April 7, 1936. R. J. WEAN 2,036,615

COATED SHEET METAL AND PROCESS OF MAKING THE SAME

Filed Feb. 20, 1934

Fig. 1.

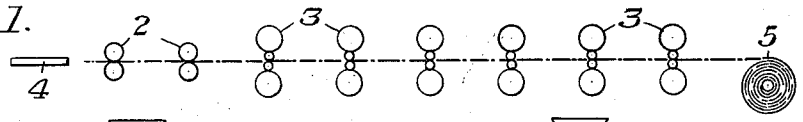


Fig. 2.

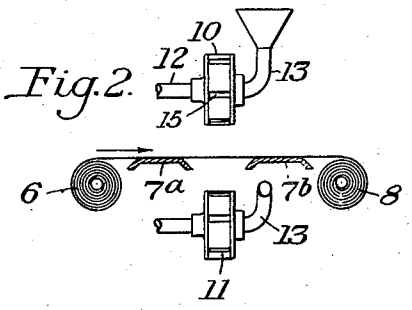


Fig. 3.

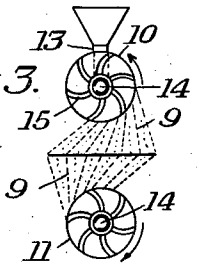


Fig. 4.

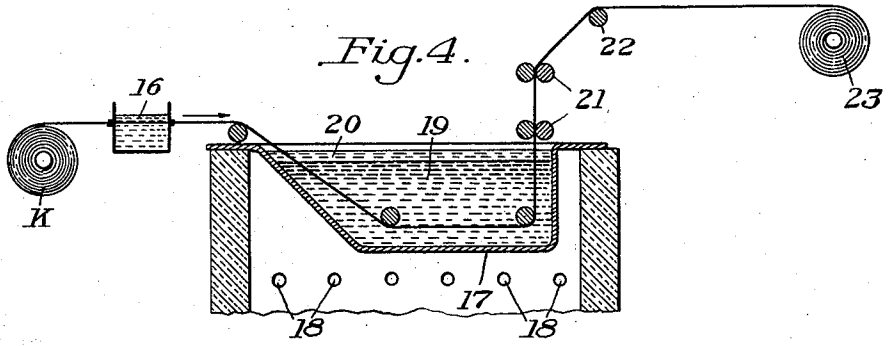


Fig. 5.

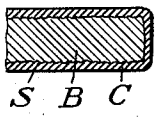


Fig. 7.

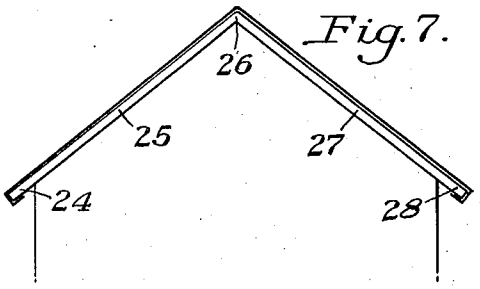


Fig. 8.

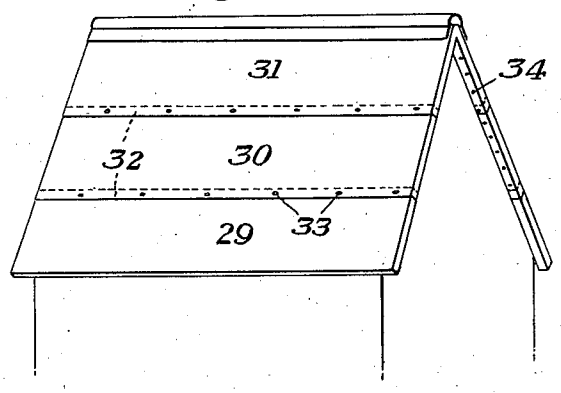


Fig. 6.



