T. D. WEST.

ART OF MAKING METAL CASTINGS.

APPLICATION FILED AUG. 28, 1911.

1,025,436. Patented May 7, 1912.

Fig. 1.

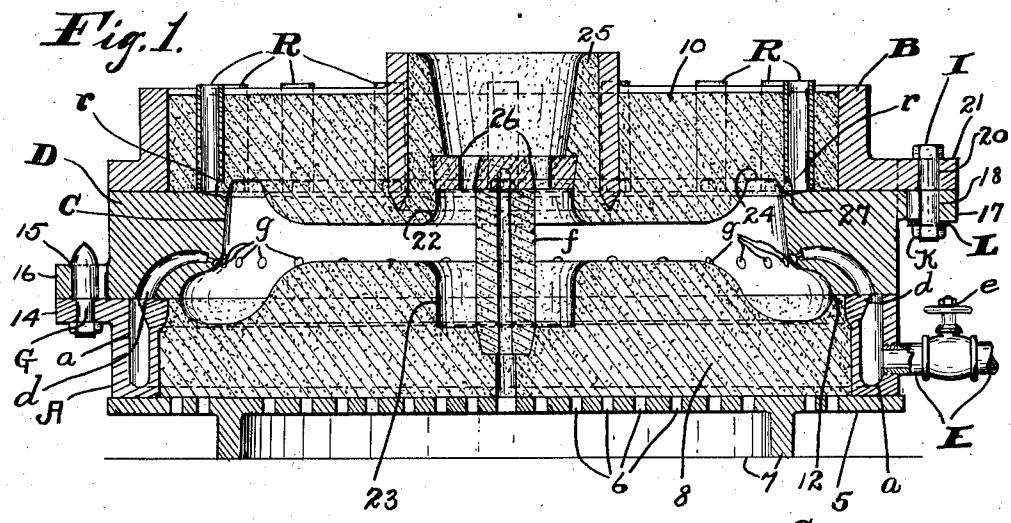


Fig. 3.

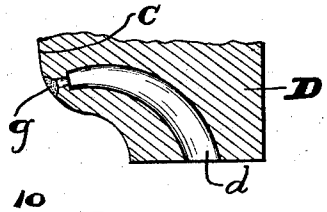
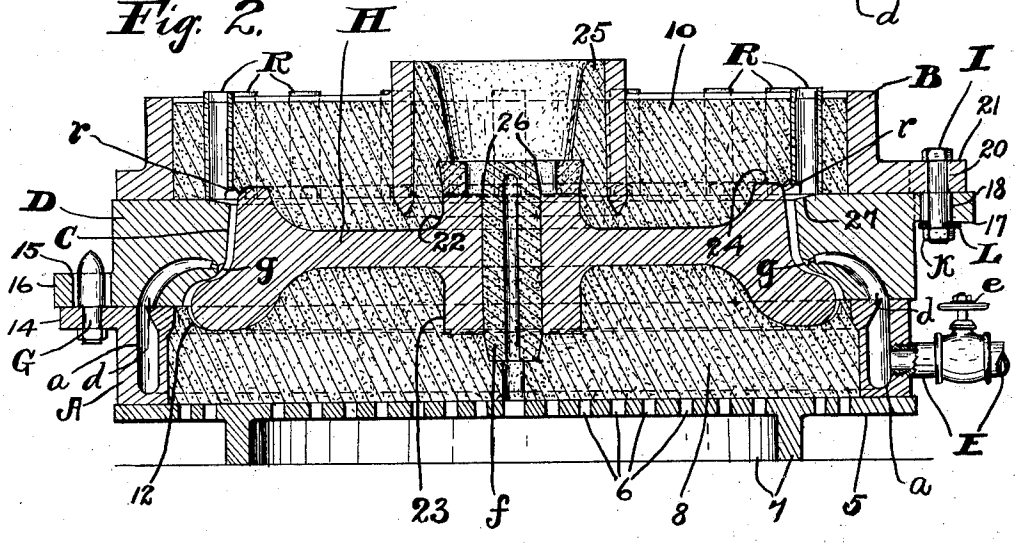


Fig. 2.



