(No Model.)

W. G. RICHARDS.

CAR WHEEL MOLD.

No. 451,578. Patented May 5, 1891.

Fig. 1

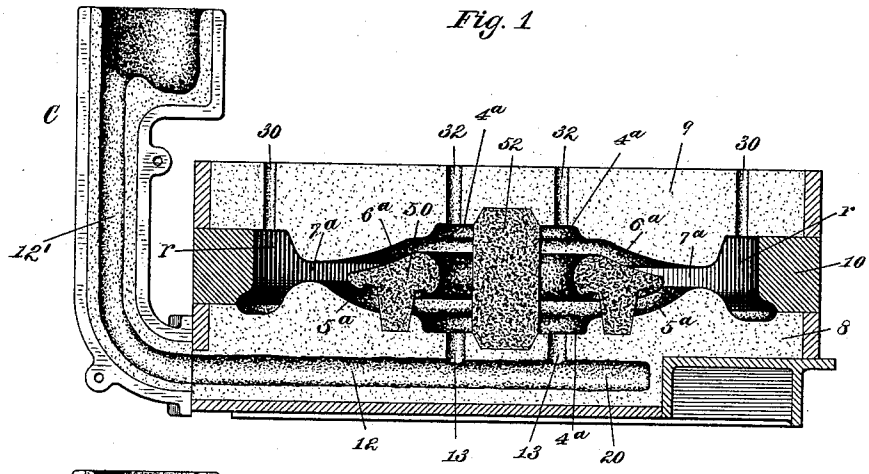


Fig. 2

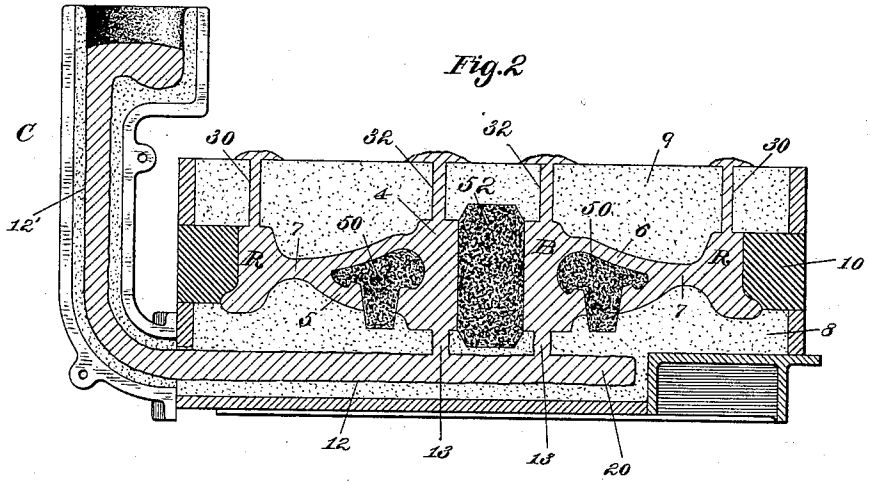
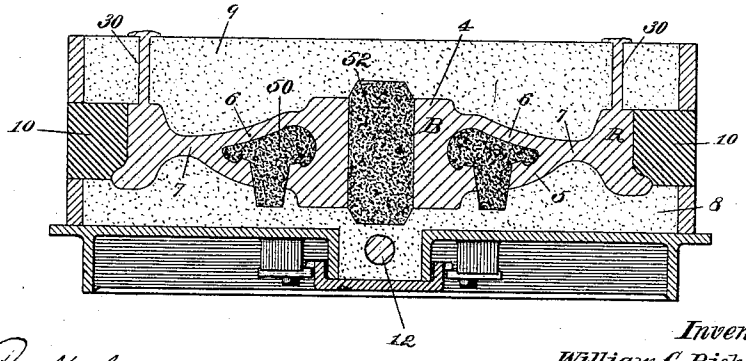


Fig. 3



Witnesses:
Henry L. Reckard.
Wm. Byorkman,

Inventor:
William G. Richards,
By his Attorney
F. A. Richards.

UNITED STATES PATENT OFFICE.

WILLIAM G. RICHARDS, OF BOSTON, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE AMERICAN STEEL WHEEL COMPANY, OF NEW JERSEY.

