April 17, 1956 G. R. HAZLETT 2,741,814

APPARATUS FOR POURING INGOTS

Filed Sept. 17, 1952 2 Sheets-Sheet 1

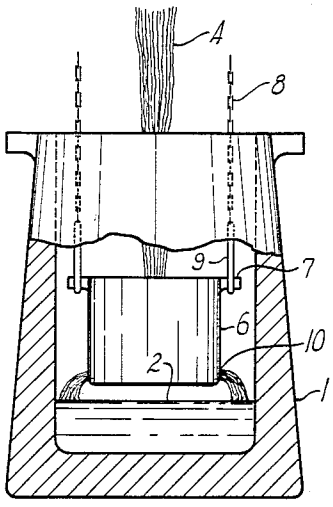


Fig. 1

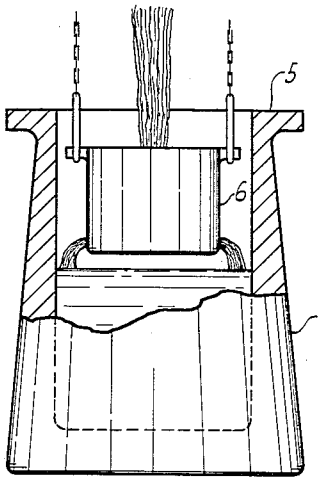


Fig. 2

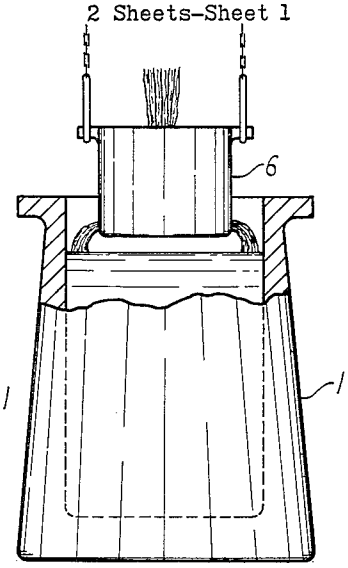


Fig. 3

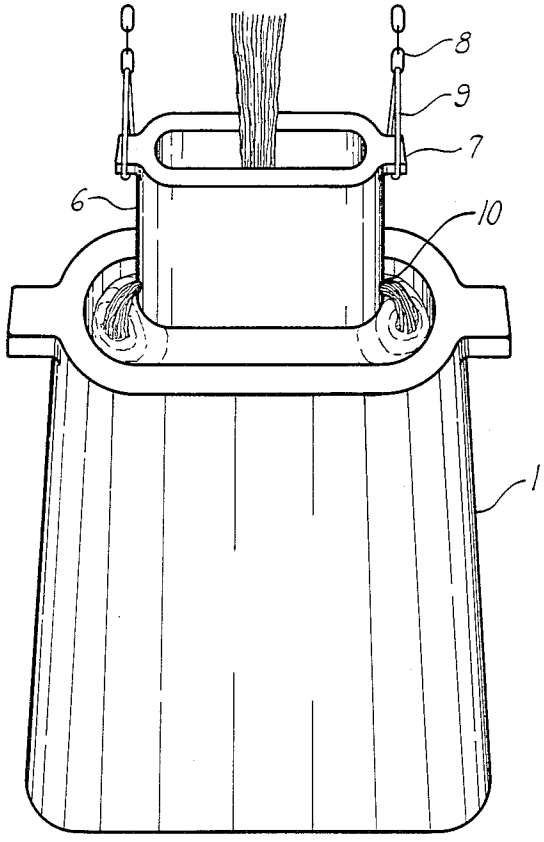


Fig. 4

INVENTOR.
George Ross Hazlett
BY William B. Jaspert
Attorney.

