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D. L. SUMMEY

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METALLURGICAL APPARATUS

Original Filed May 14, 1932

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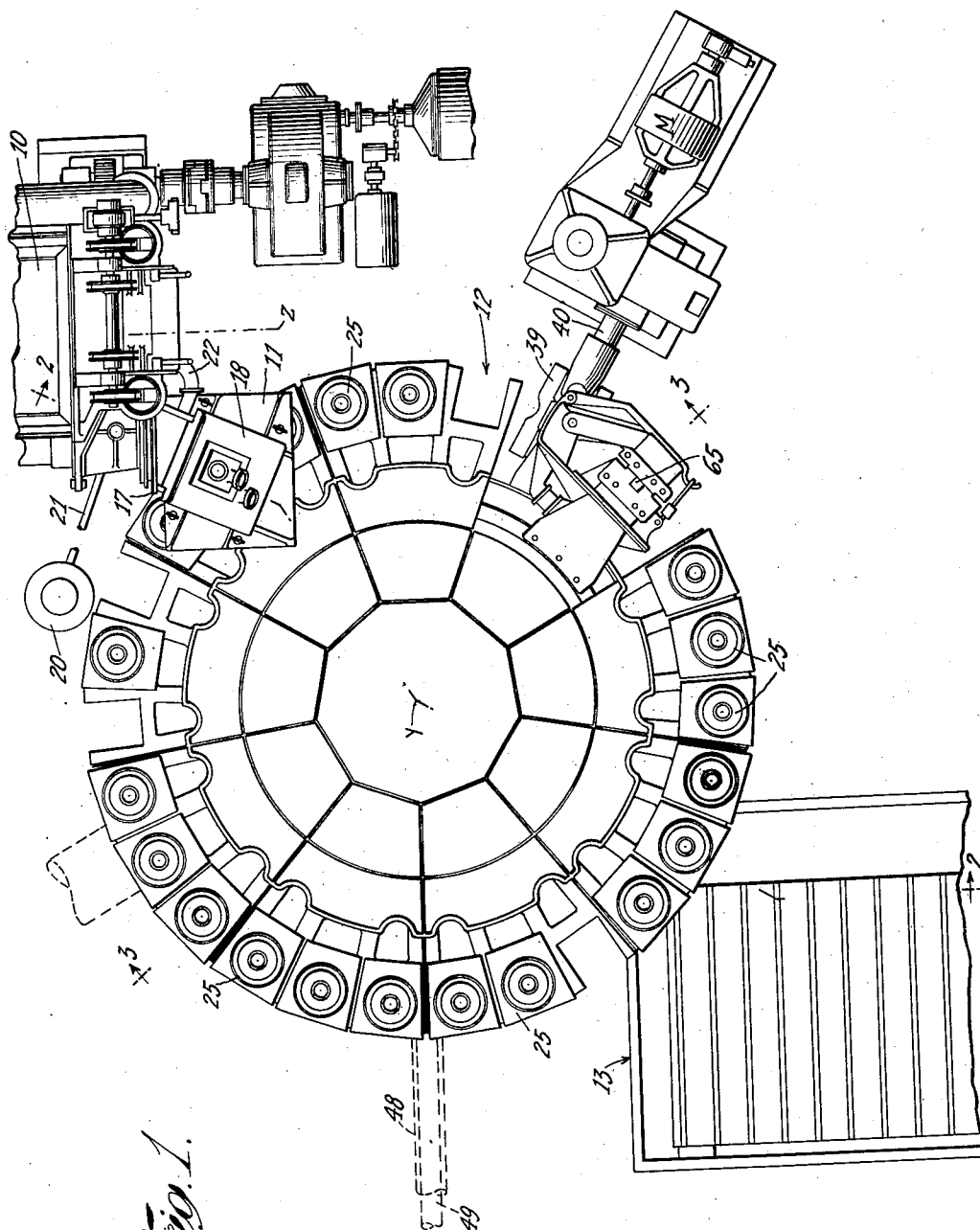


Fig. 1.