INVENTOR

Raymond J. Wean

by his attorneys

Byrnes, Stetland & Blenko

Patented Apr. 7, 1936 2,036,615

UNITED STATES PATENT OFFICE

2,036,615

COATED SHEET METAL AND PROCESS OF MAKING THE SAME

Raymond J. Wean, Warren, Ohio, assignor to The Wean Engineering Company, Inc., Warren, Ohio, a corporation of Ohio

Application February 20, 1934, Serial No. 712,160

9 Claims. (Cl. 91—70.2)

This invention relates to coated sheet metal and is particularly advantageous where the metal is in strip form.

Ferrous sheet metal with a protective coating, as, for example, of lead, tin or zinc, has a wide variety of uses, among which may be mentioned roofing, building siding, culverts, "silver tin" coated sheets for baking pans, etc. Sheets of relatively limited length produced by the Welsh process and strips produced by hot rolling or a combination of hot and cold rolling form the base metal for these products. It is generally necessary to subject the base metal to cleaning processes so that the coating metal will adhere over the entire surface. In those cases where the required coating is of considerable thickness, as, for example, in culvert stock, the cleaning process is very drastic and usually involves the expenditure of a large amount of time in order to get sufficient cleaning. The cleaning is generally effected in any case by a pickling bath and this has disadvantages in that the process is a dirty and disagreeable one and is not uniformly efficient unless very carefully controlled. Pickling often adversely affects the base material causing hydrogen inclusions, which are a fruitful cause of defects such as "blisters".

Continuous coating processes have heretofore been proposed but have not been successful, and I believe that a large part of the difficulty encountered has arisen from the manner of cleaning the base material.

By my invention it is possible to coat sheet-like material either in long or short lengths with a coating metal such as lead, tin or zinc and to obtain a highly superior product. Instead of pickling, I use surface blasting in order to clean the base metal. I thereby obtain a roughened surface peculiar to such process, which surface I have found is ideal for receiving the coating metal. I have found from tests that the coating adheres very firmly to such a base and permits of crimping or bending the metal to a marked degree without peeling of the coating. This is an exceedingly important consideration commercially.

I employ centrifugal means for discharging the cleaning or abrading agent. Shot blasting of various articles, as, for example, castings, is of course well known, but the general practice has been to use air as a carrying medium for the particles. I have found that this is very undesirable for the cleaning of sheet metal intended to be used as a base for coating. The amount of material to be blasted in a commercial operation is so large that the cost of compressed air is generally prohibitive; but entirely apart from this it is undesirable to use an air-borne blasting medium because of the effect on the product. There is always a strong tendency toward the condensation of moisture around compressed air operations, and this is particularly marked on the surface of sheets which have been blasted by an air-borne abradant. There is always danger of corrosion to some degree between the time the sheets are blasted and the time they are immersed in the coating bath, and there is also danger of minute quantities of water collecting in the small pits resulting from the blasting, which moisture prevents continuous adherence of the coating to the base metal.

In the accompanying drawing illustrating present preferred embodiments of my invention,

Figure 1 is a diagrammatic view illustrating the rolling of a strip of ferrous metal constituting the base of my improved coated article;

Figure 2 is a diagrammatic view of a centrifugal blasting device for cleaning the surfaces of such material;

Figure 3 is a transverse view thereof;

Figure 4 is a diagrammatic view showing the coating apparatus;

Figure 5 is a transverse view to enlarged scale showing the manner in which the edge of the metal is protected;

Figure 6 is a view similar to Figure 5 but showing different surface treatments for the two sides of the material;

Figure 7 is a view showing my improved product applied to a roof; and

Figure 8 is a view showing another application of the product for a roof covering.

Referring to Figure 1, there is illustrated more or less diagrammatically a continuous mill consisting of two-high stands 2 and four-high roller bearing stands 3 for the hot rolling of a slab 4 into a coil of strip metal 5. Depending on the desired final gauge, this material may be substantially cold rolled. It is desired that the base material ultimately obtained shall have the width and gauge of a sheet and the unlimited length of a strip. The gauge actually employed will depend upon the use to which the material may be put, but as a specific example I prefer for roofing material that the width shall be 34 to 36 inches and the gauge shall be from 24 to 30.

