Aug. 25, 1931. A. H. BEALE ET AL 1,820,176

METHOD OF GRANULATING STEEL AND FORMING WROUGHT IRON

Filed July 19, 1928

Fig. 1.

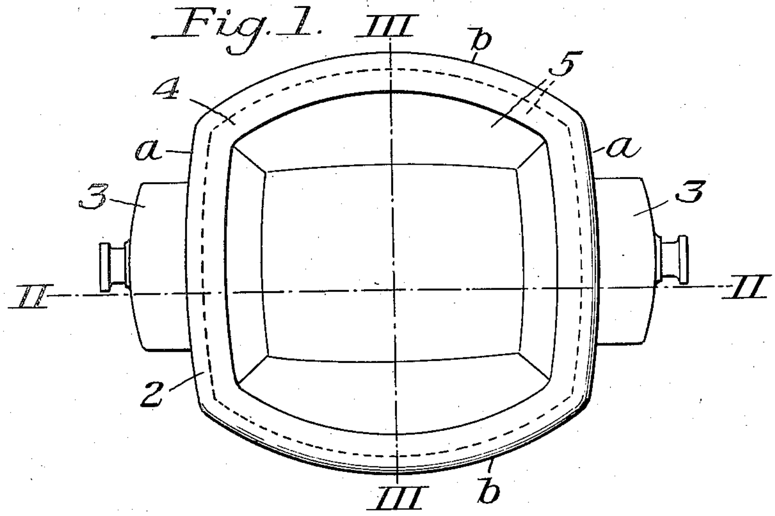


Fig. 2.

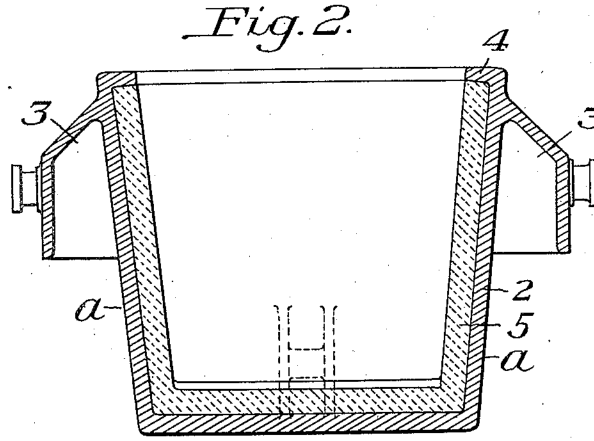
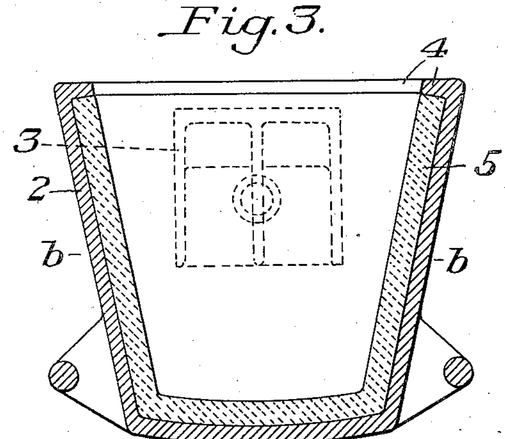


Fig. 3.



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UNITED STATES PATENT OFFICE

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METHOD OF GRANULATING STEEL AND FORMING WROUGHT IRON

Application filed July 19, 1928. Serial No. 294,040.

Our invention relates to the Aston process of making wrought iron, such, for example, as set forth in several United States patents of James Aston, such as No. 1,370,507, granted March 8, 1920, for method of making wrought iron pipe; No. 1,412,823, granted April 18, 1922, for method of making wrought iron; and No. 1,469,373, granted October 2, 1923, for manufacture of wrought iron.

In this process, the molten product of a steel-making process is poured into a slag bath and shotted or granulated by reason of the temperature difference between the bath of slag and the steel poured in. The granules descending through the slag bath form a ball in the bottom by the welding together of the granulated portions.

In the early work on this process, considerable difficulty was encountered in obtaining uniform balls of the desired characteristics.

In long study and experimenting in connection therewith, we have discovered that to obtain the desired results definite relations should be maintained, not only between the temperature of the steel poured in and the temperature of the slag bath, but also as regards the depth of the slag bath, the total weight or mass of slag relative to the total weight of metal poured in, the height of the falling stream, the thickness of the stream, and the time consumed for the shotting of a given weight of metal.

