CASTING PROCESS FOR ROLLS

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Field of Search 164/98, 106, 95, 114, 288, 164/95, 96, 112, 99-103, 105, 113

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ABSTRACT
The invention consists of a method for making solid rolls, for example, metal working rolls, wherein a cylindrical shell comprising the roll working surface is first centrifugally cast in a horizontal cylindrical mold having removable end plates, and as soon as the shell has solidified, the end plates are removed, the mold containing the hot solidified cylindrical shell is mounted between two journal molds to form a complete roll mold, and metal of suitable composition is cast in the mold whereby there is formed a solid roll core which is metallurgically bonded to the said hollow shell and has integrally formed journal portions extending beyond the cylindrical shell.

5 Claims, 4 Drawing Figures
CASTING PROCESS FOR ROLLS

BACKGROUND OF THE INVENTION

1. Field of the Invention

In the manufacture of rolls it is necessary to obtain a working surface which is suitable for the intended service and an inner core including journals which is tough and machineable. In the manufacture of such a roll it is desirable to form the working surface of a first composition and the core of a second composition, to secure a good metallurgical bond between the two compositions, to obtain a dense working surface having uniform thickness and properties, and to utilize minimum quantities of metal in the process.

2. Prior Art

It is known that rolls having two distinct layers can be cast centrifugally. For example, in U.S. Pat. No. 2,008,196 the casting of rolls in a vertical mold is taught, however the size limitations and various technical problems connected with vertical casting make its use for casting rolls undesirable.

On the other hand, with horizontal centrifugal casting it is not possible to completely fill the cavity so it is necessary to raise the mold to a vertical position in order to completely fill the mold to give a solid core. In known processes, the journal portions of the roll are formed either by cutting away the hard surface layer from the ends of a cylindrical casting of uniform diameter or by means such as sand cores in the ends of the cylindrical mold to reduce the diameter of the end portions. In the first case, excess metal must first be cast and then machined away, whereas in the second case, a large massive mold structure must be used in the centrifugal operation.

In all of the known centrifugal processes, the mold placed on the spinner is long enough to provide a casting having a length at least as long as the roll to be cast including the working surface necks, i.e., journals and wobblers. The centrifugal process is desirable because it permits the casting of a uniformly thick working surface of high density, but insufficient as the core, including the journals, is concerned it is not essential that centrifugal casting be used. It is inefficient to use such large centrifugal molds and to load a spinner with a mold large enough to make a complete roll when advantage is gained only by centrifugally casting the working surface portion of the roll.

SUMMARY OF THE INVENTION

The present invention provides a method for casting rolls having a working surface of one composition and a solid core of a second composition. A cylindrical shell comprising the working surface of the roll is centrifugally cast in a horizontal mold having removable end plates, then as soon as the shell has solidified and while it is still hot, the end plates are removed, the centrifugal mold is mounted between two journal molds and the solid core portion of the mold is statically cast by filling the resulting mold cavity with molten metal.

DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates in cross section a centrifugal mold containing a cylindrical shell which is to form the working surface and journal extensions.

FIG. 2 illustrates in cross section a centrifugal mold containing a cylindrical shell which forms the working surface inside of which is metallurgically bonded a layer of a second composition.

FIG. 3 illustrates in cross section a bottom pour roll mold wherein the centrifugal mold of FIG. 1 has been stacked between bottom and top journal mold sections, the bottom section being provided with a pouring tube.

FIG. 4 illustrates in cross section a top pour roll mold wherein the centrifugal mold of FIG. 2 has been stacked between bottom and top journal mold sections, the top section being provided with a pouring basin having a bottom strainer.

DESCRIPTION OF PREFERRED EMBODIMENTS

In FIG. 1, spinner rollers support and rotate centrifugal mold 2 which has a bore 3 of suitable diameter and length to form the working surface of the mold, with machining allowances being provided. Each end of the mold is counterbored to provide enlargements 4 and 5 for receiving mold end rings 6 during the centrifugal casting operation and subsequently journal mold sections. The end rings are secured in place by any suitable known means, for example by means of pins driven into radial holes drilled in the counterbore portion of the mold. The centrifugal mold illustrated is provided with a circumferential band 7 provided with diametrically opposite recesses 8 and 9 into which trunnions may be inserted when the mold is to be picked up and transferred to the roll molding station (see trunnions 13 and 14 in FIG. 3).

Shell 10 is centrifugally cast in known manner of metal having the properties desired in the working surface of the roll to be made and of sufficient thickness to give the desired thickness in the finished roll with allowance being made for any remelting during the casting of the solid core. Preferably, a small flange 11 is formed at one end of the shell to assure that it will not slip from the mold when it is rotated to the vertical position with the flange 11 at the top end.