INVENTOR
DAVID L. SUMMEY

BY
Emery, Booth, Varney & Whittemore
ATTORNEYS.

Feb. 11, 1936.

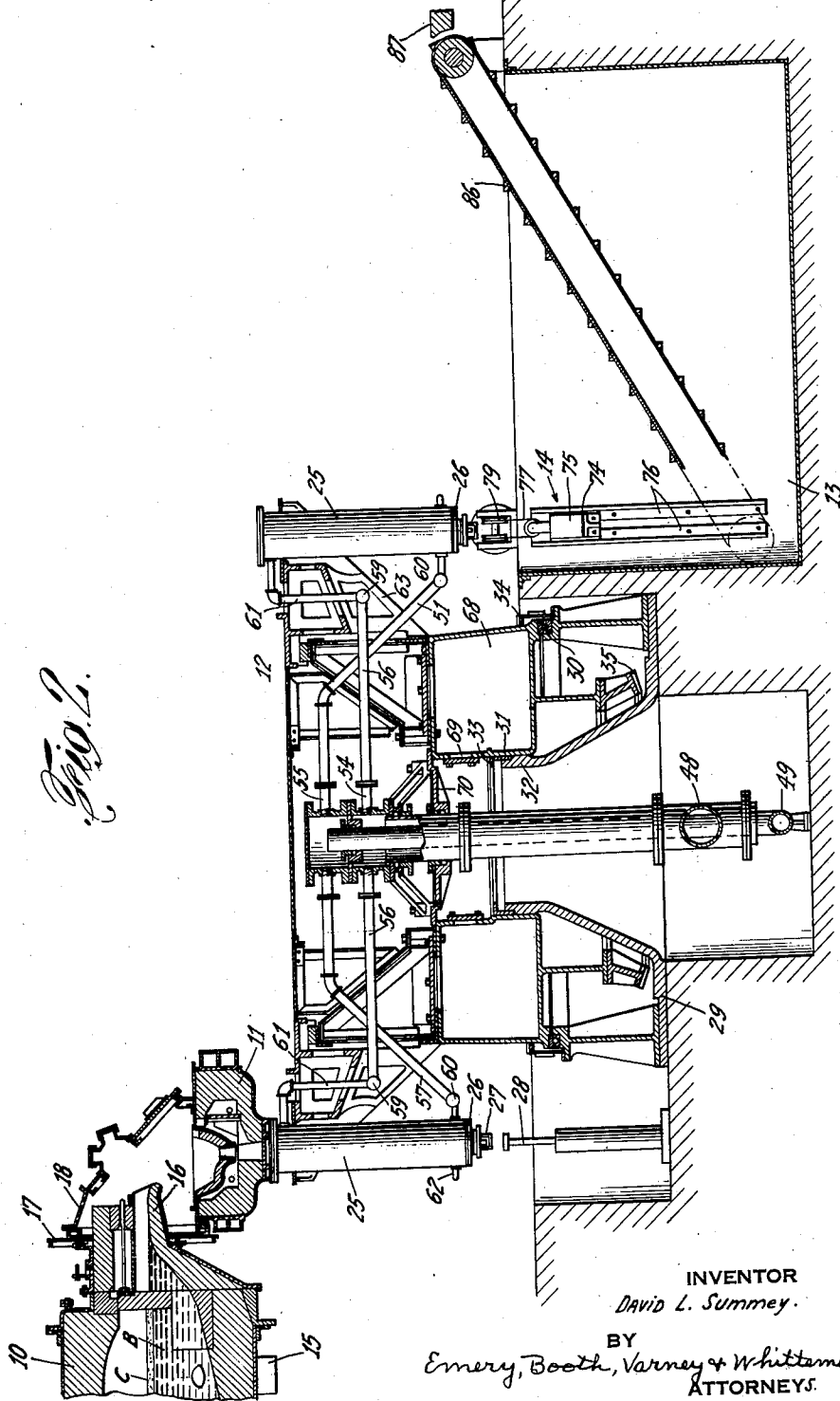
