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ELECTROLYTIC TIN PLATE

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This invention relates to electrolytic tin plate that is sufficiently thin gauged and has a sufficiently thin tin coating to permit its use in many cases where the relatively high cost of hot-dip tin plate prevents the use of the latter material. By way of example, the thickness of the electrolytic tin plate may range from 38 to 21 gauge, and the thickness of the tin coating may range from .00001 to .0001 of an inch.

Within the above thickness ranges, electrolytic tin plate can compete in cost with materials such as paper, pasteboard and the like in making articles of a nature not requiring the corrosion protection afforded by the thick tin coating on hot-dip tin plate, providing the processing of the electrolytic tin plate is sufficiently economical. Thus economy indicates the production of the steel base by the cold reduction strip method and the use of a continuous electrotinning line to effect the plating of the cold reduced strip.

Electrolytic tin plate produced in the above manner has two objectionable characteristics, one being that it is unattractive in appearance and the other being that the tin coating is very easily marked. The unattractiveness of the material results from the fact that the continuous cold reduction strip method results in a base metal having a very shiny surface which carries marks resulting from the manufacture of the strip, these marks standing out against the shiny background in a very conspicuous manner and the very thin tin coating dictated by economy being unable to hide these marks. Any other method of producing the base metal with a shiny surface will also lead to the unattractive appearance, it being understood that all known quantity production methods result in the appearance of manufacturing marks. The ease with which the tin coating is marked also can be blamed on the shiny finish of the base metal, the tin coating being unable to resist friction marking since it is in the form of a flat malleable layer that is easily displaced by rubbing contact with another object.

The present invention is characterized by producing electrolytic tin plate of the character under discussion, with the surface of the steel base roughened to a mat finish obscuring the marks resulting from the manufacture of the base and which are prominent on a shiny surface, the tin coating by itself being too thin to hide such marks or to be materially resistant to marking during the fabrication of the tin plate into articles and the handling of the latter, the mat finish appreciably increasing the resistance of the tin coating to such marking and in conjunction with the tin coating imparting a lustrous satin or frosted finish to the tin plate. The character of the mat finish may vary from an extremely fine-grained mat to one that is relatively coarse-grained, but in no instance should the grain be so coarse as to

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permit the production of flat light-reflecting surfaces of sufficient areas to be individually visible to the unaided normal eye. The maximum permissible fineness of the grain is limited by the fact that there must be sufficient roughness to cause enough scattering of reflected light to at least materially reduce the visibility of the marks resulting from the manufacture of the base, it being remembered that the tin coating is too thin to hide such marks by itself.

As a specific example of the production of the new material, steel of tin plate analysis is produced as cold reduced strip tin plate base with a thickness ranging from 38 to 21 gauge, the cold reduction strain being removed by annealing to produce a dead-soft material. The necessary temper is imparted to this dead-soft material by passing the strip through a temper mill having its rolls uniformly roughened by shot blasting to the degree of roughness or mat that must be imparted to the strip to adequately obscure or mask the manufacturing marks it carries on its shiny surface. The only cost involved by this procedure is that of shot blasting the temper mill rolls, it following that the cost added to the production of the material by this invention is sufficiently slight to make it economically practical.

The strip now carrying a uniform mat finish is sent to the continuous electrotinning line where it is tin coated to a thickness ranging from .00001 to not more than .0001 of an inch. The resulting material will have the described lustrous satin or frosted finish, all manufacturing marks on the base metal being obscured or masked to a degree rendering them invisible to the ordinary observer. The tin coating will not be subject to easy friction marking because it will follow the contour of the roughened strip surface so as to present innumerable little peaks of very small areas which reduce the areas that can be presented to rubbing contact with a marking object, and a'so because the satin or frosted background prevents what marks may appear from being rendered prominent.

A large majority of the tin plate produced is made into tin cans, and many of these are identified and decorated by printing applied directly to the tin surface. This is done by printing the tin plate prior to the making of the cans, the lithographing process usually being used in the manner familiar to those acquainted with this art. In the case of electrolytic tin plate that is not made in accordance with the present invention, it is necessary to first apply a printing background of enamel or the like to the tin coating for the purpose of hiding the previously mentioned unattractive appearance and forming a proper background on which to print. Remembering that the resulting tin can must compete in cost with packages made of paper, pasteboard

and the like, it is obviously desirable to avoid the cost of this printing background.

