

J. C. DAVIS.

CASTING APPARATUS AND PROCESS.

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1,193,670.

Patented Aug. 8, 1916.

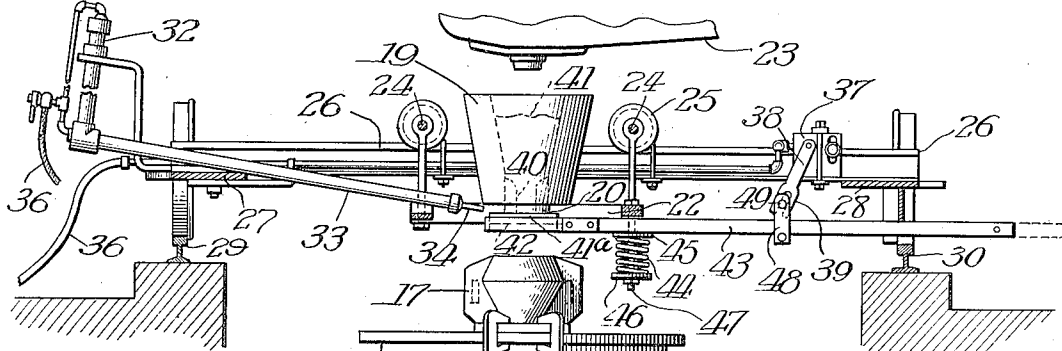


Fig. 1.

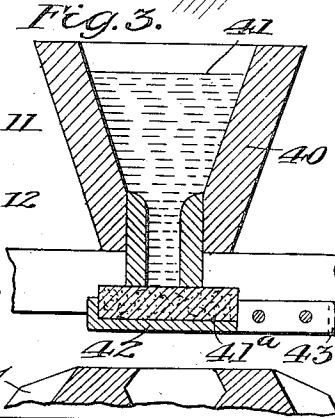


Fig. 3.

