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METHOD OF CENTRIFUGALLY
CASTING PIPE

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Our invention relates to the method of centrifugally casting cast iron pipe described in the patent to Russell and Langenberg, Number 1,949,433, granted March 6, 1934, and, more particularly, to the utilization of this method in the production of pipe having the characteristic structure which forms the subject matter of the Russell and Langenberg patent, Number 1,954,892, granted April 17, 1934. Generally speaking, the method is characterized in that an externally cooled metallic centrifugal pipe mold is progressively coated with finely divided dry coating material by directing a jet of carrier gas charged with such finely divided dry coating material against successive areas of the mold surface and then, the mold being in rotation, pouring molten metal in contact with the so coated portions of the mold so as to bring about the formation of a centrifugally cast pipe and preferably the coating is applied to the mold progressively along its length and the molten metal progressively poured along the length of the mold immediately following the deposit of the coating upon the sections of the mold with which the stream of molten metal comes in contact, as is described in the said Russell and Langenberg patents. As is pointed out in the Russell and Langenberg patents, the process gives its best results where the thickness of the coating applied to the mold does not substantially exceed such thickness as will bring about the formation of the pipe casting without chill and this is particularly important where a pipe is to be cast having the structural features described in the Russell and Langenberg patent, 1,954,892.

In the practice of the Russell and Langenberg process, it has been found that defective pipes are occasionally produced which are unfit for delivery and use and have to be scrapped and that at times temporary distortions of the mold occur which slow up the rate of production and the object of our invention is to bring about such improvement in the practice of the method as will eliminate or materially reduce the percentage of unusable pipe and the occurrence of temporary distortions in the shape of the mold. Careful study and investigation has convinced us that the occurrence of defective castings and of distortions of the mold are largely due to two causes, the first of which is the presence in the mass of finely divided dry coating material with which the carrier gas is charged, of an unduly high percentage of comparatively large size particles of the material making up the bulk of the coating and the second of which is the occur-

rence in the material with which the carrier gas jet is charged of an unduly large percentage of very finely divided particles. It will be understood that with the grinding of such material for coating to bring it to the necessary fine state of division there will be produced a ground material made up of particles of different sizes and that, for commercial reasons, it is quite impracticable to grade the particle size of the ground product so as to eliminate the occurrence of particles of relatively very different sizes but having satisfied ourselves that the presence in the ground material charged to the carrier gas jet of relatively large and very small particles was not incompatible with the production of an entirely satisfactory coating by the Russell and Langenberg method provided that the relatively large and very fine particles did not occur in the carrier gas charge in unduly large proportions, we proceeded by experimentation to ascertain approximately conditions as to particle size of the finely divided dry coating material charged to the carrier gas jet which would give the best results as applied in the form of a coating to the mold surface and we have ascertained that by charging the carrier gas jet with finely divided dry coating material of such size that not more than 5% of the particles will be retained on a sieve of 150 mesh while not less than 10% of the particles will be retained on a sieve of 200 mesh, that a very materially better coating can be applied to the face of the mold than would be the case either if more than 5% of the particles were retained on the 150 mesh screen or less than 10% would be retained on a 200 mesh screen. Again, we have found it desirable, although not absolutely necessary, that at least some percentage of the finely divided coating material should be retained on the 150 mesh screen and we have also found it highly desirable that not less than 15% of the particles should be retained on a 200 mesh screen.

While we believe that with all finely divided dry coating materials which may be employed to charge the carrier gas jet and form the mold coating, the grinding of the material to the state of particle division which will insure that not more than 5% of the particles will be retained on a 150 mesh screen and not less than 10 to 15% retained on a 200 mesh screen will give materially better results in the formation of an effective coating for the mold of the Russell and Langenberg process, we believe that the improved regulation of the particle size is especially advantageous where ferro-silicon is used as the coat-

ing material for we have found that by charging the carrier gas jet with finely divided dry particles of ferro-silicon so ground that not more than 5% of the particles will be retained on a 150 mesh screen while not less than 15% of the particles will be retained on a 200 mesh screen that it is practicable by the Russell and Langenberg process to build up upon the mold a very thin coating which is entirely effective to prevent chill in the casting and to bring about the formation of the advantageous structure described in the Russell and Langenberg patent, 1,954,892, while, at the same time, the coating is materially less liable to slip on the mold either during application or the subsequent casting and, again, if the ferro-silicon embodies an undue proportion of exceedingly fine particles, such as those of micron size, it has been found that when air is used as the carrier gas the jet is liable to ignite in which case no efficient coating is deposited upon the mold and the deposit of the finely divided oxides upon the mold is very liable to bring about distortions in the mold shape involving at least a temporary dis-use of the mold in the casting of pipes. In using ferro-silicon as a coating material in the Russell and Langenberg process we have successfully used alloys containing from 40 to 95% of silicon, but believe that the best results are secured where the alloy has a silicon content of approximately 75%, say, between 70% and 80%, and finely divided dry particles of ferro-silicon containing this proportion of silicon have been found to give notably good results when so ground as to comply with the conditions as to particle size which we have above described.

