Aug. 23, 1966 F. W. BRODERICK 3,268,378

METHOD OF PREPARING MATED EMBOSSING ROLLS

Filed Dec. 16, 1964 2 Sheets-Sheet 1

Fig. 1

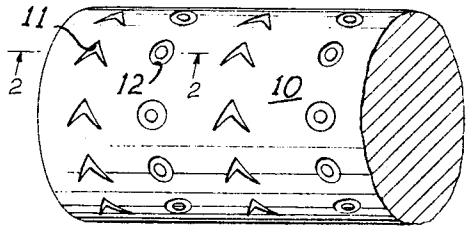


Fig. 2

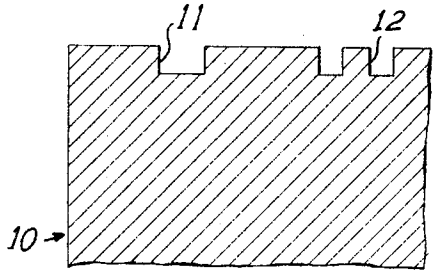


Fig. 3

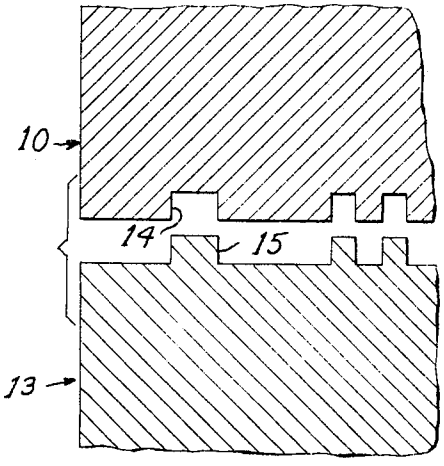


Fig. 4

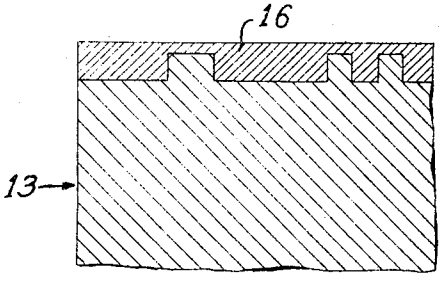


Fig. 5

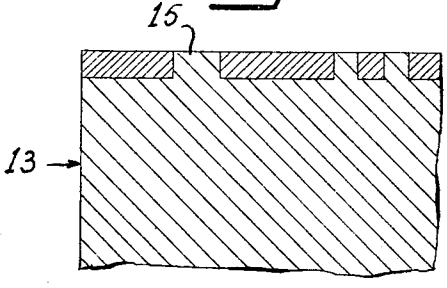
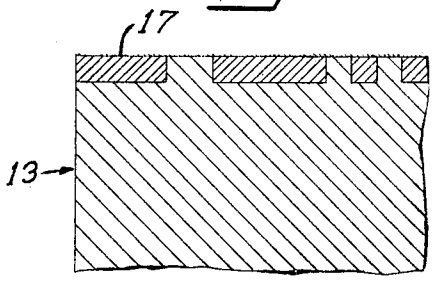