April 17, 1956 G. R. HAZLETT 2,741,814

APPARATUS FOR POURING INGOTS

Filed Sept. 17, 1952 2 Sheets-Sheet 2

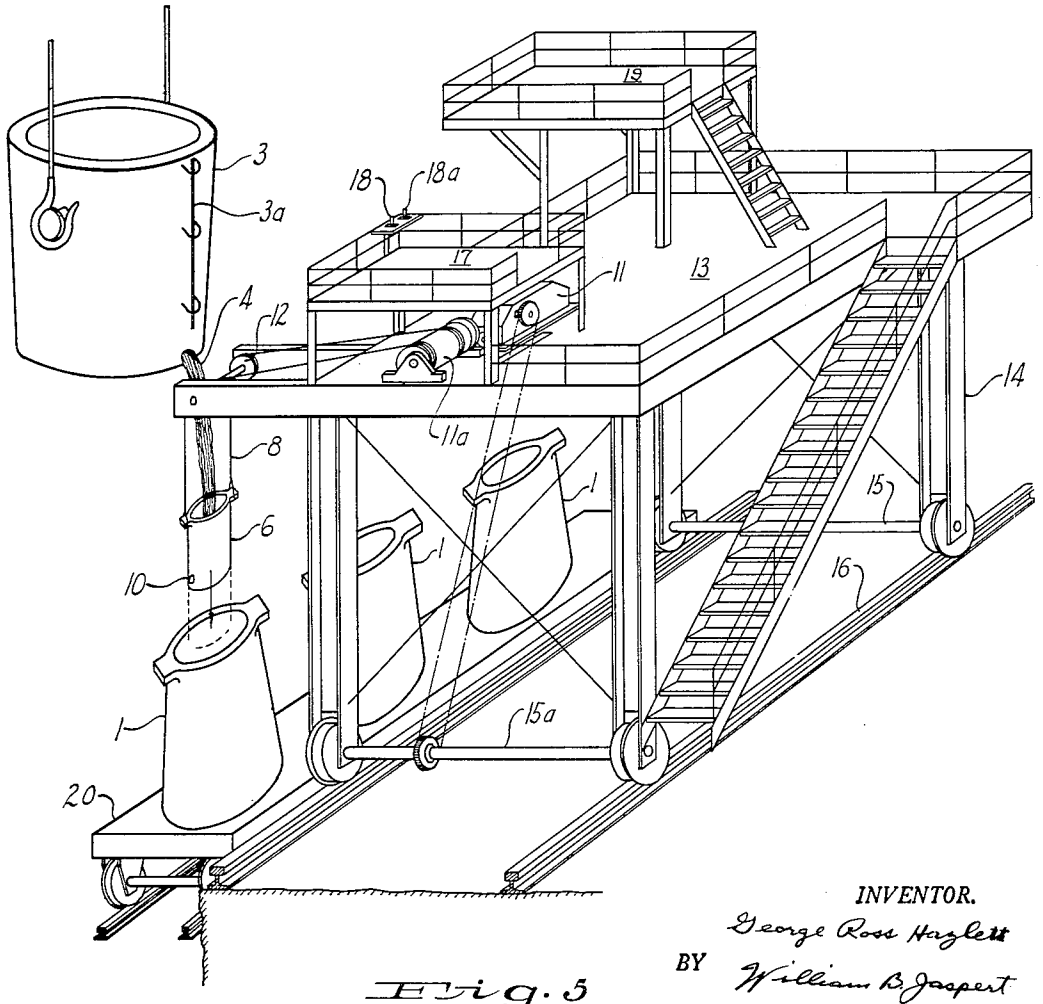


Fig. 5

INVENTOR.
George Ross Hazlett
BY William B. Jaspert
Attorney

United States Patent Office 2,741,814
Patented Apr. 17, 1956

2,741,814

APPARATUS FOR POURING INGOTS

George Ross Hazlett, Tarentum, Pa.

Application September 17, 1952, Serial No. 310,096

1 Claim. (Cl. 22—79)

This invention relates to new and useful improvements in apparatus for pouring ingots, and it is among the objects thereof to provide for the pouring of solid ingots which are substantially free of piping without the need for hot tops or other methods of feeding metal to the center of the ingot after the ingot has been poured.

The invention will become more apparent from a consideration of the accompanying drawings, constituting a part hereof, in which like reference characters designate like parts, and in which—

Fig. 1 is a vertical section, partially in elevation, of an ingot mold and a movable pouring ladle embodying the principles of this invention;

Fig. 2 is a similar view illustrating the position of the pouring ladle when the pouring of the ingot is half-way completed;

Fig. 3 is a similar view illustrating the position of the pouring ladle adjacent the top of the mold;

Fig. 4 is a view in perspective of the ingot mold and pouring ladle to more clearly illustrate the same; and

Fig. 5 is an isometric view diagrammatically illustrating the equipment used in connection with the invention.

With reference to Figures 1 to 4 of the drawings, the numeral 1 designates a conventional ingot mold in which the molten metal, designated by the reference numeral 2, such as delivered by an open-hearth ladle, is poured and allowed to solidify to form the ingot that is subsequently employed in the rolling of slabs, bars or shapes, such ingots weighing several tons.

Ordinarily the metal is poured into the top of the ingot from an open-hearth ladle such as the ladle 3 shown in Fig. 5, the stream of molten metal in Figs. 1 and 4, designated by the numeral 4, being that emitted from the open hearth ladle 3.

When pouring ingots direct from the open-hearth ladle to the mold 1 as in conventional practice, the metal strikes the base of the mold with considerable force and causes splashing of the molten metal on the walls of the mold. Such splashing results in freezing of the metal and produces a rough surface on the ingot after it has solidified and is stripped from the mold, which requires laborious chipping or grinding operations, particularly on ingots of alloy steel.