The length will vary, but I prefer that it shall be in excess of 25 feet. Of course, in certain cases shorter pieces may be rolled, but for purposes of economy I prefer the longer lengths. It is impossible by the ordinary pack rolling process to roll pieces in excess of 25 feet long, and while I contemplate that in certain aspects of my invention the base material may be produced by pack rolling, I prefer the use of long lengths such as are obtainable from the strip metal. A good example of the value of this may be found in the case of roofing material. The general practice has been to make it in lengths of from 8 to 12 feet. The sheets are assembled together in a roll consisting of 100 linear feet of material and sold as ridge roll roofing. By my invention the roll may be made of a single piece, or multiples of this length up to 2000 feet or more may be readily obtained. This greatly simplifies the problem of roofing and, as hereinafter pointed out, results in an improved roof structure.

After the base material has been rolled it is cleaned with the apparatus shown diagrammatically in Figures 2 and 3. The material to be blasted is fed from a reel 6 over a table 7*a*, 7*b* to a gathering reel 8. In its passage over the table it is subjected to the action of abrasive particles as indicated at 9 from centrifugal blasting wheels 10 and 11. These wheels, which are more particularly described and claimed in U. S. Patent No. 1,953,566 granted to Louis D. Peik on April 3, 1934, are mounted on and driven at high speed by shafts 12 and are supplied with a suitable abradant, such as sand or metal shot, through feed pipes 13. The abradant is fed to the wheels through a stationary member 14 having an opening extending around a limited portion only of its periphery. The abradant is thus fed to spiral passages 15 in the wheels and travelling through them is brought up to high velocity and discharged against the material to be treated. The use of the member 14 permits of discharging material around a limited portion only of the periphery of the wheel, as best indicated in Figure 3. The effect of the wheels is to remove any oxide or other adherent impurity on the base metal and to remove any high polish which the surface may have, leaving it with a characteristic mat or pebbled finish, the coarseness or fineness of which is determined by regulating the size of the grit or shot employed, the speed at which the material is moved through the blasting zone, and the rate of feed of abradant. As a specific example I have used number 60 steel grit at the rate of 260 pounds per minute for the surface treatment of hot rolled sheets 28 inches wide. These sheets were moved through the abrading zone at the rate of 6 feet per minute.

An important feature of the invention is that the roughened surface thus obtained which is characteristic of dry surface blasting is ideal for the reception of protective coating metal and is free from moisture or hydrogen inclusions. Hydrogen inclusions, which result from pickling, are the direct cause of what is known as blisters which develop when the material is subjected to further heating, as occurs upon passing the base material through a molten bath of coating metal.

Figure 4 shows a coating operation in diagram. The base material with its surface suitably prepared, as above described, is fed from a coil K through a bosh 16 containing acidulated water, and then around suitable guide rolls into and through a metal pot 17 kept up to temperature by burners 18. The molten coating metal which, in the preferred form of my invention, may be any one of the group consisting of lead, tin and zinc is indicated at 19. It may be desirable, particularly in the case of lead, to preliminarily apply a thin coating of tin, although the surface treatment above described causes remarkably good adherence. The surface of the molten coating metal is protected by a suitable flux as indicated at 20. After leaving the coating bath the strip passes through exit rolls 21 and thence over a guide roll 22 to a gathering reel 23.

