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PREPARATION OF CASTING MOULDS IN FOUNDRY

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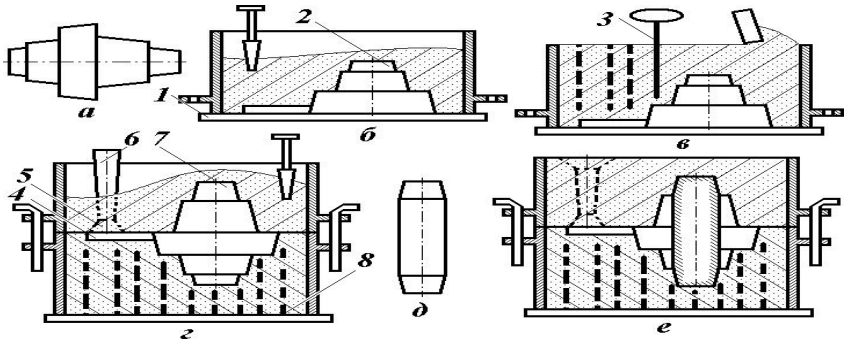
Abstract: This article covers technological processes such as the preparation of castings, manual forming, machine forming, automatic forming flow, core preparation, cooling, ejection and cleaning of castings, special methods of obtaining castings, casting according to soluble patterns, casting in a shell form, pressure casting, and centrifugal casting.
Key words: Casting in molds, sand-clay molds, apilka, fuel oil, casting, capacity, alloy, casting system, shape, core, sprue, temperature, cooling rate, sand clay molds, automatic forming flow, mold materials, casting in molds

Enter: Foundry enterprises are one of the important branches of the mechanical engineering industry, where pre-prepared castings of various sizes and weights are poured into pre-prepared molds in various ways. The process of preparing castings is called shaping. This is the main, most complex and extremely important operation, which greatly affects the quality of the casting. The degree of mechanization distinguishes between manual and machine shaping. Manual shaping is used in piece and small-scale production, small-scale production is used in the production of small and medium-sized castings and large and medium-sized castings, and machine shaping is used in serial and mass production.

Manual molding: Depending on the configuration of the casting and production conditions, various methods of manual molding are used: on the ground, in molds, according to a template, in cores, etc., the most common of which is molding in double molds. Both opening and non-opening models are used. Molding in two molds according to a solid model is carried out when the model has a simple appearance and removing the model from the mold does not cause difficulties. Molding in two molds according to opening models is carried out in the following sequence. The lower part of the model 2 is provided with the models (Fig. 1, b, c) and the lower mold is placed on the model plate 1.

Figure 1. Scheme of casting in two molds of a mold with a removable mold.

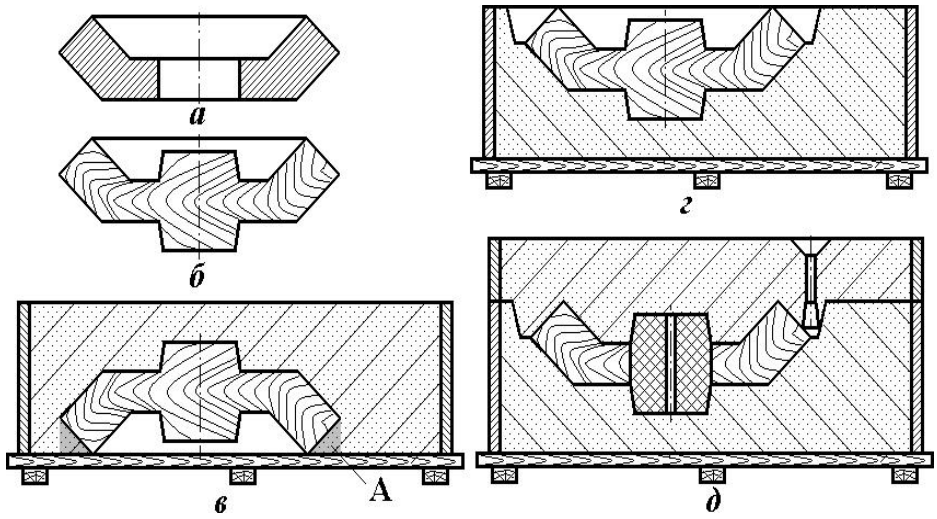


The facing mixture is applied to the mold, then - the filler. The mixture is compacted by ramming. The

excess mixture is cut off, the ventilation channels 8 are plugged, which facilitate the release of gases from the mold when pouring metal. The lower half-mold is turned 180. The upper part of the model 7, the mold holder, the column and ejector models are placed on the plane of the opening according to the centering element. The upper mold is placed, a thin layer of the dividing mixture is sprinkled on the surface of the opening and the upper half-mold is formed (Figure 1 g, d). When the upper half-mold is finished, the pouring system is cut off, the column and ejector models are removed, the upper half-mold is removed. In the half-molds, the models of the half-molds, the feeder and slag models are removed. A mold is installed on the lower half-mold and the mold is closed. During casting, the half-molds are pulled together to prevent the liquid metal from flowing out of the mold opening [1-2].

