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[21] Appl. No. **818,299**
[22] Filed **Apr. 22, 1969**
[45] Patented **Apr. 27, 1971**
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[32] Priority **Apr. 23, 1968**
[33] **Great Britain**
[31] **3594/68**

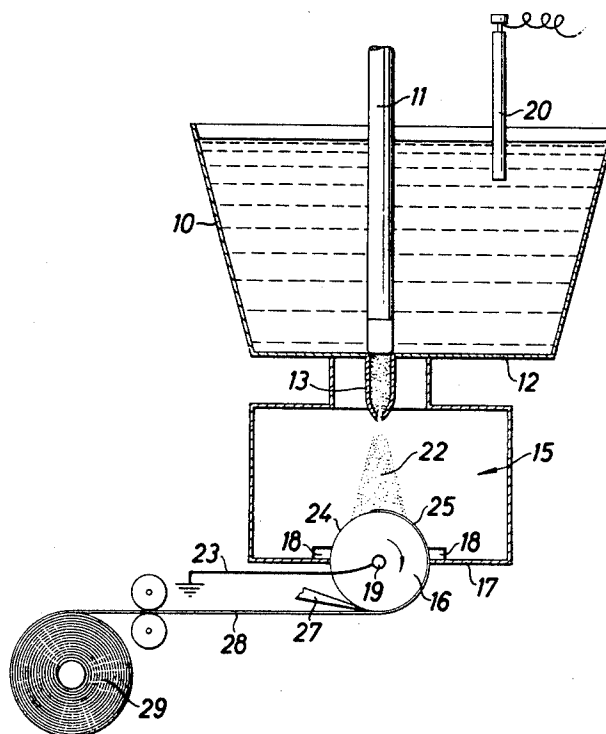
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[54] **FORMATION OF STEEL STRIP**
15 Claims, 1 Drawing Fig.

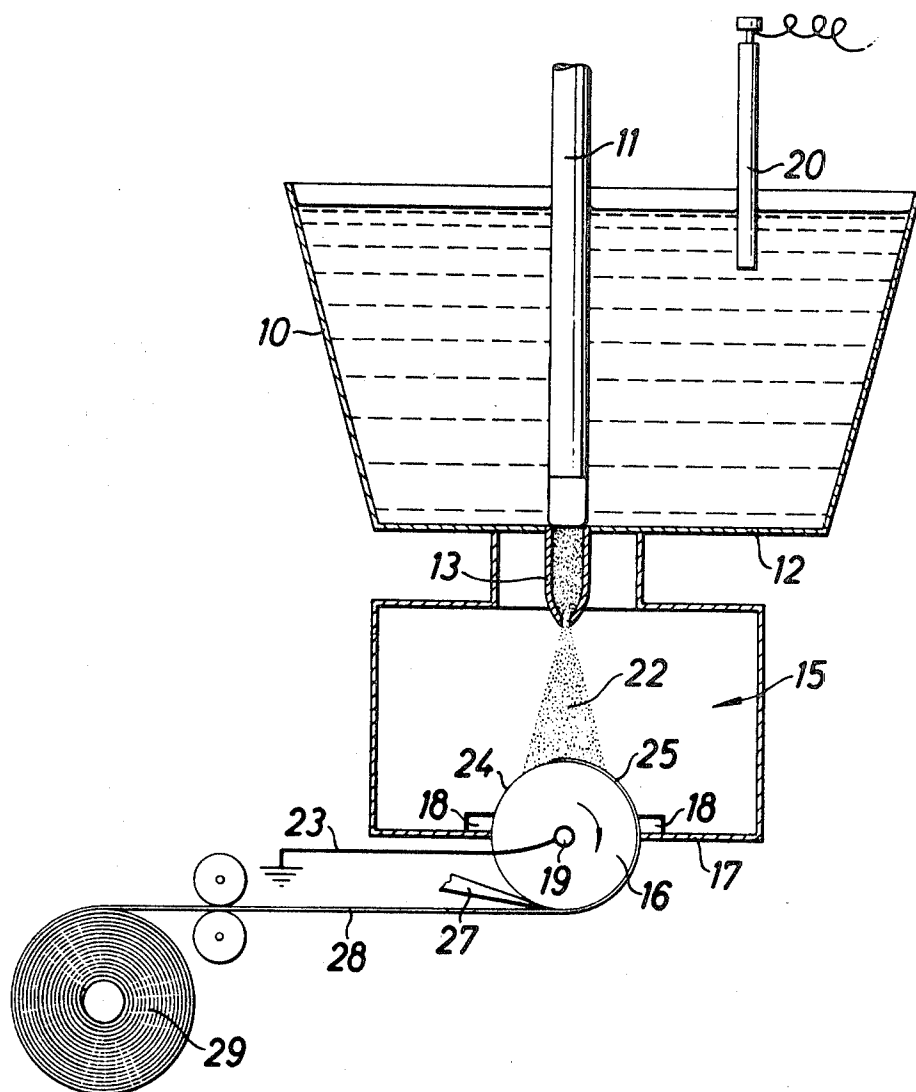
[52] U.S. Cl. **164/48,**
117/93.4, 117/93.43, 164/46, 164/87, 164/278,
164/281
[51] Int. Cl. **B22d 27/02**
[50] Field of Search 164/48, 46,
278, 281, 87; 117/93.4 (Inquired)—93.44

