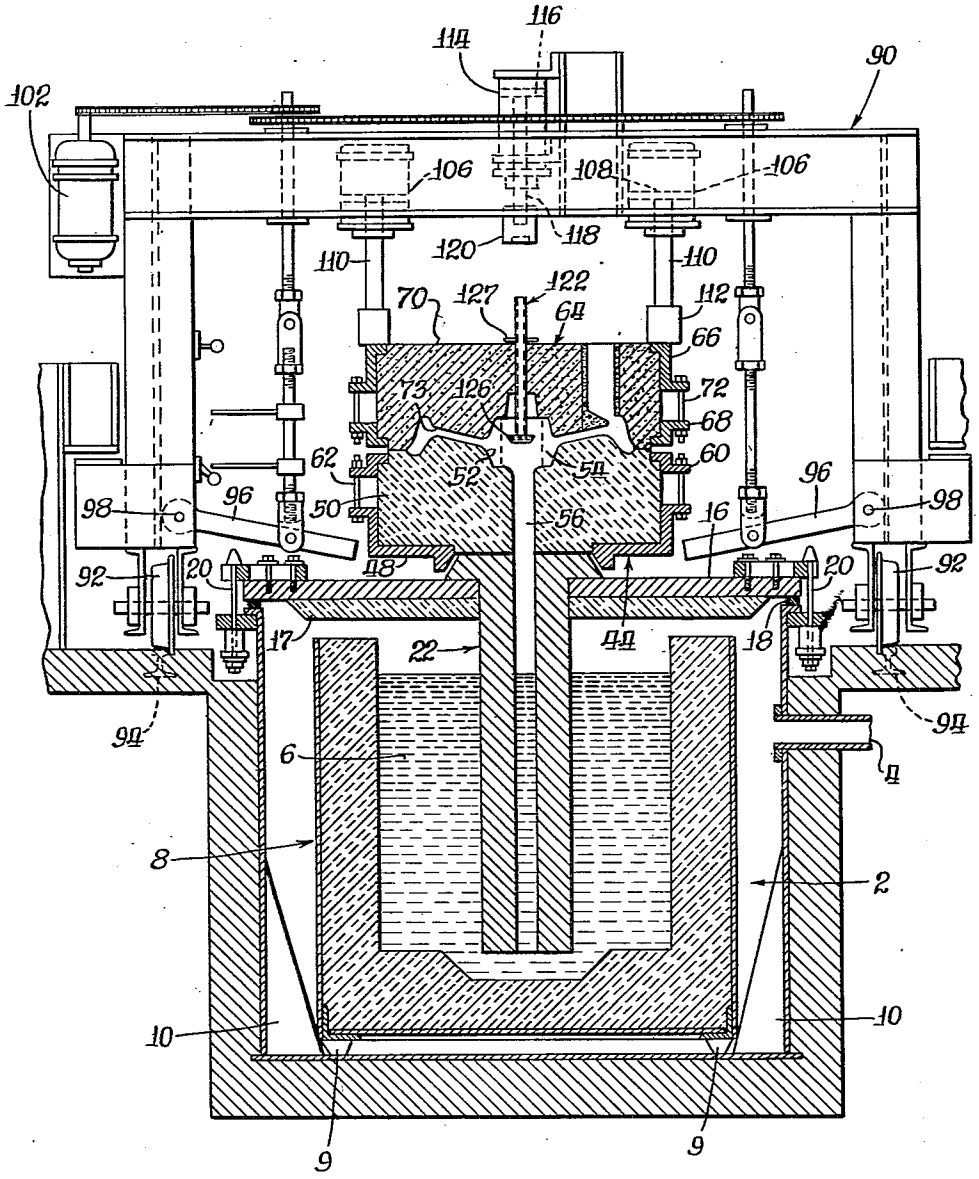
May 21, 1957 E. Q. SYLVESTER 2,792,606

METHOD FOR MAKING CASTINGS

Filed May 15, 1956 2 Sheets-Sheet 1

Fig. 1.