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ART OF MAKING METAL CASTINGS.

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To all whom it may concern:

Be it known that I, THOMAS D. WEST, a citizen of the United States of America, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in the Art of Making Metal Castings; and I hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

This invention relates to improvements in the art of making metal castings, and more especially to an improved process of casting circular objects, such, for instance, as car-wheels and rolls.

The primary object of this invention is to treat a body of hot metal in a mold, upon the formation of a crust on the said body of metal, with a heat-absorbing medium, such, for instance, as air or gas or any blowable fluid, substance or material, by causing said heat-absorbing medium to pass rapidly through the mold and to rapidly carry off heat from the metal while the crusted body of metal or casting is within the mold and thereby beneficially affect or influence the casting in any one or more of various ways, such, for instance, as rendering the casting stronger or more durable, or increasing the depth or hardness of chilling beyond the chilling or hardening capacity of a metal chill or chiller, or hardening the surface of any casting while the casting is within the mold, or effecting chemical changes in the constituents of said crusted body of metal or casting to better qualify or fit it to withstand any ordinary or special service to which it may be subjected, or preventing shrink-holes and contraction-cracks in the casting, or producing what I term an "inside" chilling,—that is, a chilling of the casting at a point spaced inwardly from the surface of the casting.

Another object is to supply a space created next exteriorly of the aforesaid crust while the crusted body of hot metal or casting is within the mold with air or other heat-absorbing medium introduced to the said space and causing or permitting said heat-absorbing medium, upon the absorption of heat from the metal, to escape from the mold, so as to utilize said heat-absorbing medium in carrying off heat from the crusted body of metal or casting and in beneficially affecting the character and quality of the casting.

Another object is to carry out my invention more especially in the casting of a circular object, such, for instance, as a car-wheel or roll, by, first, pouring a mold having a circular chamber for receiving molten metal, and, upon the formation of a peripheral crust on the body of hot metal supplied to the said chamber and creating an annular space next exteriorly of and surrounding the said crust while the said body of metal is within the mold, supplying air or other heat-absorbing medium to the said space and surrounding the said body of metal by said heat-absorbing medium, and causing or permitting said heat-absorbing medium upon the absorption of heat from the metal to escape from the mold.

Another object in the art of making circular metal castings is to establish a pneumatic pressure in the said annular space and consequently next exteriorly of and around the crusted body of metal or casting being treated, and to utilize said pneumatic pressure not only in beneficially affecting the crusted body of metal or casting interiorly but in affording lateral support to the casting all around the casting and in participating or assisting in maintaining the crusted body of metal or casting centered relative to the mold.

Another object is to carry out my invention, in casting a metal car-wheel having a flange at one end of the tread-forming portion of the wheel, in such a manner that said tread-forming portion can be treated by my improved process without in any appreciable degree correspondingly treating the flange-forming portion of the wheel.

With these objects in view, and to the end of attaining other advantages hereinafter appearing, this invention consists in the steps or features hereinafter described and pointed out in the claims.

A mold suitable for use in carrying out my invention in the manufacture of a chilled car-wheel is illustrated in the accompanying drawings, in which—

Figure 1 is a central vertical section of

said mold ready for pouring. Fig. 2 is a central vertical section of the mold, showing a car-wheel H cast within the mold. Fig. 3 is a vertical section of a portion of the chiller or chill D of the mold and is drawn on a larger scale than Figs. 1 and 2.

The mold illustrated consists in the main of an upper mold-part or cope, a lower mold-part or drag and a central mold-part in the form of an annular chiller or chill.

Referring to the drawings, A indicates an annular metal casing which forms a portion of the lower mold-part or drag and is arranged vertically and rests upon a horizontally arranged metal plate 5 forming the bottom of the drag, which bottom is provided with vent-holes 6 and a vertically downwardly projecting annular flange 7 serving to elevate the bottom above the floor or support upon which the mold is to be mounted. The drag is suitably rammed with sand, and the top or upper portion of the body of packed sand 8 of the drag has the contour required to form the bottom of the casting.

