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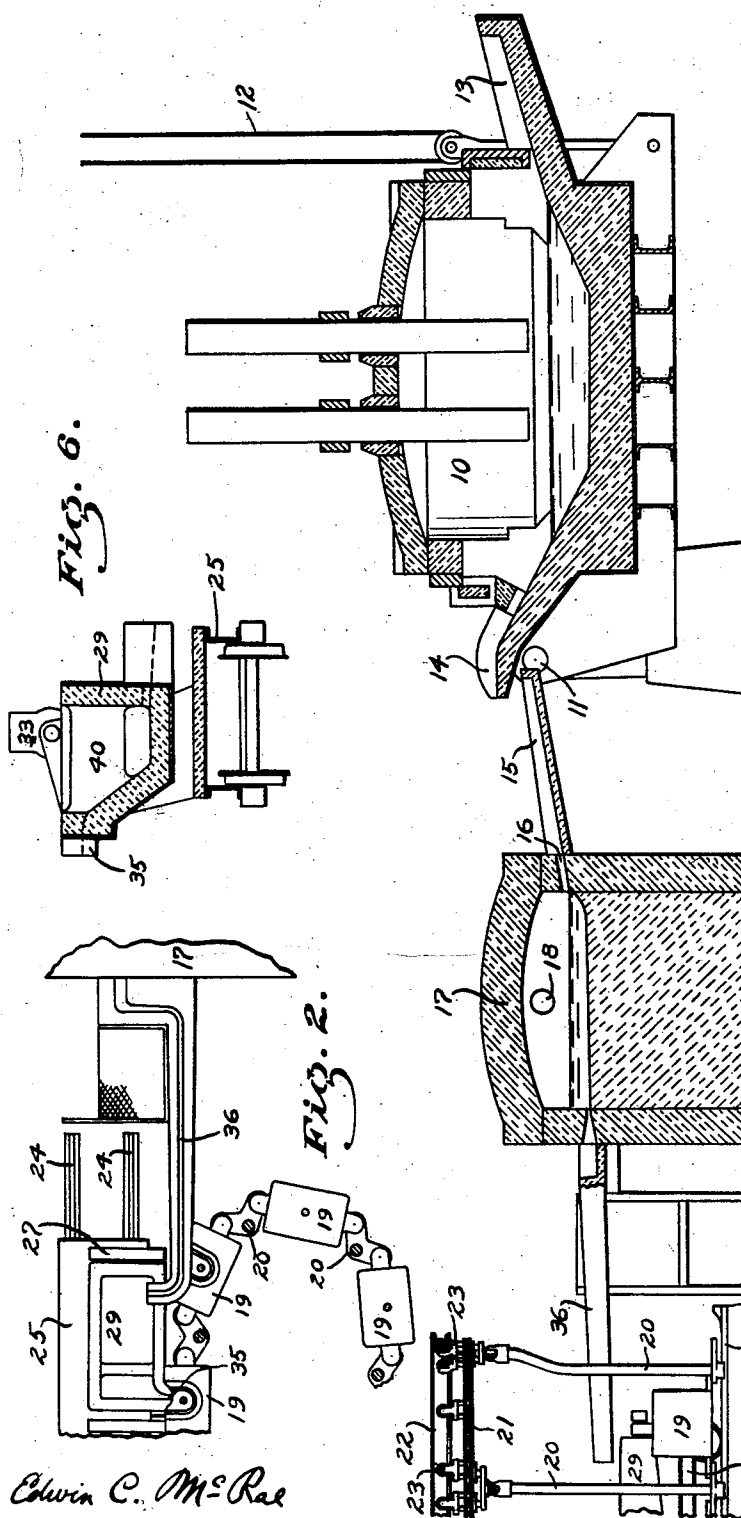
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APPARATUS FOR CASTING