In such experimenting we have found that in order to allow proper release of the oxides and gases from the granules and their absorption by the slag bath, which is of great importance in order to obtain the desired grade and uniformity of the wrought iron ball, the depth of slag at the start of the pouring operation should be not less than 18 or 20 inches, and is preferably 3 or 4 feet. The pouring spout or nozzle of the receptacle containing the molten product of the steel-making operation should be more than 6 feet above the level of the slag, and is preferably 10 to 12 feet above that level.

We have also found that to give the best results the total volume of slag should be at least four times that of the metal poured in and shotted. We have also found that the time element in pouring is important, and that the pouring should be at such a rate that not less than 1½ minutes are consumed for every ton of metal poured in and shotted from a single spout or nozzle; and that preferably about 2¼ minutes per ton is of advantage.

If the stream is too thin or small, there is too great a loss of temperature in pouring, and if the stream is too thick or large, the metal is not properly shotted.

The above limits have been found after long and careful study and experimenting, and are highly important in obtaining improved and uniform results.

In the drawings,—

Figure 1 is a plan view showing one form of receptacle for carrying out our invention; and

Figures 2 and 3 are vertical cross-sections of the same on the lines II—II and III—III, respectively, of Fig. 1.

In the drawings, which show a preferred form of shotting cup or receptacle, 2 is an iron or steel shell which may be either cast or of wrought material. This shell preferably converges downwardly to a slight extent on two sides *aa* and to a greater extent on the sides *bb*. The sides *aa* are preferably cast with hollow projections 3, 3, forming parts of trunnion pads and lifting lugs. The casting is preferably provided with an inwardly projecting flange 4 and is lined with a refractory material, such as firebrick 5, covering the bottom and sides. The internal dimensions of the lined vessel are about as follows: at the bottom, 3 feet between the sides *bb* and 4 feet between the sides *aa*, with a depth of about 4½ to 5 feet.

In practice, the liquid slag is poured into this receptacle to a depth of preferably 3 to 4 feet, and the liquid steel is then poured in from a height of 6 to 12 feet, and preferably about 10 to 12 feet. The pour is regulated so that the pouring rate is not faster than 1½ tons per minute and the volume of slag is more than four times the volume of metal poured into said slag.

In practice, we prefer to make the steel by the Bessemer process, as we have found that in carrying out the process the converter practice is of considerable advantage.

The advantages of our invention result from the quality of the ball or wrought iron mass, resulting from the discovery of the proper depth and volume of slag, and the desirable pouring height to obtain the best results; together with the rate of pour, which should not be beyond a certain volume per minute.

The vessel shown is, of course, merely an example.

Changes may be made in the form, size, etc., of the vessel, and other changes may be made, without departing from our invention.

We claim:

1. In the making of wrought iron, the step consisting of pouring metal from a steel-forming operation into and through a bath of puddle slag of a depth greater than 18 inches.

2. In the making of wrought iron, the step consisting of pouring metal from a steel-forming operation into and through a bath of puddle slag of a depth of about 3 to 4 feet.

3. In the manufacture of wrought iron, the step consisting of pouring metal into a slag bath from a height of not less than 6 feet above the slag level through a bath of puddle slag of a depth greater than eighteen inches.

4. In the manufacture of wrought iron, the step consisting of pouring metal into a slag bath from a height of 10 to 12 feet above the slag level through a bath of puddle slag of a depth greater than eighteen inches.

5. In the manufacture of wrought iron, the step consisting of pouring the molten product of a steel-making process into a slag bath in a stream at a rate not faster than one ton in 1½ minutes.

6. In the manufacture of wrought iron, the step consisting of pouring a stream of the molten product of a steel-making process into a slag both at a rate of about 2 minutes per ton.

7. In the manufacture of wrought iron, the step consisting of pouring into a bath of puddle slag the product of a steel-making operation to an amount not more than one-fourth the volume of the slag.

8. In the manufacture of wrought iron, the step consisting of pouring steel into a bath of puddle slag of a depth of more than 18 inches, and restricting the volume of steel poured into less than one-fourth the volume of the slag.

9. In the manufacture of wrought iron, the step consisting of pouring into the bath of puddle slag the product of a steel-making process at a rate not greater than one ton in 1½ minutes and to a total amount less than one-fourth the volume of the slag bath.

In testimony whereof we have hereunto set our hands.

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JAMES ASTON.