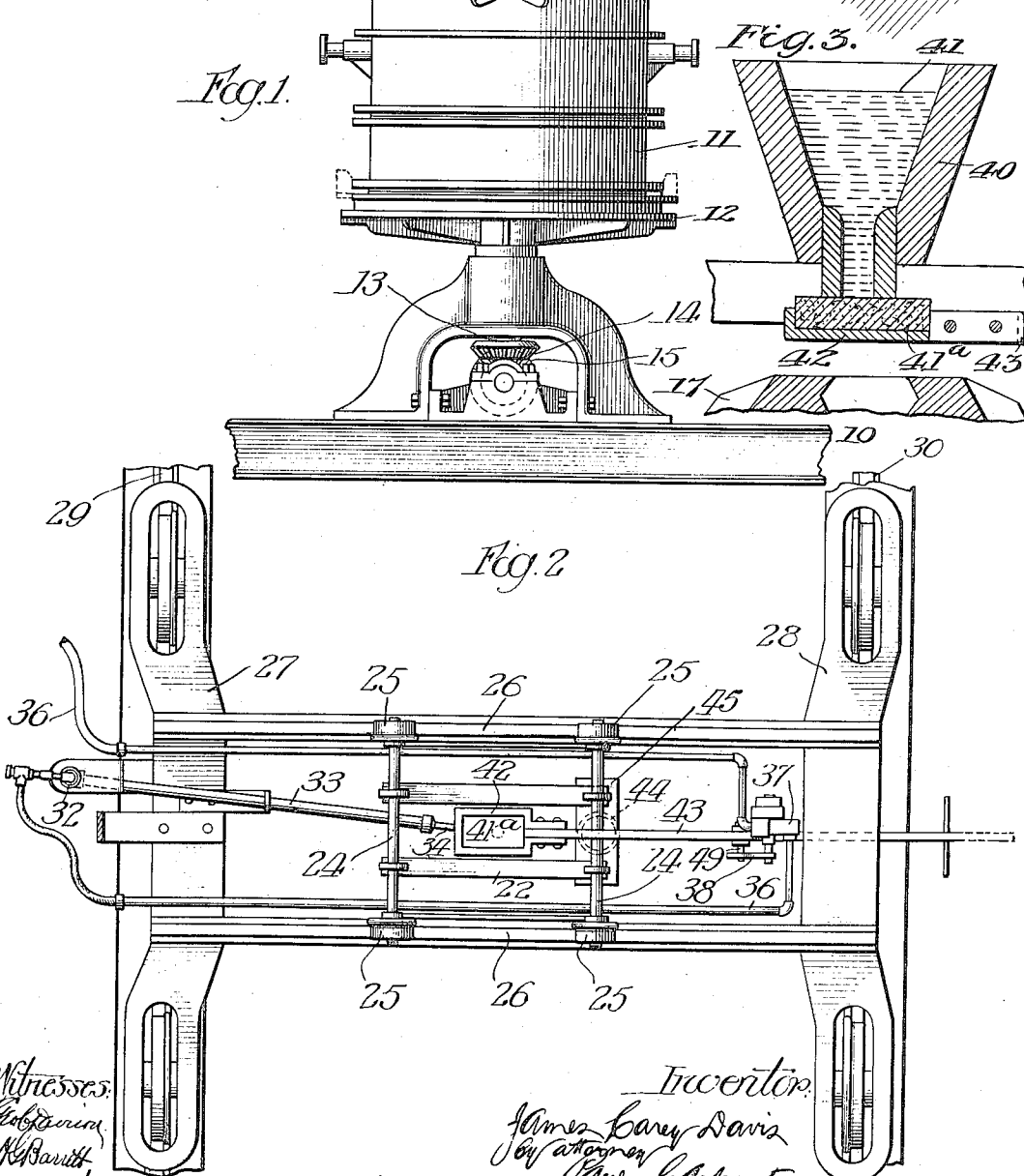


Fig. 2.

Witnesses:
John A. Barrett,
Atty.

Inventor:
James Cary Davis
by attorney
John A. Barrett att.

UNITED STATES PATENT OFFICE.

JAMES CAREY DAVIS, OF HINSDALE, ILLINOIS.

CASTING APPARATUS AND PROCESS.

1,193,670.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JAMES CAREY DAVIS, a citizen of the United States, and a resident of Hinsdale, in the county of Dupage and State of Illinois, have invented certain new and useful Improvements in Casting Apparatus and Processes, of which the following is a specification.

My present invention relates to the art of casting metal in general, and more particularly to means for subjecting the molten metal to certain modifying elements after it has left the ladle, and has special reference to the provision of improved means for introducing a hardening or other modifying element into the metal before it flows into the mold, whereby the admixture and distribution of the modifying element may be regulated and determined with greater nicety than has heretofore been known to me, to the end that a homogeneity of metal throughout the casting of certain parts thereof may be secured.

The principal objects of my present invention are the provision of an improved apparatus for the stated purposes by means of which a release of molten metal into the mold will be accomplished in the form of a substantially solid column, and one wherein the release of a stream of molten metal is simultaneously accompanied by the actuating of the means for introducing the modifying element into the stream, which will more uniformly mix the molten metal and the modifying element than has heretofore been done in any manner known to me; and to provide means whereby the size and velocity of the stream of molten metal may be made uniform and constant from the beginning, to the end that the proportion of the modifying element introduced thereinto may be more precisely controlled, and consequently castings of a more closely predetermined composition produced, together with such further objects as will hereinafter appear.

My invention further contemplates the provision of an improved process of making castings, which may, if desired, be of differing degrees of hardness in different portions, such as those made of steel which is hard and resistant and consequently of good wearing qualities at the exterior and relatively softer toward the center, and therefore more tough and less likely to fracture, such process being especially useful for the

production of cast steel wheels and like structures.

In the production of cast steel wheels and other structures containing a modifying element by apparatus and processes heretofore known to me I have experienced no little difficulty in attaining the desired constant proportions between the principal element forming the body of the casting and the modifying element introduced thereinto at the time of the pouring, ensuant upon the tendency of the molten metal as it comes from the pouring device to flow in a stream of extremely irregular contour, tending to spurt or spread in an irregular manner instead of descending in a solid column as is desirable where a modifying element is used, which in practice I find not only renders it substantially impossible to secure the introduction of the proper proportion of modifying element into the stream of molten metal, but also to properly incorporate the modifying element with all parts of such stream.