It will be understood that the conditions of the finely divided dry coating material as to particle size are to be ascertained by testing samples of the ground material in laboratory sieves and under conditions as to the cleanness of the sieve and the observance of the proper technique which are ordinarily observed in sieving tests made in laboratories.

It will be understood from what we have said that our invention consists in the practice of the Russell and Langenberg process by charging the carrier gas jet with a finely divided dry coating material of such make-up with regard to its particle size that not more than 5% of its particles will be retained on a 150 mesh screen and not less than 10% and preferably not less than 15% of its particles will be retained on a 200 mesh screen and that particularly our invention has reference to the charging of the carrier gas with ferro-silicon ground to such particle size as will comply with these requirements.

It has been found advantageous, as is pointed out in the application of Stuart, Hunt and Arnold, filed March 22, 1934, Serial Number 716,768, to charge the carrier gas jet with finely divided dry coating material with which is admixed a percentage of silica sand or equivalent grains of a material of a hard and compact crystalline structure substantially nonreactive and nonfusible under conditions existing during a casting operation, these sand grains being relatively large as compared with the particle size of the coating material proper, as it has been found that the presence of such relatively large sand grains in the coating deposited by the carrier gas jet upon the mold surface would more securely anchor the coating in position upon the mold surface, and it must be understood that in specifying and claiming the charging of the

carrier gas jet with finely divided dry coating material made up of particles not more than 5% of which will be retained on a 150 mesh screen and not less than 10 to 15% of which will be retained on a 200 mesh screen we are not to be understood as excluding from admixture with the so described finely divided dry coating material a percentage of the relatively large sand grains or as having in view the presence of such sand grains in providing that not more than 5% of the finely divided dry coating material should be retained on a 150 mesh screen since substantially all of the sand grains would be retained on such a screen and as used would materially exceed 5% of the mixture of finely divided mold coating material and relatively large grains of sand.

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

1. In the method of centrifugally casting pipes in which an externally cooled centrifugal metallic pipe mold is coated with a finely divided dry coating material by progressively directing against adjacent sections of the mold surface a jet of a carrier gas charged with finely divided dry particles of mold coating material and the mold being in rotation at a speed effective for the centrifugal casting of pipe, pouring molten metal in contact with so coated portions of the mold to form a centrifugally cast pipe, the improvement which consists in charging the jet of carrier gas with a finely divided dry coating material of such a state of division that not more than 5% of its constituent particles will be retained on a 150 mesh screen and not less than 10% of its constituent particles will be retained on a 200 mesh screen.

2. In the method of centrifugally casting pipes in which an externally cooled centrifugal metallic pipe mold is coated with a finely divided dry coating material by progressively directing against adjacent sections of the mold surface a jet of a carrier gas charged with finely divided dry particles of mold coating material and the mold being in rotation at a speed effective for the centrifugal casting of pipe, pouring molten metal in contact with so coated portions of the mold to form a centrifugally cast pipe, the improvement which consists in charging the jet of carrier gas with a finely divided dry coating material of such a state of division that some but not more than 5% of its constituent particles will be retained on a 150 mesh screen and not less than 10% of its constituent particles will be retained on a 200 mesh screen.

3. The method of centrifugally casting pipe as set forth in claim 1, in which the particle size of the finely divided dry coating material with which the carrier gas jet is charged is such that not less than 15% of its particles will be retained on a 200 mesh screen.

4. In the method of centrifugally casting pipes in which an externally cooled centrifugal metallic pipe mold is coated with a finely divided dry coating material by progressively directing against adjacent sections of the mold surface a jet of a carrier gas charged with finely divided dry particles of mold coating material and the mold being in rotation at a speed effective for the centrifugal casting of pipe, pouring molten metal in contact with so coated portions of the mold to form a centrifugally cast pipe, the improvement which consists in charging the jet of carrier gas with

finely divided dry particles of ferro-silicon of such particle size that not more than 5% of the particles will be retained on a 150 mesh screen while not less than 10% of the particles will be retained on a 200 mesh screen.

- 5 5. In the method of centrifugally casting pipes in which an externally cooled centrifugal metallic pipe mold is coated with a finely divided dry coating material by progressively directing against adjacent sections of the mold surface a jet of a carrier gas charged with finely divided dry particles of mold coating material and the mold being in rotation at a speed effective for the centrifugal casting of pipe, pouring molten metal in contact with so coated portions of the mold to form a centrifugally cast pipe, the improvement which consists in charging the jet of carrier gas with finely
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divided dry particles of ferro-silicon of such particle size that some but not more than 5% of the particles will be retained on a 150 mesh screen while not less than 10% of the particles will be retained on a 200 mesh screen.

6. The method of centrifugally casting pipe as set forth in claim 4, in which the particle size of the finely divided dry ferro-silicon is such that not less than 15% of the particles will be retained on a 200 mesh screen.

7. The method of centrifugally casting pipe as set forth in claim 4, in which the ferro-silicon is of a composition comprising between 70 and 80% of silicon.

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