F. E. THOMES.

MOLD FOR METAL CASTING.

APPLICATION FILED NOV. 24, 1917. RENEWED SEPT. 25, 1920.

1,410,775. **Patented Mar. 28, 1922.**

Fig. 1.

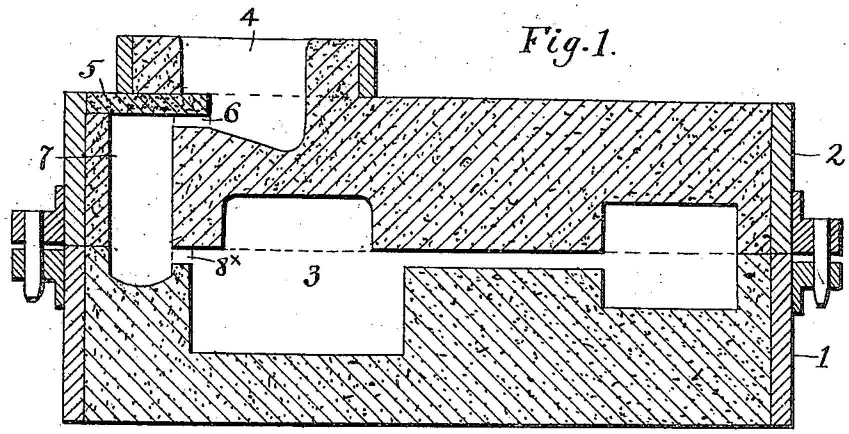


Fig. 2.

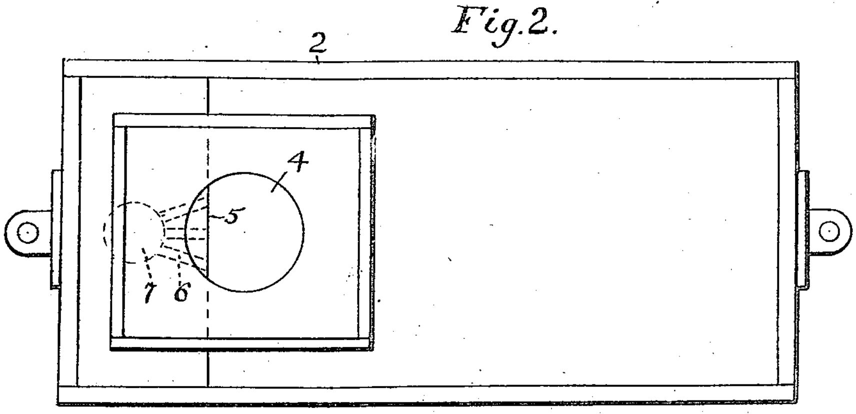


Fig. 4.

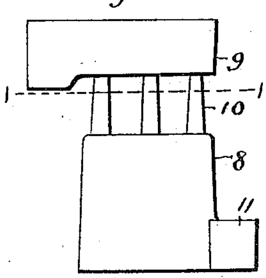


Fig. 3.

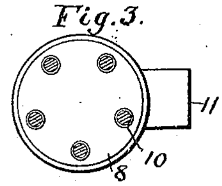
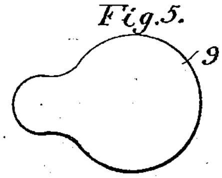


Fig. 5.



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UNITED STATES PATENT OFFICE.

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MOLD FOR METAL CASTING.

1,410,775. Specification of Letters Patent. Patented Mar. 28, 1922.

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To all whom it may concern:

Be it known that I, FRANK E. THOMES, a citizen of the United States, residing at Portland, in the county of Cumberland and State of Maine, have invented certain new and useful Improvements in Molds for Metal Casting, of which the following is a specification.

My invention relates to the construction of molds for casting iron, steel, bronze and other metals.

In foundry practice as hitherto carried out many castings have spoiled by being imperfectly molded. This has been particularly the case where heavy castings including thick and bulky parts like hubs and flanges were combined with thin webs or other thin parts, or in castings of large area. In this latter class of castings it is common to put in a pouring gate at one point of the mold and at some other point usually opposite, a so called "riser" or overflow opening where the surplus metal flows up and indicates that the mold is full.

