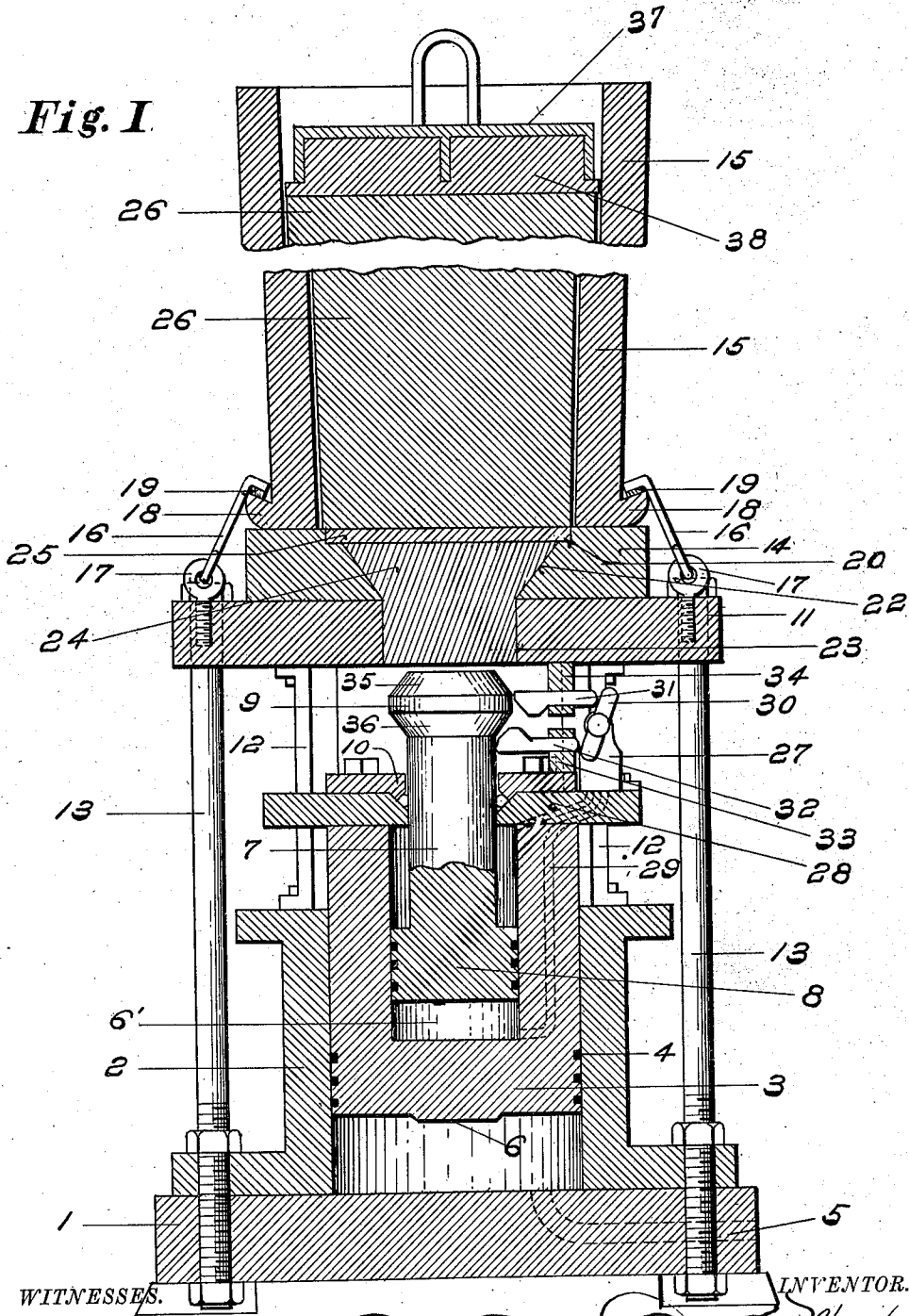


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 APPARATUS FOR MAKING CASTINGS.
 APPLICATION FILED MAR. 9, 1911. RENEWED OCT. 4, 1912.

1,062,289.