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2. Sheets-Sheet 1



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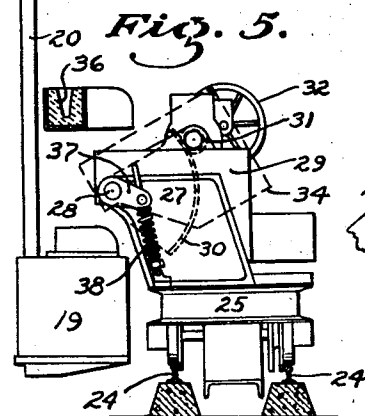
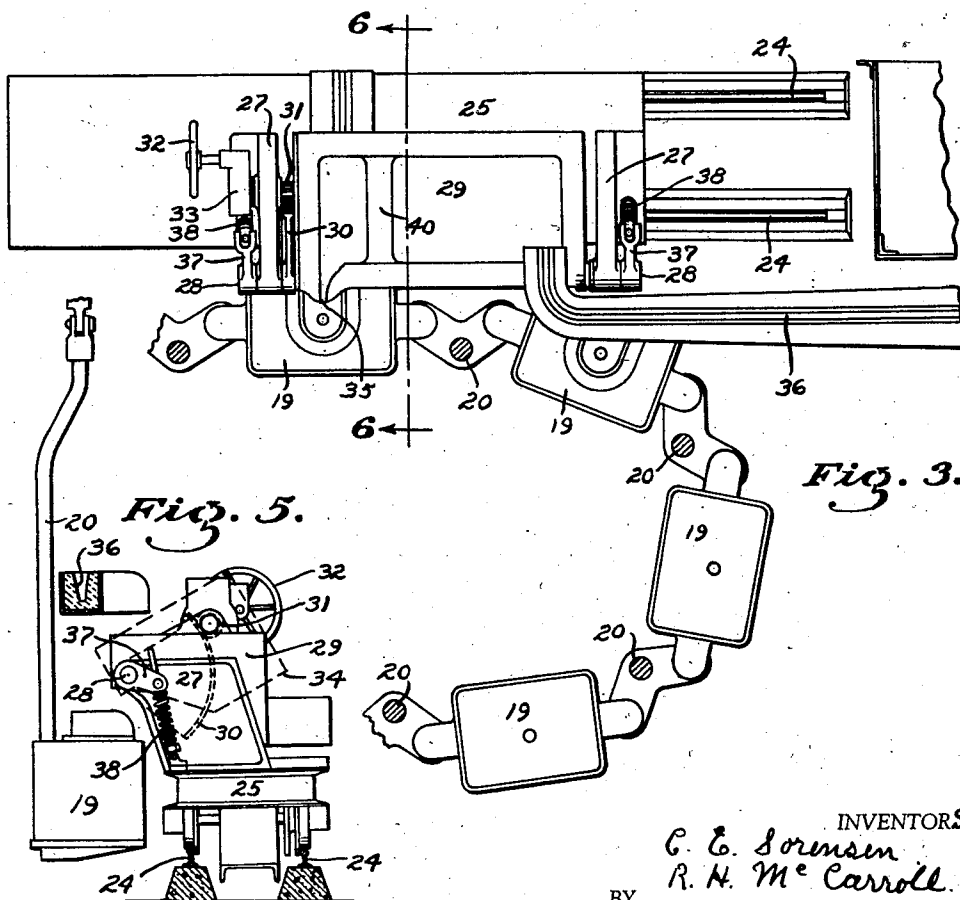
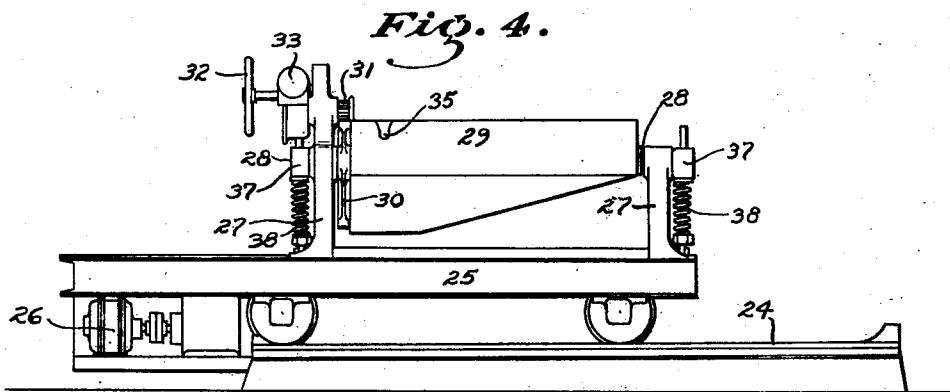
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2 Sheets-Sheet 2