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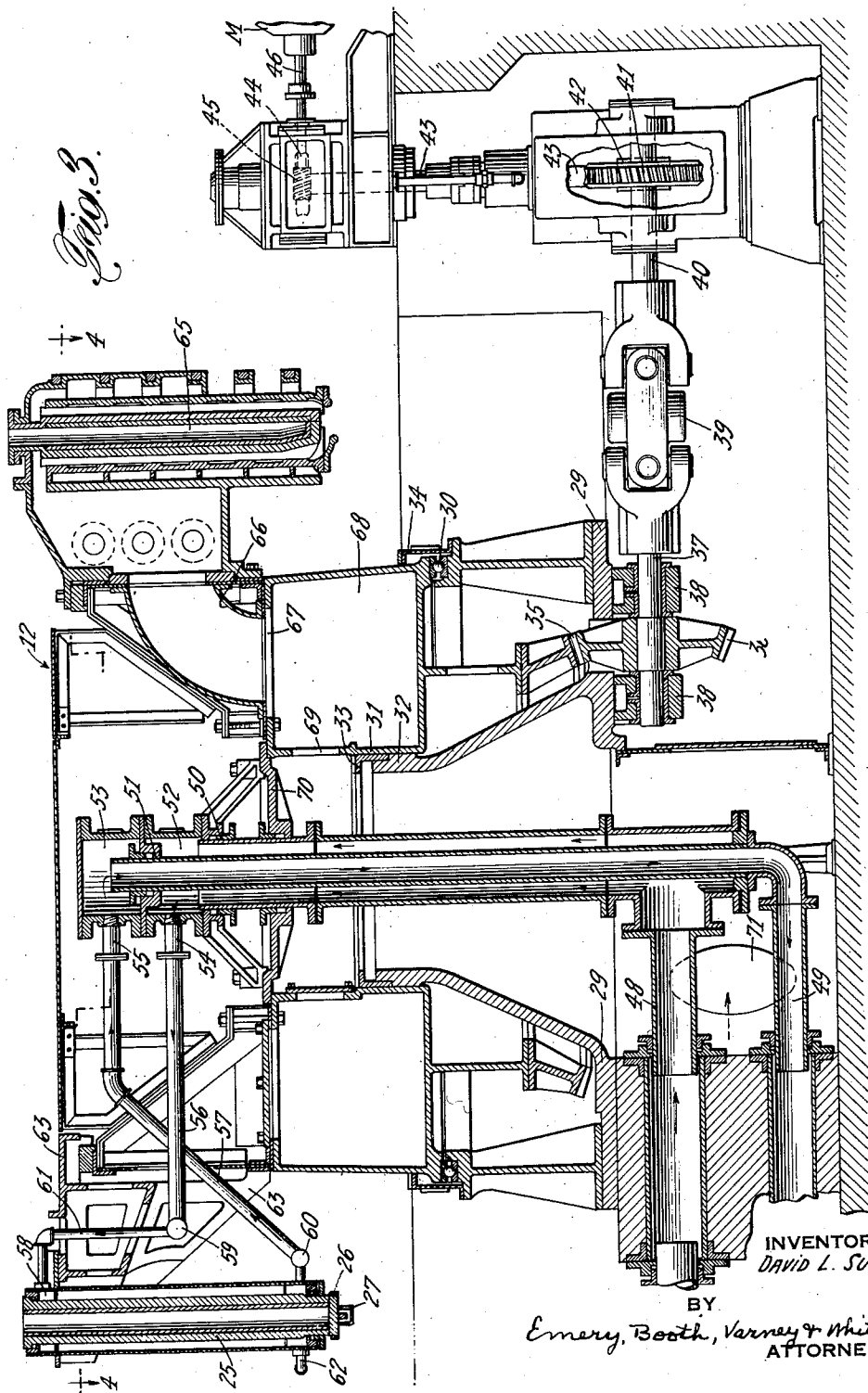
D. L. SUMMEY