Patented May 20, 1913.
 2 SHEETS—SHEET 1.

Fig. I



WITNESSES.

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Fig. 2

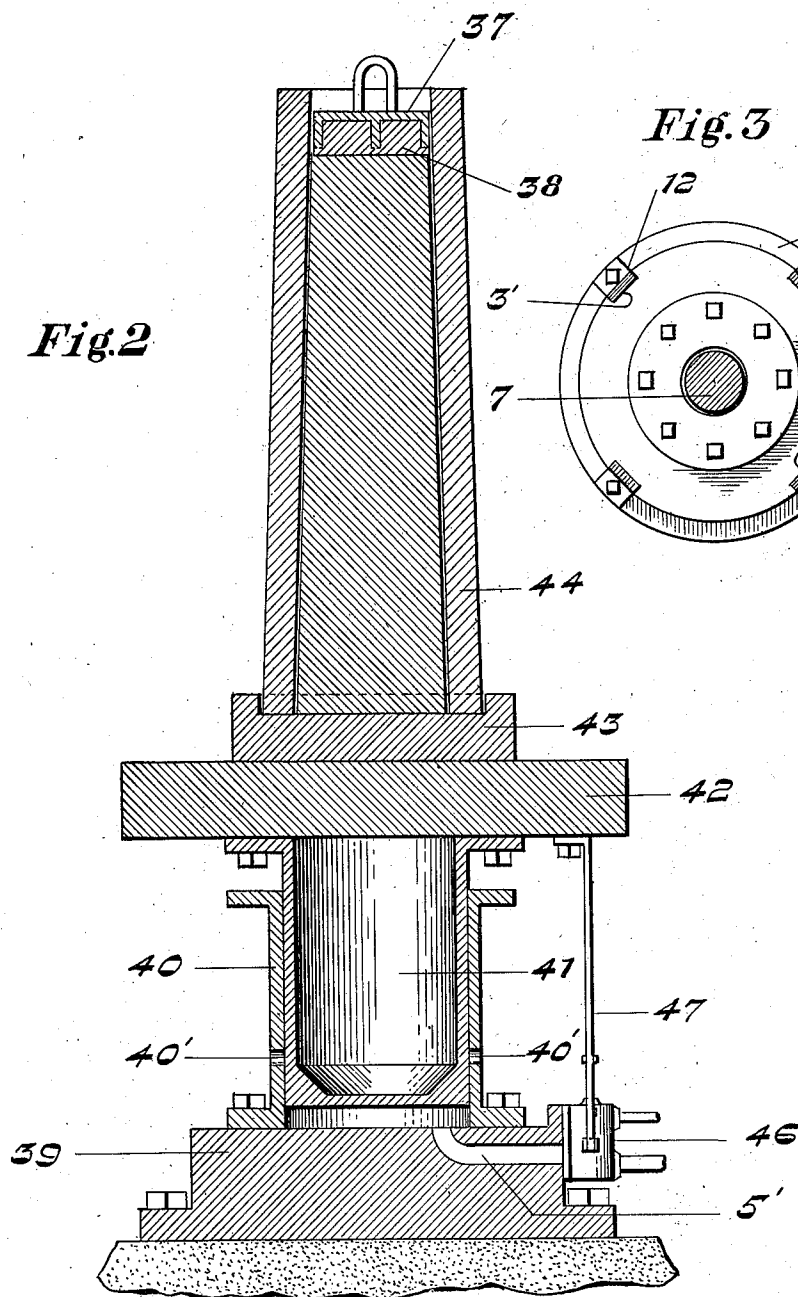
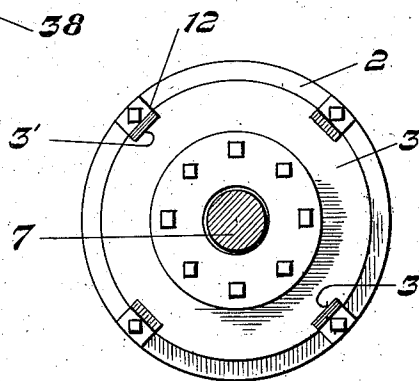


Fig. 3



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APPARATUS FOR MAKING CASTINGS.