ABSTRACT: The present disclosure relates to a process for the continuous casting of metal strip, which process comprises imparting an electrostatic charge of at least 80,000 volts to a stream of molten metal, passing the stream of metal through a nozzle into an inert atmosphere and allowing the stream leaving the nozzle to atomize to a fine spray, collecting the spray droplets on a cool receiving surface to form a layer of metal on said surface and continuously stripping the layer of metal from said surface.



PATENTED APR 27 1971

3,576,207



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FORMATION OF STEEL STRIP

The present invention relates to the formation of steel strip.

At the present time steel strip is formed from ingots by slabbing and hot rolling. The present process is to some extent wasteful since in the formation of slabs from ingots, a certain amount of wastage results due to cropping of the ends of the ingot after it is rolled into a slab. These cropped ends have to be severed from the slab and are scrapped. There is also a large loss in yield due to scaling of the ingot and slab in the various stages of the known process.

According to the present invention there is provided a process for the continuous casting of metal strip, which process comprises imparting an electrostatic charge of at least 80,000 volts to a stream of molten metal, passing the stream of metal through a nozzle into an inert atmosphere and allowing the stream leaving the nozzle to atomize to a fine spray, collecting the spray droplets on a cool receiving surface to form a layer of metal on said surface and continuously stripping the layer of metal from said surface.

The receiving surface may be the cylindrical surface of a water-cooled roll and the receiving surface may be earthed. The inert atmosphere may be any gas which will not react with or dissolve to an appreciable extent in steel under the particular process conditions and which does not adversely affect the quality of the steel but is preferably argon, krypton or other inert gas.

The stream of molten steel may be tapped from a ladle or tundish which is insulated from its surroundings, the melt contained therein contacting with an electrode charged to a potential of at least 80,000 volts and preferably 100,000 to 200,000 volts to impart a charge to the contents of the tundish and to a stream of molten steel leaving the same.

The layer of steel stripped from the collecting surface may subsequently be rolled to form strip of the desired thickness.

Following is a description by way of example and with reference to the accompanying drawing of one method of carrying the invention into effect.

The accompanying drawing is a diagrammatic side view partially in section of apparatus for use in the process of the present invention.

A tundish 10 is provided with a discharge opening including a downwardly extending nozzle 13. A tapping rod 11 is vertically disposed with respect to the bottom 12 of the tundish 10 and extending therethrough to terminate at a lower end which is adapted to close the discharge opening. The tapping rod is provided with control means for controlling the flow of molten steel passing from the tundish 10 and through the nozzle 13. The nozzle end 13 of the tapping rod 11 is disposed within a collecting chamber 15 having an inert atmosphere of, for instance, argon which is maintained in the collecting chamber under a pressure slightly greater than atmospheric. Immediately below the nozzle 13 is disposed a rotatable water-cooled roll 16 which is disposed within the bottom surface 17 of the collecting chamber 15 glands 18 being provided to permit rotation of the roll 16 about its axis 19 with respect to the chamber 15 and without substantial loss of argon.