CAR-WHEEL MOLD.

SPECIFICATION forming part of Letters Patent No. 451,578, dated May 5, 1891.

Application filed July 14, 1890. Serial No. 358,657. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM G. RICHARDS, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Molds for Casting Steel Car-Wheels, of which the following is a specification.

This invention relates to molds for casting articles by pouring them from below, the object being to furnish a mold of that class which shall be especially adapted for casting sound car-wheels of steel.

In the drawings accompanying and forming a part of this specification, Figure 1 is a vertical section through the mold before the casting operation. Fig. 2 is a similar view showing the mold after it has been filled. Fig. 3 is a vertical section taken on a line at right angles to the plane of Figs. 1 and 2.

Similar characters designate like parts in all the figures.

The flask herein shown for holding the mold is made the subject-matter of a separate application, Serial No. 358,655, filed July 14, 1890, to which reference may be had for a more particular description thereof.

The mold herein described is adapted to be used for making steel car-wheels by the method described and claimed in my application, Serial No. 304,075, filed February 11, 1890, and allowed October 16, 1890.

The flask, as herein shown, consists of the bottom board, the nowel-frame, the chill, the cope-frame, and a pouring-head connected to the flask below the chill and whose channel continues along the lower part of the mold underneath the wheel-space therein. The nowel-frame, the chill, and the cope-frame being all substantially circular in plan view, no plan of them is herein shown. The mold consists of the nowel 8, the chill 10 set on the nowel and its frame, and the cope 9 set on the chill, substantially as indicated in the drawings. The pouring-head C is attached to one side of the mold at or near the base thereof and extends to a point somewhat above the top of the mold, substantially as indicated in Figs. 1 and 2. The channel 12′ of the pouring-head extends downward and connects with the horizontal runner 12, formed in the nowel underneath the mold, as indicated in Fig. 1, which runner terminates in an abutment.

From the horizontal runner 12 one or more short connecting-channels or mold-filling passages 13 extend upward into the lower end of the hub-space 4^a, through which channels the metal enters the mold. Over the hub-space of the mold are formed a series of vents 32, usually two or more in number, for the escape of air and gases from the mold and to provide for overflowing the metal when this is desired. Other similar vents 30 are formed at suitable distances apart over the rim-space r of the mold for a similar purpose. The usual "arch-core" 50 is provided to form the space between the upper and lower plates of the wheel, and the usual center core 52 is provided for making the usual central opening in the hub. The arch-core divides that part of the mold-space surrounding the hub-space into the front-plate space 6^a and the back-plate space 5^a, as shown in Fig. 1. That part of the mold surrounding the arch-core between the rim-space and said arch-core is designated as the "single-plate space" 7^a.

The horizontal runner underneath the mold is extended beyond the vertical passage or passages 13 to form the catch-chamber 20, constituting a receptacle for the first inflowing metal and to catch the débris and "wash" of the pouring-head surfaces always accompanying the first influx of metal, also to hold at a high temperature metal serving as a heat-reservoir for prolonging during the latter part of the pouring operation the fluidity of the metal in the vertical connecting passage or passages from said runner to the mold-space.

In the process of casting the wheel the molten steel is steadily poured into the head C, flows rapidly through the channel or runner 12, and enters the mold through the channel 13 at the lower end of the hub 4.

The wheel B shown in the mold in Figs. 2 and 3 is a car-wheel of the double-plate variety, having the rim R, the hub 4, the back plate 5, the front plate 6, and the single plate 7, which may be considered as a continuation of the two plates 5 and 6 for joining these two plates and the rim. It is found to be es-

sential to the successful use of steel wheels in railway service that the entire wheel, but more especially the hub thereof, shall be substantially sound throughout and free from porosity and from shrinkage or other internal cavities. It is the principal object of my invention to furnish a mold adapted for casting steel car-wheels of that character.