1,062,289.

Specification of Letters Patent.

Patented May 20, 1913.

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To all whom it may concern:

Be it known that I, DAVID MAXWELL, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Apparatus for Making Castings, of which the following is a specification.

This invention relates to the art of casting, and while applicable to the making of castings in general, is particularly designed for use in making ingots, and has for its object to prevent piping and segregation and to enable the stripping of a casting upon one and the same apparatus.

With these and other objects in view, the present invention consists in the combination and arrangement of parts as will be hereinafter more fully described, shown in the accompanying drawings and particularly pointed out in the appended claims, it being understood that changes in the form, proportion, size and minor details may be made within the scope of the claims, without departing from the spirit of the present invention.

In the drawings,—Figure 1 is a vertical central longitudinal sectional view of one form of apparatus for practising the invention. Fig. 2 is a similar view of another form of apparatus for applying the impacts in a different manner from that of Fig. 1. Fig. 3 is a reduced plan view, partly in section, showing the manner of guiding the hydraulic or adjustable piston shown in Fig. 1.

Referring at first to Fig. 1 of the accompanying drawings, 1 designates any suitable base or bed from which rises a cylinder 2 having an open top through which works a piston 3 suitably packed, as at 4. Water is admitted into the bottom portion of the cylinder 2 through a suitable port 5 formed through the bed or base 1 or located at any other suitable point as may be desired. The bottom of the piston 3 is provided with a central depending boss 6 designed to strike the base or bed 1 so as to support the bottom of the piston slightly above the bed or bottom 1 to provide a space

to receive the water initially introduced into the cylinder. It will of course be understood that the exhaust from the cylinder passes out through the port 5. The piston 3 is hollow or provided with a central longitudinal bore 6' opening through the top of the piston. Working in the bore of the piston is a plunger including a stem or shank 7 of somewhat less diameter than that of the bore of the piston. This shank is provided at its lower end with a piston head 8 suitably packed and working in the cylinder formed by the hollow piston 3. At the upper end of the stem 7 there is a striking head 9 designed to apply impacts to the casting as will be hereinafter explained. The top of the cylinder 3 is provided with a suitable gland 10 through which the piston shank or stem 7 works. For the support of an ingot above the striking head 9 there is provided a table or platform 11 supported by standards 12 rising from the top of the fixed or stationary cylinder 2. Suitable tie bolts or rods 13 extend between the base or bed 1 and the table or platform 11. Upon the table or platform 11 is a casting plate 14. Any form of mold, such for instance as an ingot mold 15 rests upon the casting plate 14, and is held down against said plate by means of suitable fastenings. As illustrated in the accompanying drawing, these fastenings consist of hooks 16 hinged or loosely connected to the table or platform 11 by means of eyes 17, each hook being designed to be engaged with a suitable ear or lug 18 as commonly provided upon ingot molds. In order to insure a snug engagement between the hook and adjacent lug or ear a wedge 19 is driven in between the hook and ear. By the means just described, a mold may be very conveniently and rigidly held against the casting plate so as to avoid displacement by the blows imparted by the striking head 9 of the reciprocating plunger 7. In the top of the casting plate 14 is a central depression or seat 20 of suitable shape corresponding to the cross sectional shape of the lower end of the casting. A downwardly tapered opening 22 extends through the casting plate from the seat or