In operation, the tundish is periodically charged with molten steel and an electrode 20 is inserted in the molten steel and maintained at a potential of 100,000 volts. The tundish 10 and collecting chamber 15 are substantially insulated from their surroundings and the tapping rod 11 is operated to allow a continuous controlled stream of molten steel charged at a potential of 100,000 volts to pass down the tapping rod and out of the bottom end of the nozzle 13 into the collecting chamber 15. Free of the constraint provided by the walls of the conduit 21 in the tapping rod 11, the stream of molten steel debouching from the lower end of the nozzle 13 separates into a finely atomized spray 22 of steel droplets, the atomization being caused by the electrostatic charge on the stream which causes the stream to split into a number of small droplets each containing a lower electrostatic charge.

The roller 16 disposed below the nozzle 13 is earthed by means of conductor 23 and the droplets and the spray are attracted towards the surface 24 of the roll 16 and are deposited thereon to form a thin layer 25 of steel. The droplets coalesce on the cooled surface of the roll to form an uniform layer. The roll 16 is slowly rotated and is continually cooled by water passing through the inner structure of the roll.

The layer 25 of steel so formed is carried by the surface 24 of the roll 16 out of the collecting chamber 15 through the gland 18 between the wall 17 of the collecting chamber 15 and the surface 24 of the roll 16 and at a point externally of the collecting chamber, is stripped from the surface 24 of the roll 16 by suitable stripper means 27. The steel strip 28 so produced is then passed between one or more stands of rollers to a coiler 29 in the usual way. The strip obtained on the coil may be suitably reduced in a reduction mill to a desired thickness.

The sealing glands 18 between the roll 16 and wall 17 may comprise elongate conduits disposed adjacent the roller surface along which a nitrogen or mixture of nitrogen or argon is blown under pressure in an endeavor to prevent or restrict the escape of argon from the collecting chamber.

It will be appreciated that the process described above can effectively replace the stages of the present process for forming steel strip, from the ladle of steel obtained from the converter, through the ingot stage, soaking pit, slabbing furnaces, and coarse rolls on the hot reduction mill.

I claim:

1. A process for the continuous casting of metal strip, which process comprises imparting an electrostatic charge of at least 80,000 volts to a stream of molten metal, passing the stream of metal through a nozzle into an inert atmosphere and allowing the stream leaving the nozzle to atomize to a fine spray, collecting the spray droplets on a cool receiving surface to form a layer of metal on said surface and continuously stripping the layer of metal from said surface.

2. A process as claimed in claim 1 wherein the metal is steel.

3. A process as claimed in claim 1 wherein the receiving surface is the cylindrical surface of a water cooled roll.

4. A process as claimed in claim 1 wherein the receiving surface is earthed.

5. A process as claimed in any one of the preceding claims wherein the inert atmosphere is a gas which will not react with or dissolve to an appreciable amount, in the metal.

6. A process as claimed in claim 5 wherein the inert atmosphere is argon, krypton or other inert gas.

7. A process as claimed in claim 1 wherein the stream of molten metal is tapped from a ladle or tundish which is insulated from its surrounding.

8. A process as claimed in claim 7 wherein the melt contained therein is contacted with an electrode charged to a potential of at least 80,000 volts.

9. A process as claimed in claim 8 wherein the magnitude of the electrostatic charge is within the range 100,000 to 200,000 volts.

10. A process as claimed in claim 1 wherein the metal strip from the collecting surface is subsequently rolled to form a strip of the desired thickness.

11. A process as claimed in claim 1 for the production of steel strip wherein a tundish is provided with a tapping rod vertically disposed with respect to the bottom of the tundish and extending therethrough to terminate at a lower end in a downwardly extending nozzle.

12. A process as claimed in claim 11 wherein the tapping rod is provided with control means for controlling the flow of molten steel passing from the tundish and through the nozzle.

13. A process as claimed in claim 12 wherein the nozzle end of the tapping rod is disposed within a collecting chamber having an inert atmosphere of argon which is maintained in the collecting chamber under a pressure slightly greater than atmospheric.

14. A process as claimed in claim 13 wherein immediately below the nozzle there is disposed a rotatable water-cooled

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roll which is located within the bottom wall of the collecting chamber, glands being provided to permit rotation of the roll about its axis with respect to the chamber without substantial loss of argon so that part of the peripheral surface of the roll is disposed externally of the chamber.

15. A process as claimed in claim 14 wherein the tundish is periodically charged with molten steel and an electrode is inserted in the molten steel and maintained at a potential of 120,000 volts.

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