March 15, 1960 J. N. PORTERFIELD 2,928,148

APPARATUS FOR CASTING MOLTEN METAL

Filed June 23, 1958 2 Sheets-Sheet 1

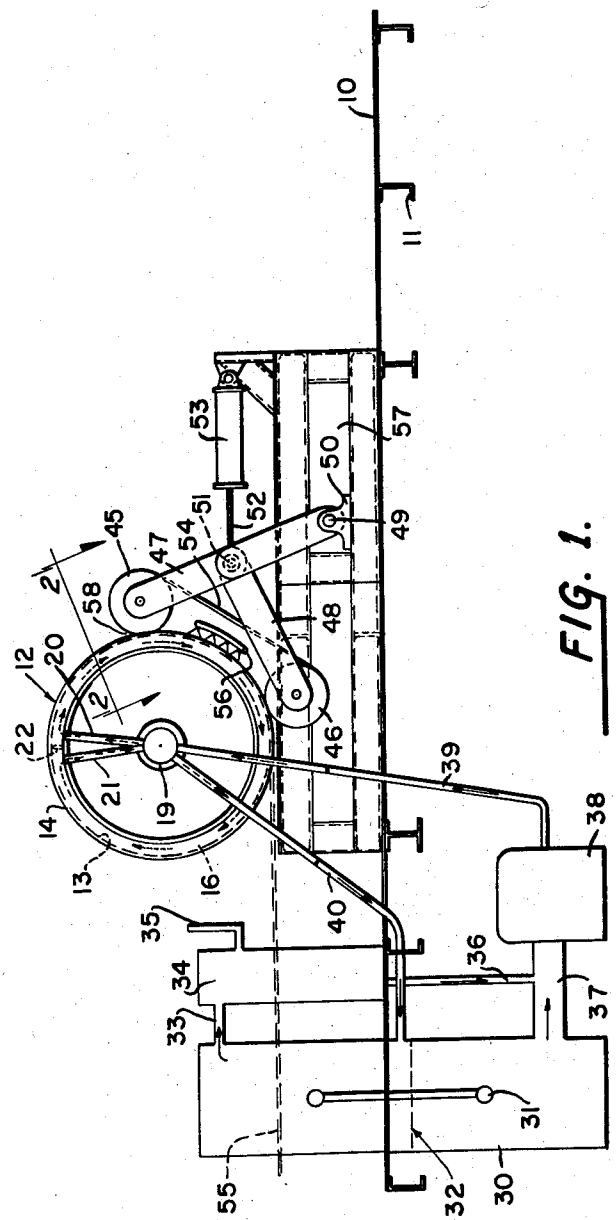


FIG. 1.

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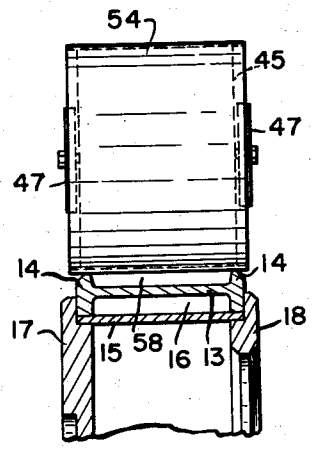


FIG. 2.

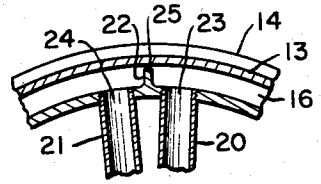


FIG. 3.

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APPARATUS FOR CASTING MOLTEN METAL

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Application June 23, 1958, Serial No. 743,788

1 Claim. (Cl. 22—57.4)

This invention relates to apparatus for casting molten metal, and more particularly to apparatus for casting continuous strips from molten metal in a continuous operation.

The main object of the invention is to produce continuous strips of predetermined selected width and thickness, and of uniform quality and characteristics. Prior art mechanisms have not been efficient for this purpose due to lack of means for controlling the temperature of the casting wheels which are part of such mechanisms.

I have found that the contact of molten metal with the casting wheel rim in the area which receives the molten metal from the furnace causes steam to form adjacent the inner surface of the rim opposite said area, that the presence of a stationary layer of such steam prevents water introduced into the wheel for cooling purposes to function as intended, and consequently the wheel is not cooled uniformly or efficiently. Under such conditions it is impossible to form a continuous strip from molten metal in an uninterrupted operation. In the apparatus shown and described herein, I have provided means for preventing the formation of a stationary steam layer which heretofore has interfered with the efficient cooling of the casting wheel.

For efficient production of a metal strip cast from molten metal, the casting wheel temperature must be controlled so that the molten metal is transformed from its fluid state to a formed self-supporting strip during approximately one-quarter revolution of the casting wheel. By use of the apparatus shown and described herein, this object can be achieved efficiently in a continuous operation.

Other objects and advantages will be apparent from the following specification.

In the drawings:

Fig. 1 is an elevational view, partly diagrammatic, of apparatus for casting molten metal, embodying my invention.

Fig. 2 is a transverse sectional view on an enlarged scale, in the plane of the line 2—2 of Fig. 1.

Fig. 3 is a vertical sectional view of a portion of the casting wheel which is part of the apparatus.

In that embodiment of the invention shown in the drawings, 10 indicates a raised platform on cross members 11 for supporting the casting apparatus herein described.