INVENTOR.
Edmund Q. Sylvester
BY
Orin O. B. Garner
Atty.

May 21, 1957 E. Q. SYLVESTER 2,792,606

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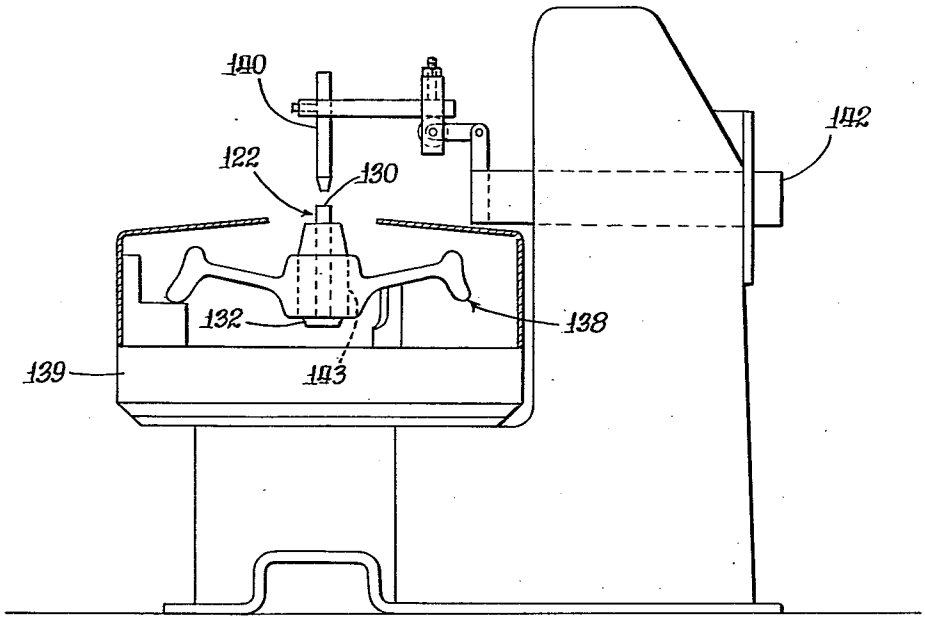


Fig. 3.

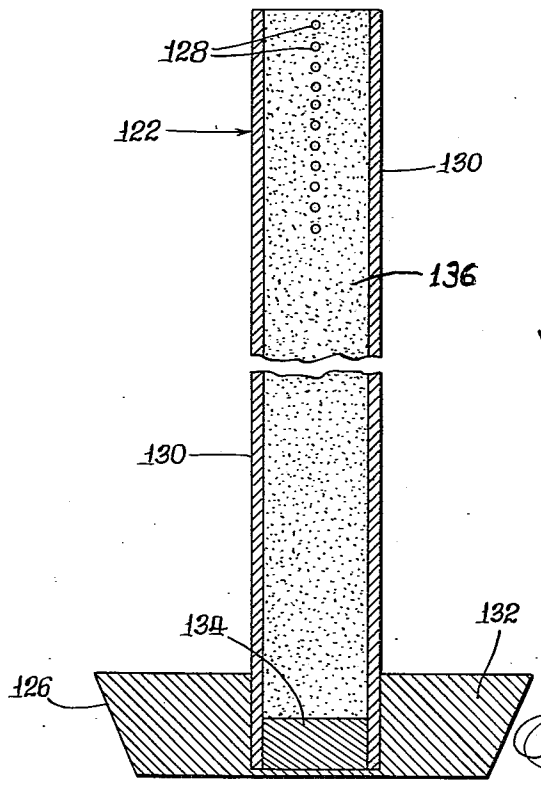


Fig. 2.

INVENTOR.
Edmund Q. Sylvester
BY
O. B. Garner
Atty.

