July 14, 1942. H. PROJAHN ET AL 2,289,681

MOLD FOR CENTRIFUGAL CASTINGS

Filed Jan. 10, 1940

Fig. 1.

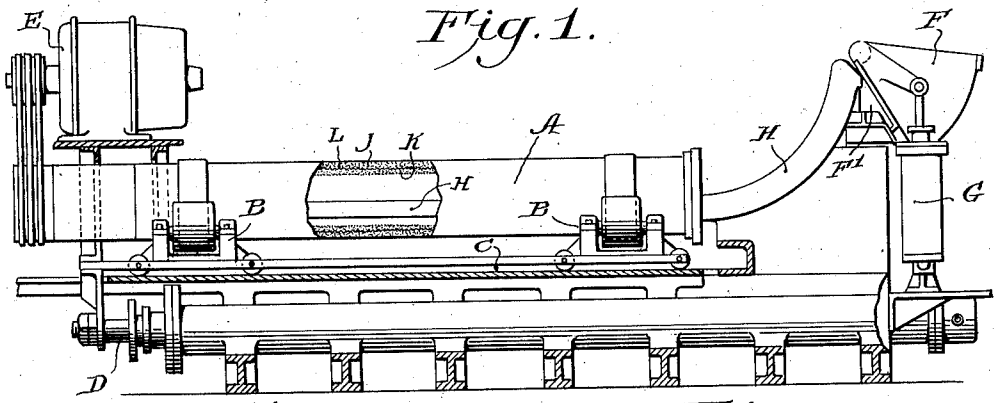


Fig. 2.

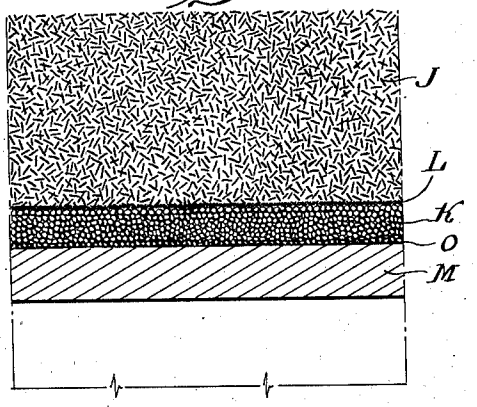


Fig. 3.

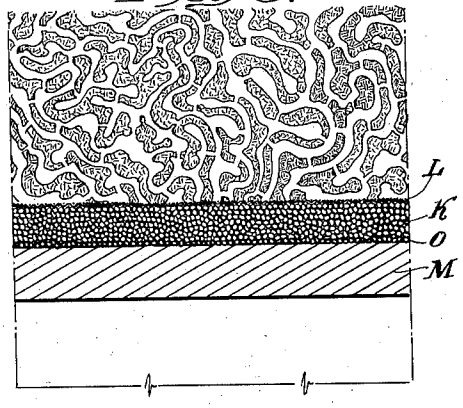


Fig. 4.

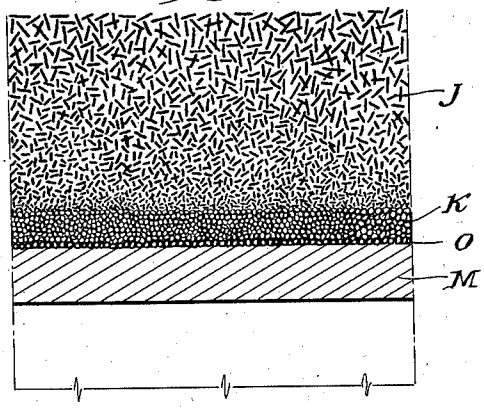
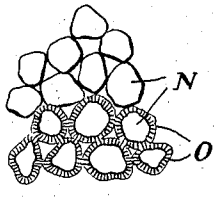


Fig. 5.



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Patented July 14, 1942 2,289,681

UNITED STATES PATENT OFFICE

2,289,681

MOLD FOR CENTRIFUGAL CASTINGS

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Application January 10, 1940, Serial No. 313,188
In Germany December 7, 1938

5 Claims. (Cl. 22—65)

Our invention relates to the construction and make up of molds adapted for use in the centrifugal casting of iron or steel tubes such as pipes. Our mold construction involves a permanent metallic outer wall, a substantial part of which is of approximately cylindrical form and an impermanent inner lining of substantial thickness made up of refractory granular material adapted to keep the casting made in the mold at a substantial distance from the metallic mold wall and thereby minimize the chilling effect of the metal wall during the pouring and hardening of the molten metal. A prime object of our invention is to provide both the lining and the metal wall structure with multitudinous intercommunicating interstices whereby air or other gases and vapors can escape freely in a radial direction from any point in the lining in which they exist or may be created, thereby greatly decreasing the liability of a defective casting being produced by undue pressure of gases or vapors during the period when the outer wall of the casting is in fluid or in partly fluid condition.