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INVENTOR
DAVID L. SUMMEY

BY

Emery, Booth, Varney & Whittemore
ATTORNEYS.

Feb. 11, 1936.

D. L. SUMMEY

2,030,482

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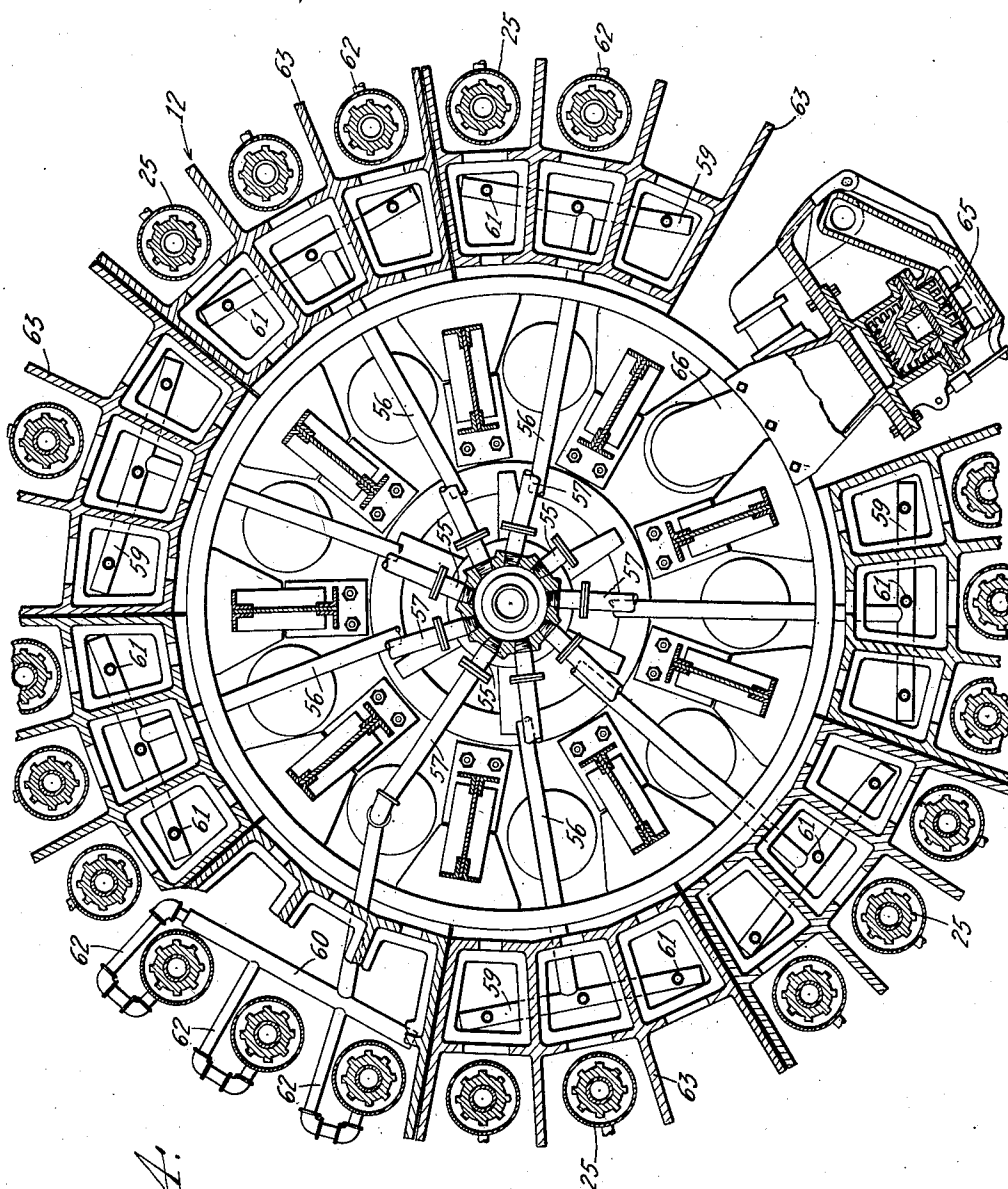


Fig. 4.

INVENTOR

DAVID L. SUMMEY.

BY

Emery, Booth, Varney & Whittemore
ATTORNEYS.

Feb. 11, 1936.

