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H. BLUMBERG ET AL

PRODUCTION OF PIPE COUPLINGS BY CENTRIFUGAL CASTING

Filed May 3, 1924

Fig. 1.

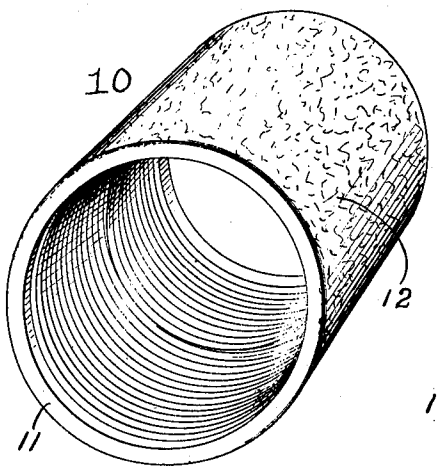


Fig. 2.

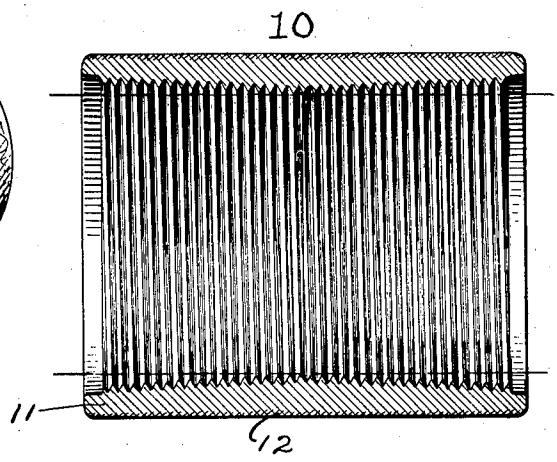


Fig. 3.

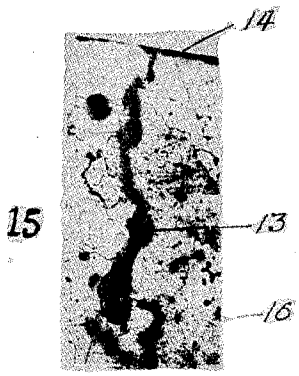
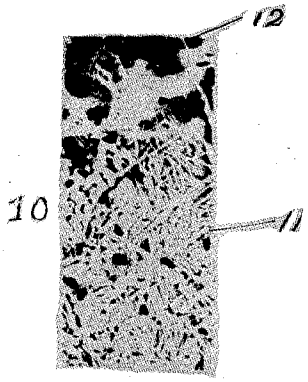


Fig. 4.



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UNITED STATES PATENT OFFICE.

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PRODUCTION OF PIPE COUPLINGS BY CENTRIFUGAL CASTING.

Application filed May 3, 1924. Serial No. 710,728.

Our invention relates to the production of pipe couplings designed particularly for uniting the ends of lengths of pipe of large diameter, such as are employed in deep wells. The invention resides in the manufacture of pipe couplings by the practice of an improved method of centrifugal casting, whereby such couplings may be produced as integral structures, wholly free from blemishes or defects, usually inherent to centrifugally cast tubular articles as produced heretofore in accordance with known methods.

Centrifugal casting of tubular articles has been practiced for many years, but not to our knowledge has such practice been applied to the production of pipe couplings of large diameter. In our experimentations conducted with a view to the production of centrifugally cast steel pipe couplings of this type, we have encountered many difficulties in perfecting the article. In the casting operation, it is desirable to use metallic molds in the form of hollow cylinders, which are rotated at high speed, and into which a measured quantity of molten steel is poured while the mold is being rotated.

The molten metal readily adapts itself to the circular interior of the mold in the form of a tubular coating or deposit of uniform thickness and density, and in the casting thus produced, the lighter resident impurities are expressed to the inner surface of the casting by the superior pressure exerted by centrifugal action upon the heavier metal in its fluid state. The lateral flow of the metal is restricted by the end plates or dams with which the mold is provided, and thus the length of the pipe coupling is determined.

But we have found it to be a characteristic of such centrifugally cast steel pipe couplings, that there exist upon their outer surface numerous cracks in the skin formation, which cracks are regarded as defects and sources of weakness. These defects we have discovered, after careful study of the attendant conditions, are due to the fact that in the first flow of the molten metal into the mold, the thin layer first introduced is immediately and unduly chilled by the sudden contact with the cooler surface of the mold, and that it freezes or solidifies much more quickly than does the remainder of the liquid metal, which latter backs up the first thin layer to complete the mass or body of the casting, and which is not subjected to sudden contact with the mold surface.

The purpose of the present invention is to surround the casting operations with new conditions, so that the defects and sources of weakness before referred to will be eliminated, and this very desirable result we have achieved in a very simple manner, the practice of which has enabled us to produce greatly improved centrifugally cast steel pipe couplings which are wholly free from blemish, and as near perfect as it is possible to make them.

