

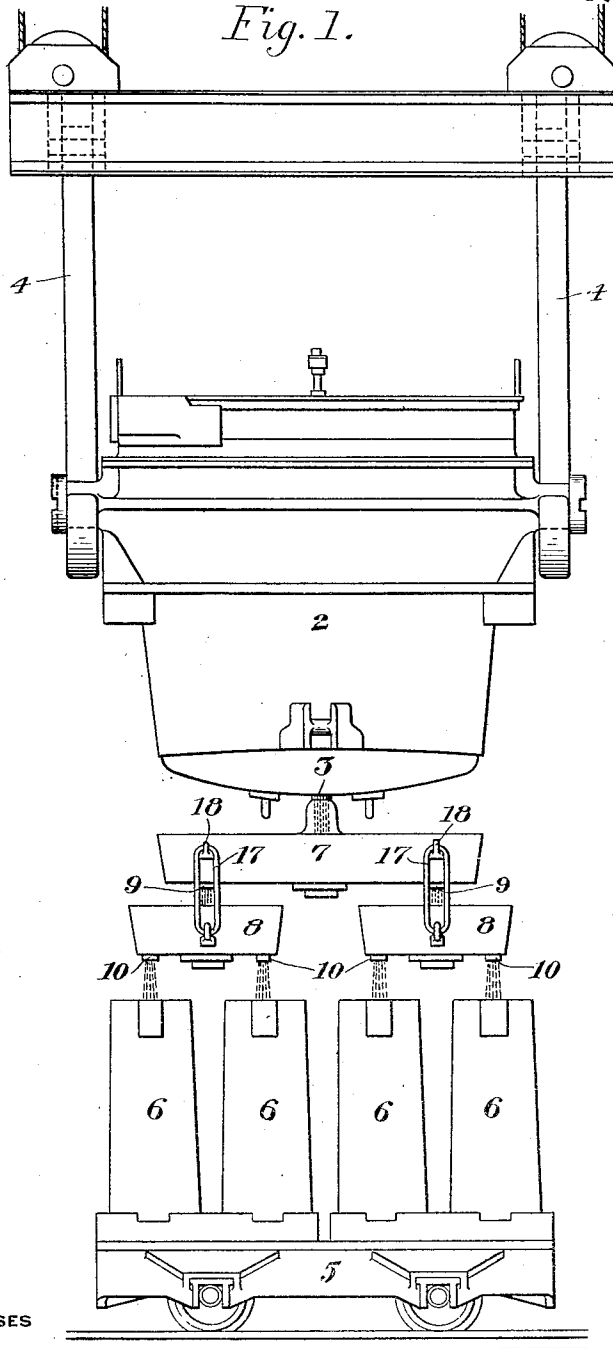
W. H. WARREN.
METAL CASTING.
APPLICATION FILED NOV. 8, 1917.

1,336,768.

Patented Apr. 13, 1920.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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Fig. 2.