The molten metal being run to the mold through the horizontal runner underneath the mold ultimately heats the walls of the said runner to the highest degree of any part of the mold, so that on the cessation of the pouring the hottest metal in the mold is in the large runner below the wheel, from whence it is drawn into the hub by the contraction of the metal contained in the hub part of the mold during the cooling of the casting. The runner extending for a considerable distance along close underneath the casting is thereby prevented from being cooled by the upward absorption of heat by the casting, thus being retained for the longest time in its excessively hot and fluid state. Connecting the horizontal runner with the lower end of the hub are short vertical passage-ways or mold-filling runners, through which the metal runs directly into the mold and in which the metal flows with the highest velocity during the pouring operation. It is from these vertical columns that the metal is supplied for feeding the hub part of the casting during the cooling thereof, said columns being supplied from the horizontal runner by reason of the "head" or pressure in the vertical pouring column or head, aided by the natural suction produced by the shrinkage of the casting.

The connecting-passages 13 when made, as in practice I make them of less aggregate area than the runner 12, give to the upflowing metal a relatively high velocity, whereby the metal flowing into the mold is carried well up into the hub-space, and whereby the inflowing metal is thoroughly mixed with that already in said hub-space, thus distributing the excess of temperature in the inflowing metal more widely throughout the metal of the hub and promoting the uniform shrinkage of the hub metal immediately following the cessation of the influx of metal into the hub-space.

In the operation of pouring the mold the highly-heated molten steel is poured into the pouring-head C and follows down through the large runner 12 at a rapid velocity, due to the height of the pouring-head, and flows along the horizontal part of the runner under the mold until it strikes abruptly against the abutment formed at the terminus of said large runner. During this passage at the first touch of the metal against the cooler surfaces of the mold there is formed a thin coating or scale, adhering to the granular material of the mold and constituting a hot metallic tube, within which the molten steel afterward continues to flow during the pouring operation. At the mold-filling passages 13 said metallic tube or casing (there being a space at said passage rather than a continuous surface) is formed thinner or with a break therein. On the metal striking the abutment beyond said passages there occurs a violent reaction in the nature of a blow, whereby the metal in the large runner contiguous to said passages is forcibly imparted between the metal against the abutment and the oncoming heavy stream from the pouring-head. The effect of this reaction is to impart a sudden and violent pressure to the metal immediately at the said mold-filling passages, whereby the aforesaid scale or tube (when the same has formed at said passages) is burst through, and whereby the metal then in the large runner at said passages is violently driven at a high velocity through the passages into the mold. By this method of inaugurating the mold-filling current or stream of metal (by which term I designate the current in the aforesaid passages 13) the highest attainable velocity of said mold-filling current is obtained, whereby the cross-sectional area of said passages may be reduced to a minimum. By this method of casting the first metal entering the runner suffers the greatest chilling of any metal entering the mold during the pouring operation, since it traverses the entire length of the large runner, and thus comes directly in contact with the largest area of cold mold-surface. By reason of the cooling of said first inflowing metal this first metal becomes unfit for or incapable of entering the mold through a sufficiently small mold-filling passage, and one feature of my invention relates to the disposition and also the utilization of said cooled first inflowing metal, this being carried beyond said inlet-passages against the reactionary abutment, whereby it is detained from entering the mold and is utilized for effecting the impact above described, by which the mold-filling current is inaugurated. After the pouring operation is begun and said mold-filling current or currents are established the cooled metal, first delivered into the large runner beyond said mold-filling currents, is gradually reheated, so that at the end of the pouring operation it becomes substantially uniform in temperature with other parts of the runner, this reheating taking place gradually by reason of and from the action of the currents existing in said runner and passage-ways. At the moment the first inflowing metal reaches the terminus of the large runner the elongated mass acquires a considerable momentum, and thus acts on the principle of a ram to drive the metal laterally through the small runners with a relatively great force. This feature will be readily understood when it is observed that the aggregate mass of the heavy fluid metal in the large runner is very considerable, and the velocity, owing to the height of the head C, is also considerable, thus furnishing ample means for causing a reactionary effect of high intensity.

Where two or more of the small secondary passages are used, the one nearest the terminus of the large runner will first receive the effect to the reaction described above, which will be quickly extended to the runners more distant from the abutment.

