

UNITED STATES PATENT OFFICE

2,510,857

MAKING RUBBER-COATED COLD REDUCED
STEEL PRODUCTS

Victor W. Bihlman, Wheeling, W. Va., assignor to
Wheeling Steel Corporation, Wheeling, W. Va.,
a corporation of Delaware

No Drawing. Application October 12, 1946,
Serial No. 702,897

10 Claims. (Cl. 154-130)

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This invention relates to making rubber coated cold reduced steel products. It has to do with the making of products out of cold reduced steel to which rubber is applied as by vulcanizing, such, for example, as automobile running boards.

For purposes of explanation and illustration the invention will be described as practised in the making of an automobile running board although the invention is not limited to the making of that particular product and is applicable to the making of rubber coated cold reduced steel products broadly.

It has been customary to make automobile running boards by vulcanizing rubber onto a blank of hot rolled steel. The steel is thinly coated with copper by galvanic deposition. The hot rolled surface of the steel when thus coated with copper is receptive to the rubber which adheres thereto very satisfactorily.

Since the development of cold reduced steel it is desirable for economic and other reasons to employ cold reduced steel in the manufacture of automobile running boards. However, the surface of ordinary cold reduced steel is not adaptable for rubber coating as the rubber does not satisfactorily adhere to it. I have discovered how to make fully satisfactorily a rubber coated product employing cold reduced steel; I treat the steel so that its surface becomes ideally receptive to rubber so that the rubber adheres to it at least as effectively as to the surface of hot rolled steel. I scale cold reduced steel, remove the scale, apply a thin coating of copper to the steel and vulcanize rubber onto the steel. As the steel is generally die-formed into a blank before the rubber is applied it should be annealed. However, the cost of the blank must be kept at a minimum since automobile running boards are in a highly competitive field and even a small increase in cost may render such a product non-competitive. The steel may be scaled and annealed simultaneously by subjecting it to an open anneal. Indeed, I anneal the steel only contemporaneously with scaling it. This importantly reduces the cost of preparing the blank. Desirably the steel is open annealed and scaled at a temperature of the order of 1400° F. for a time of the order of four minutes although the time and temperature may be varied within limits which will be appreciated by those skilled in the art. Each thickness of the steel should be separate so that the steel is scaled effectively and uniformly. The simultaneous annealing and scaling operation may be performed on sheets which have already been cut from cold

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reduced strip, the sheets being advanced through a heat treating chamber on a conveyor, or the cold reduced strip may be passed through a furnace continuously in known manner.

I also find it important for most satisfactory results to press the cold reduced steel to roughen the surface of the steel. Desirably the steel is rolled with a roughened roll, as, for example, an etched roll. If rubber is to be applied only to one side of the steel only one roughened roll need be used, a smooth roll being positioned opposite the roughened roll. Ordinarily rubber is applied to only one side of the steel. However, it may be desired to produce products in which rubber is applied to opposite sides of the steel, in which case the cold reduced steel is desirably rolled between opposed roughened rolls. I preferably pass the steel through a cold rolling mill and cold reduce the steel therein and roll the steel with a roughened roll in the final stand of the cold rolling mill to roughen the surface of the steel.

Desirably the steel first has its surface roughened by pressing as above explained, whereafter it is simultaneously scaled and annealed also as above explained. The scale is then removed from the steel. I find it highly desirable to remove the scale by pickle-etching. This may be done in sulphuric acid (a 10% solution of sulphuric acid being satisfactory) or it may be done in a pickling solution of sulphuric acid mixed with a relatively small quantity of hydrochloric acid, which is advantageous. I desirably employ a pickling solution of 10% sulphuric acid and 2% hydrochloric acid. The steel is preferably immersed in the solution for at least about 15 minutes. The scale is removed and the surface of the steel is desirably etched to place it in condition to receive the rubber. Desirably an inhibitor is not used in the pickling solution.

After removal of the scale the steel has applied to it a thin coating of copper. This is preferably done by galvanic deposition. The steel is passed through what is known in the art as a copperizing line in which the steel is successively (a) washed with high pressure water sprays, (b) immersed in a tank containing a dilute solution of copper sulphate and sulphuric acid and wherein a thin coating of copper is applied to the steel by galvanic deposition, (c) washed with hot high pressure water sprays, (d) dried and (e) oiled. The copperizing treatment is known and is not per se claimed by me as my invention.