As the metal begins to cool within the mold a contraction takes place in the body of the metal. When the casting thus shrinks inside the mold it naturally draws into the mold enough molten metal to compensate for the contraction and in this manner the mold or matrix is supposed to be kept completely full and a complete casting filling the entire matrix is the result. This inflow of molten metal into the body of the casting as it cools takes place through the interior portions of the metal which lie next to the gate or point of inlet and in the portions of the casting heading toward the interior.

The surfaces of the metal where they come in contact with the molding sand cool and set first, leaving the inside molten and the metal required to supply the deficiency caused by the contraction is drawn from the interior of the stream after the surface is set. If there is not a supply of molten metal accessible to the casting to fill up the space taken up by the contraction in cooling, if, for instance, the metal at the pouring gate is allowed to set before the inside of the casting sets, or if for any reason the contraction of the casting does not draw to itself melted metal from some source of supply, internal strains will be set up within the casting or voids, cavities, or recesses will appear in the casting or the latter will partake of a porous quality.

In the common foundry practice this difficulty is attempted to be overcome by the "risers" above spoken of and by "churning" the metal in the riser to keep it from setting or hardening. This is done so that that portion of the casting shall have molten material to draw from as it contracts. This so called "churning" is effected by thrusting iron rods into the riser and thus forcing the fused metal down into the body of the mold keeping it from hardening and leaving it molten. This "churning" is supplemented often in large castings by pouring into the risers portions of metal fresh from the furnace to assist in keeping the metal in the riser from setting and to supply the molten metal needed to fill the mold as the metal cools and shrinks.

The difficulty with this operation is that the metal as it enters the riser is the coldest metal in the mold as it has traversed the entire length or width of the mold subject to the cooling effect of the moist sand. As the cooling and "churning" take place the metal tends to lose its fluidity and to become thick and pasty so that it does not flow readily to fill the voids in the casting. The result is that many castings are spoiled and others are defective so that they have to be tested to make them sufficiently sound to answer their purpose.

The object of my invention is to do away with this mechanical feeding of the casting and to devise a construction of the mold whereby there will always be a body of very hot molten metal available to feed all parts of the casting without the aid of any mechanical means for forcing it into the matrix.

My invention consists essentially in forming below the pouring basin a feeding chamber connected with the pouring basin preferably by a skim gate. This feeding chamber is connected with the matrix by a feeding gate and the chamber is formed of sufficient size to supply all the molten metal required to compensate the casting for shrinkage caused by cooling.

The chamber varies in size according to the bulk of the casting, but it is of relatively large size so that it will contain a relatively large body of highly heated metal, the hottest metal in the casting.

Thus as the metal begins to run in through the pouring basin, first through the skim gate where the dross and impurities are separated, and then through the feeding chamber, the interior of the chamber becomes very highly heated.

The first contact with the walls of the chamber as the metal enters tends to cool the latter. The metal passes through the chamber, however, and as more is poured in the interior of the chamber becomes substantially as hot as the metal and tends to regenerate the heat of the metal as the latter passes through it. The large body of metal within the chamber thus tends to keep up to the fusing point, as it is surrounded with what are in effect insulating walls. There is no tendency to chill or harden, and the body of very hot metal is thus brought close to the opening of the casting causing the metal to flow through the spaces in the matrix more readily and uniformly than where the metal has to flow through a long and small channel before reaching the matrix. The metal as it enters the matrix is thus kept much hotter and more fluid than by the old method, and this large body of hot fluid metal remains in place to furnish molten metal to the interior of the casting as the cooling and shrinking of the casting draws it in.

If the casting is unusually large or contains bulky portions separated by thin portions it may be necessary to make use of more than one of my improved gates and it is always necessary to proportion the size of the feeding chamber to the bulk and shape of the casting.

A little experience will soon show the foundryman how much of an allowance as to size should be made so that the chamber will hold plenty of metal to make up for the contraction in any given pattern.

The result of the action of my feeding chamber is that it is not in any case necessary to use the risers or to do any mechanical feeding whatever.

Sound castings of any size or shape may be made without internal strains, cavities or porous webs and practically every casting comes out perfect. The feeding of the matrix from a large body of what is in effect superheated metal of the utmost fluidity produces effects not before known in foundry practice.

