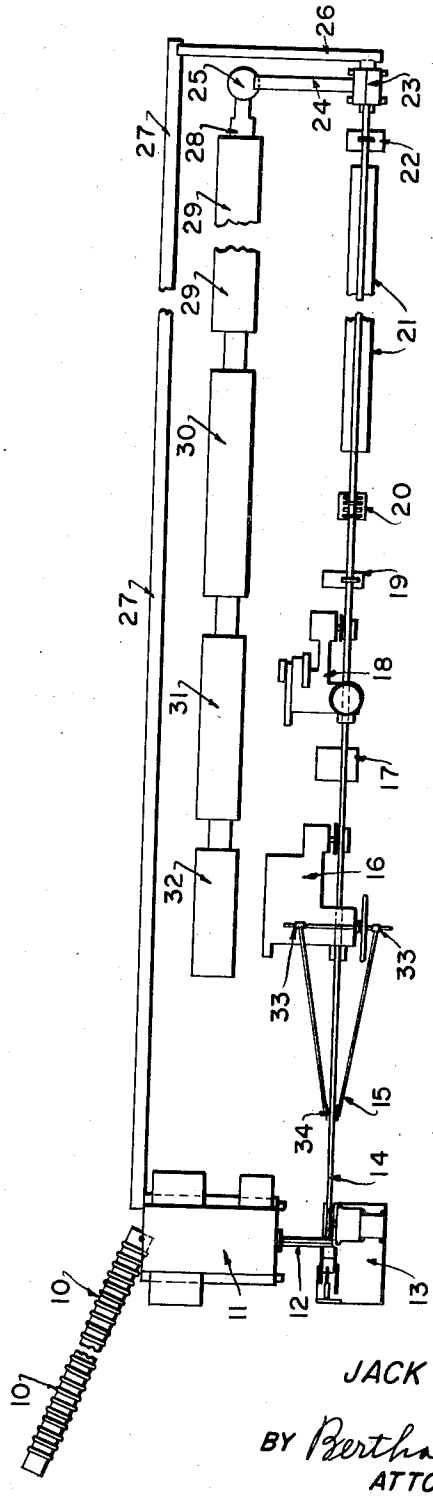
June 12, 1962 J. N. PORTERFIELD 3,038,250

METHOD OF CONTINUOUSLY CASTING STRIPS FROM MOLTEN METAL AND MAKING SLUGS THEREFROM

Filed July 7, 1958



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United States Patent Office 3,038,250
Patented June 12, 1962

3,038,250

METHOD OF CONTINUOUSLY CASTING STRIPS FROM MOLTEN METAL AND MAKING SLUGS THEREFROM

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Filed July 7, 1958, Ser. No. 747,002
1 Claim. (Cl. 29—529)

This invention relates to a method of continuously casting strips from molten metal and making slugs therefrom in a continuous operation.

Slugs heretofore have been punched out of strips of metal such as aluminum, aluminum alloys, magnesium, magnesium alloys and other metals, but not in a continuous operation. It has been customary to cast slabs of metal, five to ten feet long and about one inch thick, and to subject the slabs to repeated rolling to produce a strip thirty or forty feet long of reduced thickness. It also has been customary to cast such strips in various lengths, and to roll them into coils for natural cooling, the casting being interrupted at intervals to provide the desired length for a coil. After cooling it was necessary to uncoil the strips and to straighten them in a rolling mill. Manual handling of the coils and transportation from one area or machine to another has been required for each of the successive steps of feeding the separate strips to a rolling mill, lubricating tank and punch press. Slugs punched from the strips have been moved in barrels from the punch press to the annealing furnace and other machines for subsequent operations.

The object of my invention is to cast a continuous strip from molten metal, to subject the strip to successive steps leading to the punching of slugs therefrom, to subject the slugs to finishing processes, and simultaneously convey scrap from the punch press back to the furnace which supplies the molten metal, all without interruption of the process and without manual handling of the strips and slugs punched therefrom.

Essential to the efficient operation of my method is the production of a continuous strip of metal, the automatic taking up of slack between successive steps and feeding of the strip without pull thereon.

Apparatus shown diagrammatically in the single FIGURE of the drawing is employed in performance of my method. Included in the apparatus is the casting apparatus which is the subject of my copending application, Serial No. 743,788, filed June 23, 1958, now Patent No. 2,928,148. This casting apparatus is efficient for casting a continuous strip from molten metal.

In the drawing, an automatic ingot feed conveyor is indicated at 10, and a furnace for heating the ingots to molten condition at 11. A chute or pipe 12 conveys molten metal to the strip casting apparatus indicated as a whole at 13. A strip 14 of cast metal is shown emerging from the casting machine 13.

An automatic slack and feed control 15 is located between the casting apparatus 13 and a hot rolling mill 16, to permit the strip 14 to pass at proper speed over the control 15 and into the mill 16. An automatic equalizer and tension control 17 is located between the hot rolling mill 16 and a cold rolling mill 18. A spray system (not shown) preferably is located between the control 17 and cold rolling mill 18.