socket 20, with its lower open end registering with an opening 23 extending through the table or platform 11 in alinement with the striking head of the reciprocating plunger. Working in the openings 22 and 23 and conforming to the shape thereof is an impacting and stripping head 24, the lower end of which is in the path of the striking head 9 so as to be driven upwardly thereby when the percussive piston 7 is in operation. A suitable plate 25 rests loosely in the seat or socket 20 so as to be interposed directly between the impacting and stripping head 24 and the casting or ingot 26 in the mold. For the automatic control of the percussive piston there is provided a valve chest 27 carried by the cylinder 3, there being upper and lower ports 28 and 29 communicating between the valve chest 27 and the bore of the cylinder 3. The valve in the chest 27 is controlled by suitable tappet mechanism including a rocker arm 30 and upper and lower reciprocating tappet elements 31 and 32 arranged to cooperate with the striking head 9 and the rocker arm 30. The lower tappet member is mounted in a suitable guide 33 carried by the top of the adjustable cylinder 3, while the upper tappet member works in a guide 34 carried by the table or platform 11. The striking head 9 of the percussive piston is provided with upper and lower beveled portions 35 and 36 cooperating with the respective tappet elements 31 and 32 to slide the same back and forth and thereby throw the rocker arm 30 to shift the valve in the valve chest 27. For the purpose of guiding the adjustable cylinder 3, the head of the cylinder, as best shown in Fig. 3 of the drawings, is provided in its outer edge with notches or recesses 3', each of which receives one of the standards 12, whereby the cylinder 3 is guided in a true vertical direction during its up and down movements.

In practising my invention by means of the apparatus herein shown and described, molten metal is poured into the mold through the open top thereof, and after a suitable quantity has collected in the bottom of the mold, depending upon the character of the metal under treatment, air or other compressible fluid under pressure is admitted into the bottom of the cylinder 3 through the port 29 so as to drive the percussive piston upwardly to strike the reciprocating impacting head 24 and thereby apply an impact directly against the ingot 26. When the percussive piston reaches its upper limit by striking the bottom of the reciprocating head 24, the tappet 31 will have been moved outwardly to its limit by the striking head 9 wiping across the ends of the tappet, whereby the rocker-arm 30 will be thrown and the valve in the valve chest 27 reversed so as to admit air through the port 28 to force the percussive piston downward, dur-

ing which time the port 29 is an exhaust port. When the percussive piston 7 reaches its downward limit, it will actuate the tappet member 32 to return the valve in the valve chest 27 to its original position, whereupon air will be admitted beneath the piston head 8 and the percussive piston again driven upwardly. By this means, a succession of impacts may be very conveniently and effectively applied directly to the metal in the mold. The effect of the impact or jars upon the metal is such as to cause the metal to pack convergently downward along the longitudinal axis of the casting, whereby secondary pipe is effectively prevented. In the initial impacting operation, the apparatus is controlled so as to impart a vibrating or trembling motion to the molten metal for the purpose of maintaining the metal in suspension. As the level of the molten metal gradually rises in the mold, this trembling or vibration of the molten metal is kept up in order that the metal may always be in suspension throughout the successive levels of the molten metal during the pouring operation. By thus maintaining the metal in suspension, segregation is effectually prevented. As the level of the molten metal rises in the mold it becomes necessary to increase the impact, depending upon the character of the metal under treatment. To effect this change in the character of the impact all that is necessary to do is to lower the adjustable cylinder 3 by permitting water to escape through the port 5, whereby the stroke of the percussive piston will be increased and the power of the impact correspondingly increased. When the level of the molten metal reaches the upper portion of the mold where there is a tendency to form bridges, hanging walls and piping, the power of the impacts is materially increased for the purpose of breaking down any hanging walls, bridges and crust which form or tend to form at the upper portion of the casting. By thus breaking down the bridges, hanging walls and crust, the broken portions are thrown into the molten portion and are remelted therein, whereby bridges and piping are effectually prevented and the top of the metal is maintained in a molten condition except for the annular freezing at the inner walls of the mold.

From the foregoing description of the operation, it will be understood that the impacts are quick and relatively light during the initial pouring of the mold and, as the level of the molten metal rises, the character of the impacts is varied by increasing the length of the stroke of the percussive piston and decreasing the rate thereof, the heaviest blows being struck during the pipe forming and bridge-forming periods.

After pouring, and for the purpose of preventing the molten metal from splashing

out through the open top of the mold and also to retain heat, I employ a cover 37 which fits loosely within the open top of the mold and floats upon the molten metal. This cover preferably is in the form of a spidered casting filled with some suitable refractory or infusible material 38 forming a facing for the lower side of the cover to come in direct contact with the molten metal. By the use of this cover, oxidation of the upper surface of the molten metal is prevented and the metal is maintained in a molten condition for a relatively long period.