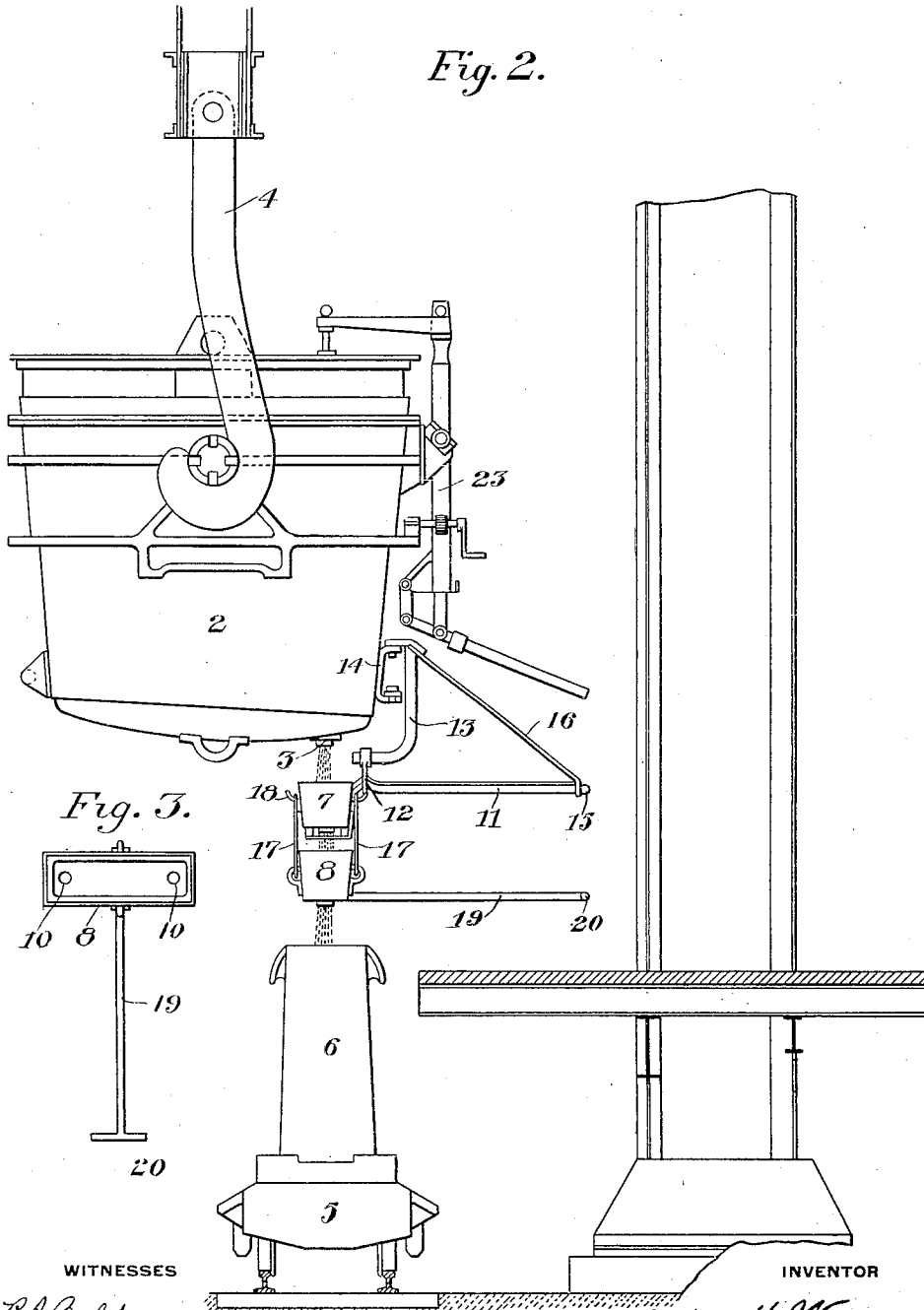


Fig. 3.

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METAL CASTING.

1,336,768.

Specification of Letters Patent.

Patented Apr. 13, 1920.

Original application filed December 6, 1916, Serial No. 135,306. Divided and this application filed November 8, 1917. Serial No. 200,906.

To all whom it may concern:

Be it known that I, WILLIAM H. WARREN, a citizen of the United States, residing at Youngstown, Mahoning county, Ohio, have
5 invented a new and useful Improvement in Metal Casting, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which:

10 Figure 1 is a side elevation of apparatus for carrying out my method of casting.

Fig. 2 is an end view of the apparatus, and

Fig. 3 is a detail plan view of one of the troughs.

15 This application is a division of my co-pending application, Serial No. 135,306, filed December 6, 1916.

The invention relates to the art of metal casting, and more especially to a method of
20 casting steel ingots, although the method in its broader aspects, is not so limited.

