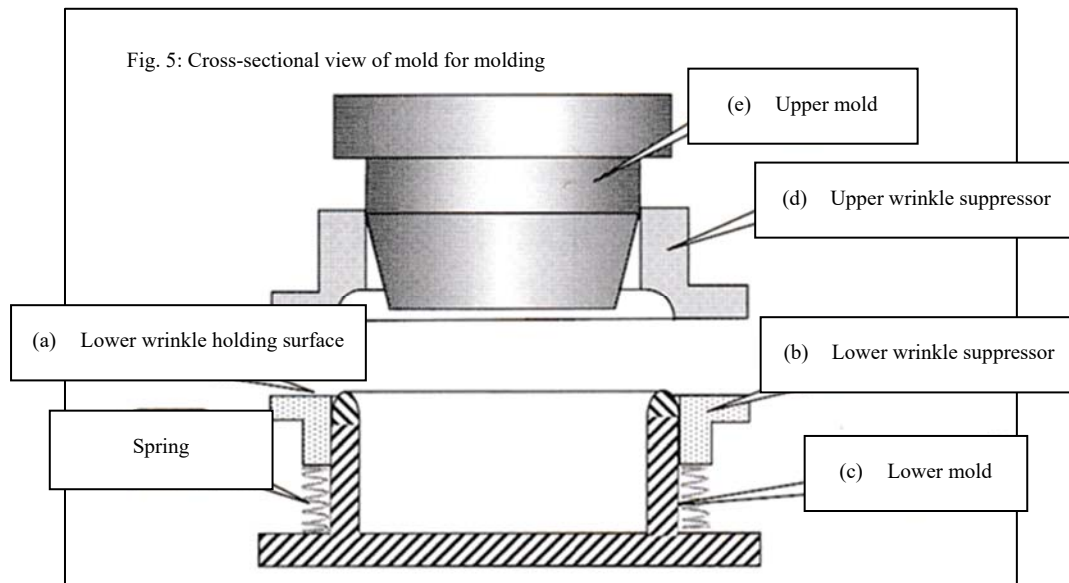


(2) Overview of washbasin molds

① Mold for molding

i. Type configuration

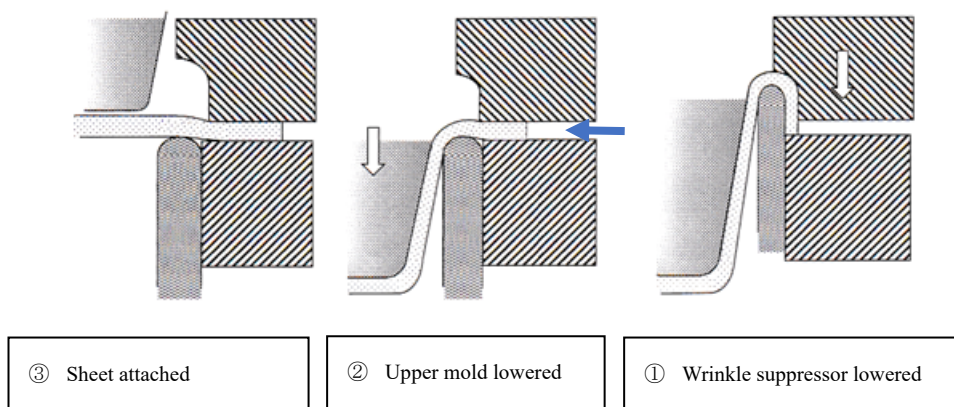
Fig. 5 shows the cross-section of the molding die. The upper mold (male) is provided with a ring-shaped slidable clamp (b) on the outside of the core (a). The inner circumference of the wrinkle holder has a rounded end and engraved to make the cross section U-shaped. The lower mold (female) does not have a product shape. The ends are rounded. Outer periphery of the cavity has a vertically sliding ring-shaped wrinkle suppresser. The wrinkle suppresser is supported by the coil spring and is located near the cavity end when the mold is open.



ii. Molding process

It is cut into a disk shape in the mold shown in Fig. 5, inserting the celluloid plate softened by heating. As the mold is closed, the upper and lower wrinkle suppressors pinch the celluloid plate (Fig. 6 ①). As further clamping proceeds, the core goes down and the washbasin is molded (Fig. 6 ②). Then the spring that supported the lower mold wrinkle holder (Fig. 5 (d)) shrinks, and the celluloid plate is pushed up by the cavity end and enters the inside of the upper wrinkle holder engraved. The end of the molded product sandwiched between them is rounded in a slip U-shaped cross section inside the wrinkle retainer (Fig. 6 ③). The celluloid plate of the wrinkle holding portion must slide inward (arrow in Fig. 6 ②) during rounding. For this purpose, various ideas seem to be made in pressure, temperature conditions, wrinkle pressing surface condition, etc.