Due to shrinkage of the metal, a cup will be formed in the top of the casting containing some molten metal. This cup may be filled up by the addition of molten metal, the cover replaced and the impacts continued until the metal in the cup portion of the casting has become solidified. When the additional molten metal is poured into the cup portion a violent eruption is produced by reason of the very hot metal mingling with the relatively cooler metal, whereby all the impurities in the molten metal contained in the cup will rise to the surface, and the molten metal will solidify and unite to the walls of the cup and thus render the casting homogeneous clear to the top thereof.

After the treatment of the casting has been completed, the adjustable cylinder 3 is elevated to its limit, and hydraulic fluid pressure is admitted beneath the bottom of the percussive piston to force the same slowly upward, whereby the solidified ingot will be stripped upwardly through the mold which is held down by the hooks 16, until the top of the ingot can be caught by a crane and pulled entirely out of the mold. As soon as an ingot has been stripped from the mold, it is of course apparent that the latter can be immediately poured and the treatment of the ingot proceeded with in the manner hereinbefore described. In other words, a single mold serves for successive castings and need not be removed from the impacting apparatus until it has become unserviceable.

Instead of applying the impacts directly to the material in the mold while holding the mold fixed, the mold and its contents may be lifted up and dropped so as to apply impacts to the metal. This manner of applying impacts may be carried out by an apparatus such as shown in Fig. 2 of the accompanying drawings wherein 39 designates a suitable base upon which is supported an upright cylinder 40 containing a piston or plunger 41 working through the upper open end of the cylinder. Upon the top of the piston or plunger is a table or head 42 designed to support a casting under treatment. Where it is an ingot that is being treated the usual casting block 43 is placed upon the head or table, and the open

ended ingot mold 44 is placed upon the casting plate in the usual manner. Impacts are applied to the casting by admitting fluid pressure into the bottom of the cylinder 40 through a suitable port 5' and afterward exhausting through this port so as to drop the cylinder and the table or head carrying the mold. With this type of apparatus, the impacts are not applied directly to the metal in the mold independently of the mold while the latter is held fixed or stationary, as in Fig. 1 of the drawing, but the mold and its contents are lifted up and then dropped. The cylinder 40 is provided with ports or openings 40' normally closed by the plunger 41 so as to prevent the escape of fluid pressure in the cylinder 40, but which operate as escape ports in the event of the plunger 41 being elevated above such ports, thereby to prevent excessive elevation of the plunger. It will of course be understood that a floating cover 37 is employed as hereinbefore explained in connection with Fig. 1. The admission and exhaust of fluid pressure to the cylinder is effected by means of a valve chest 46, the valve of which is controlled by a connecting rod 47 extending between the valve in the chest and the head or table on the top of the piston. Any suitable or preferred means may be employed for adjusting the rod 47 to vary the throw of the valve for the purpose of increasing the stroke of the piston and for increasing the rate thereof.

In using either form of apparatus for carrying out the method, the mold may be used with its small end uppermost or its large end uppermost as may be desired, and the effects of the two machines on the metal in the mold are identical.

This application is a division of my co-pending application Serial No. 601,742, filed January 9, 1911.

What is claimed is:—

1. An apparatus for applying impacts to castings while solidifying including a reciprocating impact member, fluid actuated means for reciprocating said member, and means for automatically controlling the fluid-actuated means.

2. An apparatus for applying impacts to castings while solidifying, including an impact member, fluid actuated means for reciprocating the impact member, means actuated by a moving part of the impacting means for controlling the supply and discharge of fluid pressure and means to vary the character of the impacts without stopping the operation of the apparatus.

3. An apparatus for applying impacts to castings while solidifying, including a reciprocating impact member, fluid actuated means for reciprocating the impact member, means actuated by moving part of the impacting means for controlling the supply and discharge of fluid pressure and means

to vary the stroke of the fluid actuated means without stopping the operation of the apparatus.

4. An apparatus for applying impacts to castings while solidifying, including a reciprocating impact member, fluid actuated means for reciprocating the impact member, means actuated by a moving part of the impacting means for controlling the supply and discharge of fluid pressure and means for varying the rate of operation of the fluid actuated means without stopping the operation of the apparatus.