The material is now in condition to be used. As stated, it may be made in extreme lengths and, as in the case of roofing or culverts, made to the desired width. This is advantageous in that the edges of the strip have a protective coating thereon which is not true in the case of pieces which are sheared from coated sheets. In Figure 5 I have indicated the base metal at B and the coating metal at C. It will be noted that the surface S of the base metal is roughened from the abrasion and this greatly facilitates the adherence of the coating metal, depending on the amount of roughening of the surface. The roughness may or may not be reflected in the exterior surface of the coated article. In cases where a smooth finish is important a finer "grain" may be imparted to the surface by controlling the blasting conditions. Ordinarily it is desirable for culvert or roofing stock to have some irregularity in the surface because such irregularities permit of applying a heavier adherent coating. One of the difficulties of present culvert stock manufacture is that drastic pickling must be resorted to in order to get the desired roughness of surface. The objections to pickling have already been pointed out. It will be found in many cases that it is desirable to have one surface of the material rougher than another. This is shown in Figure 6 wherein the top surface S—1 has been considerably roughened by the blasting operation and the other surface S—2 has a much finer grain, or, in certain cases, may even be left unblasted. It is possible to obtain different surface characteristics with my process whereas this is impossible by ordinary pickling methods.

In many cases it will be desirable to provide some irregularity in the surface for the sake of the pleasing and desirable appearance thus obtained and in the case of zinc coating it is found that the surface obtained by dry blasting affects the spangle of the zinc in some degree and gives a product having a very desirable appearance. For billboard use it will be found desirable to have a somewhat roughened surface as this forms a better base on which posters may be pasted.

Figure 7 shows a roof wherein a single length of my improved material is extended from under one eave, as indicated at 24, across one roof surface 25, over the ridge 26, down the other roof surface 27, and is secured under the eave 28. There is thus presented a continuous strip of roofing from eave to eave, the only joints being between adjacent strips. These joints may be seamed or soldered so that a roof with practically no chance of leakage is formed. Figure 8 shows the material extended lengthwise of a roof, there being strips 29, 30, and 31 placed successively over

the roof starting at the lower edge and working toward the ridge, the strips being shingled over one another as indicated at **32**. The roofing is secured along its upper edge as indicated at **33** and by its inturned ends as indicated at **34**. The exposed and overlapping edges may be "tacked" at intervals as by soldering, or may be soldered continuously. It will be understood that the advantages of the invention may likewise be obtained by running roofing strips from eave to ridge on each side of the roof, the ridge being protected by the usual ridge roll. This phase of my invention is also disclosed and claimed in my copending application Serial No. 727,717, divided herefrom.

Another use wherein my material has superior qualities is in baking pans having a so-called "silver tin" finish. This type of finish is only procurable at considerable expense by ordinary methods, but by my process it is obtainable merely by seeing to it that the surface of the base metal is fairly well pebbled by the cleaning blast, and then applying a tin coating sufficiently thin that the pebbled effect is not unduly suppressed. The product has a characteristic finish and the surface is capable of retaining a small amount of grease so that bread baked in pans made of such material does not stick in the pans. This material may advantageously be made with one side smoother than the other, the smooth surface being outermost in the baking pan.

Another use to which my material may be readily put is for fencing. In certain places it is desirable to have a fence which is continuous in character. For example, in certain parts of South America fences made of steel sheets have been proposed as a means of preventing the incursion of grasshoppers. At present the general practice is to take zinc coated sheets and hang them by means of holes punched in one edge on hooks carried by a support, thereby forming a continuous barrier about 28 inches high. It has also been proposed to take pieces of limited length and crimp them end to end to form rolls which are unrolled at the place of use and fastened to spaced supports. My invention permits of making up the material in continuous pieces, hundreds or even thousands of feet long, which pieces may be much more readily handled and provide a superior barrier.

As stated, my improved material may have the unlimited length of a strip and the width and gauge of a sheet. It may vary from, say, 12 inches up to any width obtainable by available rolling equipment. For example, it is possible to produce material up to 72 inches wide. The gauge will depend upon the use to which the material may be put within the usual range of sheet gauges. As indicated, I anticipate that the gauges from 24 to 30 inclusive will be the most useful for roofing. For other purposes lighter or heavier gauges may be used. For example, culvert stock will usually run from 14 to 20 gauge. Metal within this range of gauges is capable of withstanding within a reasonable amount the shocks imparted by centrifugal surface blasting without becoming unduly distorted. The amount of coating applied is important. It should be sufficient to insure that adequate protection will be obtained and yet should not be so heavy as to be unduly expensive. I append hereto a tabulation of preferred minimum coating weights for zinc coatings, the weight stated in the table being a total coating expressed in ounces on both sides of a sheet one foot square.

