Feb. 28, 1939. M. BUNKE 2,148,802

APPARATUS FOR THE MANUFACTURE OF CENTRIFUGALLY CAST PIPES

Filed Dec. 8, 1936

Fig. 1.

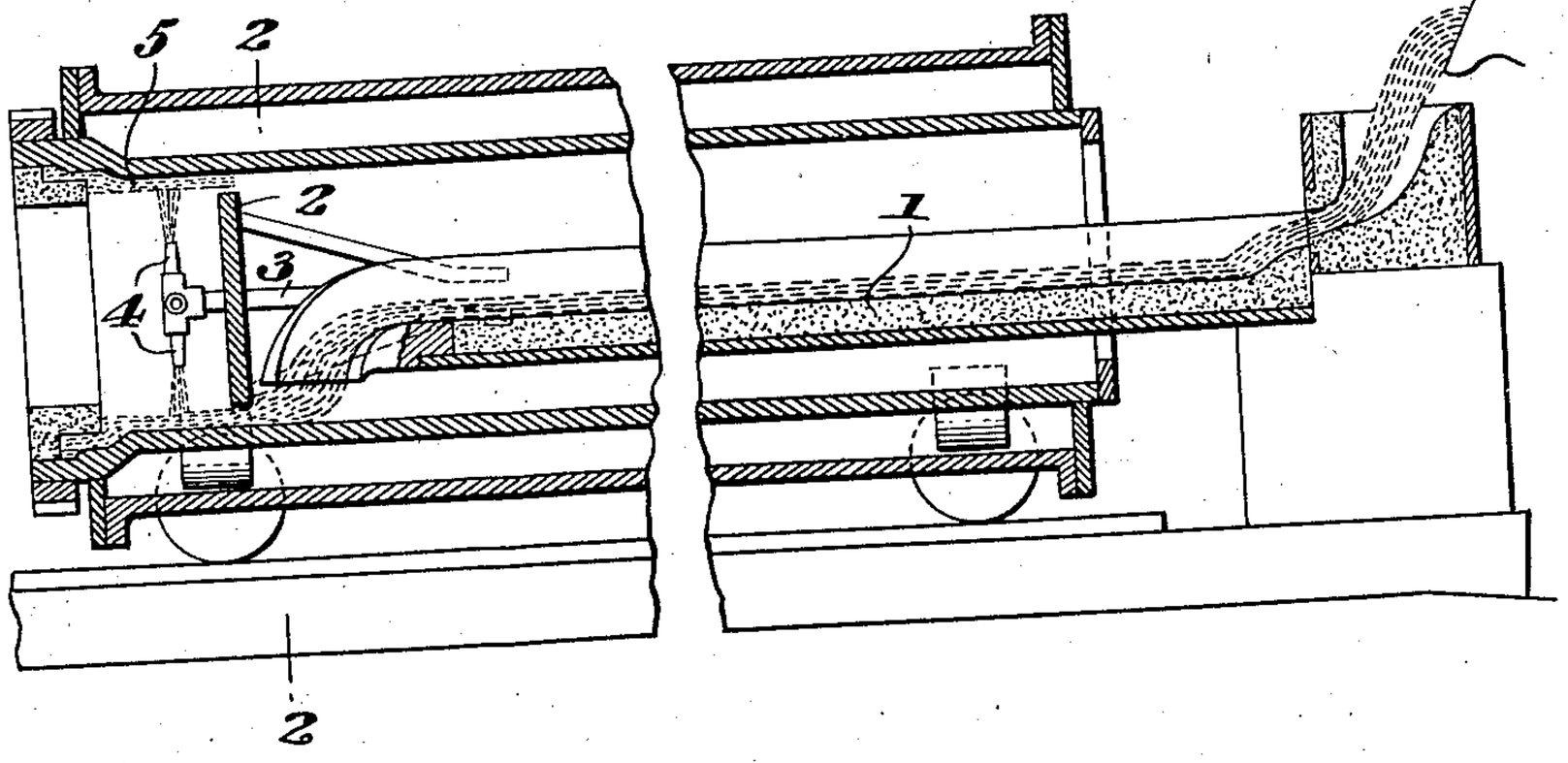
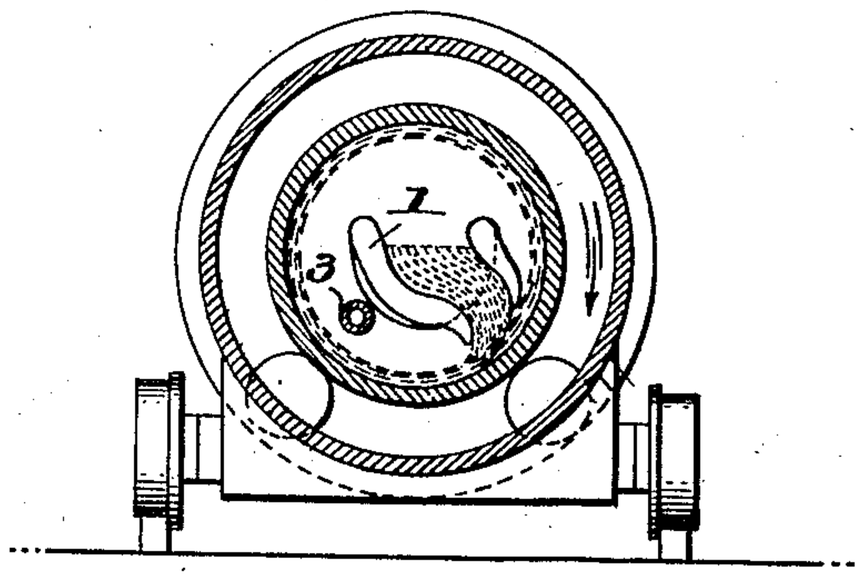


Fig. 2.



