United States Patent Office 3,249,996 Patented May 10, 1966

3,249,996

METHOD OF MAKING HOT ROLLED STRIP SUITABLE FOR COLD ROLLING TO #3 BEST FINISH USING A DOUBLE SCARFING TREATMENT

Robert M. Clevenger and John G. Cutton, Youngstown, Ohio, assignors to United States Steel Corporation, a corporation of Delaware

No Drawing. Filed Nov. 2, 1962, Ser. No. 235,154
5 Claims. (Cl. 29—528)

This invention relates to the production of steel strip, and more particularly to the production of hot rolled steel strip suitable for cold rolling to strip having a high surface luster substantially free of defects.

Cold rolled non-aging steel having a high surface luster free of defects is required for many deep-drawing applications, particularly when the end product is to be electroplated or otherwise finished to a high polish. Toasters, rotisseries and other plated appliances are examples of end products that require this special type of cold rolled steel. The steel for such appliances is cold reduced from hot rolled strip using special rolls to give the desired smooth reflectant surface known as "No. 3 (best bright finish)."

Although a fully aluminum killed steel is non-aging, it is unsatisfactory for these applications because of a high incidence of surface slivers and seams. For this reason vanadium treated (non-aging) rimmed steel has been preferred for these applications. However, even though the vanadium treated rimmed steel has proved to be better than aluminum killed steel, it has not been entirely satisfactory when the hot rolled coil has been produced by conventional methods. Many of the finished cold rolled coils of this vanadium steel have exhibited a defect known as "shadow lines." These lines appear on the surface of the strip, after cold rolling, as parallel lines extending in the direction of rolling. These lines tend to "open" during subsequent deep-drawing operations. For this reason a high incidence of these lines is undesirable from a quality standpoint. The extact cause of these lines is unknown, although it has been determined that they are of only superficial depth and do not appear to be the result of any inhomogeneity of the hot rolled steel strip.

It is therefore a principal object of this invention to produce a hot rolled strip of non-aging steel suitable for cold rolling to a steel strip having a high surface luster substantially free of defects.

A related object of this invention is to provide a method of producing a hot rolled strip of non-aging steel which can be cold rolled to a strip having a high surface luster substantially free of surface defects.

A more specific object of this invention is to provide an improved method of processing vanadium treated rimmed steel to produce a hot rolled coil of steel suitable for cold rolling to a strip having a defect free "No. 3 (best bright finish)" surface.

These and other objects will become apparent from the following description and claims.

It has been found that vanadium treated rimmed steel, when produced according to this invention will produce a cold rolled steel strip having a No. 3 (best bright finish) surface substantially free of shadow lines. A conventional heat of vanadium treated rimmed steel is melted in any suitable open hearth, electric, or oxygen steel making furnace and teemed into ingots. Preferably the steel contains up to .10% carbon; .30% to .40% manganese; up to .10% vanadium, and the balance iron and normal residual impurities such as sulfur and phosphorous. The rimming action of the molten steel in the mold must be closely controlled so that upon solidification the ingot does not "rise" or "grow" to any appreciable extent. Mold additions of sodium fluoride is one conventional and

acceptable way of controlling the rimming action to prevent ingot "growth."

When the ingots are solidified the molds are stripped, and the ingots charged into soaking pits and then rolled on a conventional primary mill to slabs following conventional mill practice. After the slabs have cooled they are given a special scarfing treatment. Both the top and bottom surfaces are completely scarfed, preferably by hand scarfing torches, and both edge surfaces are also completely scarfed also preferably by hand scarfing torches. The end surfaces need not be scrafed since they will be cropped and discarded. Both edge surfaces are then given a second scarfing and also the top and bottom surfaces are given a second scarfing inwardly from the edges a distance equal to at least one-fourth of the width of the slab and preferably a distance equal to about one-third of the width of the slab. The slab is then conventionally hot rolled to a coiled strip of steel on a conventional hot mill. The hot rolled coil so produced is suitable for cold rolling to a strip having a No. 3 (best bright finish) substantially free of surface defects.

The scarfiing operations are of critical importance in the production of the steel strip. Single scarfiing of the top and bottom surfaces and the edges was tried, with special attention being given to the removal of any apparent defects. Although some improvement was noticed over conventionally produced coils, there was still an extremely high incidence of shadow lines. No matter how carefully the scarfiing was done, there was still too many of these shadow lines. It was discovered that if the edges were double scarfed, and the top and bottom surfaces were double scarfed inwardly from each of the edges to a distance equal to one fourth the width of the slab then the incidence of shadow lines was substantially reduced, although there were still some instances of such defects. It was then determined that if the double scarfing of the top and bottom surfaces was extended in from each surface a distance equal to about one-third of the width of the slab, the incidence of shadow lines on the finished cold rolled strip was almost completely eliminated. Double scarfing the entire top and bottom surfaces was also performed on some slabs, but this did not improve the results obtained, although no detrimental effect was observed. Thus, in the interest of saving time, money and material it is preferred to scarf the top and bottom surfaces inwardly from the edges a distance equal to about one-third of the width of the slab.

While the foregoing discloses the preferred practice of our invention it will be understood that adaptations and modifications may be made without departing from the scope of the following claims.

We claim:

1. A method of making hot rolled steel strip suitable for cold rolling to strip having a high surface luster and characterized by substantial freedom from shadow lines comprising the steps of making an ingot of vanadium treated non-aging rimming grade steel, controlling the rimming action of the molten steel in the mold to prevent any substantial rise of the solidifying steel in the mold, thereafter rolling the ingot to a slab, then completely scarfing the top and bottom surfaces and both edge surfaces, thereafter completely scarfing both edge surfaces a second time and scarfing a second time both the top and bottom surfaces inwardly from each of the edges a distance equal to at least one-fourth the width of the slab, and then hot rolling the slab to steel strip.

2. The method of claim 1 wherein hand operated torches are employed for the scarfing.

3. A method of making hot rolled steel strip suitable for cold rolling to strip having a high surface luster and characterized by substantial freedom from shadow lines

comprising the steps of making an ingot of vanadium treated non-aging rimming grade steel, controlling the rimming action of the molten steel in the mold to prevent any substantial rise of the solidifying steel in the mold, thereafter rolling the ingot to a slab, then completely scarfing the upper and lower surfaces and both edge surfaces, thereafter completely scarfing both edge surfaces a second time and scarfing a second time both upper and lower surfaces inwardly from each of the edge surfaces a distance equal to about one-third of the width of the slab, and then hot rolling the slab to steel strip.

4. The method of claim 3 wherein hand operated torches are employed for the scarfing.

5. A method of making hot rolled steel strip suitable for cold rolling to strip having a high surface luster and characterized by substantial freedom from shadow lines comprising the steps of making an ingot of vanadium treated non-aging rimming grade steel having up to .10% carbon; .30% to .40% manganese; an effective amount up to .10% vanadium; the balance iron and residual impurities, controlling the rimming action of the molten steel in the mold to prevent any substantial rise of the solidifying steel in the mold, thereafter rolling the ingot to a slab, then completely scarfing the upper and lower surfaces and both edge surfaces, thereafter completely scarfing both edge surfaces a second time and scarfing a second time both upper and lower surfaces inwardly from each of the edge surfaces a distance equal to about one-third of the width of the slab, and then hot rolling the slab to steel strip.

References Cited by the Examiner

UNITED STATES PATENTS

2,306,370	12/1942	Anderson	148—9.5
2,555,527	4/1951	Anderson	148—9.5

WHITMORE A. WILTZ, *Primary Examiner.*

P. M. COHEN, *Examiner.*