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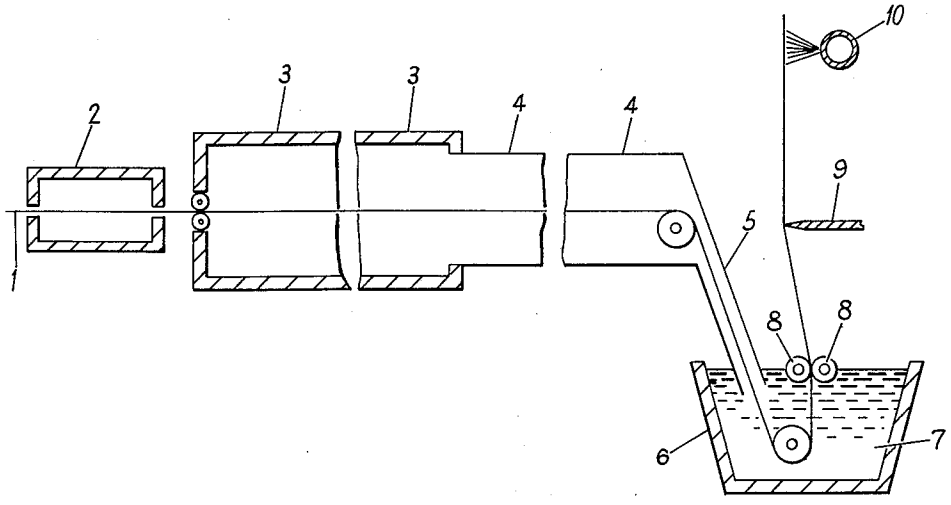

INVENTOR.
GEORGE LUSA,
BY Yuraglitt, Melville, Strasser + Foster,
ATTORNEYS.

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DIFFERENTIALLY COATED GALVANIZED STRIP

George Lusa, Dayton, Ohio, assignor to Armco Steel Corporation, Middletown, Ohio, a corporation of Ohio

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The invention relates to galvanized, i.e. zinc coated, ferrous strip or sheet materials bearing on one side a standard or heavy-weight zinc coating, and on the other side a coating which, while derived from zinc, is very much thinner.

It has hitherto been realized that there are various uses for a galvanized product having a heavy or standard coating upon one side and a lighter coating upon the other. For example, when galvanized sheets are used for roofing or siding on buildings, the heavy weights of coating are needed on the exterior to secure a long life and resist corrosion when exposed to the weather; but the inside surface of such sheets, not being exposed to the elements, do not require such a heavy weight of coating.

Various suggestions have been made in the past looking toward the provision of differentially coated galvanized sheets or strip. In the coating operation, the ferrous material is passed through a bath of molten zinc and emerges therefrom between exit rolls which are grooved to control the extent and uniformity as well as the thickness of the coating. It has been found that the exit roll on one side of the strip may be grooved in such a way as to leave a lesser weight of coating on the strip surface at that side. Again, it has been disclosed in the copending application of Whitley, Kemplin and Jones, Serial No. 733,708, filed May 7, 1958, now Pat. No. 2,992,941, and entitled Exit Machine for Coating Apparatus and Method of Controlling Coating Thickness, that the use of an air blast on the meniscus at the exit rolls can decrease the amount of coating metal which is applied or left on the surface of the strip. The meniscus, of course, refers to that quantity of zinc which collects above an exit roll and between it and the surface of the strip as it is leaving the exit roll.

It has also been found that the use of a wiper blade on one side of the strip above a standard exit roll will serve to wipe off almost all of the coating resident on that side of the strip. The blade may be made of metal or any other substance of sufficient strength and capable of withstanding the heat involved.

One difficulty with the formation of differentially coated galvanized strip lies in the fact that the wiped or otherwise more thinly coated side of the material is likely to have a streaked and unsightly appearance. While this may make no difference in certain uses, where the thinly coated side of the product is exposed to view, it will usually be desired to have it covered with paint or enamel. Zinc coatings as usually produced are not very receptive to coatings of paint and enamel unless they are given pretreatments. These pretreatments are generally expensive and involve the installation of fairly bulky apparatus.