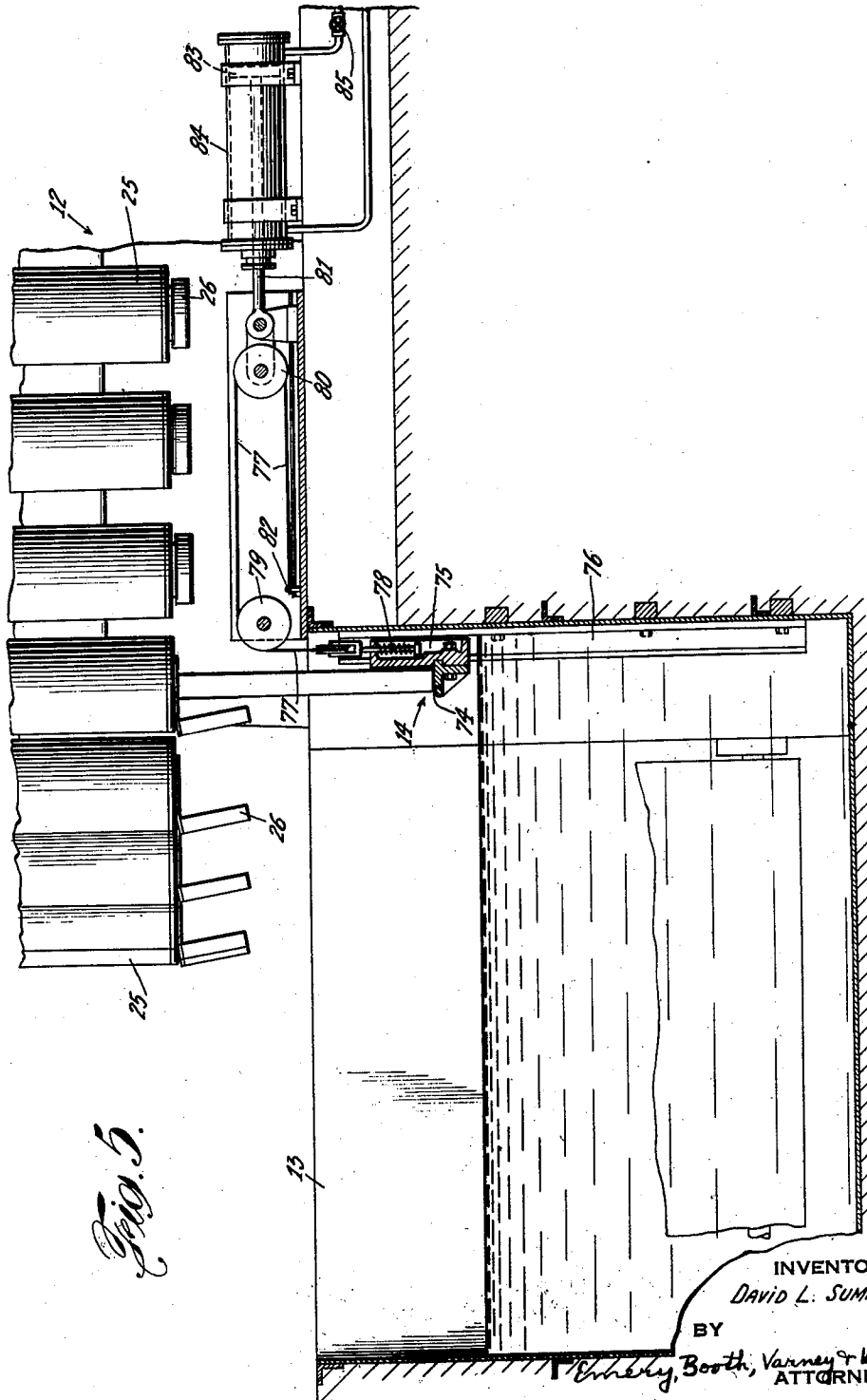
D. L. SUMMEY

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METALLURGICAL APPARATUS

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5 Sheets-Sheet 5



UNITED STATES PATENT OFFICE

2,030,482

METALLURGICAL APPARATUS

David L. Summey, Waterbury, Conn.; The Colonial Trust Company and Richard P. Weeks Summey, executors of said David L. Summey, deceased, assignors to Scovill Manufacturing Company, Waterbury, Conn., a corporation of Connecticut