Fig. 6: View of washbasin molding

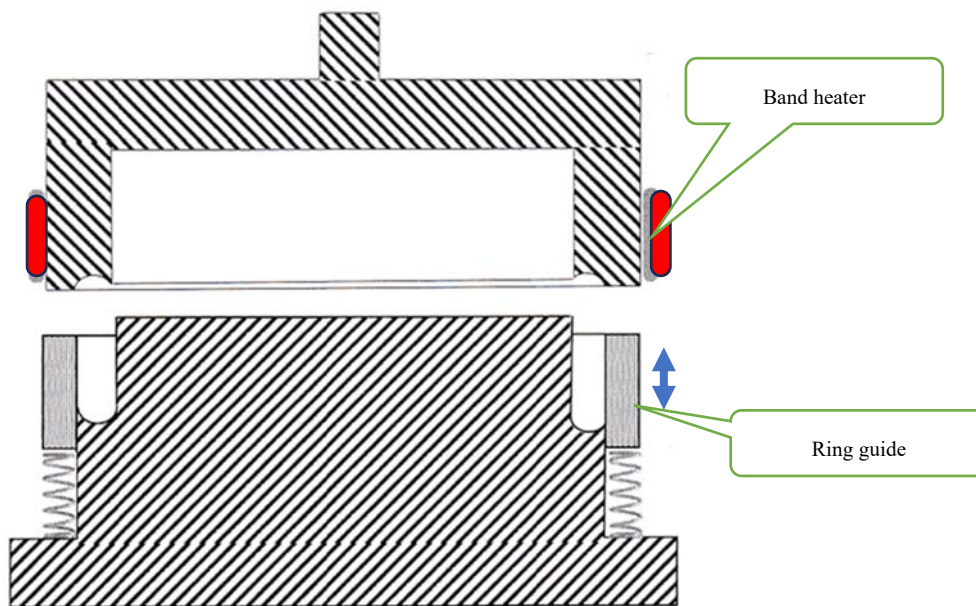


② Curling mold

i. Type configuration

As shown in Fig. 7, it consists of a combination of upper female mold and lower male mold. A washbasin (semi-finished) with a U-shaped end is attached to this type. The band heater is wound around the upper die. A ring-shaped guide pushed up by a coil spring is attached to the outside of the lower mold core.

Fig. 7: Cross section of curling mold

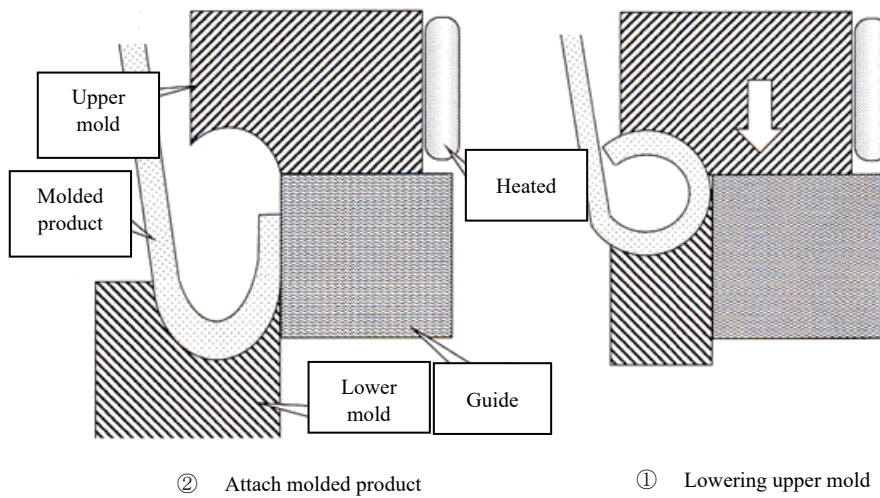


ii. Scene of curling process

A washbasin whose end face is rounded in a U-shape is mounted on the mold of Fig. 7 (Fig. 8 ①), and when the mold is closed, the U-shaped cross-sectional portion cannot escape to the outside by the guide, and since this nearby is heated by the heater to a high temperature, it is deformed along the semicircular cross-sectional groove of the upper and lower molds (Fig. 8 ②) and becomes O-shaped cross-section to complete the curling.

At the time of curling, the semi-finished end must be maintained at a deformable temperature. Immediately after the solidification was completed in the molding process (e.g., 60 to 70°C), it is assumed that the mold was released and curled quickly. Thus, heating time and heating cost in the curling mold is possible to save. From this fact, it is presumed that the forming press and the curling press were operated side by side in a pair.

Fig. 8: View of curling at end face of washbasin



7. Summary

The celluloid house storage clamping mold was improved, and the combination of male and female (pairing) was advanced. As the result, it was possible to list about 70 types. In this process, the function of the mold and actual condition of the forming work were able to be grasped outlinely.

The largest washbasin molds in the collection have a mold for molding and curling molds arranged. This mold was sketched, combined, and the working method was examined, and the state of the forming was able to be clarified. And, it was also proven that the deburring work was unnecessary by cutting the raw material celluloid plate into a circular shape and performing the curling processing in this type.

8. Afterword

Through the organizing work of the mold clamping mold, the state of the mold clamping molding was able to be clarified a little.

However, at this time

- (1) Insufficient consideration of the male-female combination,
 - (2) The combination of the main body molds for boxes and the lid molds has not been studied yet,
 - (3) There are some molds (parts) for which the applications are not known,
- and I am wishing to continue to examine them further.

9. Reference

- (1) Isao Sato, Celluloid Mold

Celluloid town and museum in Katsushika city and astronomical (2016), P70

- (2) Isao Sato, Mold Clamping Mold, Mold Technology Vol.33, No.2, P79
- (3) Isao Sato, Terminal Treatment, Mold Technology Vol.33, No.5, P74