In still other uses, one side of the galvanized product may be given an organic coating of paint, enamel or other material, while it is desirable to have the other side carry a standard or heavy galvanized coating. If the organic coating can be made to adhere to a very thin zinc layer upon the one side of the product, it will obviously not be necessary for both sides of the product to carry heavy or standard zinc coatings. As an example of one such use, there are ceretain sheet metal parts of an automobile body, such as the so-called rocker panels, where the outer surface will be covered and protected with the ordinary automobile finish, but where the inner surface is exposed to air, moisture, and other corrosive influences but cannot readily be painted or otherwise protected. The sheet

metal of this invention is useful for such parts. The external finish of the body will adhere very well to the thinly coated side of the product of the invention, which is located outwardly, while a full single coating on the inner side will protect that side from corrosive influences.

Another problem is involved in the use of galvanized sheets on the under sides of automobiles. It is usual to spot weld adjacent panels together; but the standard zinc coatings cause a considerable amount of build-up on the copper welding electrode tips. This impedes the welding operation and makes for a frequent cessation of the work so that the electrode tips may be cleaned.

The principal object of the invention is the provision of a new galvanized product and a method of making it, which avoids all of the difficulties mentioned above. This object, and others which will be set forth hereinafter or will be apparent to one skilled in the art upon reading these specifications, is accomplished by that procedure and in that product of which certain exemplary embodiments will now be described.

The drawing is a diagrammatic representation or flow sheet of one mode of carrying on the process.

The copending application of Schnedler, Serial No. 753,015, filed August 4, 1958, now Pat. No. 2,986,808, teaches that a zinc coated sheet, which has been subjected to a heat treatment so as to cause an increase in the thickness of the interface alloy, will be usefully increased as to its acceptance of paints and enamels while still having a surprising amount of corrosion resistance. However, it is not generally advantageous to increase the extent of the interface alloy on both sides of the sheet for reasons which will now be set forth:

The galvanized sheets are preferably formed from strip stock which has been galvanized in accordance with the teachings of the Sendzimir U.S. Patent No. 2,197,622. In the practice taught by this patent, cold rolled strip 1 is first passed through an oxidizing furnace 2 in which oils, greases, carbonaceous smudges, and other non-reducible materials are removed from their surfaces, and a thin, controlled coating of oxide is formed thereon. The strip is next led into a reducing furnace 3 wherein the thin coating of oxide is completely reduced. The temperature in the reducing furnace may, if desired, be sufficient to anneal the stock. From the reducing furnace, the strip passes through a cooling hood 4 in which it is still protected by reducing gases, and thence is carried as at 5 beneath the surface of a pot 6 of molten galvanizing metal 7 the entrance end of which is flux-free. The strip has a very short path of travel through the galvanizing pot. Zinc metal in the pot contains a small proportion of aluminum. All of these conditions combine to produce a galvanized product in which the interface alloy is extremely thin. It is believed to be due largely to this factor that the galvanized product is characterized by extraordinary ductility and adherence of the coating, so that the coating can withstand substantially any bending, forming, drawing, or other working operations which can be performed on the base stock. A heat treatment which would result in an increase in the thickness of the interface alloy would, to a considerable extent, impair the ductility and adherence of the galvanized coating.

It has been found, however, in accordance with the present invention, that if one side of the galvanized strip is wiped shortly after it emerges from the exit rolls 8 and before the zinc coating thereon has hardened, so as to remove the greater part of the coating thereon, it then becomes possible to apply a small amount of heat to the thinly coated side of the strip so as to cause the zinc coating on that side to alloy rapidly with the base material, and that if the heat is properly controlled, the interface alloy on the opposite side of the strip will not be increased in thickness, and that the standard or heavy

zinc coating thereon will not be affected as to its adherence or ductility. The new product, therefore, is a sheet or strip which has a standard or heavy zinc coating upon one side, the characteristics of which have not been affected, and upon the other side a very thin layer of zinc alloyed with the ferrous base metal. Such a product has never before been produced.

In the practice of the invention the pretreatment of the strip and the coating are carried on as is usual in the practice of the Sendzimir patent to which reference has been made. If desired, the exit rolls may be grooved in such a way as to apply coatings of different thicknesses to opposite sides of the strip, or an air blast may be used on the meniscus on one side, as mentioned above. These expedients, however, are not necessary. The use of a scraper blade 9 is the preferred procedure, the blade being so located as to deflect the strip as shown and insure contact all across its width. A blade properly used will be effective in removing the major portion of the zinc galvanizing metal on the side of the strip contacted by it.

