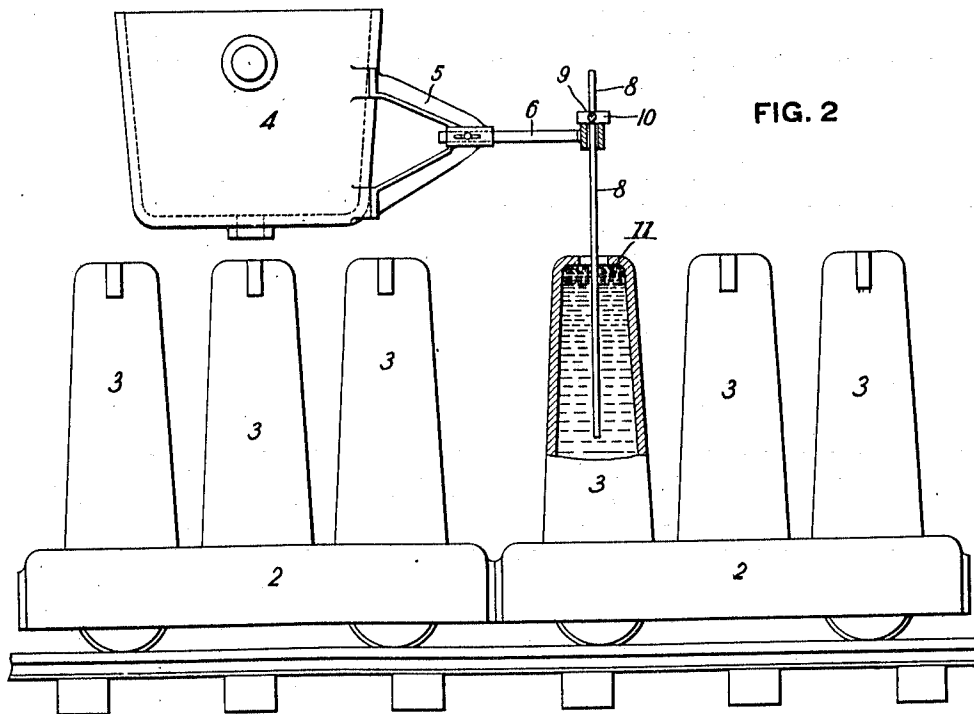
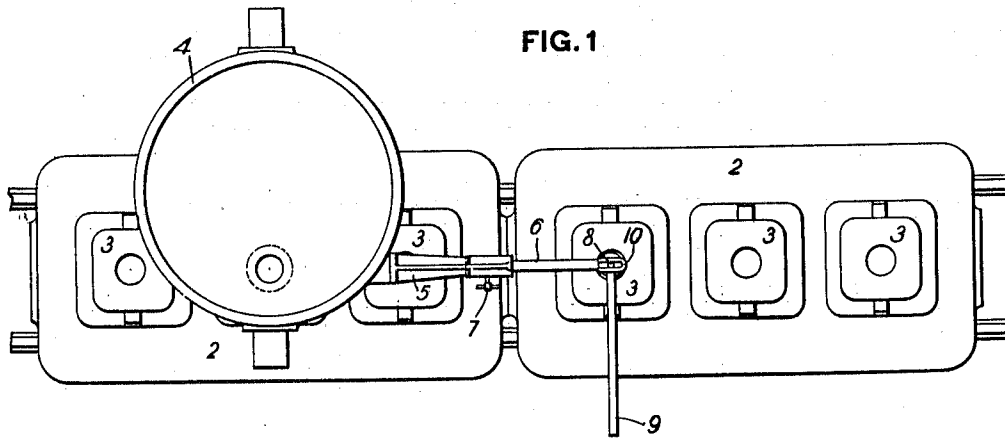


G. P. McNIFF.
 PROCESS OF TREATING CAST INGOTS.
 APPLICATION FILED AUG. 28, 1911.

1,053,738.

Patented Feb. 18, 1913.



WITNESSES

R. D. Little
M. P. Alexander

INVENTOR

G. P. McNiff
by Luthman, Felt & Fuller
his Attorneys

UNITED STATES PATENT OFFICE.

GILBERT P. McNIFF, OF MUNHALL, PENNSYLVANIA.

PROCESS OF TREATING CAST INGOTS.