Application May 14, 1932, Serial No. 611,294
Renewed December 20, 1934

7 Claims. (Cl. 22-77)

This invention relates to metallurgical apparatus, particularly to apparatus for casting and conveying metal billets, bars, slabs or other workable shapes and has for an object the provision of improvements in this art. The invention may be variously embodied but is herein illustrated as a unit of a plant for producing oxygen-free copper by a process claimed in my co-pending application, Serial Number 535,829, filed May 8, 1931, so the present description will be especially directed to that embodiment. In the accompanying drawings thereof which form a part of this specification:

Fig. 1 is a plan view of the apparatus which is particularly embraced by the present invention together with parts of certain related units of the plant;

Fig. 2 is a vertical section taken on the line 2-2 of Fig. 1;

Fig. 3 is an enlarged vertical section taken on the line 3-3 of Fig. 1;

Fig. 4 is a horizontal section taken on the line 4-4 of Fig. 3;

Fig. 5 is an enlarged section of the billet discharging mechanism;

Referring to Figs. 1 and 2, the plant as herein shown comprises a pour hearth 10 which may oscillate about its central horizontal axis Z, a hooded strainer unit 11 which may move up and down vertically, a mold wheel or carrier frame 12 which is rotatable about a vertical axis Y, a cooling vat or bosh tank 13, and a billet submerging device 14. The pour hearth may be used either for melting metal or for maintaining it in a molten condition. It is designed to produce or maintain metal in a very high state of purity and for this purpose may be heated by electrical induction units 15, is completely enclosed to exclude atmospheric air, and is supplied with a covering such as carbon C above the metal bath B for purifying the metal or keeping it pure. If metal such as cathode copper is taken in the solid state it will usually require merely a melting under such conditions as to maintain its initial purity. This pour hearth is disclosed more in detail and claimed in my co-pending application, Serial Number 605,147 filed April 14th, 1932. The pour hearth 10 is horizontally cylindrical and is provided at about its mid-height at one corner with a spout 16 which is inclined outwardly in a horizontal plane from the end of the hearth. This location furnishes the maximum discharge of metal with the minimum movement of the hearth and permits of the sealing of the space about the spout by an articulated

hood of simple design. The hood includes a spring pressed sealing plate 17 which moves with the spout and the box-like hood or casing 18 which moves with the strainer 11. A part of the casing 18 bears against the plate 17 along a plane which is parallel to the end of the hearth. Gas from a source 20 may be supplied to the casing 18 by way of a pipe 21. The pipe has a slip joint 22 to accommodate the movements of the casing. The strainer and related parts are described more in detail and are claimed in my co-pending application, Serial Number 608,177 filed April 29th, 1932.

The mold wheel 12 supports a plurality of molds 25 which are moved in succession beneath the strainer 11. When an empty mold is positioned fairly beneath the strainer the latter is lowered until it rests upon the flat top of the mold so as substantially to form a tight seal therewith. The mold at the bottom is provided with a hinged cap 26 which is fastened by a U-shaped latch 27. The cap hangs slightly open as the mold arrives at pouring position. After the mold has been halted in position the cap is pushed up tightly against the bottom of the mold by a vertically disposed ram 28 which is located at this position. The ram may be operated by hydraulic pressure controlled by hand or otherwise, preferably by hand, since it is contemplated that an operator will be stationed near this position any way.

The mold wheel 12 (Fig. 3) is mounted upon a fixed base 29, anti-friction bearings 30 being used between the wheel and base. The hub 31 of the wheel has a tight rotating fit with the tubular core 32 of the base, a sealing ring 33 being used if desired. The space about the bearing joint is sealed by an annular circumferentially split jacket 34 part of which is fixed to the base and part of which is attached to the wheel. This jacket protects the bearings from dust.