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METHOD FOR MAKING CASTINGS

Edmund Q. Sylvester, Lake Forest, Ill., assignor to Griffin Wheel Company, Chicago, Ill., a corporation of Delaware

Application May 15, 1956, Serial No. 585,019

14 Claims. (Cl. 22—200)

This invention relates to the art of casting and more particularly to a novel method and means for producing stress-free annular castings of ferrous metals forced under pressure into a mold. The present application is a continuation-in-part of my copending application, Serial No. 294,235, filed June 18, 1952, now abandoned, for Method and Means for Making Stress-Free Castings.

A primary object of the invention is to eliminate stresses in a cooling annular casting such as a wheel without removing the casting from the mold.

A further object of the invention is to cool the casting gradually by suspending it between the cope and the drag sections of the mold, thereby eliminating resistance to radial contraction of the casting as it cools.

Another object of the invention is to provide a suspension for the casting, particularly adapted to facilitate the cutting of a hole therethrough as, for example, an axle hole through a wheel casting after the latter has cooled.

Still another object of the invention is to utilize a hollow stopper to close the mold after filling thereof, and to suspend the casting as above described, and to provide a starting opening through the casting through which opening the flame of a cutting torch may be directed to initiate cutting of a hole through the casting around the stopper.

The foregoing and other objects and advantages of the invention will become apparent from a consideration of the following specification and the accompanying drawings, wherein:

Figure 1 is an elevational view partly in central vertical section of a novel casting apparatus by which the invention may be practiced;

Figure 2 is an enlarged central vertical sectional view of the stopper illustrated in Figure 1, and

Figure 3 is a side elevational view illustrating a preferred form of apparatus for cutting a hole through the casting around the stopper.

Describing the invention in detail and referring first to Figure 1, a pressure tank generally designated 2 is connected to a pneumatic supply line 4 adapted to deliver pneumatic pressure fluid such as compressed air to act on molten metal 6 within a ladle generally designated 8. A novel system for providing such pneumatic pressure is described in detail in my above mentioned copending application.

The ladle is preferably provided with lugs or feet 9 seated on the bottom of the tank 2 and is centered therein by guide plates 10 which are preferably spaced at approximately 90° about the perimeter of the ladle 8. The pressure tank 2 is closed by a readily removable cover 16 having a layer of any suitable insulating material 17 on the underside thereof, said cover being releasably clamped against a sealing ring 18 by a plurality of clamps 20. The cover 16 and insulation 17 are provided with aligned openings, respectively, for the reception of a pouring tube generally indicated at 22 which is snugly fitted in said

openings and is seated against the upper side of the cover 16.

The drag section 44 of the mold comprises an annular pan 48 containing a block 50 of ceramic material such as graphite having a mold surface 52 machined in the upper face thereof and defining the bottom side of a mold cavity 54 which is illustrated in the form of a standard freight car wheel. The mold cavity is provided with a gate 56 adapted to mate with the tube 22 to accommodate pouring of the molten metal 6 into the mold cavity 54 as hereinafter described. The drag section of the mold also comprises a ring 60 in shouldered engagement with the graphite block 50 and clamped to the pan 48 as by bolt and nut assemblies 62.

The cope section 64 of the mold comprises top and bottom rings 66 and 68 in shouldered engagement with a graphite block 70 and clamped together by a plurality of bolt and nut assemblies 72, said block 70 having a machined surface 73 on the underside thereof defining the upper side of the mold cavity 54.

The novel casting apparatus also comprises a gantry crane or car generally designated 90 which is supported by wheels 92 on rails 94 for movement to and from a position over the pressure tank 2. The crane 90 comprises a pair of mold elevating levers 96 fulcrumed thereto as at 98 and actuated by a power cylinder device 102 mounted in the crane 90.

It will be noted that the levers 96 are adapted to support the drag section 44 of the mold until the gate 56 thereof is aligned with the pouring tube 22, whereupon the device 102 is actuated to lower the levers 96 thereby lowering the mold gate 56 into communication with the pouring tube 22 prior to pouring of a casting in the mold cavity 54. After the casting has been poured as hereinafter described, the levers 96 are actuated by the device 102 to lift the mold from engagement with the pouring tube 22, whereupon the gantry 90 may be moved to a position whereat the poured mold is at one side of the pouring tube 22 and a new mold is in alignment therewith preparatory to pouring of another casting.

