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METAL TREATMENT

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This invention relates to sheet material of rimmed steel which has been rendered non-aging by the addition of small amounts of vanadium of the order of from .01% to .15%. It relates particularly to deep drawing sheet prepared from such steel and to certain steps in the process of producing such deep drawing sheet.

In making deep drawing sheet from rimmed steel the general practice prior to our invention has been to hot roll a blank of rimmed steel to form strip, and then, when the strip emerges from the finishing stand, to cool the strip rapidly by a water spray until it is at a black heat, after which the strip is coiled. If the strip were to be coiled without the rapid cooling the ultimate sheet metal would have too coarse a grain to give the best deep drawing characteristics. Following the rapid cooling and coiling operation of the old practice, the strip is pickled, cold reduced to sheet, and then annealed.

We have discovered that with rimmed steel, which has been rendered non-aging by the addition of small amount of vanadium of the order of .01% to .15% a far more uniformly deep drawing sheet is produced when the strip is slow cooled after the hot rolling instead of rapidly cooled as in the prior practice with other types of rimmed steel, especially if the slow cooling is initiated at or near the finishing temperature of the strip as it leaves the finishing stand of the hot mill. By this slow cooling of the strip the ultimate sheets which are produced possess far more uniformly the degree of ductility required for the most effective deep drawing operations.

The slow cooling of the material, following the hot rolling operation, may be effected in various ways. In the actual practice of our invention the strip is coiled after it leaves the finishing stand of the hot strip mill, the strip going directly from the last stand of the hot mill to the coiling rolls. The coils of strip thus produced are then allowed to cool. As there are many turns of closely adjacent metal in each coil, the metal cools slowly.

So far as the desired physical characteristics are concerned resulting from the slow cooling step, any other means of slow cooling would be effective. For example, the strip could be drawn through a slow cooling chamber maintained at the temperature to give the desired slow rate of cooling or the strip could be cut into suitable lengths and then stacked upon each other in order to retard the cooling. However, we deem it most practical to coil the strip from the finishing stand of the hot mill as above indicated as this method of slow cooling adapts itself to the present day equipment and procedure employed in making deep drawing sheet. It is to be understood that our invention in its broadest aspects

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is not limited to any particular manner or means of effecting slow cooling.

The strip will ordinarily leave the hot rolls at a temperature of between 1600° F. and 1700° F. and it will ordinarily reach the coiler at a temperature not substantially below 1500° F. Consequently, the slow cooling will ordinarily begin before the metal has cooled substantially below 1500° F. Ordinarily, to get the full effects of our invention the slow cooling should start before the strip cools below 1400° F.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In a method of producing sheet, the steps of hot rolling a blank of rimmed steel containing vanadium between about .01% and about .15% into strip and slow cooling the strip from near the hot finishing temperature and while it is at least 1400° F.

2. A method of producing cold rolled sheet from a vanadium-containing non-aging rimmed steel which comprises hot rolling said steel into strip form, coiling said strip while it is at a temperature between approximately 1400° F. and 1700° F., cooling slowly and then cold rolling.

3. In a method of producing cold rolled sheet from a vanadium-containing non-aging rimmed steel, the steps which comprise hot rolling said steel into strip and immediately thereafter coiling said strip while it is at least 1400° F. without applying any cooling medium thereto, cooling slowly and cold rolling.

4. In a method of producing sheet, the steps of hot rolling a blank of rimmed steel containing vanadium between about .01% and .15% into strip, slow cooling the strip from near the hot finishing temperature and at a temperature of at least 1400° F., cold reducing and annealing.

5. A rimmed steel sheet containing vanadium between about .01% and about .15% having the properties of non-aging and deep drawing and having been produced by hot rolling a blank of rimmed steel, cooling slowly from near the finishing temperature of the hot rolling, cold reducing and annealing.

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