Nov. 12, 1957 C. F. STROM 2,812,571

COMPOSITE ROLL STRUCTURE WITH HARD CASE

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Fig. 3.

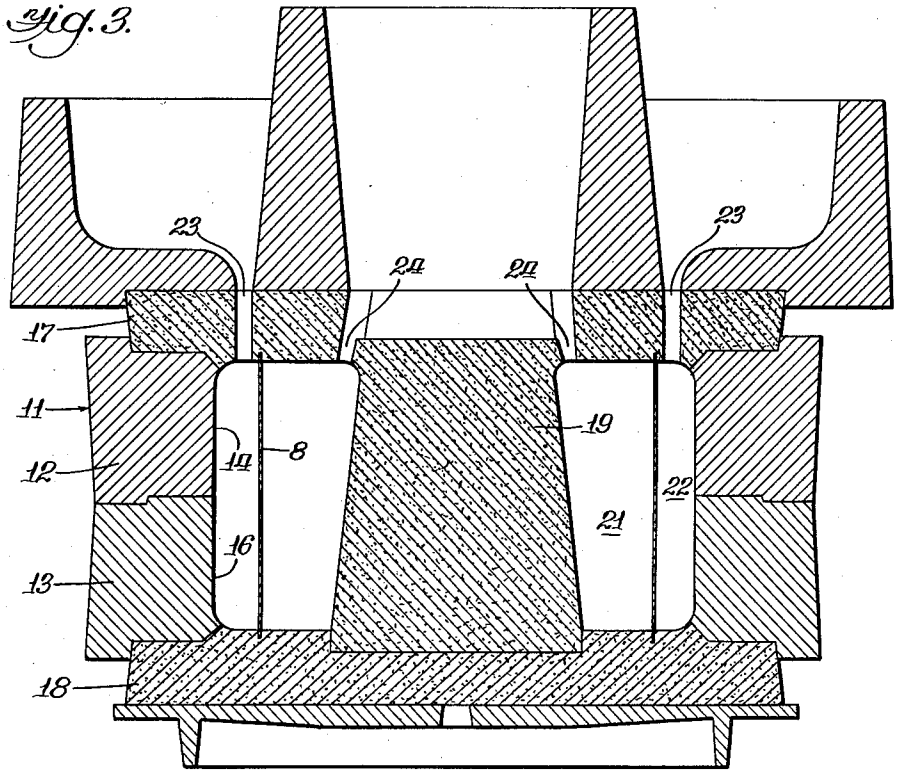


Fig. 1.

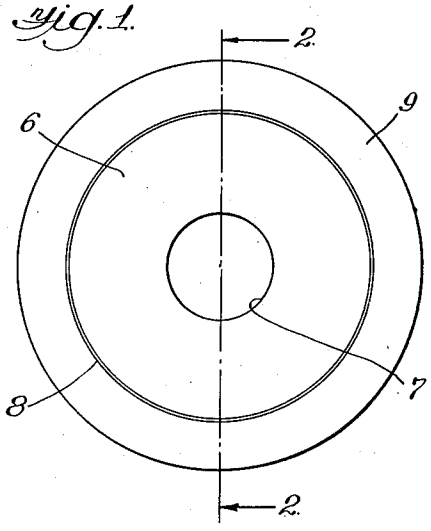
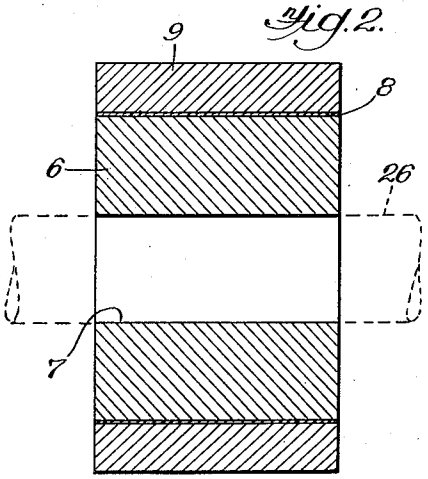


Fig. 2.