The outer metallic wall of our mold, or at least such portion of its length as corresponds with the cylindrical portion of the casting to be produced, is made up of a metal structure provided with a multiplicity of intercommunicating interstices affording free radial passage for gases and vapors existing or generated in the mold lining during the casting operation. The lining portion of the mold should also be of such a structure as to provide intercommunicating interstices forming multitudinous channels for the escape of gases and vapors in a generally radial direction through the lining during the casting operation. Such metallic structures as are adapted for our purposes in making the outer wall are known and consist of fritted or sintered metal powder, metal chips or other small metallic particles, or what are known as metal sponges. So far as the make up of the lining is concerned, that best adapted for the purposes we have in view is a lining made of refractory granules contacting with each other preponderantly only at points and largely stabilised, positioned and held in position on the metallic wall of the mold by centrifugal force generated by the revolution of the mold at sufficiently high speeds, first, to help in the distribution of the lining material into proper form and then to impart sufficient stability to the lining as to counteract the washing effect of the molten metal during the pouring operation. For practical purposes, however, a binder may be used in such quantity as to coat at least the inner portion of the lining and cause adherence of contacting points of the granules without closing the intercommunicating interstices, but care is taken that the binder should not be used in such quantity as to practically embed the granules in the binder and form a lining structure having no, or very greatly reduced, permeability to gases in a radial direction.

Where considerable structural strength in the lining is considered advisable the granules of refractory material used in its formation may be provided with a thin coating of a substance which, under the conditions existing during the casting operation, will so fuse or be otherwise affected as to form a union of the coating of contacting grains at their points of contact thus forming an effective binder for the grains without seriously contracting the intercommunicating interstices between the grains. We would mention as substances or compounds adapted for such usages silicates with sodium or potassium, bentonite, sulphite solution, pot-flour, oil-binder, tar-binder and so on, but obviously any substance or compound coating the grains and having the property of causing adhesion between the contacting points of grains may be used with advantage.

For practical purposes we have found that, in most cases, the refractory granules making up the lining will be sufficiently stabilised if only their inner layer is provided with coatings adapted to bring about adhesion between contacting points, and that the binder can be satisfactorily applied to the inner layer of the lining in the form of a liquid spray which will preferably be used in quantity sufficient only to insure that the contacting particles on this inner layer are made adherent to each other without entirely closing the intercommunicating interstices of this layer. Obviously however the closure of intercommunicating interstices at or immediately beneath the interior surface of the lining would not be seriously detrimental if the great body of the lining has its granules sufficiently spaced to afford a free flow of gases and vapors radially.

Experiments have shown that considerable stability can be imparted to the inside layer of the lining by applying to the inside face of the lining a facing, for example, of fine graphite black. Such a facing may be built up of metallic substances, such as aluminum powder, or metallic oxides, such as aluminum oxide. Magnesia can also be used as a facing. It is particularly advisable to use emulsions or colloidal

solutions of such materials in water-glass or even in oleaginous binding agents, or to incorporate or apply boric acid or similar substances behaving like glass under not too great heat in or on the innermost layer coming into contact with the casting material. The use of such facings presents the advantage that they fuse on to the casting in varying thicknesses and facilitate the drawing of the casting.

It is also possible to use in known manner a wire fabric or the like and to arrange this on or in the inner surface of the mold lining composed of granular materials, with the result that a reduction of the critical speed of rotation is also rendered possible.

Such a lining as we have described for use in metallic molds of the ordinary kind and having no radial permeability to gases, has been described and claimed in United States patent applications by Projahn, Serial Number 240,495, filed November 15, 1938, and Serial Number 240,643, filed November 16, 1938, and is only intended to be covered in this application when used in connection with radially permeable metallic molds such as described herein.