By the conventional center pouring process hot tops are employed which are usually made of refractory clays and are supported on the top edge 5 of the ingot mold. The pouring of the molten metal is continued until both the ingot mold 1 and the hot top, not shown, are filled. Subsequent cooling of the molten metal results in shrinkage that forms what is known as a pipe or hollow portion in the center of the ingot. In avoidance of pipe formation the surplus metal of the hot top feeds into the piping or ingot cavity to obtain a solid ingot with a minimum of croppage, which is the excess metal in the region of the hot top that has to be removed after pouring. This piping is to a large degree caused by the swirling action of the metal rising in the ingot mold caused by center pouring, and the present invention is designed to

overcome the splashing and swirling of the metal and to a large degree eliminate piping so that the need of hot topping the ingot molds is dispensed with.

In accordance with my invention I employ a special pouring ladle 6 having ears 7 by which it is suspended as, for example, by chains 8 having links 9 that loop over the ears 7. The bottom of the pouring ladle 6 is provided with a plurality of pouring outlets 10, which are best seen in Figure 4, from which the molten metal feeds into the ingot. By mounting the chains 8 on a drum 11, Fig. 5, the ladle 6 can be raised and lowered in relation to the cavity of mold 1. The stream of metal 4 flowing from the spout of ladle 3 falls into the special pouring ladle 6 and flows out through openings 10 into the mold.

In the initial pouring step the pouring ladle 6 is adjacent the bottom of the ingot mold 1 and the metal is poured in as shown in Fig. 1 and flows out through the outlets 10 into the ingot mold without producing any splashing of the metal. Any splashing resulting from the pouring of the stream 4 takes place inside of the pouring ladle 6 where it cannot splash the inner walls of the ingot mold 1.

As the metal rises in the mold 1 as shown in Fig. 1, the pouring ladle 6 is gradually raised in the manner shown in Figs. 2 and 3, maintaining substantially the same clearance between the bottom of the ladle and the level of the molten metal in the ingot mold 1 until the mold 1 is complete filled. The raising and lowering of the pouring ladle 6 may be regulated in proportion to the rate of pouring of the stream 4 from ladle 3 by means of a power unit comprising the usual speed reducer and motor, generally designated by the numeral 11, Fig. 5. The chains 8 pass over pulleys 12 and are connected to drum 11. As shown in Fig. 5, the apparatus for operating the pouring ladle 6 may consist of a mobile unit, generally designated by the numeral 13, mounted on uprights 14 having wheeled axles 15 movable on track 16. The apparatus is provided with a control platform 17 for the operator that controls the movement of the pouring ladle 6 by the control element designated by the numeral 18 that operates the power mechanism 11. An observation platform 19 may also be provided for supervising the movement of the mobile unit in relation to a group of ingot molds that are customarily mounted on trucks 20. The open-hearth ladle 3 is provided with a stopper mechanism 3a that controls the flow of the stream 4 and stops such flow when desired.

In the pouring of ingots by the method hereinabove described, the pouring ladle 6 is successively lowered into the ingot molds 1 on the trucks 2 and the open-hearth ladle 3 is moved by a crane to the position of bringing its flow spout above the pouring ladle 6. The stopper is removed by the operating mechanism 3a and the metal pours, as shown in Fig. 5, into the pouring ladle 6, but not before the latter is in its lowermost position within the ingot mold as shown in Fig. 1. As the pouring progresses and the pouring ladle 6 rises to the top as shown in Figs. 3 and 4, the stopper mechanism 3a is operated to stop the stream 4. The trucks supporting the ingot molds 1 are then successively moved under the pouring ladle 6 until they are all filled, a sufficient number of ingot molds being provided to receive the capacity of the open-hearth ladle 3. A control lever 18a may be actuated to drive the wheeled axle 15a to cause the entire pouring unit to move on the track 16 to align the pouring ladle 6 with the next ingot, or if the ingot molds are moved by their supporting trucks, the pouring unit may remain stationary along with the ladle 3 while all the molds are filled.

The structure of Fig. 5 is for illustration only as the invention resides in the use of the pouring ladle and the

method of pouring rather than in the structural equipment for handling the pouring ladle and ingots.

By means of the above described pouring method solid, sound ingots are formed with clean outer surfaces that require a minimum of touching-up to rid the ingot of surface flaws which may result from the handling of the ingot in the soaking pit furnaces or elsewhere after they have been stripped from the ingot molds.

Although one embodiment of the invention has been herein illustrated, it will be evident to those skilled in the art that modifications may be made in the details of construction and the pouring ladle and its manipulation, and in the number of flow streams from the pouring ladle to the ingot mold without departing from the principles herein set forth.

I claim:

Apparatus for pouring ingots comprising a substantially

elliptical shaped ingot mold, a substantially elliptical shaped receptacle suspended to be movable in a vertical direction in said mold above the level of the molten metal in the mold, said receptacle having an imperforate bottom and having spaced divergent horizontal flow passages at the end walls thereof to divert the flow of metal poured into the receptacle to areas of the ingot mold remote from the center thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

304,314	Haffey	Sept. 2, 1884
512,005	Cantz	Jan. 2, 1894
1,375,589	Hosack	Apr. 19, 1921
1,961,529	Rowe	June 5, 1934
1,983,579	Ennor et al.	Dec. 11, 1934