The crane 90 also carries a pair of clamping cylinder devices 106, each comprising a piston 108 and a piston rod 110 carrying a clamp member 112 for engagement with the cope section 64 to clamp the mold sections together and to clamp the tube 22 tightly against the cover 16 during a pouring operation. The crane is also provided with a plunger actuating cylinder device 114 comprising a piston 116 and a piston rod 118 supporting an abutment 120 engageable with a plunger generally designated 122, sleeved within a complementary opening of the cope block 70, the lower end of the plunger being provided with a conical seat 126 adapted for engagement with a complementary seat at the upper end of the gate 56 to close the same, as hereinafter described, after the mold cavity 54 has been filled with molten metal 6 from the ladle 8.

The plunger 122 is releasably held in its upper or open position by a readily deformable wire or nail 127 sleeved through one of a series of vertically spaced openings 128 (Figure 2) in the plunger 122, said nail being engaged at opposite sides thereof with the upper end of the block 70 as seen in Figure 1 to releasably support the plunger 122 prior to actuation thereof by the device 114.

The plunger 122 is illustrated in detail in Figure 2 and comprises a tube 130 which may be formed of any suitable material such as iron or ceramic. The tube 130 is provided with the above mentioned openings 128 and is also provided with a conical seat portion 132 formed of any suitable material such as ceramic on the lower end thereof to define the above mentioned seat 126. The lower end of the tube 130 is also preferably provided with a tightly fitting plug 134 which may be formed of

any suitable material such as iron or ceramic and is fitted tightly in the lower end of the tube **130**. The tube **130** is preferably filled with sand **136** to prevent collapse of the tube; and the plug **134** is particularly adapted to prevent escape of sand from the lower end of the tube **130** in the event that the ceramic seat portion **132** should be cracked as the stopper **122** is actuated to closed position thereof by the device **114**.

In pouring a casting with the apparatus of Figure 1 in the condition illustrated therein, pneumatic pressure admitted to the tank **2** forces the molten metal **6** upwardly through the pouring tube **22** into the gate **56** until the mold cavity **54** is filled, whereupon the device **114** is automatically or manually actuated to urge the stopper **122** to closed position closing the mold cavity **54** from communication with the gate **56**. At this time, further increase of pneumatic pressure in the tank **2** is terminated; and, if desired, this pressure may be decreased slightly to lower the level of the molten steel **6**, as described in said co-pending application.

The levers **96** are then actuated to lift the mold from the pouring tube **22**, and the crane **90** is rolled to a position whereat the mold may be removed therefrom.

After sufficient time has elapsed for the molten metal to solidify within the mold cavity **54**, the casting formed by the solidified metal is suspended between the cope and drag sections **64** and **44** of the mold. This is accomplished by inserting another nail **127** in an opening **128** of the plunger **122** above the upper surface of the cope block **70** when the plunger is in closed position, and then elevating the cope **64** in any desired manner as, for example, by jacks until the cope is lifted from the casting and the casting is lifted by the plunger **122** from the drag block **50**. It will be noted in this connection that the plunger is thus afforded a lost motion connection with the cope **64**, whereby as the cope is elevated, the weight thereof is relieved from the casting until the cope abuts the nail, whereupon further elevation of the cope lifts the casting from the drag so that the casting as it cools may contract radially thereof without being subjected to stresses caused by the weight of the cope or by the weight of the casting itself. Furthermore, the residual heat of the cope and drag sections of the mold during this step of the process are effective to prevent excessively rapid cooling of the casting thereby preventing cracks and other defects therein as might be caused by rapid cooling.