Shearing is used when castings have complex or curved configurations based on non-opening patterns. (Figure 2).

Fig. 2. Shaping by cutting



a - casting; b - model; c - compacted lower half-form; d - lower half-form after cutting off excess mixture; d - assembled form; A - the volume of the mixture that prevents the removal of the model.

When installing the model on the model plate (Fig. 2.c), the model does not reach it with its plane, therefore, when the mixture is compacted, the model is surrounded by the molding mixture on all sides, and the model cannot be removed from the mold without breaking the SHA. In this case, the half-form is turned 180 degrees and cut so that the model can be removed from the half-form freely, without damage [3].

Shaping by removable models is used in the preparation of castings of sufficiently complex configuration, when the use of single-opening models allows the casting to be removed from the mold. Figure 3 shows a casting model that opens along the AA plane.

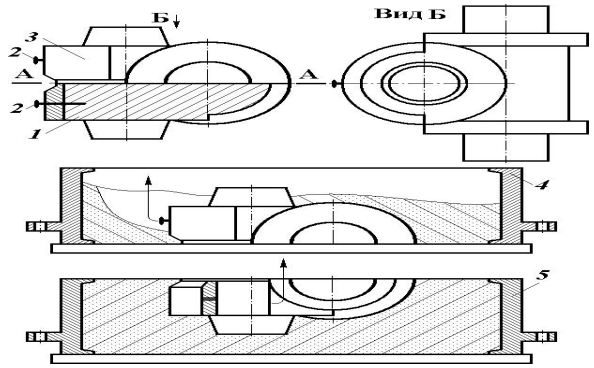


Figure 3. Forming on models with removable parts:
1-model, 2-removable parts, 3-pins, 4-upper half-form, 5-lower half-form.

The protruding parts prevent the model halves from being removed from the half-form. This problem is not solved even if a different plane of the opening is chosen. Therefore, in addition to the opening, the model design provides for 2 removable parts, which are fastened to the models with pins. The lower part of the mold is formed according to the usual technology, up to the level of the pins, carefully compacting it around the removable parts, after which the pins are removed and the rest of the mold is filled. The upper part is formed in a similar way [5-6].

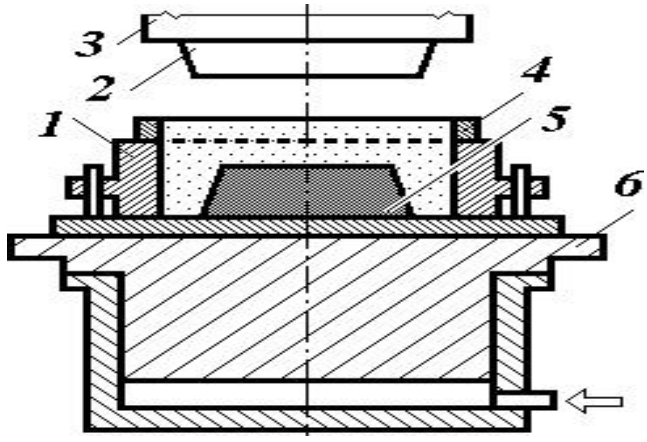
When removing the model from the half-form, the removable parts remain in the mold cavity. They can be removed from the half-form by moving them in the horizontal direction.

Machine forming: Machine forming is used in the preparation of castings in mass and serial production. In machine forming, instead of models, model plates are used, on which models of castings, models of the casting system, as well as centering elements and bushings are fixed. The plates are one-sided, that is, half of the upper half-form models are installed on one plate, and half of the lower half-form on the other. Machine forming ensures uniform compaction of the molding mixture, high geometric accuracy of castings, increases productivity, eliminates labor-intensive manual operations. Depending on the density of the mixture, presses, vibrating sandblasters and sandblasters, sandblasters, and sandblasters are used [7].

The principle of operation of press machines is based on compaction by pressing the molding mixture into the mold. Compaction of the mixture can be carried out by upper and lower pressing, in which relatively wide upper pressing machines are used. On the machine table 6, a mold plate with a mold 5 is fixed (Fig. 4). Using a guide element, a mold 1 and a filling part 4 with a molding mixture are installed on the plate.

Figure 4. Upper pressing scheme:
1-mould; 2-block; 3-crossbar; 4-filling part; 5-model; 6-machine table.