Fig. 6



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Fig. 7

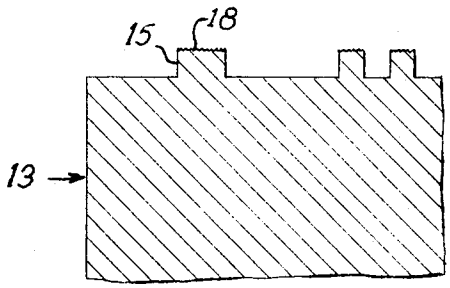


Fig. 8

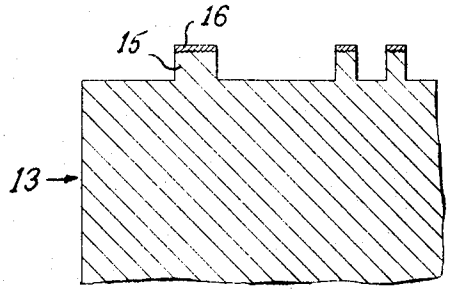


Fig. 9

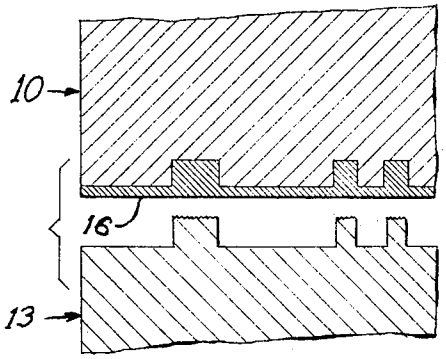


Fig. 10

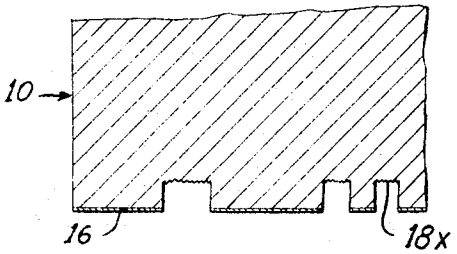


Fig. 12

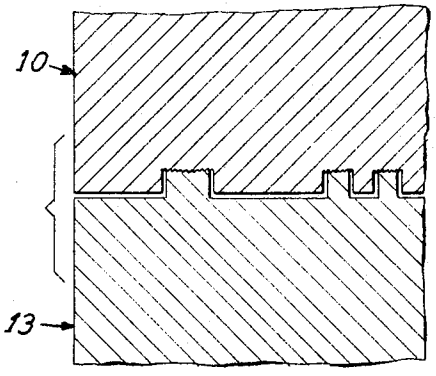


Fig. 11

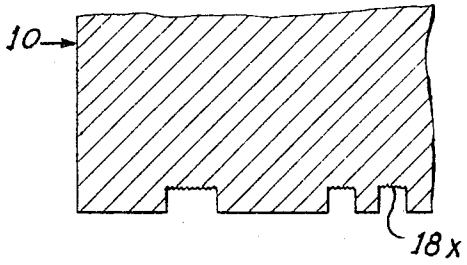
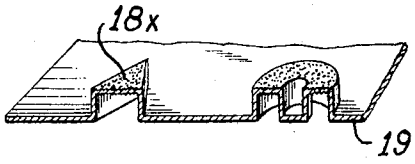


Fig. 13



United States Patent Office 3,268,378 Patented August 23, 1966

3,268,378

METHOD OF PREPARING MATED EMBOSSING ROLLS

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4 Claims. (Cl. 156—14)

This invention relates to a method of preparing mated embossing rolls and more particularly to a method and apparatus of cold finishing with cold embossing of a strip of dull finish aluminum sheet to produce depressed glossy cold finished surfaces adjacent to elevated non-glossy wearing or pitted surfaces.

This invention is a continuation-in-part of patent application Ser. No. 145,956, filed October 18, 1961, now abandoned.

In the preparation of treads now commonly used in automobiles, the embossed glossy surfaces elevated above the original horizontal plane are easily scratched and otherwise disfigured by conventional shoe traffic going in and out of the automobile, thereby presenting treads having unsightly scratched embossed designs thereon.

Moreover, the present practice of purchasing highly polished aluminum sheet for preparing treads for automobiles is unsatisfactory in that such polished aluminum sheet is relatively expensive and is easily marred in transportation and normal handling so as to produce scratches thereon rendering the sheet a piece of scrap.

It is an object of this invention to prepare a mated pair of embossing rolls adapted to produce an embossed metal sheet or foil having a design the top wearing surfaces of which are provided with a roughened design pattern or texture.

It is also an object of this invention to provide a method of producing metal sheet or foil having embossed designs having raised non-glossy surfaces, such as for example pebble grain, satin finish, and the like type of surfaces.

It is another object to provide a method of converting commercial aluminum sheet having a conventional non-glossy mill finish to a sheet of glossy finish by contacting the dull surface of the sheet with a suitably highly polished female roll.

In the preparation of aluminum treads for automobile use, the dull aluminum sheet surface is converted into a glossy surface simultaneously as the sheet is being embossed into the design cavities of the female embossing roll, the bottom surfaces of said cavities being provided with the desired pebble grain or satin finish.