B indicates an annular metal casing which forms a portion of the upper mold-part or cope and is arranged vertically and supported as will hereinafter appear. The cope is suitably rammed with sand, and the body of packed sand 10 of the cope has its bottom or lower portion contoured as required to form the top of the casting. The cope is arranged over and spaced from the drag to form a chamber C between them, which chamber is enlarged diametrically and annularly at its lower end, as at 12.

D represents the chiller or chill which forms the central mold-part. The chill D is annular and arranged vertically and instrumental in forming the surrounding wall of the chamber C. The chill D is of cast-iron or other metal.

The flange of the car-wheel to be cast in the mold illustrated is formed next above the outer portion of the drag, and the lower portion of the chill is shaped internally as required to form the upper portion of the said flange, and the body of packed sand 8 of the drag is contoured as required to form the lower portion of the said flange. The periphery or tread of the said wheel between the flanged end of the said wheel and opposite end of the wheel is formed in the main by the internal surface of the chill D.

The chill D is supported from the drag, and preferably the drag-casing A is provided with an annular chamber *a* which extends to and along the upper edge of the said casing. The chamber *a* is arranged externally of and spaced from and surrounds the lower diametrically enlarged portion 12 of the chamber C.

The chill D is provided with holes *d* which are spaced circumferentially of the chamber C. The holes *d* communicate with and form outlets of the recess *a* and extend from the said recess upwardly and laterally inwardly to the chamber C. The holes *d* therefore extend through the chill D.

A pipe E, which has a normally closed valve *e*, is placed in communication at its discharging end with the chamber *a* and is employed in supplying air or other heat-absorbing medium, under pressure, to the said chamber. The pipe E is applied to the drag-casing A in any approved manner.

Each hole *d* is plugged, as at *g*, at its discharging end,—that is, at the internal surface of the chill,—with a mixture of pulverized coke or other blacking, rosin and liquid. The rosin and coke or blacking of said mixture are in the proportion, by measure, of two parts of pulverized coke or other blacking to one part of pulverized rosin, and enough clear water, or water diluted with molasses or beer, is used in preparing said mixture to cause the mixture to be of the consistency of putty. The plugs *g* prevent the passage of molten metal from the chamber C into the holes *d* but are blown from said holes by the air or heat-absorbing medium discharged under pressure into the said holes from the chamber *a* upon supplying the last-mentioned chamber with said air or heat-absorbing medium under pressure by the pipe E upon opening the valve *e*.

The drag-casing A is shown provided at its upper end and externally with a laterally and outwardly projecting lug 14 which is provided with a vertically arranged pin G suitably attached to the said lug. The upper portion of the said pin projects above the said lug into a slot 15 formed in and extending vertically through a lug 15 formed on and externally of the chill at the lower end of the chill. The relative arrangement of the parts is such that in the normal condition of the chill, before any lateral and outward expansion of the chill by heat, the pin G, as shown in Fig. 1, is arranged next to the outer end wall of the engaging slot 15 which extends inwardly beyond the said pin toward the chamber C of the mold far enough to accommodate a lateral and outward expansion of the chill by heat.

The cope-casing B is mounted on and therefore supported from the chill D. The chill D is shown provided at its upper end and externally with a laterally and outwardly projecting lug 17 which is provided with a slot 18 arranged radially of the chill. The slot 18 extends vertically through the lug 17 and is engaged by a bolt I which extends vertically through the said slot and through a corresponding bolt-hole 20 formed in and extending vertically through a lug 21 with which the cope-casing B is provided. It will be observed that in the normal con-

dition of the chill, before any lateral or outward expansion of the chill by heat, as shown in Fig. 1, the outer end portion of the slot 18 is in line vertically with the bolt-hole 20 and that the bolt I has its head resting on the top surface of the lug 21. The shank of the bolt I extends a suitable distance below the lug 21, and a nut K is mounted on the said bolt below the said lug. A washer L is interposed between the nut K and the lug 21. The relative arrangement of the parts is such that in the normal condition of the chill, before any lateral and outward expansion of the chill by heat, the bolt I, as shown in Fig. 1, is arranged next to the outer end wall of the engaging slot 18 which extends far enough inwardly beyond the said bolt toward the chamber C of the mold to accommodate a lateral and outward expansion of the chill by heat.