In casting steel ingots, it is advantageous to have the metal in the ladle at the high temperature at which it is tapped from the
25 furnace. This keeps the metal in the ladle in a fluid well mixed condition and prevents excessive waste in forming a scull in the ladle. However, for the best casting of ingots the metal should be at a considerably
30 lower temperature than that at which it is tapped from the furnace, and should be poured into the ingot molds slowly, so that the bottom of the ingot will freeze before the top is poured, and thereby minimize piping and other defects which occur when hotter metal is more rapidly poured into the ingot mold. In the preferred practice of the present method and as applied to casting
35 steel ingots, the steel is tapped from the furnace into a casting ladle and immediately transferred to the ingot molds. The molten steel at high temperature is poured from the casting ladle and the stream of steel issuing from the casting ladle is sub-divided into a
40 plurality of smaller streams and exposed to the air sufficiently to cool the steel to the best casting temperature. The sub-division into smaller streams of metal not only permits the more rapid cooling of the metal, but also permits a number of ingot molds to be
45 poured at once. This permits the ladle to be emptied rapidly, but permits each ingot mold to be filled comparatively slowly. The

pouring of the molten steel through the atmosphere a plurality of times in the subdivided streams also gives a maximum opportunity for the gases to escape from the hot metal. The illustrated apparatus for carrying out the method will now be described.

Referring first to Figs. 1 and 2, the numeral 2 designates a casting ladle of the bottom-pour type, having a single metal pouring
60 nozzle 3. 4 designates a ladle carrier of any suitable or usual form and which may be suspended from an overhead crane, not
65 shown. 5 designates an ingot mold car having a plurality of ingot molds 6. 7 designates a trough which is supported between the nozzle 3 of the ladle 2, and 8 and 8 are two smaller or auxiliary troughs which are
70 suspended one underneath each end portion of the main trough 7. The trough 7 has a bottom-pour nozzle 9 at each end and each of the troughs 8 has a bottom-pour nozzle
75 10 at each end.

The main trough 7 may be attached to the ladle 2 in various ways. In Figs. 1 and 2 I have shown it as having a rigidly projecting lever arm 11, which is arranged to fulcrum
80 and also to turn somewhat in a stirrup 12 hung on an arm 13 which is detachably engaged with a bracket 14 on the ladle 2. The outer end of the lever arm 11 has a handle projection 15 extending at substantially
85 right angles, and is also provided with a bearing in the oblique brace member 16. Each of the troughs 8 may be conveniently suspended from the trough 7 by means of the links 17 which engage open hooks 18 on
90 the trough 7. Each trough 8 is also preferably provided with a laterally extending arm 19 having an actuating handle 20 extending at substantially right angles thereto.

The ladle 2 is filled with steel tapped from the furnace and at substantially the
95 furnace temperature. The ladle is immediately swung over the ingot molds 6. The hot metal, still at substantially the furnace temperature, is discharged from the nozzle 3 of the ladle 2 into the main trough 7. For
100 convenience this stream may be spoken of as the primary stream of metal. When the trough 7 is in a substantially horizontal position, the primary stream of metal discharged therein is sub-divided into two secondary
105 streams which issue from the trough

7 through its two nozzles 9. These two secondary streams are discharged in turn into the auxiliary troughs 8. The auxiliary troughs 8 in turn sub-divide the metal stream into four streams flowing into the ingot molds through the four nozzles 10 of the troughs 8. For convenience these four streams may be termed tertiary streams.

The above described apparatus permits each of the ingot molds or flasks 6 to be filled at approximately one-fourth of the rate of flow of the metal through the pouring nozzle 3 of the casting ladle 2. The metal, in flowing from the ladle 2 to the molds 6, is exposed to the air in seven streams; one primary stream from the ladle 2 to the main trough 7, two secondary streams from the main trough 7 to the auxiliary troughs 8, and four tertiary streams from the auxiliary troughs 8 to the ingot molds 6. Thus, the metal in flowing from the ladle to any one of the ingot molds is exposed to the air in three successive streams of successively diminishing volume, the last streams from the troughs to the molds being smaller and exposing a comparatively greater cooling surface to the air than the larger stream from the ladle to the main trough. This facilitates the escape of the gases from the hot metal, it cools the metal to the proper casting temperature, and permits the cooled metal to be poured slowly into each ingot mold. This eliminates, to a great extent, piping, segregation and blow-holes or honey-combing.