We attain the results so highly desired by covering the interior surface of the mold, prior to each casting operation, with a substance or material possessing properties which will react with and be absorbed by the first thin layer of molten metal at the time the latter is introduced into the mold, and which action will have the effect of lowering the melting point of the surface of such first layer very quickly, so that the chilling effect of the sudden contact with the mold of the molten metal with its extremely high temperature, at the commencement of the casting operation, is obviated, and a slower cooling is effected.

The result of this practice is the production of a centrifugally cast steel pipe coupling having an unbroken exterior surface or skin coating over the whole thereof, and which latter is constituted differently from that of the main body of the pipe coupling, due to the absorption of the alloying material introduced as a retardant to the transition of the metal of the surface from a fluid to a solid state, so that both the exterior surface and the body of the pipe coupling are enabled to freeze at a comparatively uniform rate. We thus avoid the formation of the surface cracks which are inevitable results in the practice of the usual methods of centrifugal casting, in which the initial freezing is rapid. Such surface cracks would be immaterial in ordinary casting processes, but in the case of devices of the class comprehending the present invention it is important that all sources of possible structural weakness be eliminated from the articles, as is demanded by the trade.

Having thus outlined in a general way, the purpose and nature of the improvement which we have perfected in centrifugally

casting steel pipe couplings, we will now describe some of the methods by which our invention may be reduced to practice, and will point out the novelty of the invention in the claims appended to this specification.

In the accompanying drawing:

Figure 1 shows in perspective a centrifugally cast steel pipe coupling produced in accordance with our invention.

Fig. 2 is a sectional view of the coupling through the longitudinal center thereof.

Fig. 3 is an enlarged photo-micrographic view transversely of a section of a certrifugally cast steel pipe coupling produced in accordance with the common practice, and showing how the surface is cracked in the nonuniform cooling of the metal from which the coupling is formed.

Fig. 4 is a similar view of a section of a centrifugally cast steel pipe coupling produced in accordance with our invention, and showing the perfect surface formation produced by the absorption by the molten metal of the retardant which is introduced into the mold to prevent the formation of the surface cracks resulting from the common practice, as shown in Fig. 3.

In carrying out our invention, we spray or otherwise treat the interior surface of the circular mold which is used in casting the pipe coupling, with a coating of material or a substance which will act as an insulator for the molten steel upon the contact of the first stream or thin layer thereof with the surface of the mold, and so retard the immediate and rapid transfer of heat from the molten metal upon such contact. During the application of such coating, the mold is in rotation, so that the coating may be evenly and uniformly applied to the surface thereof, and this treatment is given the mold prior to each casting operation. The purpose of such treatment is to place within the mold a material or substance which will check radiation of heat and react with and be absorbed in the first flow of the molten steel, so that the melting point of the latter is lowered to a degree at which the transfer of the heat will be retarded and the metal will be caused to freeze at a slower rate.

We have found graphite to be a suitable material for the purposes of our invention, and it may be conveniently applied in connection with a carrying medium or liquid, such as gum arabic, which will permit its ready application to the mold in the manner before described. The carburization which takes place in the absorption of the graphite by the molten steel upon the first contact, acts directly to lower the melting point of that portion of the metal which forms the exterior surface of the pipe coupling. The retarded freezing action thus brought about enables the metal at the surface of the pipe coupling to set more slowly with relation to that of the adjacent mass, by virtue of which the stresses which cause the cracks are reduced to a point where their effect is negligible, and the surface cracks in the skin incident to the older practices of casting are entirely eliminated. A perfect pipe coupling free from blemishes or defects is thus produced. The result of the reaction and absorption described, is the formation upon the pipe coupling of an outer surface possessing characteristics which differ from those constituting the body of the pipe coupling.

But any other elements or compounds having properties which will alloy with the steel and be effective in producing the desired results may be used in lieu of that of which carbon is the principal constituent. For instance, we have also found that manganese in the form of ferro-manganese, together with aluminum, is entirely satisfactory in the production of such results, and even superior, inasmuch as the exterior surface of the pipe coupling is more attractive, it presenting a finely pebbled appearance under this last mentioned treatment. The alloying of the metals at the outer surface of the pipe coupling is immediate upon the deposit in the mold of the first flow and spread of the molten metal, and does not affect or penetrate to any great extent the body of the metal from which the pipe coupling is formed, for the reason that the alloying action is effected upon the pouring of the first layer or portion of the molten metal, and it does not enter into the construction of that which is later poured in the continuous pouring operation in which the casting as an integral unit is completed. Any resident impurities in the molten metal will be expressed to the inner surface of the casting by reason of the superior force acting centrifugally upon the heavier particles of the molten steel in the casting operation, and a pipe coupling of uniform density in any cross-section is produced.