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APPARATUS FOR CASTING

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2 Claims. (Cl. 22-209)

The object of our invention is to provide a new method of forming castings, particularly engine cylinder block castings.

A further object of our invention is to provide a method of casting which will better equalize variations in composition and temperature of the metal being cast, to thus produce more uniform castings. This is particularly advantageous where complicated castings are to be formed as it reduces the scrap to a large extent.

Still a further object of our invention is to provide a method of casting wherein the output of the furnace which is used to heat the metal is almost doubled. The commercial advantage of this result is obvious.

Still a further object of our invention is to provide a unique pouring ladle which is designed to be used in conjunction with a continuously moving conveyor system which supports the molds for forming the castings.

With these and other objects in view, our invention consists in the several steps which comprise our improved process, together with the apparatus used herein, as described in the specification, claimed in our claims and illustrated in the accompanying drawings, in which:

Figure 1 is a vertical central sectional view through an electric furnace and a holding furnace, both of which are used in carrying out our improved process.

Figure 2 is a plan view of our improved ladle showing its relation to the holding furnace, shown in Figure 1.

Figure 3 is a more detailed plan view of the pouring ladle showing its relation to the conveyor which supports the molds.

Figure 4 is a side elevation of the ladle which is shown in Figures 2 and 3.

Figure 5 is an end view of the pouring ladle, and

Figure 6 is a sectional view, taken on the line 6-6 of Figure 3.

In order to better appreciate the advantages of our improved process, it may be well to briefly describe the steps which have heretofore been necessary in forming cylinder block castings. The iron was first heated to considerably above its melting temperature in either a cupola or an electric furnace and then the molten iron was intermittently poured from the furnace into ladles. These ladles were conveyed from the furnace to the molds in which the castings were to be formed. This conventional process has two disadvantages, the one being that the castings varied considerably for the reason that the

iron poured first from the ladle was considerably hotter than that poured from the bottom of the ladle. Furthermore, unavoidable variations in the time taken to convey the several ladles from the furnace to the molds also resulted in temperature variations. Where complicated iron castings are to be formed, it is very desirable to have the iron poured at a uniform temperature so that the structure of the iron in all castings will be similar.

A further disadvantage of the conventional process is that the furnace is idle all of the time the iron is being poured. When a fifteen ton electric furnace is used, it requires about twenty minutes to pour a batch of metal from the furnace into the ladles. Inasmuch as it requires only twenty minutes to bring the charge up to the heat in such furnace, it is apparent that the furnace operates to heat the metal only half the time. Furthermore, pouring must be carried on intermittently with its resulting inefficiency. With our improved process not only is the pouring continuous, but the output of the electric furnace is almost double that possible with the conventional method of casting.

Briefly our improved process comprises melting the iron in an electric furnace and when it has attained its proper temperature pouring the contents of the furnace into a holding furnace. This pouring operation only requires from one to two minutes. The holding furnace is constructed to have a normal capacity of about twice that of the electric furnace so that an equalization in the contents of successive batches from the electric furnace is obtained. A trough extends from the holding furnace through which a stream of metal continuously flows, this metal being deposited in a specially designed ladle. This ladle is mounted upon a dolly which moves back and forth along a short track. The molds are suspended from an overhead track and move along a path parallel to the track upon which the ladle moves. Thus, when the ladle is moving along with one of the molds, the ladle may be tipped to fill the mold. The ladle is so constructed that the trough from the holding furnace continuously discharges metal into same.