In the accompanying drawing I have illustrated one form in which my invention may be carried out.

Fig. 1 is a longitudinal vertical section.

Fig. 2 is a plan of a mold made up according to my invention.

Fig. 3 is a section of a modification on the line 1—1.

Fig. 4 is an elevation of the same.

Fig. 5 is a plan.

In the drawing 1, indicates the nowel or drag, 2 is the cope flask and 3 is the matrix or the print to be occupied by the casting.

Adjacent to the matrix is formed the feeding chamber 7 connecting with the matrix by a short gate 8ˣ.

This feeding chamber is preferably cylindrical in form and it is large enough to provide all the metal the casting will require as it contracts.

The chamber is connected with a pouring basin located at some point on the top of the cope and necessarily above the level of the chamber 7. Interposed between the feeding chamber and the pouring basin is a skim gate whereby the dross and impurities which rise to the surface of the metal are separated from the molten metal.

As here shown, I cover the top of the feeding chamber with a flat core 5 having a series of small horizontal openings 6 leading into the lower portion of the pouring basin 4.

The floor of the basin slopes away from the openings 6 so that the metal will have a chance to run freely through the skim gate formed by the core and the openings beneath it.

The feeding chamber if desired may be formed directly beneath the pouring basin as illustrated in Figs. 3, 4 and 5 and the skim gate may be formed in the ordinary molding sand instead of a core.

In some cases the skim gate with several openings may not be necessary, the only point being to separate the dross and lighter impurities from the body of the metal and to always keep the feeding chamber and the connecting passage or passages to the pouring basin filled.

In practice I form patterns of various sizes for molding the feeding chamber and the pouring basin using these patterns in connection with the regular patterns for producing the matrix.

In Figs. 3, 4, and 5 I have illustrated a pattern which is kept in stock and used as occasion requires, the size varying, however, according to the size of the casting. When formed by this pattern the feeding chamber is directly beneath the pouring basin with screening opening between. The feeding chamber pattern 8 has connected with its lower portion a gate extension 11 which connects with the regular casting pattern.

On the top of the feeding gate pattern 8 are a series of rods or columns 10 secured preferably to the pattern 8 and tapering slightly to give the necessary clearance. Resting on the upper ends of the rods 10 is the pouring basin pattern 9.

The rods 10 may be secured to either the pattern 8 or 9 so that they may be conveniently molded.

The connection between casting and the feeding chamber is relatively small leaving little to be ground away when the casting is cleaned. The metal contained in the chamber and pouring basin which has to be remelted is little if any more bulky than the waste metal under the present practice where risers are used and by my method a perfect casting is assured in practically all cases. While the invention is well adapted to all kinds of metal casting, it is particularly useful in casting steel and bronze where the contraction is relatively great.

A pouring basin with a perforated bottom for straining the metal into the feeding chamber may be made in the form of a core so that it may be inserted above the feeding chamber and will not require any further molding.

The connecting gate leading from the feeding chamber to the casting should be of sufficient size so that it will not cause the metal to cool and set. It may be as large as the chamber, but the larger it is the more metal there will be to cut away from the casting.

While the perforated or other skim gate may not always be necessary, particularly where clean metal is drawn from the bottom of the ladle it is desirable that the passage from the pouring basin to the feeding chamber should be always kept full of metal so as to prevent any air being admitted to cool the metal.

In steel castings where the shrinkage is relatively great it has been the practice to make use of numerous shrink heads or risers to fill the matrix and without any mechanical churning but the metal in these shrink heads having passed through the matrix is far less fluid than that in our feeding chamber. This latter receives the hot metal and continually grows hotter as the pouring operation is continued so that when the pouring is complete the feeding chamber is the hottest portion of the mold.

I claim:

A sand mold for making metal castings including a matrix having its upper surfaces imperforate, a feeding chamber adjacent thereto and communicating laterally therewith, a pouring basin communicating with said feeding chamber, a skim gate interposed between said pouring basin and said feeding chamber, said feeding chamber being of sufficient size to keep the casting supplied with metal during its cooling and contracting and extending above the level of the highest portion of the matrix whereby a constant fluid pressure is exerted on the upper inner surface of the matrix by the pressure of the contents of the said feeding chamber.

In testimony whereof I affix my signature

FRANK E. THOMES