A casting wheel indicated as a whole at 12 comprises a rim 13 provided with side flanges 14 and an inner band 15 concentric with and spaced from the rim 13 to form an annular chamber 16 between them. At one side of the wheel is an adaptor 17 for mounting the wheel on drive means (not shown) and at the opposite side is a ring 18, the parts 17 and 18 being recessed to receive the rim side flanges 14 as shown in Fig. 2. The hub of the wheel is a double rotating joint 19 communicating with a water intake pipe 20 leading into the wheel rim chamber 16 and a water return pipe 21. A partition 22 extends transversely across the chamber 16 between the

openings 23, 24, of the water intake pipe 20 and return pipe 21, respectively, as shown in Fig. 3. The partition 22 separates the incoming water from the return outlet but there is a small space 25 between the inner surface of the rim 13 and the free edge of the partition which permits passage of a small stream of water across the partition for uniform cooling of the rim.

The means for supplying water to the casting wheel comprises a flash cooler 30 provided with water conduits 31 for maintaining a water supply at level 32, the cooler communicating at its upper end through pipe 33 with condenser 34 provided with outlet 35 to the atmosphere. The lower end of the condenser 34 is connected through pipe 36 to the water supply line 37 which connects the lower part of the flash cooler 30 to a high pressure pump 38. Water is pumped through the pipe 39 to that part of the double rotary joint 19 which communicates with the intake pipe 20. Water from the return line 21 passes through that part of the double rotary joint 19 which communicates with the return pipe 40 which enters the flash cooler above the water level 32. The operation of the water circulating apparatus will be described hereinafter.

Adjacent the rim of the casting wheel 12, as shown at the right of the wheel in Fig. 1, are two drums 45, 46, rotatably mounted on links 47, 48, respectively. The link 47 is pivotally connected at 49 to a support 50, and the link 48 is connected pivotally at 51 to the link 47. The latter is connected to the rod 52 actuated by any suitable means such as indicated at 53 for the purpose of adjusting the positions of the drums 45, 46, relatively to the wheel rim 13. A thin band or endless belt of steel 54 is supported on the drums 45, 46, as shown in Fig. 1, the belt 54 being spaced from the circumferential surface of the rim a distance determined by the thickness of the metal strip 55 being cast by the apparatus.

A water sprayer 56 is located adjacent the belt 54 between the drums 45, 46, and opposite that area where the belt supports the cast strip 55 against the wheel rim. A water tank 57 is located beneath the wheel 12 and belt 54 and is provided with a water line to supply the sprayer 56 and to receive the returned spray.

For the production of aluminum strips in a continuous strip casting process, the metal is heated to about 1300° F. and at approximately that temperature the molten metal is poured in a controlled flow to the space 58 between the wheel rim 13 and the metal belt 54 where it is supported on the upper drum 45, the metal being confined between the flanges 14 of the wheel rim, whereby the width of the strip is predetermined. The delivery of molten metal into the space 58 between the wheel rim 13 and belt 54, defining a casting gate, is controlled so that the molten metal supply moves immediately into strip form with the slowly rotating wheel 12 and is not permitted to accumulate or to be retained in a pool above the mouth of the space 58 between belt and wheel rim. For efficient production of a cast aluminum strip, the transformation from molten state at approximately 1300° F. to a formed strip should be performed under controlled wheel temperature and should be completed while the metal moves with the casting wheel in about one-quarter of a revolution of the wheel and while it is supported between the wheel rim and the belt 54 on drums 45 and 46.

I have found that the desired results can be achieved by control of the casting wheel temperature by use of the herein described apparatus. The introduction of water into casting wheels for cooling purposes by prior art methods has been ineffective due to the fact that a layer of steam is formed adjacent the inner surface of the wheel rim in the area where the highly heated metal con-

tacts the outer surface of the rim, and that steam layer prevents the water from cooling the wheel rim and the metal being cast as is required for continuous casting of a metal strip.

To overcome the difficulties encountered by the practice of prior art methods, I convey water from the supply line 37 and pump 38 at a temperature of about 200° F. under high pressure in excess of 75 p.s.i. thru the pipe 39, joint 19, and pipe 20 to the chamber 16 of the casting wheel, the place of entry 23 being a short distance to the right of the partition 22 as viewed in Fig. 1. The pressurized water stream forces any steam layer which may exist adjacent the inner surface of the rim 13 to pass with it through the annular chamber 16 to the opening 24 of the return pipe 21. The temperature of the return water becomes increasingly greater as it passes the area adjacent the cast strip, rising from approximately 200° F. to 240° F., so that after it has passed through the return pipes 21 and 40 and enters the flash cooler 30, part of the return flow is steam which passes upwardly to the condenser 34 and the remainder falls into the water supply in the cooler 30. The condensed steam passes through the pipe 36 to the supply line 37, from whence it recirculates through the wheel 12 in the manner described.

It will be understood that the water pressure may be varied according to the size of the wheel and chamber 16, but must be sufficient to eliminate stationary steam layers adjacent the rim.

An obvious advantage of the apparatus lies in the fact that the same water is recirculated and therefore a treated supply may be used and corrosion and forming of scale in the apparatus is prevented.

In describing the invention, reference has been made to a particular example embodying the same, but I wish it to be understood that the invention is not limited to the construction shown in the drawing and that various changes may be made in the construction and general arrangement of parts without departing from the invention.

I claim:

An apparatus for casting a continuous strip from molten metal comprising a casting wheel mounted to rotate about a horizontal axis, said wheel having a rim provided with side flanges defining the width and thickness of the strip to be cast; means in contact with the periphery of said flanges to provide a casting gate; two concentric walls with connecting walls defining a chamber in said rim; a partition in said chamber attached to an inner concentric wall and extending a part of the radial distance to an outer concentric wall of said chamber leaving a small aperture, a fluid intake communicating with said chamber on one side of said partition, an outlet communicating with said chamber on the other side of said partition, said partition directing the fluid to circulate around the circumference of said chamber and means for supplying cooling fluid under pressure to said intake.

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