Means are provided for turning the wheel. In the present embodiment (Fig. 3) the wheel is provided with an annular bevel gear 35 which is driven by a pinion 36 fast on a drive shaft 37. The shaft 37 is mounted in bearings 38 secured beneath the base 29. The shaft is connected by flexible couplings 39 to a horizontal gear shaft 40. Through suitable worm gearing 41, 42 the shaft 40 is driven by a vertical gear shaft 43 which through suitable worm gearing 44, 45 is driven by a motor shaft 46 of a motor M.

The mold wheel is equipped to supply either water or air for cooling the molds. Ordinarily

only one type of mold is used at a time and most of the molds which are shown in Figs. 1-4 are water cooled. One air cooled mold is shown to indicate its air supply connections. This mold is divided longitudinally as shown in Figures 3 and 4 to allow the billet to be discharged. Referring to Fig. 3, water at the desired temperature is supplied by an inlet main 48 and is withdrawn after service at the molds by an outlet main 49. At the vertical axis of the mold wheel the inlet and outlet mains are concentrically arranged and are provided with packed turn joints 50, 51 respectively to supply rotatable inlet and exhaust headers 52, 53. A plurality of flanged nipples 54, 55 in the inlet and outlet headers respectively connect with a plurality of inlet and outlet pipes 56, 57. The inlet pipes connect interiorly (i. e., near the axis of the wheel) to the upper ends of the mold jackets 58, while the outlet pipes connect exteriorly with the lower ends of the mold jackets. As shown in Fig. 4 each set of inlet and outlet pipes is divided toward the outer end by laterals 59, 60 and branches 61, 62 whereby to supply a plurality (three here) of molds. The molds and piping may be quickly disconnected and removed if desired. The brackets 63 which support the molds are likewise readily removable from their anchorages on the carrier frame (see Fig. 3) to permit replacement by brackets of other types for other types of molds.

At the right of Figs. 1, 3 and 4 an air cooled mold 65 is shown in place of water cooled molds. This mold is supplied with air by pipes 66 which are attached about openings 67 to an annular series of boxes 68 formed in the wheel. Air is supplied to the boxes through interior openings 69 which connect with the tubular space within the wheel and the core 32 of the base. An annular plate 70 covers the upper end of the central air space about the water mains and has a packed rotatable bearing with the outer main 48. Air is supplied beneath the base within the floor trench within which the water mains are disposed by an air main 71.

Means are herein provided for cooling the billets or such other shapes as are cast in the molds, after they drop out of the molds. As shown in Figs. 1 and 2, the molds pass over one corner of the bosh tank 13. While a billet is being poured at the strainer another which has solidified is being discharged into the tank. If the water-cooled molds are being used, an operator releases the latch 27 to allow the cap 26 to swing open and the billet to fall out. If it does not drop readily it may be cooled further by pouring cold water on it. If the air-cooled molds are being used the operator opens them and prys the billets out.

The billets fall endwise (Fig. 5) upon the step 74 of an elevator 75 which descends with the billet into the water in the tank. The step is inclined outwardly to cause the billet to fall over sidewise after its upper end has cleared the lower end of the mold. The elevator moves along vertical supporting guides 76 which are attached to the side of the tank.

The elevator is operated by cables 77 which are attached to the elevator by a shock absorbing spring bolt 78. The cables pass over fixed sheaves 79 at the upper edge of the tank and over movable sheaves 80 which are mounted on a piston rod 81 and are anchored at their other ends 82 to any convenient fixed member. The piston rod is operated by a piston 83 working

within a fixed cylinder 84. The fall of the elevator and billet is checked by an air cushion in the cylinder 84. Thereafter the valve 85 is operated to cause the piston to move further out of the cylinder and lower the billet until it drops out of the mold and falls over in the tank. The valve 85 preferably is operated by hand but the arrangement may be otherwise. I control the flow of fluid to the head end of the cylinder so this may be referred as variable pressure fluid. The fluid pressure is maintained in the rod end of the cylinder so this may be referred to as constant pressure fluid. The supply of fluid may come from a common main and be admitted to the opposite ends of the cylinder at the same pressure. The force on the head end of the piston will be greater because the effective surface area is greater (by the amount of the cross sectional area of the piston rod) so the piston will always move toward the rod end when variable pressure is exerted on the head end. When variable pressure is cut off the piston returns toward the head end under constant pressure to raise the elevator 75.