We are aware that prior to our invention molds have been constructed, in part at least, from agglomerated metallic powders, chips or the like, so as to be permeable to gases, and that metal has been cast against the inner surface of such molds but without the use of a lining. We are also aware that prior to our invention solid metallic walled molds have been drilled through at numerous points to provide for a radial flow of gases through the wall of the mold and that such molds have been lined with the ordinary rammed lining in common use. But such drilled molds would not be practical with such comparatively loosely compacted linings as we have described, as lining particles would escape through the drilled holes or, in the alternative, tend to plug them up and moreover would not provide, as do the structures we have described, for the free radial flow of gases through the wall in all parts of the wall structure.

To diminish the liability of lining particles escaping into the inner interstices in the mold wall we consider it advisable in the manufacture of a mold to provide that the area of the interstices should be less than that of the average diameter of the granules used in the make up of the lining, and preferably we so construct the mold wall that the areas of the spaces at the inside of the mold wall should be even smaller than the areas more remote from the inner face of the mold wall. Still further to diminish the liability of particles of the lining escaping into the interstices of the wall it is advantageous to apply to the inner face of the mold wall a wire screen having a mesh which will retain lining particles of a size smaller than the average size of the granules making up the lining.

Referring to the drawing which forms a part of this specification,

Figure 1 is an elevation of a pipe casting apparatus including a mold, indicated at A, mounted for rotation on a longitudinally movable carriage B, supported on track C, means for imparting reciprocating movement to the carriage being indicated at D and means for rotating the mold indicated at E. F indicates a ladle for the molten metal supported on a pedestal F^1. G indicates mechanism for tilting the ladle. H indicates a trough for feeding molten metal from the ladle to the inside of the mold, the trough being supported on the pedestal supporting the ladle. An intermediate portion of the mold is shown in section, J indicating a section through the metallic wall of the mold. K indicating the lining forming the inner wall of the mold, and L indicating a wire mesh located between the metal wall of the mold and the outer wall of the lining. The wire mesh L may or may not be used.

Figure 2 is a view on a larger scale of the make-up of the mold as indicated in the sectioned part of Fig. 1, together with a section indication at M of the casting formed on the inner lining of the mold. This view also indicates that a binder coating O has been applied to the inner layers of the lining, the showing of the outer metallic wall of the mold indicating that it is made up of chips of metal sintered together so as to provide for intercommunicating interstices throughout the thickness of the wall.

Figure 3 is similar to the showing of Fig. 2, except that the structure of the outer metallic wall is indicated as such as would result from the use of a metallic sponge in the formation of the wall.

Figure 4 is a view generally similar to Figs. 2 and 3, except that the screen L is omitted and the metallic outer wall of the mold is shown as of a construction which indicates larger intercommunicating interstices in the outer portion of the wall than in the inner portion.

Figure 5 is a rather diagrammatic elevation on a very large scale of a construction in which the granules forming an inner layer of the lining are indicated as coated with a binding agent which forms at points where it contacts with the coating of adjacent granules a union serving to bind such granules together. The drawing also shows other granules uncoated. These granules are, of course, of refractory materials and are indicated at N while the binder coating on such granules as it is applied to is indicated in section at O.

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

1. A mold for centrifugally casting approximately cylindrical bodies of iron and steel, comprising an outer metallic, permanent shell of such construction that its wall throughout its thickness is made up of an aggregation of adherent metallic particles so disposed in the wall as to withstand the stresses due to rotation of the mold and to provide multitudinous intercommunicating interstices affording a free passage for gases or vapors throughout the entire thickness of the wall, and an impermanent lining for said shell made up for the most part of loosely arranged refractory granules used in such quantity as to provide a lining of substantial thickness and so disposed with regard to each other as to provide the lining with multitudinous intercommunicating interstices forming paths for the passage of gases and vapors throughout the greater part of the thickness of the lining structure.

2. A mold as called for in claim 1, in which the intercommunicating interstices of the metallic outer wall are made narrower at and near the inner surface of the metallic wall.

3. A mold as called for in claim 1, in which a cylindrical wire screen of a mesh smaller than the average area of the intercommunicating interstices formed through the metallic wall where such interstices open through the inner surface of the wall is located between the said metallic wall and the inner lining of the mold.

4. A mold as called for in claim 1, in which

the granules used in the make up of the lining are more or less stabilised by the application to the grains forming the inner portion of the lining of a binder in sufficient quantity to bring about an adherence between contacting parts of such grains without closing the intercommunicating interstices between said grains.

5. A mold as called for in claim 1, in which the granular material used in the make up of at least a large portion of the lining is held in place during the make up of the mold lining and during the pouring of the mold by centrifugal force generated during the make up and pouring of the mold by its rotation at sufficient speeds to impart necessary stability to the granules used in the make up of the lining.

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