After a predetermined period of cooling time, sufficient to substantially complete radial contraction of the casting due to such cooling, the casting may be completely removed from between the cope and drag sections of the mold as, for example, by moving the elevated cope **64** to a position above a conveyor and then lowering the cope until the casting rests on the conveyor, whereupon the nail may be removed from the opening **128** of the stopper and the cope may then be elevated until it is freed from the casting. If desired, the cope may be removed, and thereafter a carrier may be connected to the stopper to lift the casting from the drag and to convey the casting to a suitable conveyor which carries the casting by means of said stopper through a soaking pit to a heat treatment furnace, if heat treatment is desired.

Thereafter, the upper end of the stopper **122** may be cut off in any desired manner as, for example, by shears or by a torch, and the plug **134** may be knocked out of the tube **130** as, for example, by inserting a bar in the upper end of the tube and striking the bar with a hammer to knock the plug **134** from the lower end of the tube, permitting the sand **136** to drain therefrom. Also, if desired, the seat portion **132** may be knocked off the lower end of the tube.

The casting which is designated at **138**, in Figure 3, is then supported on a rotatable table **139**, and an oxy-acetylene torch or lance **140** is positioned in alignment with the tube **130** which thus forms a starting hole through the casting **138**, through which hole the flame of the lance

140 is directed to initiate cutting of an axle hole through the casting. After the flame of the torch **140** is directed through the tube **130**, the torch is preferably moved in any desired manner as, for example, by a slide **142** radially outwardly from the tube **130** which is concentric with the axis of the wheel casting **138**; and thereafter, the table **139** is rotated by any suitable motor means (not shown) so that the flame of the lance **140** cuts an axle hole through the casting along the dotted line indicated at **143**.

I claim:

1. A method of making an annular member comprising forcing molten metal under pressure into a gate in the bottom of a mold drag, then after the mold is filled urging a hollow stopper therein against the gate to close the same, then after the metal has solidified removing the casting from the mold and then cutting a hole in said casting by directing the flame of a torch through said hollow stopper and effecting relative movement between the torch and casting to cause said flame to traverse a path circumscribing the stopper, thereby cutting said hole therearound.

2. A method of making a cast steel wheel comprising forcing molten steel under pressure into a gate in the bottom of a mold drag, then after the mold is filled with said steel urging an annular seat of a sand filled hollow stopper in the mold against a complementary seat around the gate, then after the steel in said mold has solidified removing the casting from the mold, then removing the sand from said hollow stopper, and then directing the flame of a cutting torch through said hollow stopper, moving said flame radially outwardly from said stopper, and finally holding the flame stationary while rotating the casting so that the flame traverses a substantially circular path around the stopper to cut an axle hole through the casting.

3. A method of producing a wheel comprising forcing molten metal into a gate in the drag of a mold having a cavity corresponding to the shape of a wheel with the hub section of the cavity connected to the gate, then after the cavity is filled with said molten metal closing said gate by positioning against the inner end thereof one end of a hollow tube, then after the metal has solidified in the form of a wheel in said cavity, raising the wheel by said tube to remove the wheel from the drag, then cutting through the portion of said tube embedded in the hub of said wheel, and then cutting from said portion entirely around said portion to remove the latter and provide an axle hole in the hub of the wheel.

4. A method of making an annular member comprising forcing molten metal under pressure into a gate in the bottom of a mold drag, then after the mold is filled with said metal, urging a hollow stopper within the mold against the gate to close the same, then connecting an abutment to the stopper above the mold cope and after the metal has solidified removing the casting from the mold, and then cutting from the center of said hollow stopper radially outwardly therefrom and finally cutting entirely around the stopper to provide an opening in said member.

5. A method of making an annular member comprising forcing molten metal under pressure into a gate in the bottom of a mold drag, then after the mold is filled urging a sand filled hollow stopper therein against the upper end of the gate to close the same, then removing the casting formed by said metal from said mold, then removing the sand from said stopper, and then cutting a hole in said casting from the center of the stopper and entirely around the stopper.

6. A method of making an annular member comprising forcing molten metal under pressure into a gate in the bottom of a mold drag, then, after the mold is filled, positioning a hollow stopper therein against the upper end of the gate to close the same, then connecting an abutment to the stopper above the mold cope

and after the metal has soldified elevating the cope until the casting formed by said metal is suspended between the cope and drag until the casting has cooled sufficiently to substantially complete radial contraction thereof due to such cooling.