An inclined conveyor 86 delivers the billet from the tank to a table 87 at one end of the tank.

In operation the wheel is turned until a mold comes beneath the strainer opening. The hood and strainer assembly is lowered into sealing engagement with the mold. At this time the mold cap is partly closed, having been pushed up and loosely latched after the discharge of a billet; and shortly after the mold has been halted, the cap is pushed up tightly against the bottom of the mold by the ram—positioned therebeneath. Cooling fluid is circulated around the mold at all times. The air cooled mold shown has no hinged bottom so the ram is not operated for it. It is left slightly open until after it has been halted in pouring position and is then tightly closed. The hood and strainer are raised and the ram lowered and the mold wheel is turned to remove the filled mold and place an empty mold beneath the strainer. The top of the cooling billet is protected from the air as soon as it leaves the hood. For example, a handful of carbon (charcoal) or other protecting substance may be thrown into the upper end of the mold to cover the billet and if desired a metal plate may be slid over the mold above this. As the molds reach the bosh tank they stop over the elevator and when the latch is removed the caps open and the solidified but still hot billet drops down upon the elevator and is submerged and removed as described above. At some place between the dumping position and the filling position the molds are carefully coated with a suitable material to procure a smooth surface on the billets and to prevent the billets from sticking to the molds. The coating may be a wash of bone ash and water. Here the caps are swung up and the latches are operated to hold the caps in partly closed position ready for the gas purging operation.

While one embodiment of the invention has been described in detail it is to be understood that various changes and modifications may be made within the scope of the invention as set forth in the subjoined claims.

I claim:

1. Casting apparatus comprising in combination, a fixed base, a movable carrier mounted above the base, a plurality of molds thereon, a closing cap for the bottom of each mold, means disposed in a given position on said base beneath the path of the caps of the molds for forcing the

caps closed when the molds are halted above said cap-closing means, and means for holding said caps in closed position.

2. Apparatus as set forth in claim 1 in which
5 said means includes a vertically movable power operated ram.

3. Casting apparatus comprising in combination, a movable carrier, a plurality of molds supported thereon, a cooling tank located in a given
10 position below the path of said molds, an elevator at said tank including resilient means for checking the fall of billets from said molds into said tank and means to operate the elevator.

4. Casting apparatus comprising in combination, a movable carrier, a plurality of molds supported thereon, an elevator for resiliently checking the fall of billets from the molds, and a conveyor for removing the billets in horizontal posture, said elevator comprising a vertically movable element an inclined support thereon for the
20 lower end of a billet whereby the billet after falling clear of the mold is caused to fall over sidewise upon said conveyor.

5. Casting apparatus comprising in combination, a movable carrier, a plurality of molds supported thereon, a vertically movable elevator for resiliently checking the fall of billets from the molds, and an inclined billet-supporting step on

said elevator for causing billets to fall over sidewise after they clear the molds.

6. Casting apparatus comprising in combination, a vertical mold, a removable cap closing the bottom of the mold, an elevator for receiving a
5 billet from said mold when the cap is removed, a cylinder and piston for operating said elevator, means for supplying fluid under constant pressure to the one end of said cylinder for raising said elevator and for furnishing a cushion for
10 the falling billet, and means for supplying fluid under variable pressure to the other end of said cylinder for lowering the elevator.

7. Metal casting apparatus, comprising in combination, a mold wheel carrying a plurality of
15 molds, bottom closures for said molds means at a first station in the path of movement of said molds for closing the bottoms of the molds halted thereat, means at a second station for pouring metal in the molds, means at a third station for
20 receiving and cooling billets cast in the molds, said means including an elevator for easing the fall of the billets and dropping them over on their sides, a tank of water for receiving the billets and a conveyor for removing the billets
25 from the tank.

DAVID L. SUMMEY.