With the help of compressed air, the table rises together with the mould and compacts the mixture forming the block. The greatest compaction of the mixture occurs in the upper part of the mould, and the least in the model 5 itself [8-9].



Press machines are used to prepare relatively low (up to 200 mm.) moulds with a surface of 600x800 mm. The essence of the compaction process by shaking is shown in Figure 5. a. A model plate is fixed on the machine table together with the model 3. The mould 4 is installed on the guide elements and after filling it with the mixture, compressed air is supplied to the cavity of the cylinder 1, which under pressure moves the table, the piston with the mould with the model-forming mixture up 25-100 mm. The piston rises to a height of 100 cm. The side surface of the piston opens the outlet hole and the air pressure under the piston decreases sharply. Under the influence of its own mass, the table falls and hits the machine bed. The impact causes the molding mixture to compact, but the mixture in the flask does not compact well in one blow, so the blows are repeated at a rate of 30-80 blows per minute[10].

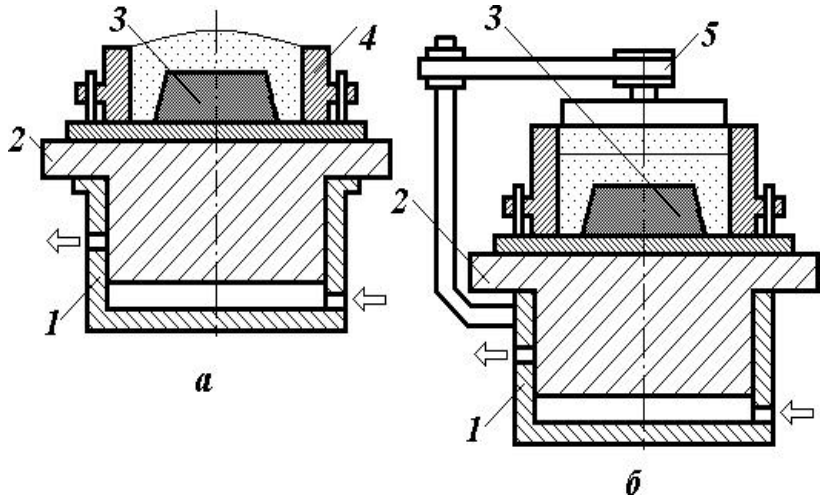
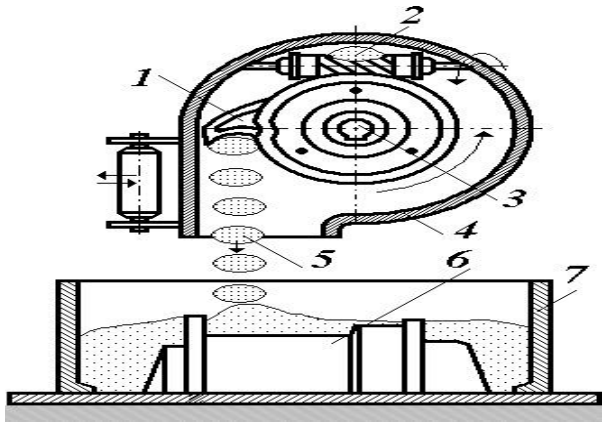


Fig. 5. Compaction by rolling (a) and by overpressing (b).

1-cylinder; 2-table; 3-model; 4-oval; 5-pressing device.

The greatest compaction of the filling during shaking is in the model, the least in the upper layers, therefore, when preparing high forms, additional compaction of the upper layers is necessary. In practice, high-pressure additional compaction shaking machines are widely used. The disadvantage of shaking machines is their relatively low efficiency and high noise level due to table impact. For filling medium and large forms, as well as for preparing cores, sandblasters (Fig. 6) are used. The main link of the sandblaster is the ejector head 4, to which the molding mixture is continuously fed through a plate conveyor.The rotor 3 is equipped with paddles 1, which, when the rotor rotates rapidly (1500 min-1), pick up the mixture 2. Due to centrifugal force, the mixture is compacted in the bucket, and then the pressed package 5 is thrown vertically down into the hopper.