5. An apparatus for applying impacts to castings while solidifying, including a reciprocating impact member, fluid actuated means for reciprocating the impact member, means actuated by a moving part of the impacting means for controlling the supply and discharge of fluid pressure and means for varying the stroke and rate of operation of the fluid actuated means without stopping the operation of the apparatus.

6. An apparatus for applying impacts to castings while solidifying, including a support for a mold, means to apply impacts to the contents of the mold independent of the mold, and means actuated by a moving part of the impacting means for controlling the supply and discharge of fluid pressure.

7. An apparatus for applying impacts to castings while solidifying, including a support for a mold, fluid actuated means for applying impacts to the contents of the mold independent of the mold, and means actuated by a moving part of the impacting means for controlling the supply and discharge of fluid pressure.

8. An apparatus for applying impacts to castings while solidifying, including a support for the mold, fluid actuated means for applying impacts to the contents of the mold independent of the mold, including a percussive piston for applying the impacts, and means actuated by a moving part of the impacting means for controlling the supply and discharge of fluid pressure.

9. An apparatus for applying impacts to castings while solidifying, including a support a mold having an open top, a cover to fit within the mold and float upon its contents and exclude air and means for applying impacts to the casting.

10. An apparatus for applying impacts to castings while solidifying including a support, a mold having an open top, a cover to fit within the mold and float upon its contents and exclude air, and means for applying impacts to the bottom of the casting.

11. An apparatus for applying impacts to castings while solidifying, including a support for a mold, fluid actuated impact means for applying impacts to the contents of the mold independent of the mold, including a percussive piston for applying im-

pacts, and means actuated by a moving part of the impacting means for controlling the supply and discharge of fluid pressure.

12. An apparatus for applying impacts to castings while solidifying, including a support for a mold, fluid actuated impacting means for applying impacts to the contents of the mold independent of the mold, including a percussive piston for applying impacts, and means actuated by the movement of the piston for controlling the supply and discharge of fluid pressure.

13. An apparatus for applying impacts to castings while solidifying, including a mold support having an opening therethrough, an impacting plunger working in said opening, and fluid-actuated impacting means including a percussive piston in operative relation with the impacting plunger.

14. An apparatus for applying impacts to castings while solidifying, including a mold support, an impact plunger working through the support, means for securing a mold to the support with its open end in alinement with the plunger, and fluid actuated impact applying means including a percussive piston in operative relation with the plunger.

15. An apparatus for applying impacts to castings while solidifying, including a mold support, fluid actuated impact applying means including a cylinder and a percussive piston, and a fluid pressure cylinder containing the cylinder of the impact applying means.

16. An apparatus for applying impacts to the castings while solidifying, comprising a mold support, a stationary fluid pressure cylinder below the support, and fluid actuating impacting means including a cylinder adjustably supported in the stationary fluid pressure cylinder, and a percussive piston working in the adjustable cylinder.

17. An apparatus for applying impacts to castings while solidifying, comprising a mold support, a stationary fluid pressure cylinder beneath the support, and fluid actuated impact applying means including an adjustable cylinder adjustably supported within the stationary cylinder, a percussive piston working in the adjustable cylinder, a valve for controlling the supply and exhaust of the adjustable cylinder, and valve controlling means including tappets carried by the mold support and the adjustable cylinder respectively in coöperative relation with the percussive piston.

18. An apparatus for applying impacts to castings while solidifying, including a reciprocating impact member, fluid actuated means for reciprocating said member, and means actuated by a moving part of the impacting means for controlling the supply and discharge of fluid pressure.

19. In apparatus for making castings, a

combined impacting and stripping member,
means to reciprocate said member for im-
pacting, and other means for moving said
member for stripping.

5 20. In apparatus for making castings, a
combined impacting and stripping member,
fluid actuated means to reciprocate said
member for impacting, and other fluid actu-

ating means to move said member for strip-
ping.

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In testimony whereof I affix my signature
in presence of two witnesses.

DAVID MAXWELL.

Witnesses:

WALTER S. WHEELER,
EDNA HOWARD.