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Patented Feb. 28, 1939 2,148,802

UNITED STATES PATENT OFFICE

2,148,802

APPARATUS FOR THE MANUFACTURE OF CENTRIFUGALLY CAST PIPES

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Application December 8, 1936, Serial No. 114,881
In Germany December 10, 1935

1 Claim. (Cl. 22—65)

In centrifugally casting pipes, particularly in cooled metal molds, the heat contained in the melt is conveyed to the mold preponderantly in the radial direction. Owing to the influence which the direction of heat flow exerts on the orientation of the crystals formed, also the individual crystallites, at least in the outer zone of the pipe, must be similarly oriented in this direction, that is radially. Since the thus produced primary structure has a far reaching effect on the final structure, a pipe manufactured in this manner containing many radially directed crystallites, like an arch subjected to expansion from within to bending in combination with shock will not yield the best attainable performance. The properties of such a pipe are improved if the radial crystal orientation is replaced by the arrangement of crystallites lying in different intersecting directions, and it is particularly advantageous if very many of these crystallites extend in the direction parallel to the axis of the pipe. It is the primary object of the present invention to produce such a crystallite formation and this is achieved by increasing the flow of heat in the direction of the axis of the pipe, relatively to the radial heat flow.

When the heat flow is increased in the axial direction without changing the conditions for the heat flow in the radial direction, then it is not the case that the part of the radially flowing heat will combine with the part of the heat which is flowing axially to produce a resultant somewhat inclined to the wall of the mold. The progress of the heat within crystal grids and through melts between crystal grids, takes place rather as a stepwise progress. Each element of heat flow follows the already present direction of least resistance. If during its flow the temperature falls below the freezing limit, there is produced at the respective place a crystal nucleus, the preferred direction of growth of which is in the direction of the heat element flow. Thus in the case of simultaneous radial and axial heat flow the crystals produced are not oblique to the mold but radially directed crystals intersected by axially directed crystals are formed. At the places where the temperature field, owing to non-uniformity of its carrier, forms eddies in space obviously crystallites lying in any direction may be formed.

The increasing of the heat flow in axial direction may be achieved by strongly cooling the mold introduced melt from the inner surface directly after pouring, so that the heat from the newly supplied melt passes for the greater part into the already deposited melt, that is, in the axial direction. It is convenient to provide an insulating disk as a partition between the cooled section of pipe and the space into which the liquid melt is being supplied. The purpose of the cooling is thus not to increase the speed of cooling but to influence the direction of cooling particularly at the places where the melt is passing into the solid condition.

The directed heat flow has an effect not only when the material passes from the liquid into the solid condition, but also in those ranges of temperature in which the material undergoes crystallographic changes in the solid condition, such as alterations of the spaced grid structure of the crystallites forming the material. Certainly in the latter case super-position by other influences is very strong, since it is known that under some conditions the building up of the primary structure has a far going influence on the secondary structure. The influencing of the orientation of the structure formation in the solid condition is preferably undertaken during the annealing operation in centrifugally cast pipes. The pipes are then preferably passed in longitudinal direction through the different temperature zones of the furnace, preferably in the well known pilgrim step.

An apparatus for the manufacture of centrifugally cast pipe is illustrated as an example on the accompanying drawing in which Fig. 1 is a longitudinal sectional view of the apparatus, and Fig. 2 is a cross sectional view taken on the line 2—2 of Fig. 1.

Fig. 1 shows a pouring trough having a layer 1 of refractory material on which the liquid metal flows and an insulated disc 2 at the exit end. A cooling medium such as cold air is forced through a pipe 3 which is fastened to the pouring trough. As shown in Fig. 1 the exit end of the pouring trough is on one side of the insulated disc 2 and on the other side of the disc 2 the pipe 3 terminates into a number of nozzles 4 which are for the purpose of directing the cooling medium against the just centrifuged iron layer 5. Therefore, on one side of the insulated disc 2 the fluid iron is directed into the mold while on the other side of the disc the centrifuged iron casting is cooled. In this way the heat is conveyed away in a direction parallel to the axis of the pipe. Thus Fig. 1 clearly shows the insulated disc which is provided as a partition between the cooled pipe section and the space containing the liquid melt.

I claim as my invention:

Apparatus for the manufacture of centrifugally cast pipes, comprising a rotary mold, means for gradually delivering molten metal into the mold and forming a pouring zone in the mold, said mold and means being axially movable relative to each other, a disc adjacent the pouring zone to provide a cool zone adjacent the cast pipe, said disc separating the cool zone from the pouring zone, and cooling means in the cool zone to cool the gradually formed pipe.

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