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CENTRIFUGAL CAST IRON PIPE

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5 Claims. (Cl. 29—182)

This invention relates to improvements in centrifugal cast iron pipes and more particularly to a compound cast iron pipe consisting of two layers and requiring no annealing so that a great labor and fuel cost can be saved, and has for its object to provide in one operation, cast iron pipes without a chilled skin which has been the fatal defect, from the economical standpoint, of ordinary centrifugal cast iron pipes made of a single layer.

There are various machines and methods of manufacturing cast iron pipes by centrifugal casting machines. In such known machines or methods the mold revolving at high speed is made of a strong iron cylinder, cooled externally by a water jacket, and hence the outer surface of the cast iron pipe cast in the mold is chilled into white cast iron of great hardness so that it can never be machined or worked. The pipes should be annealed or heated to a high temperature to soften or graphitize the outer skin consisting of white cast iron. In annealing such pipes, if the pipe is supported horizontally in the annealing furnace it would be bent and if the pipe is hung in a vertical position it might be broken due to its own weight which makes it technically necessary to increase the thickness of the pipe. Accordingly at the present state, especially in countries where labor cost is low the ordinary centrifugal cast iron pipes could not be manufactured economically.

In order to overcome all such defects and introduce several advantages, I now propose an invention by which a compound cast iron pipe can be manufactured by means of a suitable centrifugal casting machine without chilling its outer surface which comes into contact with the mold by using cast iron of a special high silicon content for the outer layer, while the inner layer consists of ordinary cast iron, or of a high grade pearlitic cast iron.

In order to attain the objects of the present invention, the iron constituting the outer layer of the pipe contains 3.0 to 4.5% of carbon and 6 to 2.5% of silicon, the total sum of both elements amounting as high as 6.5 to 8%, while the iron constituting the inside layer may be of an ordinary cast iron or of high grade pearlitic cast iron containing 2.5 to 3.5% of carbon, 1.0 to 2.5% of silicon, 0.5 to 2.0% manganese and 0.3 to 1.5% phosphorus.

In carrying the present invention into effect an example is taken for the purpose of illustration. An iron mold having an inner diameter of 10 cm. and an outer diameter of 14 cm. and about 4 meters long is rotated at about 800 R. P. M., a steel trough with refractory lining is inserted through the mold and the molten iron of the above mentioned high silicon content to an amount of about 24 kilograms is poured into the trough at a temperature of about 1500° C. The trough is now turned at a certain angle so that the greater part of the molten metal may be poured into the mold. When the main part of the high silicon iron is poured, about 32 kgs. of molten metal of ordinary cast iron or of high grade cast iron which constitutes the inner layer is supplied at a temperature of about 1400° C. into the trough held at the tilted position and poured into the mold without interrupting the flow of the high silicon iron and the last metal remaining in the trough is drained off by turning over the trough completely.

The cast-iron pipe thus obtained presents no chilled skin on its outer surface which comes into direct contact with the metallic mold. In the above example the thickness of the high silicon iron making the outer layer is about 4 mm. and that of the inner layer is about 6 mm., though it is difficult to define the thickness of both layers separately since they are fused together at their boundary into a homogeneous iron of an intermediate composition. The relative thickness of both layers can of course be varied according to the manufacturing condition, and the above numerical example is taken only for the purpose of illustration. In practice the thickness of the inner and outer layers, the casting temperature of the molten iron, the thickness of the mold, its cooling speed and other casting conditions should be properly adjusted corresponding to the size of a pipe.

The high silicon iron having the compositions mentioned above was found in my investigations to have a peculiar property in that it presents ferrite-graphite-structure without combined carbon when it is cast in a chill mold, while it presents pearlite-graphite-structure with varying amount of combined carbon when it is cast into a dry sand mold, and the compound iron pipes made by the present invention require no annealing, which is a great merit when it is compared with the ordinary centrifugal cast iron pipes with chilled skin which afterward require annealing. Besides this merit I can now use a high grade cast iron or a semi-steel pearlitic cast iron which has great strength for the inside layer, because there is no fear of producing a chilled layer of too great thickness.

By combining the high silicon non-chilling iron

outside with the strong pearlitic cast iron inside, the compound iron pipe has a good strength and a soft skin which can be easily machined. Thus I can save both fuel and labor cost necessary for the annealing of ordinary centrifugal cast iron pipes. The cast iron pipes made according to the present invention can be profitably used for the pipe lines used for aqueducts, gas supply mains and for the supporting poles for trolley wires etc. The invention may also be economically applied to the casting of a cylindrical body such as a bomb shell and projectiles made by the centrifugal process.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A cast iron pipe having two different mutually welded layers and made directly into a finished product free from any chilled effects, wholly by a centrifugal process in a single trough so as to avoid annealing, in which pipe the outer layer consists of a cast iron alloy containing 3.0 to 4.5% of carbon and 6 to 2.8% of silicon, the total sum of the carbon and silicon being 6.5 to 8.5%, which will prevent a chilled effect in said outer layer, and its inner layer consists of an ordinary grey cast iron.

2. A centrifugally cast and unchilled cast iron pipe directly produced in a single trough as a finished unchilled product, comprising in combination, two mutually welded different layers of cast iron alloys mutually welded together, of which the outer layer contains 3.0 to 4.5% of carbon and 6 to 2.5% of silicon, the total sum of carbon and silicon being limited to 6.5 to 8.5%, and the inner layer consists of a high grade cast iron containing 2.5 to 3.5% of carbon, 1.0 to 2.5% of silicon, 0.5 to 2.5% of manganese and 0.3 to 1.5% of phosphorus.

3. A centrifugally cast iron pipe directly produced as a finished unchilled product in a single trough, comprising in combination, an outer workable layer of a cast iron carbon-silicon alloy which without annealing is free from any chilled effect directly when cast, and an inner layer of gray cast iron which is thicker than the outer layer.

4. A centrifugally cast iron pipe directly produced as a finished unchilled product in a single trough, comprising in combination, an outer workable layer of a cast iron carbon-silicon alloy which without annealing is free from any chilled effect directly when cast and contains from 3% to 4.5% of carbon and from 6 to 2.8% of silicon, the total sum of carbon and silicon ranging from 6.5% to 8.5% of the alloy, and an inner gray cast iron layer of high quality which is thicker than said outer layer and provides the necessary strength for said pipe.

5. A centrifugally cast iron pipe directly produced as a finished unchilled product in a single trough comprising in combination, an outer workable layer of a cast iron carbon-silicon alloy which without annealing is free from any chilled effect directly when cast and contains from 3% to 4.5% of carbon and from 6% to 2.5% of silicon, the total sum of carbon and silicon ranging from 6.5% to 8.5% of the alloy, and an inner layer of high quality cast iron which is thicker than said outer layer and contains from 2.5% to 3.5% of carbon, from 1% to 2.5% of silicon, from 0.5% to 2.5% of manganese and from 0.3% to 1.5% of phosphorus.

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