The inner top portion of the chill is covered by the sand-body 10 of the cope around the bore in the chill, and said sand-body is provided at its under side and centrally with a cavity 22 which forms the upper central portion of the chamber C and is arranged in line vertically with a cavity 23 which forms the lower central portion of the said chamber and is formed in and centrally of the sand-body 8 of the drag. The sand-body 10 of the cope is provided in its under side and next the internal surface of the chill D with an annular recess 24 which is arranged concentrically relative to the chill and forms an upward annular enlargement of the chamber C.

The cope and the drag of the mold illustrated are shown rammed to fit them for casting a car-wheel which has a hub provided with a central bore extending therethrough, and consequently a baked sand-core *f* is arranged vertically and centrally of the chamber C and extends through the said chamber and through the cavities 22 and 23 from within the bottom of the cavity 23 into the top wall of the cavity 22. The top wall of the cope-cavity 22 forms the bottom of a circular pouring basin 25 which is formed in any approved manner and has its bottom provided with gates or perforations 26 which establish communication between the said basin and the chamber C. The molten metal employed in pouring the mold is supplied to the pouring basin, and thence flows through the gates or perforations 26 into the chamber C and fills every unoccupied portion of the said chamber. The casting formed in the mold obviously contracts horizontally or diametrically when it cools and becomes smaller in external diameter during the cooling process and thereby frees the chill D, and obviously during the first cooling and contraction of a casting formed in the mold the chill expands laterally and outwardly by heat.

The chill is preferably beveled internally of its upper end, as at 27, and the sand body 10 of the cope covers the beveled surface 27 of the chill and is provided with a large enough number of vertically arranged pipes R which are spaced from and circumferentially of but in proximity to the upward enlargement 24 of the chamber C and at the aforesaid beveled surface. The pipes R communicate at their upper ends with the external atmosphere and extend through the sand-body 10 of the cope from the top of the cope to the chill. Each pipe R is provided at its lower end and inner side with an inlet *r* which is covered by the lower portion of the sand-body 10 of the cope and is only separated from the upward enlargement 24 of the chamber C of the mold by the said portion of the sand-body.

Any air or other heat-absorbing medium supplied to the chamber *a* upon opening the valve *e* of the pipe E passes from the said chamber into the holes *d* in the chill D and, being under pressure, blows the plugs *g* from the discharging ends of the said holes into the chamber C and consequently passes to the last-mentioned chamber from the chamber *a* through the chill.

In carrying out my invention in the casting of a chilled car-wheel chillable molten iron or metal is used and the mold illustrated is poured. As soon as a peripheral crust has formed on the body of hot chillable metal supplied to the chamber C during the pouring of the mold the normal cooling or contraction of the crusted body of metal or casting and the lateral and outward expansion of the chill D by heat during the said cooling or contraction of the said crusted body of metal or casting creates an annular space next exteriorly of and surrounding the said crusted body of hot metal or casting, whereupon the valve *e* of the pipe E is opened to supply air or heat-absorbing medium under pressure to said space. As the holes *d* are spaced circumferentially of the chamber C, as hereinbefore indicated, obviously said air or heat-absorbing medium is supplied to the said space at points spaced circumferentially of the crusted body of hot metal or casting while the said body or casting is within the mold. The discharge of air into the said space under pressure establishes a pneumatic pressure next exteriorly of and all around the crusted body of hot metal or casting, and said pneumatic pressure not only affords lateral support to the said body or casting all around the casting and participates or assists in maintaining the casting centered relative to the mold and prevents the internal pressure of molten metal within the casting from cracking or otherwise injuring the peripheral crust, but blows the sand covering the inlets *r* of the pipes R into the said pipes. I have attained