The short vertical columns between the horizontal runner and the bottom of the mold being situated between two larger masses of hot metal and being also in a vertical position, so that the heat of the lower mass of metal is naturally transmitted directly up through them into the upper mass of metal, are thereby maintained in a perfectly fluid condition a relatively long time, notwithstanding their smaller diameter. By means of this organization of said parts the necessary size of said vertical columns is reduced to the lowest point, thereby reducing one of the objections arising from the use in steel castings of large runners, since during the latter part of the cooling period the metal in the casting at the junction of the runner therewith is most nearly fluid, and, being weakest, becomes porous from the shrinkage strains. By making the large runner horizontal and connecting with the mold through short reduced passages, and by arranging those passages vertically between the large runner and the mold, I avoid the objection arising from the use of large runners connecting directly with the mold, while retaining the efficiency of the larger runner.

The horizontal runner being large relatively to the vertical ones, the stream of metal, after the reaction described whereby the mold-filling current is inaugurated, turns from the large into the small runners through an easy curve not essentially impeding the velocity of the metal. Thus the mold construction described provides for the continuous filling of the mold not less effectively than by the old way, while especially providing for the first inflow of the metal at a high velocity.

The horizontal runner lying immediately underneath the wheel and being arranged to preserve its heat for the longest practicable period constitutes a reservoir, from whence the wheel draws its feeding-supply by suction through the vertical passages, that suction being aided by the pressure of the metal in the aforesaid pouring-head. The tendency or direction of movement of the heat from the horizontal suction-reservoir or runner underneath the wheel is naturally upward, thereby tending to keep the vertical passages fluid, and thus feed the hub part of the wheel most effectively. By the old methods, in which the castings are poured through vertical runners connected immediately at the bottom thereof with the hub, the tendency of the heat is away from the connecting-passage, thus obstructing instead of aiding the feeding of the casting.

The large horizontal runner extends beyond the short vertical connecting-passage leading from said runner into the under side of the mold, thus forming a chamber 20, into which the first entering metal is driven, carrying with it the sand and impurities of the passage leading to the mold and retaining them there, preventing their entrance into the mold. Also the mass of metal beyond the vertical passage serves as a heat-reservoir to aid in maintaining the fluidity up to the latest possible moment of the metal in the vertical passage and in the horizontal runner immediately below said passage, for during the whole pouring operation the hot metal passing at a high velocity through the runner to the farthermost connecting-passage is imparting its heat by conduction to the mass in said space 20, so that at the end of the pouring operation the temperature of said heat-reservoir becomes substantially equal to that of the flowing metal itself.

Inasmuch as it is customary to use a central core 52 in the mold, it is advantageous to use a plurality of connecting-passages 13 and 13, instead of relying upon a single passage, as otherwise might be done. However, the number of said passages depends upon the shape and size of the casting to be made. In the case of car-wheels I use in practice two said passages, as shown in the drawings.

In order to obtain the best results it is necessary that the inflowing metal shall pass along constantly in the same direction without interruption from the beginning of the pouring operation until the feeding of the casting is complete with the least possible agitation.

Having thus described my invention, I claim—

1. In a mold for casting steel car-wheels, the combination, with a part forming the outer wall of the mold-space and with the cope having overflow-passages over the rim-space and over the hub-space, of the nowel having the inclosed main runner extending from one side of the mold along under the mold-space to a point beyond the hub-space thereof, mold-filling passages branching vertically from the main runner to the under side of the hub-space, and the pouring-head connecting with the outer end of the main runner, the whole being organized substantially as shown, whereby the mold may be filled to overflowing and the casting fed by a continuous and unbroken stream of metal, substantially as described.

2. In a mold for casting steel car-wheels, the combination, with a part forming the outer wall of the mold-space and with the cope having overflow-passages over the rim-space and over the hub-space, of the nowel having the inclosed main runner extending from one side of the mold along under the mold-space to a point beyond the hub-space thereof, mold-filling passages branching vertically from the main runner to the under side of the hub-space from points before the

terminus of the main runner, said main runner also extending beyond the mold-filling passages to form the catch-chamber, and the pouring-head connecting with the outer end of the main runner, the whole being organized substantially as shown, whereby the mold may be filled to overflowing and the casting fed by a continuous and unbroken stream of metal entering the mold under pressure of a reaction after the first inflowing metal has been pocketed in said chamber, substantially as described.

WILLIAM G. RICHARDS.

Witnesses:
CORNELIUS DONOHUE,
FRANK M. MAHEM.