Sheet gage	Weight of coating
No. 8	2.00
No. 9	2.00
No. 10	2.00
No. 11	2.00
No. 12	2.00
No. 13	2.00
No. 14	2.00
No. 16	2.00
No. 18	1.75
No. 20	1.75
No. 22	1.75
No. 24	1.50
No. 26	1.25
No. 27	1.25
No. 28	1.25
No. 29	1.25
No. 30	1.25

I prefer that the coating shall not exceed 2.75 ounces per square foot, although this may be exceeded in some instances. Heretofore the maximum weight of the coating has been determined in considerable measure by the amount of deformation to which it is intended the metal shall be subjected, the general rule being that the more heavily coated sheets cannot be as abruptly bent as those with lighter coatings. The material of my invention is characterized by a much greater adherence of the coating metal to the base and on this account it is possible to use heavier coatings in those cases where the metal must be sharply bent, thus increasing the life of the metal materially. In the case of tin plate the coating may be as light as 1 ounce per square foot.

If a pickled surface is particularly desired on one side of the material, for some special reason, I may subject it to the usual pickling process and, after drying, blasting one side only in the manner already described.

While I have illustrated and described preferred embodiments of my invention, it will be understood that the same is not limited thereto but may be otherwise embodied and practiced within the scope of the following claims.

I claim:

1. In the manufacture of coated sheet metal, the steps including pickling base metal in sheet form, centrifugally blasting one side only of the pickled base metal, and coating both sides of the base with a protective metal.

2. As a new manufacture, coated sheet metal comprising a ferrous base having one side pickled and the other side blasted, and a protective metal coating covering both sides.

3. In the manufacture of sheet metal, the process which consists in rolling a ferrous base metal, abrading the rolled surface with a centrifugal blast to provide a mat surface free from hydrogen inclusions and moisture, and then passing the sheet metal through a molten bath of coating metal.

4. The method defined by claim 3 wherein only one side of the base is subjected to abrasion prior to coating.

5. The method defined by claim 3 wherein opposite sides of the base are subjected to different degrees of abrasion prior to coating.

6. The method defined by claim 3 characterized by rolling said base metal into a strip having substantially the width of a sheet and the gauge of tin plate.

7. The method defined by claim 3 wherein the base metal is subjected to abrasion with the scale or oxide resulting from rolling, remaining thereon.

8. The method defined by claim 3 characterized by so regulating the thickness of the coating that the roughening of the base effected by abrasion shows through the coating.

9. The method defined by claim 3 wherein the base metal is pickled and then subjected to abrasion on one side only before coating.

RAYMOND J. WEAN.

CERTIFICATE OF CORRECTION.

Patent No. 2,036,615. April 7, 1936.

RAYMOND J. WEAN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 56, claim 2, after "side" insert centrifugally; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of May, A. D. 1936.

Leslie Frazer

(Seal) Acting Commissioner of Patents.

DISCLAIMER

2,036,615.—*Raymond J. Wean*, Warren, Ohio. COATED SHEET METAL AND PROCESS OF MAKING THE SAME. Patent dated April 7, 1936. Disclaimer filed October 6, 1938, by the assignee, *The Wean Engineering Company, Inc.*

Hereby enters this disclaimer to claims 1, 2, 3, 4, 7, and 9 with the exception that your petitioner does not disclaim the subject matter of claim 3 in combination with the subject matter of claims 5 and 6 which are dependent thereon and incorporate claim 3 by reference.

[*Official Gazette November 1, 1938.*]