In accomplishing the foregoing objects, and overcoming the disadvantages referred to, and in attaining certain further benefits to be below disclosed, I have provided the constructions illustrated in preferred form in the accompanying drawings, wherein—

Figure 1 is an elevational view of a rotatable mold, wherein a casting may be produced in accordance with my invention; Fig. 2 is a plan view of certain parts of the device illustrated in Fig. 1, and Fig. 3 is a fragmentary view in longitudinal vertical section, illustrative of the relation of certain of the parts of the apparatus shown in Fig. 1.

Referring first to Fig. 1 it will be noted that in carrying out my invention I mount in a convenient place, as in a pit 10, the desired number of molds 11 each of which is mounted upon a rotatable table 12 supported by a vertical shaft 13 carrying a gear 14 driven by a pinion 15. Upon the upper flash member 16 I arrange a pouring gate 17 provided with a refractory lining.

For the purpose of providing means whereby the molten metal from the ladle 23 may be caused to descend in a solid column of uniform diameter, contour and velocity, I provide a choke device comprising a hopper or funnel 19, preferably conically shaped, the open bottom of which is partially closed by a nozzle 20 which is formed of refractory material and may be

renewed from time to time as required in service. To the end that the choke device may be centered over the pouring gate 17, and where circumstances render it desirable
 5 moved from one flask to another, it is mounted upon a truck which comprises a supporting bed 22 carried upon axles 24 the wheels of which 25 are revoluble thereupon and arranged to ride upon rails 26 the outer
 10 ends of which are mounted upon trucks 27 and 28 which in turn ride upon the rails 29 and 30 oppositely disposed about the molds 11.

For the purpose of introducing and incorporating most perfectly and commingling and distributing most thoroughly the modifying element into the stream of flowing metal, I make use of an apparatus which here comprises a vertical casing 32 for containing the modifying element, such as manganese, chromium, vanadium, etc., a lateral extension thereof 33, a nozzle 34 the ejector of which, is depressed somewhat from the horizontal, and a pipe 36 connected to a
 25 source of air or other fluid pressure supply, and inserted into the apparatus below the casing 32 to the end that the modifying element may be drawn therefrom by fluid pressure and forced into the flowing stream of
 30 metal.

For the purpose of controlling the operation of the introducing device, I provide in the pipe 36 a valve 37 having an operating lever 38 whose lower end is bifurcated as indicated at 39 for a purpose to be below disclosed.

In order to close the orifice 40 of the choke device, until the metal has risen to such a height, as indicated at 41, where it will have
 40 sufficient head to force it to descend in a substantially even column, I make use of a suitable piece of refractory material such as fire brick, as indicated at 41^a, mounting it in a bracket 42 carried by a slidable operating
 45 rod 43 which is supported from the truck members 22 and 28, such brick 41^a being held in contact with the orifice 40 by means of a spring 44 mounted between plates 45 and 46 and held under compression by means of
 50 a threaded rod 47. The rod 43 is provided with an arm 48 carrying a pin 49 which engages the slot 39, in such a manner that when the rod 43 is moved to the right from the position indicated in the full lines in Fig.
 55 1 to the position indicated in dotted lines, the orifice 40 and valve 37 are simultaneously opened, and thereby not only does the molten metal descend in a solid stream, when it has been allowed to rise to the point
 60 indicated at 41 and thus acquire a sufficient head, but also the introducing device 33 is simultaneously operated by the admission of air thereto through the pipe 36 upon the opening of the valve 37, whereby a constant
 65 apportionment of modifying element to the

stream of molten metal may be attained from the beginning of the pour.

While I have illustrated my invention in connection with a rotating mold, available for the manufacture of wheels, and believe
 70 that it is particularly useful for the production of such articles and others wherein it is desirable to have a greater portion of the modifying element toward the periphery, my invention is useful for the manufacture
 75 of castings in stationary molds, or intermittently rotated molds, wherein are made castings of either a homogeneous composition throughout or those formed of a number of strata of material.