A shear is indicated at 19 and a leveller at 20. An elongated de-watering and strip lubricating tank 21 is located between the leveller 20 and an automatic loop control 22 adjacent a slug punch press 23. The parts of the apparatus mentioned are all aligned so that the strip 14 travels through or over them from the casting machine to the punch press 23, in a straight line in the direction of its length, as will be apparent from the drawing and description of my method.

An elevator 24 extends upwardly from the punch press 23, at right angles to the direction of movement of the strip 14, to a slug feeder 25. A conveyor 26 parallel to the elevator 24 travels between the punch press 23 and an overhead conveyor 27 leading to the furnace 11. A conveyor 28 travels from the slug feeder 25 through an annealing furnace 29, washing drying machine 30 and lubricating and drying machine 31.

The numeral 32 indicates an automatic slug weighing and packaging machine or other mechanism for fabricating products from slugs.

The apparatus shown is used in performing my method of continuously casting strips from molten metal and making slugs therefrom in a continuous operation as explained hereinafter. Ingots 10 of aluminum or other metal are conveyed to the furnace 11 and heated to molten condition, which in the case of aluminum is approximately 1300° F. The molten metal is conveyed to the casting apparatus 13 by chute 12, and a strip 14 is cast as fully explained in my aforementioned copending application. As it leaves the casting wheel, the continuous strip 14 is trained over the automatic slack and feed control 15. The arms of the control are pivotally mounted at 33 and are urged upwardly at their free end 34 which is located forwardly of the hot rolling mill 16. The roll on the free end 34 of the control arms supports the strip and the raising or lowering of the control arms 15 varies the length of the path of travel of the strip between the casting apparatus and the rolling mill, thus automatically taking up slack and preventing the strip from being pulled away from the casting wheel. The automatic slack control 15 governs the speed of the mill to prevent tautness between the mill 16 and casting wheel which is part of the casting apparatus 13.

The strip is reduced in thickness by the hot rolling mill 16. It travels from the mill over the automatic equalizer and tension control 17 to the cold rolling mill 18. Between the control 17 and mill 18 a spray system (not shown) sprays a coolant on the strip to cool it to desired temperature for rolling in the cold mill to still further reduce the thickness.

After leaving the rolling mill 18, the strip passes through the bar shear 19, over the leveller 20 and through a de-watering and lubricating tank 21 which contains kerosene or the like. If the strip 14 is relatively thin and flexible enough to be formable into a loop in advance of the punch press, the bar shear is idle and the strip merely passes through it, but when thick non-flexible strips are being processed, the shear 19 may be used to cut them into lengths of thirty or forty feet.

A loop forming device 22 is located forwardly of and adjacent to the punch press 23. To form the loop, the traveling strip is guided upwardly and trained over the top of the device 22 which may be a roller or smooth rounded horizontal bar, located in a plane several feet above the normal path of travel of the strip. The strip is curved over the roll or bar of the device 22 and then extends downwardly to its normal level for feeding into the punch press 23. The metal of the strip is self-supporting so that the length of the loop may change automatically as the amount of slack in the strip varies as it approaches the punch press. The weight of the downwardly extending portion of the loop insures feeding by gravity of the strip to the press without pulling of the strip, and renders the strip self-pushing and self-feeding.

If the strip 14 is too thick and non-flexible to form into a loop, and has been cut into lengths by the shear

19, then the strips pass to the punch press without being looped over the device 22.

The press 23 punches slugs from the strip as it is being fed into the press. The slugs are conveyed by the elevator 24 to the feeder 25 which delivers them to the endless conveyor 28 which passes through the annealing furnace 29, washing and drying machine 30, and lubricating and drying machine 31, and delivers them to a final handling machine 32 which may be a weighing and packaging machine or a machine for performing some other operation on the slugs, such as a product forming step.

Scrap from the punch press 23 is carried by the upwardly inclined conveyor 26 to the overhead conveyor 27 which carries the scrap back to the furnace 11 for remelting and use in casting strips.

Obviously the mechanism referred to herein may be varied as to type and form, without departing from the method as defined by the following claim.

I claim:

The method of continuously casting strips from molten metal and punching slugs therefrom in a punch press, comprising casting a continuous strip of metal moving in the direction of its length toward a punch press, forming slack in and controlling the speed of the strip to prevent tautness in the moving strip, subjecting the moving strip to pressure between rolls while hot, reducing the temperature of the strip, subjecting the cooled strip to pressure between rolls, leveling the strip, lubricating the moving strip, and guiding the strip as it approaches the

punch press to cause it to move upwardly from its level of travel to above the feed level of the press and then downwardly by gravity forwardly of and adjacent to the punch press to thereby form a closed top self-supporting loop having its top located above the feed level of the press, said loop being automatically self-variable as to height by variation of slack in the strip and the top of said loop being sufficiently above the feed level of the press to provide weight to make the downwardly extending portion of the loop self-pushing in the area approaching the press and self-feeding by gravity to the press without pulling of the strip.

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