FIG. 2 is in all respects the same as FIG. 1 except that shell 10 has been provided with an inner layer 12 of a second composition, for example, the composition to be used in the roll core. This layer is cast at the proper time in roll mold 11 and under proper conditions to form a metallurgically bonded dual-metallic structure in accordance with known procedures. By centrifugally casting this second layer a cushion between the shell and inner core is provided, and intermixing and remelting of the working surface layer can be closely controlled and minimized. Also, it is sometimes desirable to apply a flux coating to the inside surface of the centrifugally cast shell to avoid oxidation and facilitate bonding to the core metal.

As soon as the shell 10 has cooled to the proper temperature, mold rotation is stopped, the end rings 5 are removed from the mold, trunnions 13 and 14 are placed in recesses 8 and 9, the mold is picked up and as illustrated in FIG. 3 set down on the bottom journal mold 15 which is designed to be received in counterbore 4. The bottom journal mold 15 is made of a metal flake 16 in which a sand mold 17 is provided to form a cavity 18 of the desired configuration for the as cast roll journal. If bottom pouring is to be used, pouring tube 19 is attached to the bottom journal mold. As soon as mold 2 is in place, the top journal mold 20, which consists of metal flake 21 and a sand lining 22 forming a cavity 13 to give the desired cast journal shape, is seated on the upright counterbore 5. The roll mold assembly is then complete and molten metal of proper composition is poured through pouring tube 19 to fill cavities 18 and 23 and the hollow interior of shell 10. In FIG. 4, the centrifugal mold of FIG. 2 is illustrated mounted in a mold assembly where top pouring is to be used. In this arrangement a pouring basin 24 is placed on mold section 20, and preferably a strainer 25 is provided to prevent slag from entering the mold.

The disclosed processes may be used to cast rolls of many different combinations of material. For example, a chill iron-gray iron rolling mill roll having a working surface 600 mm long, an outside diameter of 340 mm and two cylinder-conical necks having a length of 600 mm and diameter varying between 200 and 150 mm is presently prepared by casting against a chill or by a double pour method wherein a first composition is poured into a mold and then flushed out with a second composition after a shell of the first composition has solidified against the chill. With the present method a superior roll can be prepared by centrifugally casting a white iron shell having an as cast working surface 600 mm long, an outside diameter of 355 mm and an inside diameter of 270 mm composed of 3.3 percent Carbon, 0.4 percent Silicon, 0.6 percent...
Manganese, 4.5 percent Nickel, 1.5 percent Chromium and 0.4 percent Molybdenum, and casting within the shell a core including necks, composed of 3.0 percent Carbon, 1.5 percent Silicon, 0.5 percent Nickel and 0.5 percent Chromium. The outer shell will have uniform thickness and physical properties because the thickness is controlled by the amount of metal cast, and the composition can be selected to give the properties desired in the shell without regard to how the composition would serve in the core portion. Likewise, the core portion can be made of a composition which will assure the desired amount of toughness and machineability.

I claim:

1. A method for casting rolls having a working surface formed of a first metal composition and a solid core portion with journal extensions formed of a second metal composition comprising: mounting a generally cylindrical mold having a length at least equal to the length of the working surface of the roll to be cast and less than the total length of the roll to be cast, and having removable end plates at both ends thereof in a centrifugal casting machine, centrifugally casting an outer shell of said first metal composition in the cylindrical mold, the shell having suitable outside diameter, length and thickness to form the working surface of the roll, and the length thereof being substantially equal to the length of said mold removing the end plates from the mold when the shell has solidified and while it remains hot; removing the cylindrical mold containing the shell from the centrifugal casting machine; and mounting said centrifugal mold including the shell between two journal molds; and filling the cavity formed by said two journal molds and the interior of said shell with metal of said second metal composition to form a solid core with journal extensions metallurgically bonded to said shell.

2. Method according to claim 1 wherein a second layer of metal is centrifugally cast within the shell before the end plates are removed.

3. Method according to claim 1 wherein said cylindrical mold is mounted with its longitudinal axis vertically and the metal to form the solid core is cast by bottom pouring.

4. Method according to claim 1 wherein the cylindrical mold is mounted with its longitudinal axis vertically and the metal for the solid core is cast by top pouring.

5. Method according to claim 1 wherein a layer of flux is applied to the inside surface of the shell before the cylindrical mold is removed from the centrifugal casting machine.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,670,800
Dated June 20, 1972

Inventor(s) Jacques DeVos

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In claim 1

Line 8, delete the comma (,) and substitute therefor a semicolon (;)

Line 13, after "mold" and before "removing" insert a semicolon (;)

Signed and sealed this 31st day of October 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR. ROBERT GOTTSCALK
Attesting Officer Commissioner of Patents