good results by supplying the chamber *a* with air under pressure of from sixty to seventy pounds per square inch. The air or heat-absorbing medium supplied to the space created next exteriorly of and around the crusted body of hot metal or casting while the said body or casting is within the mold absorbs heat from the metal and rises within the said space and, having blown the sand covering the inlets *r* of the pipes R through the said pipes, escapes through said pipes to the external atmosphere. The holes *d* are preferably arranged to discharge into the chamber C above and in suitable proximity to diametrically enlarged lower end of the chamber C so that the air or heat-absorbing medium supplied under pressure to the space formed as hereinbefore described next exteriorly of the crusted body of hot metal or casting enters said space above said diametrically enlarged lower end of the said chamber, and, when said space has been placed in communication with the external atmosphere through the pipes R as hereinbefore described, air or heat-absorbing medium under pressure is continually supplied through the chill into said space so as to supply air or heat-absorbing medium in ample volume to said space and cause said air or heat-absorbing medium upon entering said space to rapidly pass upwardly through said space and rapidly carry off heat from the crusted body of hot metal or casting being treated in the mold.

By my invention it will be observed that the body of hot metal is treated in the mold with a heat-absorbing medium, such for instance, as air or gas, or air accompanied by other matter, upon the formation of a crust on said body of metal in the mold and by causing said heat-absorbing medium to pass in ample volume into and rapidly through the mold so as to rapidly carry off heat from the metal while the crusted body of metal or casting is within the mold and thereby beneficially affect said body of metal or casting in any one or more of several ways already hereinbefore described. I would here remark that when a chill is used in forming the surrounding wall of the molten-metal-receiving chamber of the mold, as illustrated, the crust formed on the body of hot chillable metal or casting is of course chilled, but that depth of chilling of the casting is materially increased by the treatment of the crusted body of hot metal or casting with air or other heat-absorbing medium as hereinbefore described.

In Fig. 2 of the drawings *h* indicates the flange of the car-wheel, which flange is formed within the diametrically enlarged lower end 12 of the chamber C, and it will be observed therefore that the air or heat-absorbing medium is supplied to the space created next exteriorly of and around the crusted and already chilled body of hot metal or casting upon pouring the mold at a point above but in proximity to the flange-forming portion of the casting, and the passage of said air or heat-absorbing medium through the mold from above the said flange-forming portion to the upper and non-flanged end of the casting causes the tread-forming portion to be treated by my improved process without correspondingly treating the flange-forming portion because said air or heat-absorbing medium absorbs heat from the metal as soon as it enters the said space and therefore rapidly rises and escapes through the pipes R, and consequently said air or heat-absorbing medium does not pass transversely of the flange-forming portion of the casting, but is only caused to pass along and transversely of the tread-forming portion of the casting. The importance of applying the hereinbefore described cooling treatment more directly to the tread than to the flange of a car-wheel will be better understood upon considering the undesirability of chilling the flange as much as the tread and that undue brittleness in the flange is to be avoided.

Although I have illustrated the carrying out of my invention with a mold comprising a chill and employed in the production of a car-wheel, I would have it understood that my invention, broadly considered, may be practised in the production of any form or type of casting whatsoever or with a mold in which the walls of the molten-metal-receiving chamber of the mold are composed entirely or in the main of sand without the use of a chiller or chill.

What I claim is,—

1. An improvement in the art of making metal castings, consisting in pouring a mold in which a casting is to be formed and, upon the formation of a crust on the body of hot metal in the mold and creating a space next exteriorly of said crust while the crusted body of metal or casting is within the mold, supplying a heat-absorbing medium to said space and in contact with said crust, and causing said heat-absorbing medium upon the absorption of heat from the metal to escape from the mold.

2. An improvement in the art of making metal castings, consisting in pouring a mold in which a casting is to be formed and, upon the formation of a crust on the body of hot metal in the mold and the creation of a space next exteriorly of said crust while said body of metal is within the mold, causing fluid to pass into and through said space.

3. An improvement in the art of making metal castings, consisting in pouring a mold in which a casting is to be formed and, upon the formation of a crust on the body of hot metal in the mold and creating a space next

exteriorly of said crust while said body of metal is within the mold, supplying a pneumatic pressure to said space.

4. An improvement in the art of making metal castings, consisting in chilling a body of molten metal supplied to a mold and thereby forming a chilled crust on said body, and then introducing a heat-absorbing medium to said chilled crust and causing said heat-absorbing medium upon the absorption of heat from the crusted body of hot metal or casting to escape from the mold.