The method of this invention is illustrated in the accompanying drawing in which;

FIG. 1 is a perspective view of a portion of a photo-engraved female roll having a repeated arrow and repeated annulus design,

FIG. 2 is an enlarged section view taken on line 2—2 of FIG. 1,

FIG. 3 is a section view similar to FIG. 2, showing the conventional preparation of a male roll having protuberances of a height equal to the depth of the female cavities,

FIG. 4 is a section view of the male roll of FIG. 3 coated with a resist soluble only in methyl ethyl ketone,

FIG. 5 is a section view of FIG. 4 after a doctor blade has removed the excess resist so as to have the blade contact the top surfaces of the male protuberances,

FIG. 6 is a view similar to FIG. 5 showing the spray droplets of an asphaltum resist soluble in turpentine,

FIG. 7 is a view similar to FIG. 6 with all the resist removed and showing the etched pebble grain top surfaces on the male protuberances,

FIG. 8 is a view similar to FIG. 7 showing the application of an acid resist to only the top surfaces of the male protuberances,

FIG. 9 is a section view of the female roll coated with resist and the prepared male roll about to be mated so as to force out excess resist with metal contact or engagement between the top of the male protuberances and the bottom of the female cavities,

FIG. 10 is a section view of the female roll coated with resist and ready for acid etching,

FIG. 11 is a section view of a fully prepared female roll having the bottom walls of its cavities acid etched and receiving the design of the pebble grain finish of the top surfaces of the male protuberances,

FIG. 12 is a section view of a portion of a mated pair of a fully prepared female roll and a fully prepared male roll, shown in exaggeration the .001 to .002 clearance between the smooth surfaces of the female and male rolls and showing also the simultaneous contact of the rough or pebble grain surfaces of the female and male rolls, and

FIG. 13 is a section view of a metal sheet passed through the rolls of FIG. 12.

In this invention the bottom of the female cavities of the female embossing roll are provided with roughened or pitted, i.e. satin finish or pebble grain surfaces, which surfaces appearing on the embossed aluminum sheet do not show foot traffic or other scratches.

Turning now to the drawing, a female steel roll **10** is provided with an engraved design either by the conventional mill and die method or by the conventional photoengraving process. The design may be of a very intricate nature but for purposes of clarity of illustration a repeated arrow head **11** and a repeated annulus of ring **12** is used herein, which appear as cavities in the female roll **10** (FIG. 2).

The design of this female roll is then transferred to a male mating roll **13** in the conventional manner using an acid resist coating and a suitable metal etching acid.

By way of an example the depth of the female cavities **14** may be .008 inch and the height of the male protuberances **15** is also .008 inch. The male protuberances are then topped with an acid resist such as asphaltum and the root of the protuberances are etched away in such a manner that the height of the protuberance is increased to .010 or more thousands depending on the pattern which is to be used on the top of the protuberance. This topping and acid etching procedure is to prevent marring of the polished surface of the female roll in later transfer mating operations.

According to the concept of this invention the male roll **13** is removed from the transfer machine and is coated with a methyl ethyl ketone soluble acid resist coating **16**. This resist **16** is not soluble in turpentine.

This coating is then scraped with a metal doctor blade to remove as much excess resist as possible and the top of the protuberances are further cleaned by means of an emery block to produce an absolutely smooth surface (FIG. 5) receptive to various spray or other methods used to produce an eventual rough surface on the top surfaces of the protuberances.

The smooth, clean, metallic surfaces of the protuberances (FIG. 5) are then sprayed with a turpentine soluble asphaltum acid resist **17** to yield a desired pattern and this sprayed surface of male roll **13** (FIG. 6) is rotated in a bath of suitable etching acid to produce the desired etch pattern or suitable depth. The asphaltum resist may be washed off with turpentine leaving behind the methyl ethyl ketone acid resist **16**. Then the turpentine washed male roll **13** may be given a second asphaltum spray and the protuberances again etched in acid to give a novel final etched pattern.