Figure 6. Sandblasting machine operation scheme



1-bucket; 2- molding surface; 3-rotor; 4-head; 5-mixing box; 6-model; 7- opoka

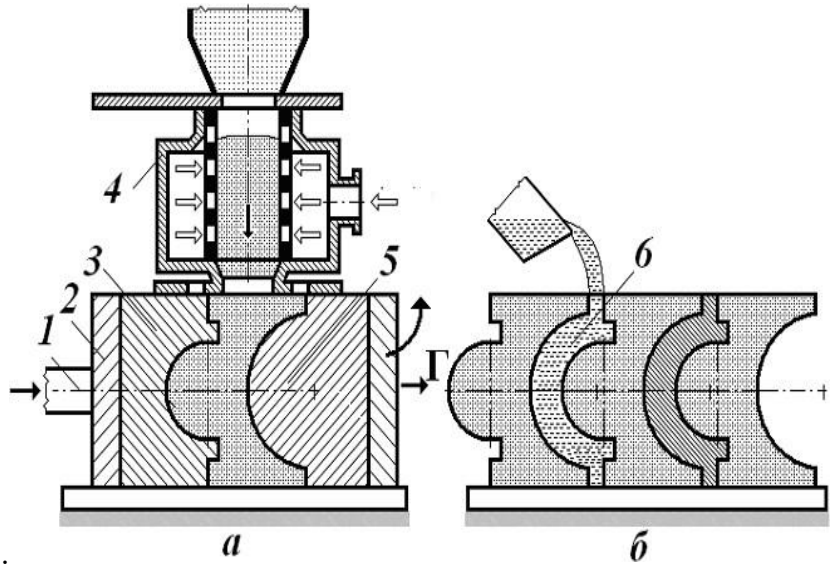


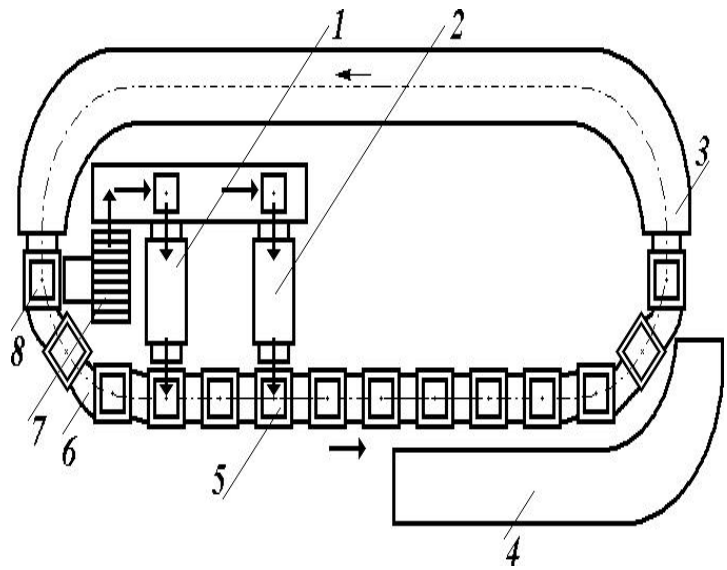
Fig. 7. Scheme of forming without a mold:

a- machine scheme; b-casting scheme; 1-press cylinder; 2-press plate; 3.5-model plate; 4-casting head; 6-form cavity;

After the casting has solidified and cooled, the mold is broken, the molding mixture is reused, and the castings are sent to the cutting departments.

Automatic forming flow: In modern foundries, forming machines are arranged around a closed conveyor (Fig. 5). The conveyor consists of a row of trolleys moving along the conveyor 6. Empty molds are transferred from the discharge position 7 to the lower 1 and upper 2 forming machines. The lower half-forms are turned 180 and transferred to the conveyor, where cores are installed in them. The upper half-forms are transferred to the 5 position, where the mold is assembled. In section 4, molten metal is poured into the mold, then they move along the cooling part of the conveyor to the discharge position 7. Here, the cast molds are placed on a vibrating grid, the molding mixture is broken and poured through the grid, and the cast remains on the grid [10].

Figure 8. Scheme of the operatin of a closed conveyor.



1-bottom forming machine; 2- top forming machine;

3-cooling section; 4-casting place; 5-form collection place; 6-conveyor; 7-place for removing the molds; 8-cart.

Core preparation : Core preparation is carried out in special core boxes designed for the production of a model set.

The inner cavity of the core box corresponds to the configuration of the core and the core marks, with the help of which it is installed and fixed in the form. Core boxes can be non-opening or opening to facilitate the removal of the finished core. In piece production, cores are made manually in wooden core boxes. In large-scale and mass production, cores are made in metal boxes of conventional shape and on special core machines.

Conclusion: Gutter systems (GTS) are a system of channels for the flow of molten metal into the mold cavity. They must ensure the correct filling of the mold with liquid metal, the solidification of the casting in the mold in a directed manner, the feeding of the casting during the crystallization and cooling of the metal, and the separation of slag and acids that accidentally fall out of it. The design of the QT should be simple, so that metal consumption is minimal, the molten metal moves evenly in the mold, there are no coils and no air, acid film and slag get into it. The location of the tundish system and the place of metal introduction into the mold should be such that the casting solidifies in the mold in a directed manner and the incoming metal is supplied with the hottest metal.

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