By means of the lever arm 11 the trough 7 may be rapidly tipped toward either end so as to concentrate its discharge through either one of the nozzles 9. In like manner by means of the lever arms 19, either one or both of the troughs 8 may be tipped. In this manner, either 2, 3 or 4 of the ingot molds or flasks may be simultaneously filled. Instead, however, of tipping the several troughs sufficiently to concentrate the discharge at either end portion thereof, the troughs may be tipped to a less extent, thus giving a different rate of pour into the different molds. This permits molds of different sizes to be poured simultaneously.

While I have described the preferred manner of practising my invention, and have described it with particular reference to the pouring of steel ingots, it is to be understood that the invention is not so limited, but may be carried out in other methods within the scope of the following claims.

I claim:

1. The method of casting metal which consists in sub-dividing a stream of molten metal at a temperature considerably higher than the proper casting temperature and exposing the sub-divided stream to the atmosphere sufficiently to cool it to the proper casting temperature, then filling a plurality

of molds simultaneously with the thus sub-divided and cooled stream of molten metal and controlling the relative rates of flow of the subdivided streams, substantially as described.

2. The method of casting metal which consists in filling a casting ladle with molten metal tapped from a furnace at substantially the furnace temperature, pouring the molten metal from the ladle in a single stream, sub-dividing the stream poured from the ladle and exposing it to the air sufficiently to cool it to the proper casting temperature, then filling a plurality of molds simultaneously with the thus sub-divided and cooled stream of molten metal and varying the disposition of the mass of metal coming from the ladle with respect to the subdivided streams to thereby control the rate of flow of such streams, substantially as described.

3. The method of casting metal, which consists in flowing the molten metal from a casting ladle into a distributing vessel having a plurality of outlets, and controlling the disposition of the mass of metal in said vessel with respect to the different outlets to thereby control the rate of flow through such outlets, substantially as described.

4. The method of casting metal which consists in sub-dividing a primary stream of molten metal into a plurality of secondary streams, subdividing the secondary streams into a plurality of tertiary streams, exposing the thus sub-divided streams of metal to the atmosphere, and filling a plurality of molds simultaneously with the streams of metal thus sub-divided and exposed to the atmosphere, substantially as described.

5. The method of casting metal which consists in filling a casting ladle or the like with metal tapped from the furnace at substantially the furnace temperature, quickly transferring the ladle from the furnace to the molds, pouring the metal from the ladle into a plurality of molds and exposing the metal, as it goes from the ladle to the molds, to the atmosphere in sufficiently small streams to cool the metal to the proper casting temperature and permit each mold to be filled comparatively slowly while controlling the relative rates of flow of the different streams, substantially as described.

6. The method of casting steel ingots which consists in sub-dividing a primary stream of steel poured at substantially the temperature at which it is tapped from the furnace into a plurality of secondary streams, sub-dividing the secondary streams into a plurality of tertiary streams, exposing the thus sub-divided stream of metal to the atmosphere sufficiently to cool it to the proper casting temperature, and then filling a plurality of molds simultaneously with

the thus sub-divided and cooled stream of molten steel, substantially as described.

7. The method of casting steel ingots which consists in pouring a primary stream
5 of hot steel from a casting ladle or the like, sub-dividing the primary stream into a plurality of secondary streams and discharging such secondary streams through the atmosphere, sub-dividing the secondary streams
10 into a plurality or tertiary streams and

discharging the tertiary streams through the atmosphere, whereby the steel is cooled and the gases permitted to escape therefrom, and directing the thus sub-divided and cooled stream of steel into a plurality of 15 ingot molds, substantially as described.

In testimony whereof I have hereunto set my hand.

WILLIAM HOBART WARREN.