It is believed that the operation of my invention will be understood without further detailed description, and that other advantages of my invention and other specific means of employing it will occur to those
 85 who are skilled in the art to which my invention pertains.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent, is the
 90 following:

1. In a casting apparatus, the combination with a container, of means external of the container movable laterally for closing the orifice of such container, a yieldingly resistant device arranged at an angle thereto for holding said closing means in contact with said orifice, and means for moving said closing means against the resistance of said yieldingly resistant device.

2. In a casting apparatus the combination with a container having a substantially vertical orifice, of substantially horizontally disposed and vertically movable means arranged exteriorly of the container but adapted to cover said orifice for closing the same, a substantially vertically disposed spring bearing on said closing means for holding the same in contact with said orifice, and means for moving said closing device laterally.

3. In a casting apparatus, the combination with a choke device, and a device for introducing a modifying element into flowing metal as it runs from said choke device, of means for closing the orifice of said choke device and actuating said introducing device.

4. In a casting apparatus, the combination with a choke device, and a device for introducing a modifying element into flowing metal as it runs from said choke device, of means for closing the orifice of said choke device and means for actuating said introducing device, the said closing means and actuating means being arranged for simultaneous operation.

5. In a casting apparatus, the combination with a choke device, and a device for introducing a modifying element into flow-

ing metal as it runs from said choke device, of means for closing the orifice of said choke device and fluid pressure means for actuating said introducing device, a valve for controlling said fluid pressure means and a connection between said valve and said closing means, whereby when said closing means is operated said valve is simultaneously operated.

6. In a casting apparatus, the combination with a choke device having an aperture to permit the efflux of molten metal, a device for introducing a modifying element into the flowing stream of metal, means for closing said aperture, means for actuating said introducing device, and means for simultaneously operating said closing and actuating means.

7. The process of introducing a modifying element into a cast body during the pouring into the mold, which consists in restraining the molten metal in a choke device, and then simultaneously releasing the metal in a stream of substantially continuous size and uniform velocity and forcing the modifying element into the stream between the choke device and the mold.

8. The process of introducing a modifying element into a cast body during the pouring into the mold, which consists in restraining the molten metal in a choke device, and then simultaneously releasing the metal in a stream of substantially continuous size and uniform velocity and forcing the modifying element into the stream in the direction of travel of such metal between the choke device and the mold.

9. The process of producing a cast body containing a modifying element, which consists in first restraining the approach of the molten metal to the mold and restraining the introduction of the modifying element thereinto, and then initiating the approach of the molten metal to the mold in the form of a substantially solid column and forcing the modifying element into the column between the ladle and the mold, both of said last mentioned steps being begun and carried out simultaneously.

10. The process of producing a cast body containing a modifying element, which consists in first restraining the approach of the molten metal to the mold and restraining the introduction of the modifying element thereinto, and then initiating the approach of the molten metal to the mold in the form of a substantially solid column and forcing the modifying element into the column between the ladle and the mold by fluid pressure, both of said last mentioned steps being begun and carried out simultaneously.

11. The process of introducing a modifying element into a cast body during the pouring into the mold which consists in simultaneously causing the molten metal to approach the mold in the form of a substantially solid column and forcing the modifying element against the column between the ladle and the mold by fluid under pressure sufficient to overcome the resistance of the molten metal and cause the element to penetrate said column.

12. The process of introducing a modifying element into a cast body during the pouring into the mold which consists in simultaneously initiating the approach of the molten metal to the mold in the form of a substantially solid column and the forcing of the modifying element into the descending column between the ladle and the mold, and maintaining the molten metal at a height substantially uniform.

13. The process of introducing a modifying element into a cast body during the pouring into the mold, which consists in restraining the molten metal in a choke device, simultaneously releasing the metal in a stream of substantially continuous size and uniform velocity and forcing the modifying element into the stream between the choke device and the mold, and maintaining the molten metal at a substantially uniform height in the choke device.