The protuberances **15** of the male roll **13** (FIG. 5) may be given mechanically applied rough top surfaces, if desired, in lieu of the etched asphaltum prepared surface. Also the spray etched surface may be given a mechanical roughness thereto.

Clearly, there are many ways of applying various rough surfaces to the top of the protuberances **15**, including brushing on resist in lieu of spraying and machine engraving to give ultimate pleasing rough wearing surfaces of a satin finish, swirl finish, emery finish, pebble grain, and other visual effects.

The use of the asphaltum turpentine soluble resist **17** in conjunction with the methyl ethyl ketone soluble resist **16** permits a washing off or removal of the asphaltum resist and repeated application by re-spraying to give a plurality of varying depths of satin or emery finishes without removal of the background methyl ethyl ketone soluble resist **16**.

Where mechanical finishes are applied to the tops of the protuberances **15**, the roll is placed in a lathe, grinding machine or engraving machine and the tops of the protuberances are ground, turned or engraved to the desired finish.

After the protuberances have received the final desired pattern **18** the roll **13** is washed free of all resist (FIG. 7).

Next, the top coating of acid resist **16** of the male roll (FIG. 8) is removed and the roll of increased protuberance height is mated to the female roll covered with acid resist, for example, acid resist **16** in the transfer machine.

The male roll is brought up so that the top surfaces **18** of the protuberances **15** contact the bottom walls of the female cavities squeezing out excess acid resist **16** to expose metal having the complementary pattern of the surface **18**. The female roll **10** is then rotated in a conventional etching acid bath and the pattern **18X** is etched into the bottom walls of the female cavities (FIG. 10). The previous provision of the extra .001 height of the protuberances prevents contact between the shiny, high polish smooth surfaces of the female roll of the original female roll and the male roll **13**.

Removal of the resist from the etched roll **10** (FIG. 10) produces the final product female roll (FIG. 11).

When the two final product male and female rolls are brought together (FIG. 12) there is a metal to metal mating of the etched top surfaces **18** of the protuberances **15** and the bottom surfaces **18X** of the corresponding female cavities but no metal engagement of the highly polished female surfaces of female roll **10** with the male roll **13**.

The embossed foil **19** made of aluminum or other metal or of foil on paper laminate is shown in FIG. 13 showing the wearing surfaces **18X** thereon as transferred from the bottom walls of the cavities of the female roll.

This invention is of a generic nature and is not to be limited by the metal used in the embossing rolls, nor to the type of rough wearing pattern transferred by the female roll to the ultimate embossed sheet and it includes

all variations obvious to those skilled in the art upon reading this disclosure. Thus, for example, the final production female roll may be buffed to restore or to enhance its polished surface to whatever degree is desired without materially harming the pattern in anyway whatsoever.

I claim:

1. The process of preparing mated steel embossing rolls to produce embossed aluminum sheet or foil with protuberances having top rough wearing patterned surfaces comprising preparing a matched set of male and female metal embossing rolls by conventional masking and etching procedure; coating the top male protuberances with acid resist; acid etching said coated protuberances to increase the height of said protuberances; removing said acid resist from said protuberances; roughening the top surfaces of said protuberances of said male roll with a desired pattern and transferring said rough pattern surfaces from said top of said male protuberances to the bottoms of the corresponding female cavities of said female roll by acid resist masking and acid etching whereby the pattern of the top protuberant surfaces of the male roll is transferred to the bottom of the corresponding female cavities.

2. The process of claim 1 wherein the rough pattern of the top surfaces of the protuberances is obtained by mechanical roughening.

3. The process of claim 1 wherein the top surfaces of the protuberances is obtained by coating said protuberances of increased height with methyl ethyl ketone soluble resist; removing excess ketone resist to present the smooth bare metal top surfaces of said protuberances; spattering said bare metal with turpentine soluble asphalt resist; acid etching said spattered surfaces and removing said asphaltic resist with turpentine to present a rough pattern.

4. The process of claim 3 wherein said rough pattern on said top surfaces of said protuberances is spattered again with asphalt resist; acid etching said respattered protuberances and removing said asphalt resist with turpentine to give a pattern rough surface.

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