1,053,738.

Specification of Letters Patent.

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Application filed August 28, 1911. Serial No. 646,509.

To all whom it may concern:

Be it known that I, GILBERT P. McNIFF, a citizen of the United States, residing at Munhall, in the county of Allegheny, State of Pennsylvania, have invented a certain new and useful Process of Treating Cast Ingots, of which the following is a specification.

My invention relates to the manufacture of ingots and more particularly relates to the treatment of ingots after being teemed into the ingot molds.

It has heretofore been proposed to insert a metal bar of approximately the same composition as the metal forming the ingot into its center while the ingot is still molten, the bar becoming welded to the metal of the ingot in order to reduce the amount of piping and segregation. It has also been the practice to introduce aluminum, in the form of shot, into the molds shortly after the commencement of the teeming operation. It has also been proposed to cover the top of the cast ingot with a carbonaceous material or a refractory non-conductor of heat or both to delay solidification of the ingot and thereby lessen piping and segregation in the ingots.

One object of my invention is to provide a novel method of treating ingots after being teemed whereby occluded gases in the ingot are dissolved, the escape of such gases is facilitated and the formation of blow holes thereby largely prevented and overcome.

Another object of the invention is to provide an improved process of treating ingots after teeming by the use of which solidification of the metal is retarded to the end that piping and segregation are materially reduced and the production of dense ingots which are uniformly solid is assured. A further object of this invention is in treating the teemed ingots by the series of novel steps as more fully appears hereinafter.

Referring to the drawings forming part of this specification, Figure 1 is a plan showing one form of apparatus adapted for use in carrying out the steps of my improved method. Fig. 2 is a side elevation, partly in section, of the apparatus shown in Fig. 1.

In the drawings, the numerals 2, 2, designate mold cars having molds 3 mounted on end thereon in the usual manner, and suspended from a traveling crane or other suit-

able carrying mechanism in position for pouring or "teeming" is a pouring ladle 4 having a bottom pouring opening through which the molten metal is delivered into the molds in the usual known manner.

Secured to the side of the ladle 4 is a bracket 5 having an arm 6 adjustably held in position thereon, the arm being lengthwise adjustable in the bracket and being held in adjusted position by means of the clamping screw 7. Extending downwardly through a vertical opening in the end of the arm 6 is a lengthwise movable rod or bar of aluminum 8 which is held in position and is manipulated by means of the lever or handle 9, this lever having a U-shaped hook 10 which embraces the rod 8.

In carrying out my improved process of making ingots, the metal is teemed into the molds 3 by any of the several known methods, aluminum in the form of shot being added while the ingots are being teemed in the usual manner when found necessary or desirable.

After teeming each ingot, a layer of non-conducting material 11 is immediately provided upon the still molten upper end of the ingot to form a blanket or cover so as to prevent chilling and delay solidification of the top end of the ingot, coke dust or other combustible non-conductor preferably being employed, as in addition to the blanketing effect of such material the heat of combustion is added thereto.

In a short time after each mold 3 is filled, when the metal of the ingot begins to set, generally as soon as the filled mold and pouring ladle 4 have been moved relatively a sufficient distance for the mold to clear the ladle, a rod or bar of aluminum or other reducing metal 8 is thrust downwardly through the coke-dust or other non-conducting material placed on top of the metal in the mold, into the center of the still molten metal in the ingot mold. The hook 10 on the end of the handle 9 is then placed to embrace and adjustably hold the rod 8 in place and to manipulate the rod manually with the lower end of the rod projecting downwardly into the molten metal within the mold.

The steel forming the ingot, which is still molten, is then stirred with the rod of aluminum or other reducing metal through the medium of the handle 9 until the rod is melted or burned off, and another shorter

rod is then employed to continue the stirring operation so as to agitate the top of the ingot for a further short interval, lasting possibly for several minutes.

5 Instead of using the apparatus shown for manipulating the rods, the insertion of the rods 8 and the stirring may be done entirely by hand, as in this way the operator can by the "feel" of the rod determine the
10 amount of stirring necessary to afford the desired result.

The rod preferably is extended downwardly to the bottom of the ingot although the distance will vary as changed conditions
15 are presented during the treating operations.

