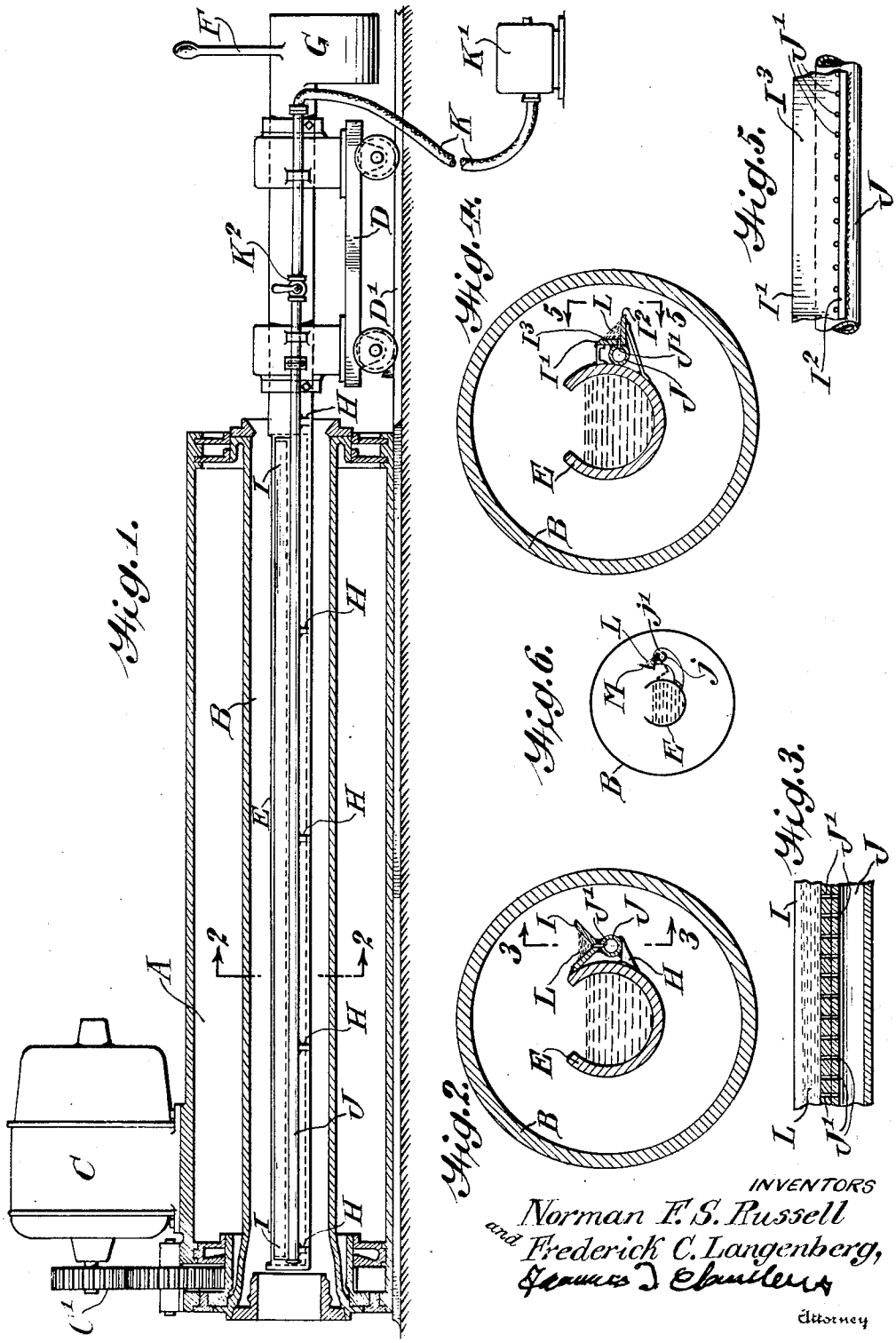
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METHOD OF CASTING CENTRIFUGAL PIPES

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METHOD OF CASTING CENTRIFUGAL PIPES

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4 Claims. (Cl. 22—200)

Our invention relates to the casting of metal pipes, particularly those cast from cast iron and has for its object to provide a method of preparing and using an externally cooled metallic centrifugal mold which will be effective to effect throughout the cylindrical portion of the mold a uniform retardation in the transfer of heat from the molten metal coming in contact with the mold surface to and through the mold and produce a pipe of improved quality.

