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PROCESS OF HOT ROLLING DEEP DRAWING STEEL SHEETS

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1 Claim. (Cl. 148—12)

In the production of steel sheet and strip, considerable care and attention is required in the production thereof with respect to the uses to which the particular strip or sheet is to be placed.

The motor vehicle industry employs enormous quantities of "heavy" and "light" rolled sheets, "deep drawing, full finish, body sheets," which are used for lower door and back panel sections, "extra deep drawing, full finish, auto body sheets," for parts formed in severe draws; and "hood and fender stock," which is stiff, flat, highly drawable and highly polished and is used for hoods, fenders, and running boards.

In some types of steel sheet and strip that are utilized in the foregoing adaptation, more difficulty is experienced in the fabrication of the final shapes than in others, and, consequently, the metallographic properties of the stock from which the respective shapes are to be fabricated assume great importance in determining the ease of fabrication and the amount of breakage which is to be expected to be encountered in the various fabrications.

Thus, considerable difficulty has been experienced in regard to the high amount of breakage encountered in the production of fenders for motor vehicles, and the losses in time and economies which are involved in such breakage.

The present invention has for its object the provision of an improved process for producing deep drawing sheets, whereby failure thereof during fabrication becomes reduced very substantially.

In the production of such sheets, starting with the ingot, two methods of procedure are possible.

Thus, the ingot may be rolled into the form of a slab, hot-sheared to lengths, and the rolling continued to the finished strip without reheating the slabs, thus making the blooming, or the slabbing, mill, a part of the rolling line. This method has an advantage of conserving heat and is employed in some mills which roll a limited number of products from a few grades of steel of one type, such as rimming steels.

In the other method, the slabs are sheared hot, permitted to cool, inspected for surface defects, conditioned and assorted as found necessary, then reheated and rolled to the product desired.

This is the practice which is followed more generally its advantages including the facilitating of the rolling of small orders requiring different grades of steel, the reducing of the amount of the finished steel product discarded in permitting early inspection, and elimination of harmful defects as well as other advantages from metallurgical viewpoints.

In accordance with this practice, the hot-rolled slabs are formed into hot-rolled strip and sheets by a succession of steps substantially as follows:

The ingot is soaked, then rolled on a blooming or slabbing mill to a slab of prescribed width and thickness and sheared into desired lengths, sufficient discard being made from the top of the ingot to assure elimination of top defects, and a cut from the bottom sufficient to square this end of the slab. When cold, the slabs are marked for identification and surface defects are eliminated by means of a burner, such as an oxyacetylene torch.

After conditioning, the slabs are subjected to a series of treatments designated as heating, descaling, roughing and finishing.

The heating is carried out in suitable furnaces which are designed for this operation, which include a preheating zone, and a soaking zone.

After the slabs have been pushed through this soaking zone, they are discharged by gravity upon a roller table, which delivers them to the first stand of rolls designated as the first scale-breaker.

The elimination of scale is a very important step in the rolling of strip. The scale-removal is effected by first deforming the slab sufficiently to break and loosen the scale and then blasting it from the surface with high pressure jets of water or steam. This scalebreaker may be an edging pass or the pass may be made horizontally, depending upon the width of the slab.

After removal of the scale the slab passes through a number of operations, the objects of which are to adjust its width, which must be equal to or slightly greater than the width of its finished strip, and the thickness to that which can be rolled in the continuous stands.

After such operations the work passes between a shear, which may be placed after the first scale-breaker, or perhaps a slab squeezer is positioned after the first scalebreaker depending on the particular mill practice.

Following the shear or squeezer are the roughing stands, which are placed sufficiently far apart so that the longest piece rolled will clear each stand before it enters the next. Otherwise, there is considerable variance in the arrangement and type of mill.

Thus, for example, there may be a mill wherein the descaler may be followed by a horizontal shear, this being followed by four roughing

stands and then descaling jets from which the work passes to the finishing line composed of a suitable number, such as six, for example, of finishing stands.

Or, as another example, a slab squeezer may follow the first descaler, the slab squeezer being followed by, say, five roughing stands, the fifth roughing stand being followed by a long cooling table at the far end of which is located a shear for squaring the ends before the slab enters the second scalebreaker and thence the finishing line.

In order to maintain tonnage of output, it is the customary practice to feed the work through the various operations as rapidly as possible and coiled as hot as possible, such as from between about 1100° F. to about 1350° F.

In following this practice the slabs enter the roughing stands at temperatures well over 2000° F.; for example, from about 2200° F. to about 2500° F. After roughing, the sheet is run through finishing rolls and coiled.

After pickling these coils are cold-rolled to the desired thickness, and box annealed.

In practice, when operating in accordance with the above procedure, substantial difficulty has been experienced because of failure of the stock during fender fabrication, such failure causing a rather large proportion of rejections.

Studies as to the cause of failures of such sheets have indicated that the size of the ferrite grains of cold reduced, box annealed, rimmed steel sheets employed for various purposes, such as fender stock, had a bearing on the failures being encountered, and by controlling the roughing temperatures, a control of the size of the ferrite grains is accomplished.

Thus, extra deep drawing sheets require different grain sizes for various requirements, and this invention rests in a control of temperatures out of the roughing stands which will control the grain size of the finished cold reduced, box annealed sheets.

Where a fine grain is required, say A. S. T. M. #6 or finer, temperatures out of the roughing train should be maintained above 2000° F., and when coarser grain is required, exit roughing temperature should be below 2000° F.

Thus, for example, it has been found that with exit roughing temperatures above 2000° F. few or no #5 grains are found, while at temperatures below 2000° F. an excess of #5 grains are found. This effect is progressive from extremely fine grains at higher temperatures to coarse grains at lower temperatures. The effect is independent of finishing and coiling temperatures.

In operation, no changes need be made from normal slab heating practice, and in order to obtain the roughing temperatures, the slabs may be held ahead of the roughing stand until the temperature reaches the desired point in the above-indicated range. In operation there is no delay on the mill, as it is possible to maintain several slabs in process simultaneously.

Specified usual finishing and coiling temperatures were controlled in the usual manner, such as, for example, by water cooling sprays, and there is no change in the subsequent cold-rolling and annealing practice.

Thus, operations in accordance with usual practice incurred a rejection for grain size of 0.353% of a total tonnage of 1,641.74 tons of sheets rolled, whereas with controlled exit roughing temperatures rejections because of grain size were only 0.062% out of a total of 1509 tons of sheets rolled. This obviously represents a substantial improvement over the prior procedure.

It will be understood, of course, that while the invention has been described specifically in connection with the production of deep drawing sheets the process of the invention is applicable for the production of rimmed steel sheets that are to be cold reduced and box annealed.

I claim:

In the production of cold reduced, box annealed, rimmed steel sheets for deep drawing fabrication, the improvement which comprises hot-rolling slabs of rimmed steel into strip adapted to be cold reduced into deep drawing sheet, while controlling roughing temperatures of all of the said slabs during rolling to maintain a roughing temperature range of from approximately 2000° F. to approximately 2050° F., to produce a predetermined range of sizes of the ferrite grains in the sheets after cold reduction and box annealing.

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