The zinc coating on the opposite side of the strip does not constitute a limitation on the invention. Depending upon the usage to which the product is to be put, the heavy coating can be as heavy as that normally produced commercially, which could be as much as one ounce or heavier, per square foot. The other, or light side, the strip can have coatings as light as .1 ounce, or less, per square foot.

The heat applied to the wiped side of the strip is conveniently produced by one or more gas ribbon burners 10 or some other suitable heat source, such as an electrical heating means. Assuming that the strip leaves the coating pot in a vertical direction, the burners will be placed in a horizontal position extending across the strip. The exact position of the burners with respect to the exit rolls is not critical; and it has been found that the burners may vary from about one foot to ten feet from the exit rolls. The burners will be located at such a distance from the surface of the strip as to produce the proper heat at that surface. In general, the burners will lie from 2 inches to 8 inches away from the strip. The heat may vary from 500° F. to about 1400° F. at the surface of the strip. The heating should be done in such a way that, while the adjacent and thinly coated surface of the strip is heated to the desired temperature, the rate of heat dissipation from the strip as it cools in air will prevent the transmission of any great degree of heat to the opposite side of the strip. The temperature may be varied in accordance with the thickness of the zinc coating remaining on the wiped side of the strip, and the amount of heat required to cause it to alloy with the base metal.

In the practice of the invention, it may be found advisable to raise the temperature of the molten metal in the coating pot. The pot temperature may be raised as high as about 870° F. without essentially affecting the characteristics of the standard or heavy zinc coating upon the one side of the sheet.

Modifications may be made in the invention without departing from the spirit of it. The invention having been described in certain exemplary embodiments, what is claimed as new and desired to be secured by Letters Patent is:

1. A process of making a differentially coated galvanized stock which comprises forming zinc coatings of unequal thickness on opposite sides of a ferrous sheet stock, and subjecting the sheet stock upon the side bearing the coating of lesser thickness briefly to localized heat sufficient to alloy the zinc on the said last mentioned side substantially entirely with the ferrous sheet stock, while leaving substantially unaffected on the opposite side of the sheet both the layer of zinc coating metal thereon and any interface alloy existing between said layer and the base metal.

2. A process of producing a differentially coated galvanized ferrous sheet product which comprises subjecting ferrous strip to a cleaning and oxidizing operation so as to form thereon a thin uniform film of oxide, passing the strip so treated through a reducing furnace and heating it therein in the presence of reducing gases so as thoroughly to reduce the said oxide layer, and through a cooling hood containing reducing gases so as to introduce it into a bath of molten zinc coating metal through a flux free surface thereof, withdrawing the said strip from said bath through exit rolls, scraping one surface of said strip above one of said exit rolls so as to remove the greater part of the coating of zinc coating metal thereon, and then subjecting the same side of said strip to localized heat to cause the remaining zinc thereon to alloy with the ferrous strip surface without essentially affecting the coating of zinc coating metal or the opposite side of said strip.

3. The process claimed in claim 2 wherein said zinc coating metal contains a minor percentage of aluminum.

4. A process of making a differentially coated galvanized stock which comprises passing ferrous strip through a bath of molten coating metal of which the primary constituent is zinc, under conditions to cause the said molten coating metal to cling to and coat the surfaces of the said ferrous strip, and upon withdrawal of the ferrous strip from the bath of molten coating metal treating the surfaces thereof so that the resident layer of coating metal upon one side of it is substantially thicker than the coating thereof upon the other side, and after the said treatment applying localized heat to the thinner coating upon the last mentioned side of said ferrous strip so as to cause the said coating metal in the said thinner coating to alloy substantially entirely with the ferrous strip, while leaving subtsantially unaffected upon the opposite side of said strip both the thicker layer of coating metal thereon and any interface alloy existing between said layer and the base metal.

5. The process claimed in claim 4 wherein the coating metal is zinc containing a minor percentage of aluminum.

6. The process claimed in claim 5 wherein the layer of coating metal upon the first mentioned side of said strip is at least about one ounce per square foot, and wherein the layer of coating metal as formed upon the second mentioned side of said strip is not greater than about 0.1 ounce per square foot of the strip surface.

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