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COMPOSITE ROLL STRUCTURE WITH HARD CASE

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6 Claims. (Cl. 29—130)

This invention relates to rolls and more particularly to a roll or roller with a hard case having relatively great wear resistance and toughness.

Rolls weighing, for example, from 100 lbs. to 1100 lbs. have heretofore been in the form of a cylindrical iron casting having its outer peripheral surface chilled during molding to a depth of approximately 1½ inches to provide an outer surface or case which is relatively harder and more resistant to wear than the inner portion of the roll. These chilled rolls are commonly used in the processing of rubber, grain, linoleum, paper, metal, etc., in which resistance to wear or abrasion is a prime factor, such rolls having a surface hardness of about 400 Brinell.

It is also well known that a correctly alloyed nickel-chromium iron is adapted for use in forming a hard close-grained roll that is very resistant to abrasion or wear, the hardness being obtained by the use of chromium, and the nickel being added to increase toughness. As alloyed nickel-chromium iron having a Brinell hardness of from 550 to 650 is not machinable, it is an object of the present invention to provide a composite roll structure comprising a machinable cylindrical gray iron core within an alloyed nickel-chromium iron case, whereby the core may be bored to snugly receive a roll shaft.

A further object of the invention resides in the provision of a composite roll structure which is relatively inexpensive to manufacture and durable in use.

The invention embodies other novel features which are hereinafter set forth in the specification and claims, and illustrated in the accompanying drawing, wherein:

Figure 1 is a side elevational view illustrating a composite roll structure embodying features of the invention.

Figure 2 is a sectional view taken along the line 2—2 of Figure 1.

Figure 3 is a vertical sectional view illustrating a flask assembly adapted for use in the casting of the composite roll structure.

Referring now to the drawing for a better understanding of the invention, the composite roll structure is shown as comprising a cylindrical gray iron core 6 having an axial bore 7, a sheet iron cylinder 8 fused to the outer surface of the core, and a relatively hard case 9 fused to the outer surface of the sheet iron cylinder.

To provide a composite roll structure having a hard, tough case which is resistant to abrasion, wear and breakage, the roll may comprise a gray iron core 6 enclosed within a chilled, alloyed nickel-chromium iron case 9, the case having substantially the elements and physical properties set forth in the following table which also lists the elements and physical properties of chilled plain iron heretofore employed in the manufacture of rolls:

Typical results of tests of plain and nickel-chromium chilled irons [1]

	Plain Iron		Ni-Hard	
	High Carbon	Low Carbon	High Carbon	Low Carbon
Brinell hardness number of chilled surface	500	400	650 to 700	575
Tensile strength in chilled section, lb. per sq. in.	35,000 to 40,000	48,000 to 53,000	55,000 to 60,000	70,000 to 80,000
Tensile strength in gray core, lb. per sq. in.	16,000 to 25,000	22,000 to 39,000	30,000 to 35,000	40,000 to 50,000
Total carbon, percent	3.50	2.75	3.50	2.75
Silicon, percent	0.75	0.75	0.75	0.75
Nickel, percent			4.50	4.50
Chromium, percent			1.50	1.50

[1] Nickel Cast Iron Data, section 3, No. 2, International Nickel Co., New York.

To provide a composite roll structure in which the gray iron core 6 and the chilled alloyed nickel-chromium iron case 9 are not subject to separation and breakage during use of the roll in material processing apparatus, the invention contemplates the provision of a novel method of casting the roll in a flask or mold assembly of the type illustrated in Figure 3 in the drawings.

The flask or mold assembly is shown as comprising a metallic side wall 11 having an upper section 12 supported upon a lower section 13. The sections 12 and 13 are formed with coaxial bores of equal diameter and present inner surfaces 14 and 16, respectively, which, when the sections are placed together, merge to define a smooth preferably cylindrical inner surface for the mold cavity. When desired, for purposes of draft, the surfaces 14 and 16 may be inclined slightly in accordance with conventional foundry practices. The axial opening defined by the side wall sections 12 and 13 is closed at its ends by top and bottom walls 17 and 18, respectively, formed of packed sand. A sand core 19 is mounted on the bottom wall 18, coaxial with the inner surfaces 14 and 16, and extends upwardly therefrom into abutting engagement with the top wall 17.

