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HONG et al.(10) **Pub. No.: US 2012/0297851 A1**(43) **Pub. Date: Nov. 29, 2012**(54) **METHOD AND APPARATUS FOR
MANUFACTURING PANELS FOR VEHICLES**(30) **Foreign Application Priority Data**

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B21D 43/28 (2006.01)(52) **U.S. Cl.** 72/324(73) Assignees: **HYUNDAI MOTOR COMPANY**,
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Seoul (KR); **HYUNDAI HYSO**,
Ulsan (KR); **KIA MOTORS
CORPORATION**, Seoul (KR)(57) **ABSTRACT**

Disclosed herein is a method and apparatus for manufacturing a panel for a vehicle. When a steel sheet is machined to form a panel for a vehicle, a blanking-texturing machine conducts a blanking process for cutting the steel sheet and a texturing process for forming depressions in the steel sheet at the same time. Therefore, the present invention reduces the number of manufacturing processes, thus enhancing the productivity, and reducing the production cost and provides a steel sheet with uniform depressions across the surface of the steel sheet, thereby reducing the coefficient of friction during the pressing process consistently.

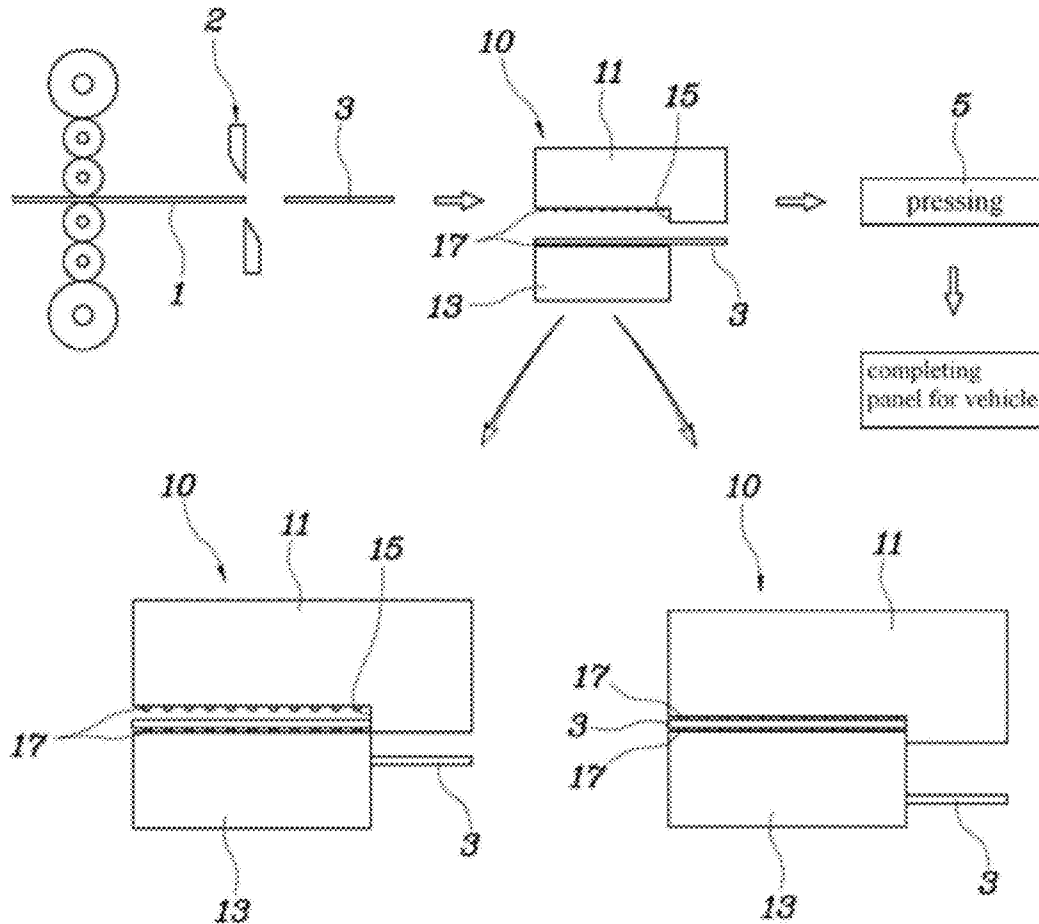
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Fig. 1