In our application filed October 19, 1932, Serial Number 638,480, we have disclosed our invention which consists, broadly speaking, in applying to the inner surface of the cylindrical portion of the mold a coating of finely divided dry coating material by progressively directing against successive contiguous portions of the mold a jet of a carrier gas charged with finely divided particles of dry coating material and pouring the molten metal in contact with the so coated portions of the mold and we have particularly described the method in which the molten metal is poured into a rotating mold by a relatively retracting runner delivering the metal to the mold in the form of a helix and the coating is applied to the rotating mold shortly in advance of the contact of the metal with the coated surface by means of a relatively retracting jet of carrier gas depositing the finely divided dry coating material upon the cylindrical surface of the rotating mold shortly in advance of the deposit of molten metal upon the coated surface, this method having the advantage of insuring that the molten metal shall come in contact with the coated surface very shortly after the coating is formed and before occluded films of the carrier gas, which forms a portion of the coating as originally deposited, have time to escape to a degree detrimental to the efficiency of the coating and also the advantage of diminishing the possible occurrence of such fractures in the coating as would result in the occurrence of uncoated or defectively coated areas of the mold surface. We have also pointed out in our said prior application that it is highly desirable that the thickness of the coating should, for the best results, particularly in the casting of cast iron pipes, be as thin as is found effective to produce the desired retardation in heat transfer from the molten metal and that we have found in using ferro-silicon as a coating material that a coating made up of ferro-silicon particles which, if evenly and compactly distributed over the coated surface of the mold, would form a coating of .0003" in thickness, is highly satisfactory as to the results produced and that it is not ordinarily necessary or desirable with any coating material to build up a coating in which the finely divided dry coating material is used in greater quantity than that which, if uniformly and compactly distributed over the coated surface, would form a coating materially in excess of .001" in thickness. We have also in our said prior application pointed out that the energy of the jet of carrier gas should be so regulated that while it will impart sufficient velocity to the particles of dry coating material to insure their impact against the side of the mold, the gas itself will not impact against the mold surface with sufficient velocity to carry away any considerable quantity of the particles deposited upon the mold surface.

While it is true that the preferred method described and claimed in our former application has manifest advantage in that it insures that the coated surface of the mold should be contacted by molten metal very shortly and preferably immediately after its deposit upon the mold, it is also true that advantageous results on the character of the casting can be obtained by coating the entire cylindrical surface of the pipe mold with a dry finely divided coating material applied by means of a jet of carrier gas in advance of the pouring of the molten metal on to the coated surface of the mold and, broadly speaking, our present invention may be said to consist in applying the coating material by means of the carrier gas jet to the entire cylindrical surface of the mold and then, after said portion of the mold has been so coated, rotating the mold at a rate of speed appropriate for centrifugal casting and charging the coated surface with molten metal to form the cylindrical surface of the pipe.

While it is obviously true that the coating of the cylindrical portion of the mold in advance of pouring metal thereto can be effected by the manipulation of a charged carrier gas jet in many ways, as, for instance, as described in our prior application, it is also advantageous to effect the coating by directing against the cylindrical portion of the mold a carrier gas jet of substantially the length of said cylindrical portion of the mold so that its charge of dry finely divided coating material will be deposited upon successive contiguous areas of the mold surface, each extending to the full length of the cylindrical portion of the mold and this method of coating the mold is particularly desirable where the molten metal is charged into the rotating mold from a dump trough located inside of the mold and extending through substantially the length of its cy-

lindrical portion so that it enables the coating to be applied directly over the whole surface of the cylindrical portion of the mold in a very short interval of time and the metal to be poured from the trough upon the coated surface with the least possible delay after the coating is so applied. These method steps also constitute an important feature of our invention.