The apparatus for carrying out our improved process comprises a conventional fifteen ton electric furnace 10, this furnace being adapted to pivot around a fulcrum 11 at one end thereof by means of a cable 12. The furnace is charged by pouring part cupola metal and part metal from the blast furnace into a trough 13, from which it flows into the hearth of the furnace 10. When 55

internal-combustion engine cylinder block castings are to be made, it has been found that using 70% of cupola iron to 30% of metal from the blast furnace results in excellent castings, the hot metal from the blast furnace alone being too high in carbon and silicon. After the metal in the furnace has been heated for approximately twenty minutes, or to a temperature between 2700 and 2800 degrees F., the furnace is tipped around the fulcrum 11 so that the iron flows therefrom through a spout 14 into a trough 15 from which it flows through a port 16 into an air furnace 17. The furnace 17 has a capacity of thirty tons, having twice the capacity of the electric furnace 10. The metal in the air furnace is maintained at 2750 degrees F. by means of a coal flame which is directed into the furnace at one end thereof through an opening 18. The flame is directed against the bath so as to maintain same at the desired temperature. Because the furnace 17 has twice the capacity of the furnace 10, it will be apparent that the device may be operated so that there is at least fifteen tons of molten metal in the furnace 17 at all times.

The molds in which the castings are to be formed have been given the reference numeral 19 and are mounted between individual carriers 20 which are suspended from a conveyor chain 21, the chain being supported from an I-beam 22 by means of a plurality of trolleys 23. The I-beam 22 and conveyor chain 21 form a continuous conveyor system whereby the carriers 20 are conducted through a loading room wherein the molds 19 are placed thereon and then conducted along a path adjacent to the furnace 17 where the molds are poured. The molds are then conveyed to a dumping rack and then the carriers return to the loading room.

In order to pour the iron from the furnace 17 into the molds 19, we have provided a reciprocating ladle which is adapted to travel along with each mold during a portion of its travel adjacent to the furnace. A pair of parallel tracks 24 are secured to the floor and the dolly 25 is mounted to travel back and forth along this track. An electric motor 26 drives the dolly 25 in both directions. A pair of supports 27 extend upwardly from the dolly 25, each support having a bearing in its upper portion in which a pair of trunnions 28 are rotatably mounted. These trunnions project horizontally from the respective ends of a ladle 29. It will be noted from Figure 5 that the trunnions 28 are disposed directly above the molds 19. A sector gear 30 is fixed to one of the trunnions 28 which gear is in mesh with a pinion 31. The pinion 31 is driven by a hand wheel 32 through a speed reducing gearing mechanism 33 so that, when the hand wheel is rotated in one direction, the ladle will be tilted up to the position shown by dotted lines 34 in Figure 5. At this time the metal in the ladle will flow out through a spout 35, and into one of the molds there beneath. Suitable arms 37 extend from the respective ends of the trunnions 28, and a compression spring 38 extends between the free end of each arm 37 and the base of the dolly 25. This spring is loaded to such an extent that it counteracts the weight of the ladle and metal therein to a large extent. Inasmuch as the trunnions 28 are towards the top and to the extreme left hand side of the dolly 25, the device is materially offset so that it would be quite difficult for the operator to tip the ladle if it were not for the counterbalancing due to the springs 38. A very important feature of this arrangement is that the

spout 35 is disposed in axial alignment with the trunnions 28 so that when the ladle is tipped the relative positions of the spout and mold do not change.

It will be noted that a trough 36 extends from the furnace 17 to position over the ladle 29, the trough being parallel to the track 24. The ladle is sufficiently long that the trough 36 is always positioned above same so that metal flowing therethrough will be deposited in the ladle irrespective of the position of the ladle and dolly 25 upon the track 24. Referring to Figures 2 and 6, it will be noted that the ladle 29 is provided with a partition 40 there across near the spout 35, the purpose of which is to keep slag from flowing out of this spout. The partition does not extend to the bottom of the ladle so that the metal is free to flow from one side of the ladle to the other, flowing beneath the partition. Consequently, slag which forms upon the surface of the metal at the receiving end of the ladle is not permitted to flow beyond the partition 40.