The sheet iron cylinder 8 is mounted in fixed position within the mold by embedment of its ends in the top and bottom walls 17 and 18, and is disposed coaxial with the core 19. The mold assembly thus described provides an inner annular chamber 21 and an outer annular chamber 22. The top wall 17 is provided with two sprues 23—23 through which molten alloyed nickel-chromium iron is poured into the outer annular chamber 22. Sprues 24 are also provided in the top wall 17 adjacent the upper end of the core 19 through which molten gray iron is poured into the inner annular chamber 21.

By simultaneous pouring of the two metals into the mold, the metals become fused to the sheet iron cylinder and form a composite roll structure in which the core 6 and case 9 are not subject to separation or breakage during use of the roll in processing material. The cylinder 8 may, for example, be formed of sheet iron having a thickness of 0.030 inch and is preferably copper coated. After the composite roll is removed from the mold, the gray iron core 6 is bored at 7 to receive a shaft 26.

In the manufacture of composite rolls by the method

herein illustrated and described, it will be noted that the simultaneous pouring of the two metals into the mold acts to partially melt the copper-coated sheet iron cylinder **8** to fuse the metals together, and that the metallic wall sections **12** and **13** act to chill the alloyed nickel-chromium iron case **9** during the molding operation to provide the roll with a hard, tough surface which is more resistant to abrasion and wear than the surfaces of conventional rolls formed of chilled plain iron. The case may be approximately 2 inches thick. After the composite casting has cooled the portions of the cylinder **8** protruding therefrom may be removed in any desired manner so that all three concentric portions of the casting are co-extensive as illustrated in Figure 2.

While the invention has been shown in but one form, it is obvious to those skilled in the art that it is not so limited but is susceptible of various changes and modifications without departing from the spirit and scope of the claimed invention.

I claim:

1. A composite roll structure comprising a cylindrical gray iron core, a hard tubular alloyed nickel-chromium iron case, encircling said core, and a sheet iron cylinder fused on its inner surface to said core and fused on its outer surface to said case, said core, said case, and said cylinder being coextensive.

2. A composite roll structure comprising a cylindrical gray iron core having an axial bore, a thin-wall metallic cylinder fused to said core, and a cylindrical relatively thick hard case fused to said cylinder, said core, said cylinder, and said case being coextensive.

3. A composite roll structure comprising a cylindrical gray iron core having an axial bore, a thin-wall metallic cylinder encircling and fused to said core, and a cylindrical relatively hard case encircling and fused to said cylinder, said case comprising chilled alloyed nickel-chromium iron, said core said cylinder, and said case being coextensive.

4. A composite roll structure comprising a cylindrical gray iron core having an axial bore, a thin-wall metallic cylinder encircling and fused to said core, and a cylindrical relatively hard case encircling and fused to said cylinder, said core, said cylinder, and said case being coextensive, said case comprising chilled alloyed nickel-chromium iron having a Brinell hardness of from 550 to 650 and a wall thickness of approximately 2 inches, said case having annular outer surfaces of increasing diameter merging to define a circular ridge.

5. A composite roll structure comprising a cylindrical gray iron core having an axial bore, a thin-wall metallic cylinder encircling and fused to said core, and a cylindrical relatively hard case encircling and fused to said cylinder, said case comprising chilled alloyed nickel-chromium iron having a Brinell hardness of from 550 to 650 and a wall thickness of approximately 2 inches, said cylinder having a wall thickness of approximately 0.030 inch, said core, said cylinder, and said case being coextensive.

6. A composite roll structure comprising a cylindrical gray iron core having an axial bore, a thin-wall metallic cylinder encircling and fused to said core, and a cylindrical relatively hard case encircling and fused to said cylinder, said case comprising chilled alloyed nickel-chromium iron having a Brinell hardness of from 550 to 650 and a wall thickness of approximately 2 inches, said cylinder having a wall thickness of approximately 0.030 inch, said case containing from 2.75 to 3.50% of carbon, 0.75% silicon, 4.50% nickel and 1.50% chromium, said core, said cylinder, and said case being coextensive.

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