5. An improvement in the art of making metal castings, consisting in pouring a mold and forming a chilled crust on the body of molten metal supplied to the molten-metal-receiving chamber of the mold and creating a space next exteriorly of said chilled crust while said body of metal is within the mold, and then treating the crusted and already chilled body of hot metal or casting by causing a heat-absorbing medium to pass through said space.

6. An improvement in the art of making metal castings, consisting in chilling a body of molten metal supplied to the molten-metal-receiving chamber of a mold and thereby forming a chilled crust on said body, and then causing a fluid to pass next exteriorly of said crust and through the mold while the crusted body of metal is within the mold.

7. An improvement in the art of making circular metal castings, consisting in pouring a mold having a circular chamber for receiving molten metal and, upon the formation of a peripheral crust on the body of hot metal supplied to said chamber and creating a space next exteriorly of said crust while said body of metal is within the mold, supplying a heat-absorbing medium to said space and surrounding the crusted body of metal or casting by said heat-absorbing medium, and causing said heat-absorbing medium upon the absorption of heat from the metal to escape from the mold.

8. An improvement in the art of making circular metal castings, consisting in pouring a mold having a circular chamber for receiving molten metal and, upon the formation of a peripheral crust on the body of hot metal supplied to said chamber and creating a space next exteriorly of said crust while said body of metal is within the mold, causing fluid to pass into and through said space and surrounding the crusted body of hot metal or casting by said fluid.

9. An improvement in the art of making circular metal castings, consisting in pouring a mold having a circular chamber for receiving molten metal and, upon the formation of a peripheral crust on the body of hot metal supplied to said chamber and the creation of an annular space next exteriorly of and surrounding said crust while said body of metal is within the mold, establishing a pneumatic pressure in said space and around the crusted body of metal or casting and effecting the escape of fluid supplied to said space.

10. An improvement in the art of making circular metal castings, consisting in pouring a mold having a circular chamber for receiving molten metal and forming a chilled crust on and circumferentially of the body of hot metal supplied to said chamber by chilling said body exteriorly and circumferentially, and creating a space next exteriorly of said chilled crust while the crusted and already chilled body of metal or casting is within the mold, and then supplying a heat-absorbing medium to said space and causing said heat-absorbing medium upon the absorption of heat from the metal to escape from the mold.

11. An improvement in the art of making circular metal castings, consisting in pouring a mold having a circular chamber for receiving molten metal and forming a chilled crust on and circumferentially of the body of molten metal supplied to said chamber by chilling said body exteriorly and circumferentially, and creating a space next exteriorly of said chilled crust while the crusted body of metal or casting is within the mold, and then causing fluid to pass through said space.

12. An improvement in the art of casting a metal wheel having a flange at one end of the tread of the wheel, said improvement consisting in pouring a mold having a circular chamber for receiving molten metal and, upon the formation of a peripheral crust on the body of hot metal supplied to said chamber and while the crusted body of hot metal or casting is within the mold, causing a heat-absorbing medium to pass rapidly and in ample volume transversely of the tread-forming surface of said peripheral crust.

13. An improvement in the art of casting a metal wheel having a flange at one end of the tread of the wheel, said improvement consisting in pouring a mold having a circular chamber for receiving molten metal and, upon the formation of a peripheral crust on the body of hot metal supplied to said chamber and the creation of a space next exteriorly of and around said crust while the said body of metal is within the mold, causing a heat-absorbing medium to pass through the said space from the inner side of the flange on the casting to and transversely of said peripheral crust.

14. An improvement in the art of casting a metal wheel having a flange at one end of the tread of the wheel, consisting in pouring a mold having a circular chamber for receiving molten metal and effecting the for-

mation of a chilled crust on the body of hot metal supplied to the mold by chilling said body exteriorly and circumferentially of the body, and then causing a heat-absorbing medium to pass to and transversely of the tread-forming surface of the casting.

In testimony whereof, I sign the foregoing specification, in the presence of two witnesses.

THOMAS D. WEST.

Witnesses:
VICTOR C. LYNCH,
W. L. MCDONNELL.