In carrying out our process molten iron is charged into the electric furnace 10 and is heated therein for about twenty minutes. The furnace 10 is then quickly discharged into the holding furnace 17 and a new charge of metal placed in the electric furnace 10. Before starting to draw from the holding furnace, it is desirable that a second batch of iron from the furnace 10 be mixed with the first batch in the holding furnace to equalize the temperature and composition of successive charges from the electric furnace. When it is desired to start the pouring operation, the holding furnace is tapped so that metal flows therefrom through the trough 36 into the ladle 29. A $\frac{5}{8}$ diameter outlet opening in the holding furnace is just about sufficient to keep up with a fifteen ton electric furnace. The metal flows continuously through the trough 36 and discharges into the ladle 29. After the ladle has become one half to two thirds full, the operator aligns the spout 35 with one of the moving molds and starts the motor 26 which conveys the dolly 25 at the same speed as the mold. The ladle is then tipped so that metal flows out through the spout 35 into the adjacent mold. As soon as the mold has become filled the ladle is dropped back to its level position and the motor 26 reversed to bring the dolly 25 back to its original starting position. The molds 19 are so spaced that, when the dolly is returned to its starting position, it will be aligned with the next mold on the conveyor so that the ladle may be immediately tipped to fill this mold while it is traveling towards the furnace. The novel feature of this process is that, during the travel of the ladle 29 in both directions, the metal is flowing continuously through the trough 36. In casting cylinder blocks a conveyor speed of eight and one half feet per minute has been found desirable where the molds are spaced at five foot intervals along the conveyor chain.

Among the many advantages arising from the use of our improved process, it may be well to mention that the output of the electric furnace is substantially doubled inasmuch as the furnace may be emptied in the matter of a minute or two whereas with the older methods of casting, where the iron was poured into individual ladles, a time equivalent to the heating time was required to empty the furnace.

Furthermore, the composition of successive charges from the electrical furnace is equalized so that more uniform castings result.

Furthermore, as the temperature of the holding furnace may be maintained at within very close limits more uniform castings result. While a loss of heat in the trough 36 and ladle 29 is inevitable, the metal dropping to 2650 degrees F. as it flows therethrough, still this drop is uniform and can therefore be compensated for in the heating of the holding furnace so that a pouring temperature within very close limits is always assured.

Some changes may be made in the various steps comprising our improved process and apparatus therefor without departing from the spirit of our invention and it is our intention to cover by our claims such changes as may reasonably be included within the scope thereof.

We claim as our invention:

1. In combination, an electric furnace, a closed type holding furnace of substantially twice the capacity of said electric furnace, a ladle, a plurality of molds, means for mixing successive batches from said electric furnace in said holding furnace, means associated with said holding furnace for adding heat to said metal to maintain same at a uniform temperature substantially above its melting temperature, a trough extending between said holding furnace and said ladle, a fixed metering jet disposed between said holding furnace and said trough whereby metal is continuously drawn from said holding furnace and

deposited in said ladle, said metering jet being of such size that a quantity of metal equivalent to one of said batches will be deposited in said ladle in the time taken to heat and pour said batch, means for conveying molds continuously past said ladle, means for reciprocating said ladle in a path parallel to the path of said molds and at a similar speed whereby each of the molds will remain fixed relative to said ladle during one stroke of its reciprocating movement, and means for pouring metal from said ladle into the adjacent mold during said fixed portion of each stroke.

2. In combination a 15-ton electric furnace, a 30-ton holding furnace, a ladle, a plurality of molds, means for intermittently heating metal in said electric furnace to a temperature between 2700° F. and 2800° F., said metal after heating being mixed in said holding furnace, means for adding heat to said holding furnace so as to maintain the metal therein at substantially 2750° F., a trough extending between said holding furnace and said ladle, said holding furnace having a 5/8" diameter outlet jet therein through which metal continuously flows from said furnace into said ladle through said trough, and means for conveying molds continuously past said ladle, and means for intermittently pouring metal from said ladle into said molds.

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