7. A method of making a casting steel wheel, comprising forcing molten steel under pressure into a gate in the bottom of a mold drag, then, after the mold is filled with molten steel, positioning an annular seat of a hollow stopper in the mold against a complementary seat at the upper end of the gate, then, after the steel in said mold has solidified, providing a lost motion connection between the mold cope and the stopper and elevating said cope until the casting is suspended by the stopper between the cope and drag, and then, after the casting has cooled sufficiently to substantially complete radial contraction thereof due to such cooling, removing the casting from between said cope and drag.

8. In a method of making a casting steel wheel, the steps of forcing molten steel under pressure into a gate in the bottom of a mold drag, then, after the mold is filled, positioning an annular seat of a stopper in the mold against a complementary seat around the gate at its upper end, then, after the steel in said mold has solidified, providing a lost motion connection between the mold cope and the stopper, and then elevating said cope until the casting is suspended by said stopper between the cope and drag.

9. In a method of producing a wheel, the steps of forcing molten metal into a gate in the drag of a mold having a cavity corresponding to the shape of a wheel with the hub section of the cavity connected to the gate, then, after the cavity is filled with said metal, closing said gate by positioning a stopper in the cavity against said gate, and then, after the metal has solidified in the form of a casting, raising the cope to relieve its weight from said casting and raising the casting by said stopper to relieve the weight of the casting against the drag until the casting has cooled between the cope and drag to a temperature value at which contraction of the casting has substantially terminated.

10. A method of forming a wheel comprising forcing molten metal into a gate of a mold drag, then, when the mold cavity is filled with said metal, positioning a stopper against the gate to close the latter while the metal in the mold solidifies, then removing the casting formed by said metal from said mold, and then piercing through an opening of the casting formed by the stopper, and then cutting from said opening in a path circumscribing said stopper to form an axle hole in the casting.

11. A method comprising forcing molten metal into a downwardly opening gate of a mold until said metal has filled said mold, then closing said gate by positioning a seat of a hollow member against said gate with said member extending through the mold and externally thereof, then, after said metal has solidified in said casting, removing said casting from said mold, then directing a cutting instrumentality through said member and from said member in a path around said member to remove the latter and provide a hole through said casting.

12. A method of producing a casting comprising pouring molten metal into a gate in a mold drag, then after the mold is filled, closing the gate with a stopper, and then after the metal is solidified lifting the casting from said drag by elevating the stopper.

13. A method of producing a casting comprising pouring molten metal into a bottom gate of a mold drag, then after the mold is filled with said metal pushing a stopper through the molten metal into abutment with the gate to close the latter, then after the metal is solidified lifting the casting from said drag by attaching a carrier to the stopper and elevating the carrier, and then moving the carrier to a conveyor for said casting.

14. A method of producing castings comprising connecting a gate in the bottom of a mold drag to a tube, then forcing molten metal through the tube until the mold is filled, then urging a stopper against the gate and terminating flow of molten metal through the tube to the gate, and then after the metal is solidified removing the casting from the drag by elevating the stopper and conveying the latter from the drag.

References Cited in the file of this patent

UNITED STATES PATENTS

461,962	Richards	Oct. 27, 1891
521,519	Adams	June 19, 1894
936,623	Griffith	Oct. 12, 1909
1,203,619	Hewitt	Nov. 7, 1916
1,242,243	Rose	Oct. 9, 1917
1,519,116	Clawso	Dec. 16, 1924
1,736,725	Sheaffer	Nov. 19, 1929
1,858,927	Gray et al.	May 17, 1932
1,917,497	Coberly	July 11, 1933
2,139,957	Inskeep	Dec. 13, 1938
2,451,505	Myskowski et al.	Oct. 19, 1948
2,480,899	Bond	Sept. 6, 1949
2,556,152	Cieslak	June 5, 1951