14. The process of introducing a modifying element into a cast body during the pouring into a mold, which consists in restraining the molten metal in a choke device, simultaneously releasing the metal in a stream of substantially continuous size and uniform velocity and forcing the modifying element into the stream in the direction of travel of such metal between the choke device and the mold, and maintaining the molten metal at a substantially uniform height in the choke device.

15. The process of introducing a modifying element into a cast body during the pouring into the mold, which consists in simultaneously initiating the approach of the molten metal to the mold in the form of a substantially solid column and the forcing of the modifying element into the column between the ladle and the mold, and maintaining the molten metal at a height substantially uniform.

16. The process of introducing a modifying element into a cast body during the pouring into the mold which consists in simultaneously initiating the approach of the molten metal to the mold in the form of a substantially solid column and the forcing of the modifying element into the column between the ladle and the mold by fluid pressure, and maintaining the molten metal at a height substantially uniform.

17. The process of introducing a modifying element into a cast body during the pouring into the mold which consists in simultaneously initiating the approach of the molten metal to the mold in the form of a substantially solid column and the forcing of the modifying element into the column between the ladle and the mold by fluid pressure, and maintaining the molten metal at a height substantially uniform.

18. The process of introducing a modifying element into a cast body during the pouring into the mold which consists in simultaneously initiating the approach of the molten metal to the mold in the form of a substantially solid column and the forcing of the modifying element into the column between the ladle and the mold by fluid pressure, and maintaining the molten metal at a height substantially uniform.

ten metal to the mold in the form of a substantially solid column and the forcing of the modifying element against the column between the ladle and the mold by fluid
5 pressure sufficient to overcome the resistance of the molten metal and cause the element to penetrate said column, and maintaining the molten metal at a height substantially uniform.

10 18. The process of introducing a modifying element into a cast body during the pouring into the mold which consists in simultaneously initiating the approach of the molten metal to the mold in the form of a substantially solid column and the forcing of
15 the modifying element into the descending column between the ladle and the mold, maintaining the molten metal at a height substantially uniform, and rotating the mold.

20 19. The process of introducing a modifying element into a cast body during the pouring into the mold, which consists in restraining the molten metal in a choke device, simultaneously releasing the metal in a stream
25 of substantially continuous size and uniform velocity and forcing the modifying element into the stream between the choke device and the mold, maintaining the molten metal at a substantially uniform height in the choke
30 device, and rotating the mold.

20. The process of introducing a modifying element into a cast body during the pouring into the mold, which consists in restraining the molten metal in a choke device,
35 simultaneously releasing the metal in a stream of substantially continuous size and uniform velocity and forcing the modifying element into the stream in the direction of travel of such metal between the choke device and the mold, maintaining the molten
40 metal at a substantially uniform height in the choke device, and rotating the mold.

21. The process of introducing a modifying element into a cast body during the pouring into the mold, which consists in simultaneously initiating the approach of the
45 molten metal to the mold in the form of a substantially solid column and the forcing of the modifying element into the column between the ladle and the mold, maintaining
50 the molten metal at a height substantially uniform, and rotating the mold.

22. The process of introducing a modifying element into a cast body during the pouring into the mold which consists in simultaneously initiating the approach of the
55 molten metal to the mold in the form of a substantially solid column and the forcing of the modifying element into the column between the ladle and the mold by fluid pressure,
60 maintaining the molten metal at a height substantially uniform, and rotating the mold.

23. The process of introducing a modifying element into a cast body during the pouring
65 into the mold which consists in simultaneously initiating the approach of the molten metal to the mold in the form of a substantially solid column and the forcing of the modifying element against the column
70 between the ladle and the mold by fluid pressure sufficient to overcome the resistance of the molten metal and cause the element to penetrate said column, maintaining the molten metal at a height substantially uniform,
75 and rotating the mold.

In testimony whereof I have hereunto signed my name in the presence of the two subscribed witnesses.

JAMES CAREY DAVIS.

Witnesses:

J. SOULE SMITH,
PAUL CARPENTER.