It should be borne in mind that, for the best results in the application of our invention, it is highly desirable that the thickness of the coating applied to the mold by the carrier jet should not materially exceed that thickness which is found in practice to effect such a retardation in the transfer of heat from the molten metal to the mold as will beneficially affect the character of the casting as, for instance, in the case of cast irons of such composition that they are liable to take a chill in contact with a cold metallic surface, such a thickness as will prevent the formation of such a chill, and it should also be borne in mind that, for the best results, the molten metal should be poured in contact with the surface of the mold as promptly as practicable after the coating is deposited upon the mold by the carrier jet because we have found that the so deposited coating loses efficiency as a retarder of heat transfer if not promptly contacted by the molten metal so that a thicker coating would be required where a longer interval occurs between the deposit of the coating and its contact by molten metal and also because fractures in the continuity of the coating are liable to occur if a considerable interval intervenes between the deposit of the coating upon the mold and its contact by molten metal.

While, for reasons that we have stated, it is advisable that the thickness of the coating deposited upon the mold should be kept as thin as will make it effective to prevent the formation of a chill, particularly with regard to the quality of the casting produced and while it is true that thicker coatings are more liable to fracture than thinner coatings, we have found that in using the dump trough method of charging a coated mold with molten metal there is less tendency for the occurrence of fractures and displacement of the coating from the impact of the molten metal than is the case where the molten metal is supplied through a retracting runner and that in such a method of casting it is practical to use a considerably thicker coating than where the metal is supplied through a retracting runner.

While our improved method can be practiced in many ways and by means of different apparatus, it can be advantageously illustrated and described as carried out by an apparatus illustrated in the drawing forming part of this specification and which apparatus form the subject matter of our co-pending applications, filed June 6, 1933, Serial Numbers 674,503 and 674,506.

In the drawing,

Figure 1 is an elevation partly in central longitudinal section through the mold of a pipe casting apparatus adapted for use in the practice of our invention.

Figure 2 is a cross-section on the line 2—2 of Fig. 1.

Figure 3, a longitudinal section on the line 3—3 of Fig. 2.

Figure 4, a cross-sectional view generally similar to Fig. 2, but showing a modification of the structure supporting the charge of finely divided dry coating material.

Figure 5 is an elevation of the modified form of coating container shown in Fig. 4, and

Figure 6 is a somewhat diagrammatic cross-sectional view of another modification in the means of charging the jet of carrier gas with finely divided dry coating material.

A indicates a housing for the mold which may serve as a water receptacle if water is used as a cooling medium, through which extends a rotatable metal mold indicated at B, the ends of which extend through the walls of the housing and are supported thereby. C indicates a motor connected by gearing, indicated at C^1, to rotate the mold. D indicates a carriage suitably supported on a track, as indicated at D^1, to move longitudinally in alignment with the mold. E indicates a dump trough supported on the carriage D and adapted, when its carriage is moved toward the mold, to extend into the mold so as to extend over and slightly beyond the cylindrical portion of the mold. F indicates a handle lever secured to the end of the dump trough and by means of which it can be tilted to discharge its contents. G indicates a counter-weight extending from the rear portion of the carriage D to balance the weight of the charged dumping trough. H, H, etc., are brackets secured, as shown, to the side of the dumping trough E, opposite to the edge of the trough over which the metal is poured and supporting, as shown in Figs. 1, 2 and 3, a V-shaped trough I, of such length as will, when the dump trough is fully inserted in the mold, extend over and slightly beyond the cylindrical portion of the mold. J is a jet nozzle for a carrier gas, air, for example, which is secured to the external apex of the receptacle I and connected with the inside of said receptacle by a series of holes, indicated at J^1, extending through the jet nozzle and the apex of the receptacle I, said holes being arranged so close together as practically to deliver the carrier gas issuing from them as a substantially continuous jet.

In order to insure an approximately even delivery of carrier gas, it is advisable that the gas should remain under pressure in the nozzle J while it is being delivered through the holes J^1 and this can be secured by making the aggregate area of the delivery holes J^1 considerably less than the cross-sectional area of the nozzle J and, of course, by a suitable regulation of the delivery of gas under pressure to the nozzle. In practice we find it advisable that the aggregate area of the outlet openings should be about one-half of the cross-sectional area of the nozzle. K is a flexible hose or conduit connecting the jet nozzle J with a supply tank of the compressed gas indicated at K^1, and K^2 is a regulating valve controlling the delivery of gas to the jet nozzle J. L indicates the charge of coating material.