The steel is die-formed into a blank and rubber is vulcanized onto the blank in known manner.

In some cases if a perfectly flat blank is desired

the die-forming step may be dispensed with. The application of the rubber to the blank is performed in known manner, the raw rubber being applied to the blank in a mold and vulcanized thereto.

When cold reduced steel is treated as above described the rubber adheres tenaciously, and in tests which have been made by attempting to tear the rubber from the steel all of the separation occurred in the rubber rather than at the juncture of the rubber and the steel. For best results the surface of the steel should be roughened by pressing and the steel should be scaled. For necessary economy in a highly competitive field the annealing requisite to render the blank drawable should be performed simultaneously with the scaling step as above explained. My method is highly satisfactory and competitive with the least costly methods of making rubber coated steel products.

While I have described a present preferred method of practising the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously practised within the scope of the following claims.

I claim:

1. A method of making a rubber coated cold reduced steel product comprising forming a scale on cold reduced steel, annealing the steel only simultaneous with the above-mentioned forming of the scale, removing the scale, applying a thin coating of copper to the steel and vulcanizing rubber onto the copper-coated steel.

2. A method of making a rubber coated cold reduced steel product comprising forming a scale on cold reduced steel, annealing the steel only simultaneous with the above-mentioned forming of the scale, removing the scale, applying a thin coating of copper to the steel, die-forming the steel into a blank and vulcanizing rubber onto the blank.

3. A method of making a rubber coated cold reduced steel product comprising rolling cold reduced steel with a roughened roll to roughen the surface of the steel, forming a scale on the steel, annealing the steel only simultaneous with the above-mentioned forming of the scale, removing the scale, applying a thin coating of copper to the steel and vulcanizing rubber onto the copper-coated steel.

4. A method of making a rubber coated cold reduced steel product comprising rolling cold reduced steel with a roughened roll to roughen the surface of the steel, forming a scale on the steel, annealing the steel only simultaneous with the above-mentioned forming of the scale, removing the scale, applying a thin coating of copper to the steel, die-forming the steel into a blank and vulcanizing rubber onto the blank.

5. A method of making a rubber coated cold reduced steel product comprising passing steel through a cold rolling mill and cold reducing the steel therein, rolling the steel with a roughened roll in the final stand of the cold rolling mill to roughen the surface of the steel, forming a scale on the steel, annealing the steel only simultaneous with the above-mentioned forming of the scale, removing the scale, applying a thin coating of copper to the steel and vulcanizing rubber onto the copper-coated steel.

6. A method of making a rubber coated cold reduced steel product comprising forming a scale on cold reduced steel, annealing the steel only simultaneous with the above-mentioned forming of the scale, removing the scale, applying galvanically to the steel a thin coating of copper and vulcanizing rubber onto the copper-coated steel.

7. A method of making a rubber coated cold reduced steel product comprising passing steel through a cold rolling mill and cold reducing the steel therein, rolling the steel with a roughened roll in the final stand of the cold rolling mill to roughen the surface of the steel, forming a scale on the steel, annealing the steel only simultaneous with the above-mentioned forming of the scale, removing the scale, applying galvanically to the steel a thin coating of copper, die-forming the steel into a blank and vulcanizing rubber onto the blank.

8. A method of making a rubber coated cold reduced steel product comprising pressing cold reduced steel to roughen the surface of the steel, forming a scale on the steel, annealing the steel only simultaneous with the above-mentioned forming of the scale, removing the scale, applying a thin coating of copper to the steel and vulcanizing rubber onto the copper-coated steel.

9. A method of making a rubber coated cold reduced steel product comprising forming a scale on cold reduced steel, annealing the steel only simultaneous with the above-mentioned forming of the scale, pickle-etching the steel, applying a thin coating of copper to the steel and vulcanizing rubber onto the copper-coated steel.

10. A method of making a rubber coated cold reduced steel product comprising forming a scale on cold reduced steel, annealing the steel only simultaneous with the above-mentioned forming of the scale, pickle-etching the steel in a pickling solution of sulphuric acid mixed with a relatively small quantity of hydrochloric acid, applying a thin coating of copper to the steel and vulcanizing rubber onto the copper-coated steel.

VICTOR W. BIHLMAN.

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