UNITED STATES PATENT OFFICE.

EVAN J. FRANCIS, OF NEW KENSINGTON, PENNSYLVANIA.

PROCESS OF MAKING SHEET METAL.

SPECIFICATION forming part of Letters Patent No. 626,994, dated June 13, 1899.

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To all whom it may concern:

Be it known that I, EVAN J. FRANCIS, a resident of New Kensington, in the county of Westmoreland and State of Pennsylvania, have invented a new and useful Improvement in Processes of Making Sheet Metal; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to a process for the manufacture of sheet metal.

One of the greatest difficulties encountered in connection with the manufacture of sheet iron and steel for tinning and other purposes is due to the oxidation of the iron or steel either in the original form of bars or plates or when reduced to sheets. To remove any scale caused by the oxidation of the metal, it has to be carefully annealed and pickled at different stages of the process. If the sheets when reduced are to be tinned or coated with another soft metal or alloy, unless all oxid has been removed previous to the dipping or coating operation an imperfect sheet will result, as the coating metal will not take effect on the spots where oxidation has taken place and where any scale remains.

The object of my invention is to provide a process of making sheet metal in which the liability of the oxidation of the metal is practically eliminated, so that the sheet when finished, whether to be finally coated with another metal or not, will be free from oxid and the danger of oxidation, while at the same time the sheet metal possesses great toughness and ductility for stamping and other uses in the arts.

To these ends my invention consists, generally stated, in coating the iron or steel body from which the metal sheet is to be formed with nickel, such as by electrolysis, heating the metal body thus coated, and then reducing the same to sheet metal of desired gage, and, if desired, in coating the sheet metal so produced with tin or other soft metal, in which case the invention includes certain economical treatment of the sheets in the tinning or like process.

In practicing my invention I take iron or steel in the form of billets, bars, or plates and remove any oxid which it may have on its surface. This is preferably done in the ordinary manner by introducing the metal into a suitable acid-bath or what is commonly known as "pickling." In this manner any oxid or scale on the metal is removed. Where my invention is to be carried out in connection with the manufacture of tin-plate, this pickling may be accomplished very economically by the use of the refuse from the pickling-pots, into which the sheets are introduced preparatory to the tinning operation. The metal body when cleaned as above is then coated with nickel. This may be accomplished in any suitable way. I prefer to insert the bars or plates in a suitable bath and deposit the nickel thereon by electrolysis, in this way obtaining a comparatively thin coating of the metal upon the metal bar or plate. The nickel completely envelops the iron or steel and finds its way into the seams and pores of the metal from which the oxid has been removed. The well-known quality of nickel to resist oxidation and corrosion is thus imparted to the surface of the iron or steel, so that the formation of rust or scale is avoided. The metal thus coated is then heated to the proper degree and rolled or hammered to reduce said metal to sheets of the required thickness or gage. The melting-point of the nickel is so high that the coating is not affected in raising the metal body to a rolling heat. The bars or plates and the thicker sheets formed from them in reducing the metal to the desired gage can also be rolled in piles without liability of the nickel coating of any two bars or sheets adhering, and they can therefore be handled in the same way as in rolling ordinary sheet-iron, while the sheets in the packs formed are easily separated. By the rolling of the metal the nickel is driven or forced into the pores of the metal, increasing its density, as well as its power to resist oxidation. In the rolling operation the coating of nickel is of course spread out in a thinner coating; but even when not perceptible to the eye it apparently gives this protection against oxidation. The nickel when pressed or forced into the pores of the iron or steel adds toughness and ductility, so that sheet metal made in this manner can be bent or twisted without fracture or rupture, which gives it great advantage as a stamping-iron. The original coating applied by electrolysis may be itself quite thin, and as the surfaces of the bar are small

as compared with the finished sheet the cost of applying the nickel coating is small.

The sheets produced as above can be coated with tin, lead, spelter, or other suitable soft-metal coating. When they are to be coated with tin, the sheets are first pickled to remove any possible oxid, and then placed in annealing-boxes and introduced into a suitable furnace to be annealed in the ordinary manner. After they have been annealed they are passed through the cold-rolls. They are then taken to the tin-house, where they may be tinned by any of the well-known methods. By my process on account of the greater ductility of the sheet metal I am enabled to dispense with the second annealing, which follows the cold-rolling in the ordinary process of manufacturing tin-plate. The preparation of the metal for tinning, by first rendering it practically non-oxidizable, is of great importance, as the sheets are practically free from oxid and scale and better adapted to receive the tin. There is a clean surface to take the tin, so that no spots remain uncovered, but a smooth even coating of tin is obtained. Again, the tin-plate produced from metal treated as above will have all the increased toughness and ductility which such metal is found to possess, so that a high grade of tin-plate is produced for stamping and other purposes.

Terne-plate can also be made in the same manner as tin-plate, which will give a roofing-plate capable of affording greater resistance to the oxidation and corrosion from exposure to the weather.

I wish to include within the scope of my invention any process of coating iron or steel with nickel and forcing or driving the nickel into the pores of the metal in reducing it to sheets in such manner as to enable said metal to resist oxidation entirely or in part, as well as to increase the toughness and ductility of the metal.

It is apparent that my invention may be applied to the manufacture of hoop and band iron or steel, the quality of toughness and ductility having marked advantages in such case.

By my invention ordinary Bessemer steel when treated as above takes the place of the more expensive open-hearth steel.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The process of making sheet metal consisting in coating an iron or steel body with nickel, heating the body as coated and reducing it to sheet metal.

2. The process of making sheet metal, consisting in depositing nickel on an iron or steel body by electrolysis, heating the body so coated, and reducing it to sheet metal.

3. The process of making sheet metal, consisting in cleaning an iron or steel body from oxid, coating it with nickel, heating the body so coated and reducing it to sheet metal.

4. The process of making sheet metal, consisting in coating bars of iron or steel with nickel, piling said coated bars and heating and rolling them to sheets.

5. The process of making sheet metal, consisting in coating an iron or steel body with nickel, heating the body so coated and reducing it to sheets, and afterward coating the sheets thus produced with soft metal.

6. The process of making sheet metal, consisting in coating an iron or steel body with nickel, heating and reducing the body so coated to sheets, annealing said sheets, passing them through cold-rolls, and finally coating the sheets with soft metal.

7. The process of making sheet metal, consisting in coating an iron or steel body with nickel, heating and reducing the body so coated to sheets, pickling and annealing said sheets, passing them through cold-rolls, and finally coating them with soft metal.

In testimony whereof I, the said EVAN J. FRANCIS, have hereunto set my hand.

EVAN J. FRANCIS.

Witnesses:
ROBT. D. TOTTEN,
ROBERT C. TOTTEN.