In the drawing which accompanies this specification, we have illustrated in Figs. 1 and 2, a centrifugally cast pipe coupling 10 produced in accordance with our invention, the body 11 of the said coupling being provided with an exterior surface 12, differently constituted from that of the structure of the body thereof.

Fig. 3, as before stated, is a photo-micrographic enlargement of a vertical section transversely of a pipe coupling 15, produced in accordance with the known method of centrifugal casting, and showing by the dark, irregular line 13, the cleavage of the exterior surface 14, constituting one of the numerous cracks or breaks which are unavoidable incidents of such former method of casting, and which cracks are produced by the too rapid transfer of heat and sudden

freezing of the first layer of molten metal upon its introduction into the mold. Particularly, it is this defect which we have overcome by our present invention. The numeral 16 indicates the body of the coupling.

Fig. 4, in a view similar to Fig. 3, but showing a section of a pipe coupling produced in accordance with our invention. In this view, it will be seen that the exterior surface 12 of the pipe coupling is unbroken and free from the defect indicated at 13 in connection with Fig. 3, and that the structure of the pipe coupling at the exterior surface is differently constituted from that of the body 11, such difference being due to the alloying action at the exterior surface which takes place in the casting operation.

The advance in the methods of manufacturing pipe couplings which we have attained, has enabled us to produce as an integral unit, an entirely perfect pipe coupling, wholly free from blemish or defect. The pipe coupling thus produced, needs only to be subjected to the operations of reaming to size and threading in order to render it ready for use. As will be understood, the length of the mold will determine that of the pipe coupling, and the quantity of molten steel introduced into the mold the thickness thereof, these factors being ascertained from the diameter of the pipes to be coupled. The molds with relation to their inside diameters will be selected as appropriate thereto.

We have found it advantageous in the preparation of the mold for the casting operation, to first apply a protective coating, as kaolin, to the surface of the mold, whereby the life of the latter is prolonged. Such coating also contributes to conservation of the heat in the metal first poured, and aids in the carburization of the outside formation of the coupling. In actual practice, we have found that the metal of the body of the pipe coupling solidifies more rapidly than does that of the exterior surface thereof, and that when the interior of the pipe coupling has frozen sufficiently to permit the coupling to be withdrawn from the mold, the exterior surface may still be in a semi-fluid state, due to the creation of a lower melting point in the metal constituting such exterior surface.

Having thus described our invention, what we claim and desire to secure by Letters Patent of the United States, is:

1. The method of producing centrifugally cast steel pipe couplings, which consists in coating the interior surfaces of a metal mold with a substance which will retard the freezing of the molten metal first introduced into the mold and form an alloy with such metal, rotating the mold, and introducing the molten metal thereinto, whereby there is created in the pipe coupling an exterior surface having a structure which differs from that of the body of the pipe coupling and is free from surface cracks.

2. The method of producing centrifugally cast steel pipe couplings, which comprises the steps of coating the interior surfaces of a metal mold with an insulating substance to retard the transfer of heat from the molten metal of which the casting is formed and which will alloy with such molten metal, rotating the mold, pouring molten metal into the mold to absorb the said substance or material and reduce the melting point of the molten metal first poured so as to retard the freezing thereof and form an alloyed outer surface for the pipe coupling, and continuing the pouring until the casting is completed, whereby there is created in the pipe coupling an exterior surface having a structure which differs from that of the body of the pipe coupling and is free from cracks.

3. The method of producing centrifugally cast steel pipe couplings, which consists in rotating a metal mold, and comprises the additional steps of spraying the interior surfaces thereof with a substance having the properties of reducing the melting point of the molten metal first introduced into the mold and alloying therewith, and continuing the pouring until the casting is completed, whereby there is created in the integrally cast pipe coupling an exterior surface having a structure which differs from that of the body of the coupling and is free from cracks, such additional steps being performed while the mold is in rotation.

4. The method of producing centrifugally cast steel pipe couplings, which consists in covering the inner surface of a metal mold with a protective coating, and placing upon the latter a substance which will alloy with the molten metal poured into the mold to form in the pipe coupling an exterior surface differing structurally from that constituting the body of the coupling, and pouring the metal in a continuous operation while the mold is in rotation to complete the casting.

5. The method of producing centrifugally cast steel pipe couplings, which consists in covering the inner surface of a metal mold with a substance which will alloy with the molten metal poured into the mold to form in the pipe coupling an exterior surface differing structurally from that constituting the body thereof, and pouring the metal in a continuous operation while the mold is in rotation to complete the casting.

In testimony whereof, we have signed our names at Milwaukee, this 30th day of April, 1924.

HARRY BLUMBERG.
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