In the case of electrolytic tin plate made in accordance with the present invention, it is unnecessary and frequently undesirable to use the usual printing background, the lustrous satin or frosted finish of the material providing a highly efficient light reflector of great attractiveness and which therefore can be advantageously used by itself as a background for the printing. In addition to the economic saving effected by the elimination of the usual printing background of enamel or the like, this offsetting the slight extra cost involved by shot-blasting the temper mill rolls, the appearance effected by the present invention is considered more beautiful by a majority of the public. Since the satin or frosted metallic finish of the material is a more efficient light reflector than a background of enamel or other non-metallic material, the visibility of the printing in dim light is much better in the case of the present invention, this being a decided advantage in the case of tin cans on display.

As a result of the above, it is possible to produce a printed tin can characterized by the steel base having a mat finish obscuring marks resulting from the manufacture of the base, the tin coating being electroplated on the base and, in the interests of economy, too thin to by itself hide such marks or to resist marking during handling of the can, the mat finish appreciably increasing the resistance of the tin coating to such marking and in conjunction with the tin coating imparting a lustrous satin or frosted finish to the can that is a highly efficient light reflector, the printing being applied so this lustrous finish forms a visible printing background. It is to be understood that the printing may be done so that the design and lettering are formed by either the obscured or visible portions of the tin plate. Also, protecting lacquer or other finishes may be applied as a final coating to protect the printing.

Although it has been suggested that the mat finish be imparted to the steel base by means of shot-blasted temper mill rolls, these rolls can be shiny and the resulting shiny tempered steel etched by some suitably controlled chemical or electro-chemical process. However, the steel base itself cannot be shot- or sand-blasted, abraded or otherwise treated by similar methods, because it is of too thin a gauge to maintain its flatness in such instances. Since it is necessary to temper the annealed steel, the use of shot- or sand-blasted temper mill rolls is best because this permits the steel base to be simultaneously tempered and matted or roughened to the degree necessary to scatter reflected light sufficiently to obscure or mask manufacturing marks which would otherwise be prominent if its surface were produced with a shiny finish.

I claim:

1. Electrolytic tin plate having manufacturing marks on the surface of its steel base that are conspicuous against a shiny background and with its tin coating too thin to hide said marks, said tin plate being characterized by having the surface of its steel base roughened to a mat finish ranging in grain size from a maximum insufficient to cause the production of flat light-reflecting surfaces of sufficient areas to be visible to the unaided normal eye, to a minimum sufficient to cause enough scattering of reflected light to at least materially reduce the visibility of said marks, said mat finish in all cases obscuring said marks.

2. Electrolytic tin plate having manufacturing marks on the surface of its steel base that are conspicuous against a shiny background and with its tin coating too thin to hide said marks, said tin plate being characterized by having the surface of its steel base roughened to a mat finish ranging in grain size from a maximum insufficient to cause the production of flat light-reflecting surfaces of sufficient areas to be visible to the unaided normal eye, to a minimum sufficient to cause enough scattering of reflected light to at least materially reduce the visibility of said marks, said mat finish in all cases obscuring said marks and said tin plate ranging from 38 to 21 gage and the thickness of its tin coating ranging from .00001 to .0001 of an inch.

3. Electrolytic tin plate having manufacturing marks on the surface of its steel base that are conspicuous against a shiny background and with its tin coating too thin to hide said marks, said tin plate being characterized by having the surface of its steel base roughened to a mat finish ranging in grain size from a maximum insufficient to cause the production of flat light-reflecting surfaces of sufficient areas to be visible to the unaided normal eye, to a minimum sufficient to cause enough scattering of reflected light to at least materially reduce the visibility of said marks, said mat finish in all cases obscuring said marks and in conjunction with said tin coating forming an efficient light-reflecting surface, printing being applied to said tin plate without the use of a printing background of enamel or the like so that said tin plate itself forms a visible background for said printing.

4. An electrolytic tin plate making method comprising the steps of producing shiny-finished cold-reduced steel strip of from 38 to 21 gage with marks conspicuous on its shiny surface, annealing said strip, tempering said annealed strip in a temper rolling mill having rolls roughened to a mat finish imparting a similar mat finish to said strip, said mat finish having a grain size ranging from a maximum insufficient to cause the production of flat light-reflecting surfaces of sufficient areas to be visible to the unaided normal eye, to a minimum sufficient to cause enough scattering of reflected light to at least materially reduce the visibility of said marks, said mat finish in all cases obscuring said marks, and electroplating tin onto said tempered steel strip to a thickness ranging from .00001 to .0001 of an inch.

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