I^1, Figs. 4 and 5, is a trough or receptacle for a charge of finely divided dry coating material which, as shown, has a horizontal member I^2 and in this construction the holes leading from the jet nozzle J extend through the upright member I^3 of the support for the coating material so as to direct the jet of carrier gas over and parallel to the horizontal member I^2.

In the modification shown in Fig. 6, the receptacle for the coating material consists of a dump trough, indicated at M, having attached at or near its pouring edge a jet nozzle *j* perforated with holes j^1 so as to deliver a jet of the carrier gas toward the side of the mold under the pouring lip of the trough M. In this figure, the trough and the jet nozle are shown in the positions they occupy when the trough is tilted to begin the delivery of coating material to the jet while we

have indicated in dotted lines what may be called the normal position of the trough and jet nozzle before the trough is tilted.

In operation and referring first to Figs. 1 to 3, the charge of molten metal is poured into the dump trough E when in retracted position, that is, when it is withdrawn from the mold, and a measured charge of finely divided dry coating material is evenly distributed throughout the V-shaped container I. The carriage is then moved toward the mold until the dump trough and container I extend over and, as shown, partly beyond the cylindrical surface of the mold and the mold is set in rotation which may, of course, be done either before or after the insertion of the dump trough and parts supported by it into the mold. Compressed air or other gas is then delivered from the tank K^1 through the hose K and regulating valve K^2 to the nozzle J and through the holes J^1 into the receptacle I, with the result that the finely divided dry coating material is picked up by the jet of carrier gas and deposited upon the cylindrical portion of the rotating mold, the deposit being made progressively along areas extending from end to end of this portion of the mold so as to build up a coating of the dry finely divided coating material upon the whole surface of the mold and of substantially uniform continuity and thickness. Carrier gas is then cut off from the nozzle J by closing the valve K^2 and the dump trough E is then rotated as by means of the hand lever F, to deliver its charge to the coated surface of the rotating mold.

The operation of the modified construction shown in Figs. 4 and 5, is practically identical with that described with reference to Figs. 1 to 3, while, with regard to the construction shown in Fig. 6, the dump trough for molten metal and the dump trough M are charged and inserted in the mold in the same way but the delivery to the jet of the finely divided dry coating material is effected by tilting the trough M so as to pour its contents into the jet of carrier gas issuing from the nozzle *j*. It should be understood that where the charged jet is directed against the rotating mold the particles of dry finely divided coating material making up the coating, are held in place partly by adherence and partly by centrifugal force exerted upon them by the rotation of the mold but, with the thin coatings with which we preferably work, a coating applied by the jet of carrier gas will have sufficient adherence to the wall of the mold and among the particles of the dry coating material to hold the coating in place with a fair degree of permanence even when the mold is not in rotation.

It should also be understood that, for the best results, the pouring of the molten metal on the coated surface of the mold should take place as promptly as possible after the deposit of the coating upon the mold by the jet of carrier gas.

Having now described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. The method of casting pipes centrifugally which consists in first building up upon the entire cylindrical surface of a pipe mold a coating of finely divided dry coating material by progressively directing a jet of a carrier gas charged with finely divided dry particles of coating material against successive areas of the cylindrical portion of the mold until the surface thereof is coated from end to end, rotating the so coated mold at a speed suitable for centrifugal casting and then charging molten metal to the coated surface of the rotating mold to form a pipe.

2. The method of claim 1, as practiced by directing an elongated jet of charged carrier gas progressively against successive contiguous longitudinal sectors of the cylindrical portion of the mold so as to effect a simultaneous coating of the mold from end to end.

3. The method of claim 1, as practiced by charging the coated mold with molten metal delivered substantially simultaneously along the length of the cylindrical portion of the coated mold.

4. The method of casting pipes centrifugally which consists in first building up upon the entire cylindrical surface of a pipe mold a coating of finely divided dry coating material by progressively directing an elongated jet of a carrier gas charged with finely divided particles of dry mold coating material against successive contiguous longitudinal sectors of the entire cylindrical portion of the mold so as to build up a continuous coating on said cylindrical mold portion, rotating the so coated mold at a speed suitable for centrifugal casting and pouring molten metal into the so coated and rotating mold substantially simultaneously along the entire length of the coated portion thereof.

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