In the operation of my improved process, with the apparatus shown, a rod of aluminum is inserted in the mold, as is shown in the drawings, and the hook 10 on the handle 9 is caused to engage the upper end of
20 the rod 8. The handle is then moved manually by the operator so as to cause the lower end of the bar 8 to rock or rotate in a circular path and in this way stir the metal
25 in the mold. The rod is lowered or permitted to descend in the mold from time to time as the lower end of the rod is melted or burned off, and a new rod inserted to replace the rod, as required.

30 The rod 8 being introduced into the ingot after the pouring operation is completed which is later in the ingot-forming operation than has been contemplated in the methods of introducing aluminum used heretofore and at a time when solidification of
35 the ingot has commenced, much more efficient results are obtained owing to the lessened solubility of steel for the gases and the oxids when the steel is solidifying.

40 Stirring the steel by means of a rod of aluminum affords a greater opportunity for the metal in the ingot to settle solidly and also permits and causes the occluded aluminum or alumina to rise to the surface.
45 The exothermic reaction of aluminum to alumina adds considerable heat locally at all points in the length of the ingot and any blow holes which have formed become filled with the hotter metal resulting from the
50 exothermic reaction.

Continuing the stirring with a rod or bar of aluminum after the first bar has been melted or burned off by contact with the molten steel reduces the extent of piping in
55 the ingot by collecting the gases and oxids nearer the top of the ingot while prolonging the time the top of the ingot remains in a molten condition permits the gases to escape and assists in lessening the amount of
60 segregation.

The advantages of my invention will be apparent to those skilled in the art.

Piping and segregation in the ingot will be reduced to a large extent while the cost
65 of treating ingots in accordance with my in-

vention will be so small as to be practically negligible.

Modifications in the steps of the process and in the apparatus used in carrying out my improved process may be made without departing from my invention. Reducing
70 metals other than aluminum may be employed in forming the rods used in carrying out my improved process.

The apparatus for handling the aluminum
75 rods may be secured to the pouring platform or other fixed support instead of to the ladle as shown and other changes may be made without departure from my invention as defined in the claims.
80

I claim:—

1. The process of treating ingots which consists in covering the top of the teemed ingots with a blanketing layer of non-conducting material and then inserting a bar
85 or rod of aluminum lengthwise into the cast ingots and stirring the molten metal in the mold therewith.

2. The process of treating ingots which consists in covering the top of the teemed
90 ingots with a blanketing layer of non-conducting material and then stirring the molten metal forming the ingot with a rod or bar of aluminum until the rod or bar is melted or burned off by contact with the
95 metal of the ingot.

3. The process of treating ingots which consists in pouring the metal into a mold and then introducing a bar or rod of aluminum lengthwise into the teemed ingot.
100

4. The process of treating ingots which consists in teeming the metal into a mold, inserting a rod or bar of aluminum lengthwise into the mold and then stirring the metal forming the top of the ingot with a
105 rod or bar of aluminum while the metal is solidifying and becoming set in the mold.

5. The process of treating ingots which consists in teeming the metal into a mold, inserting a rod or bar of aluminum lengthwise into the mold, then stirring the metal forming the top of the ingot with a rod or
110 bar of aluminum while the metal is solidifying and becoming set in the mold and then continuing the stirring of the metal forming the top of the ingot with another aluminum rod or bar until the metal of the ingot is further cooled and solidified.
115

6. The process of treating ingots which consists in covering the top of the teemed
120 ingots with a blanketing layer of combustible non-conducting material and then inserting a bar or rod of aluminum lengthwise into the cast ingots and stirring the molten metal in the mold therewith.
125

7. The process of treating ingots which consists in pouring the metal into a mold and then introducing a bar or rod formed of a reducing metal lengthwise into the
130 teemed ingot.

8. The process of treating ingots which consists in teeming the metal into a mold, inserting a rod or bar formed of a reducing metal lengthwise into the mold, then stirring
5 the metal forming the top of the ingot with a rod or bar formed of a reducing metal while the metal is solidifying and becoming set in the mold and then continuing the stirring of the metal forming the top of

the ingot with another similar rod or bar 10 until the metal of the ingot is further cooled and solidified.

In testimony whereof, I have hereunto set my hand.

GILBERT P. McNIFF.

Witnesses:

JOHN BELL, Jr.,
FRANK L. TOY.