Prior Art

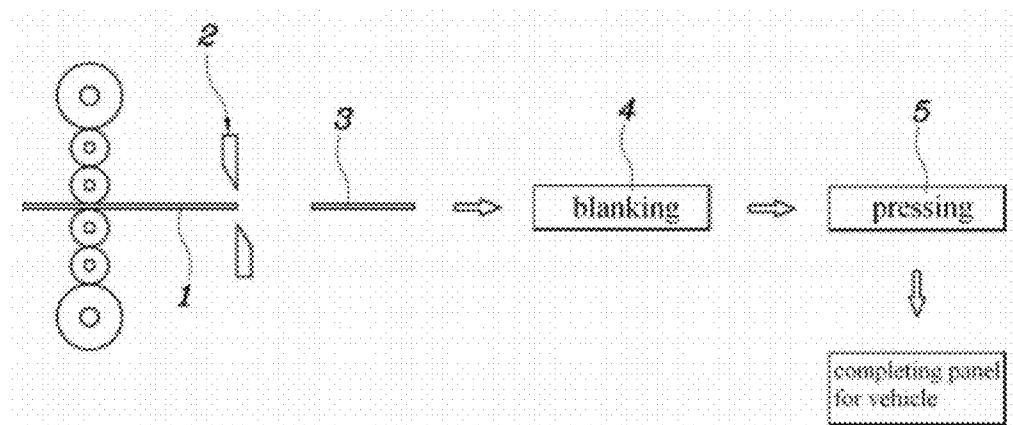


Fig. 2

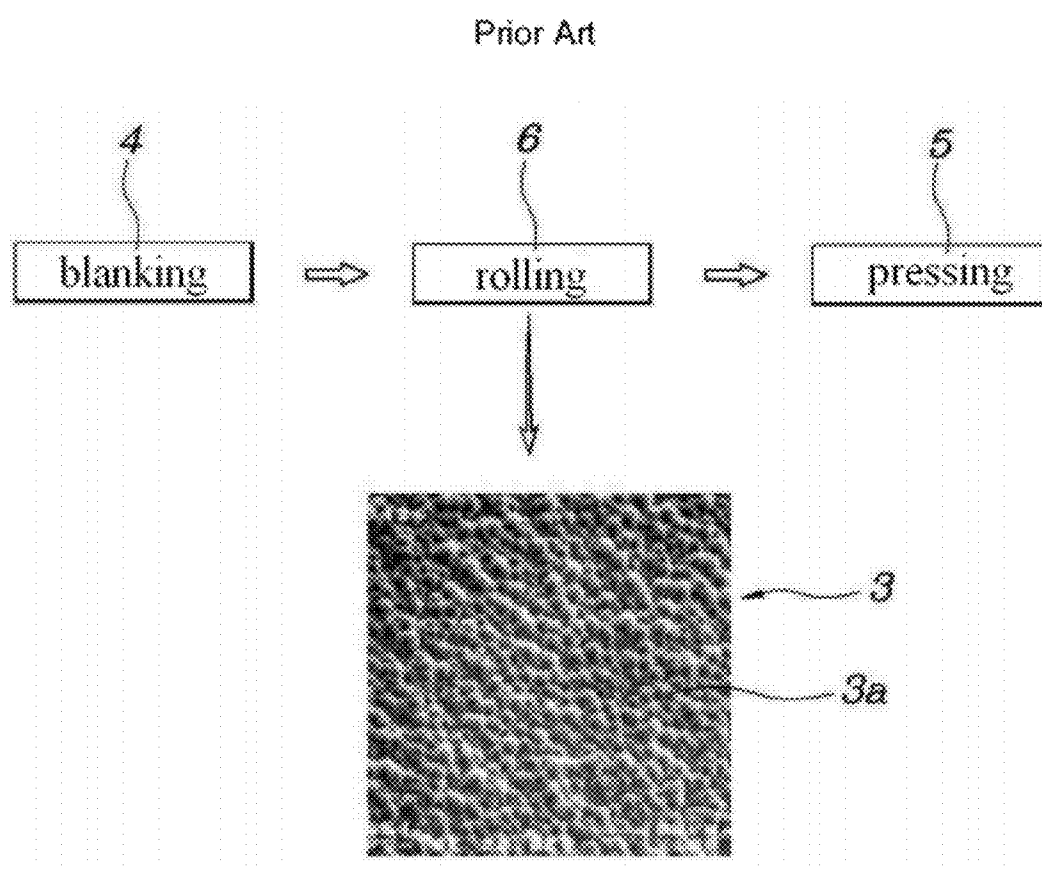


Fig. 3

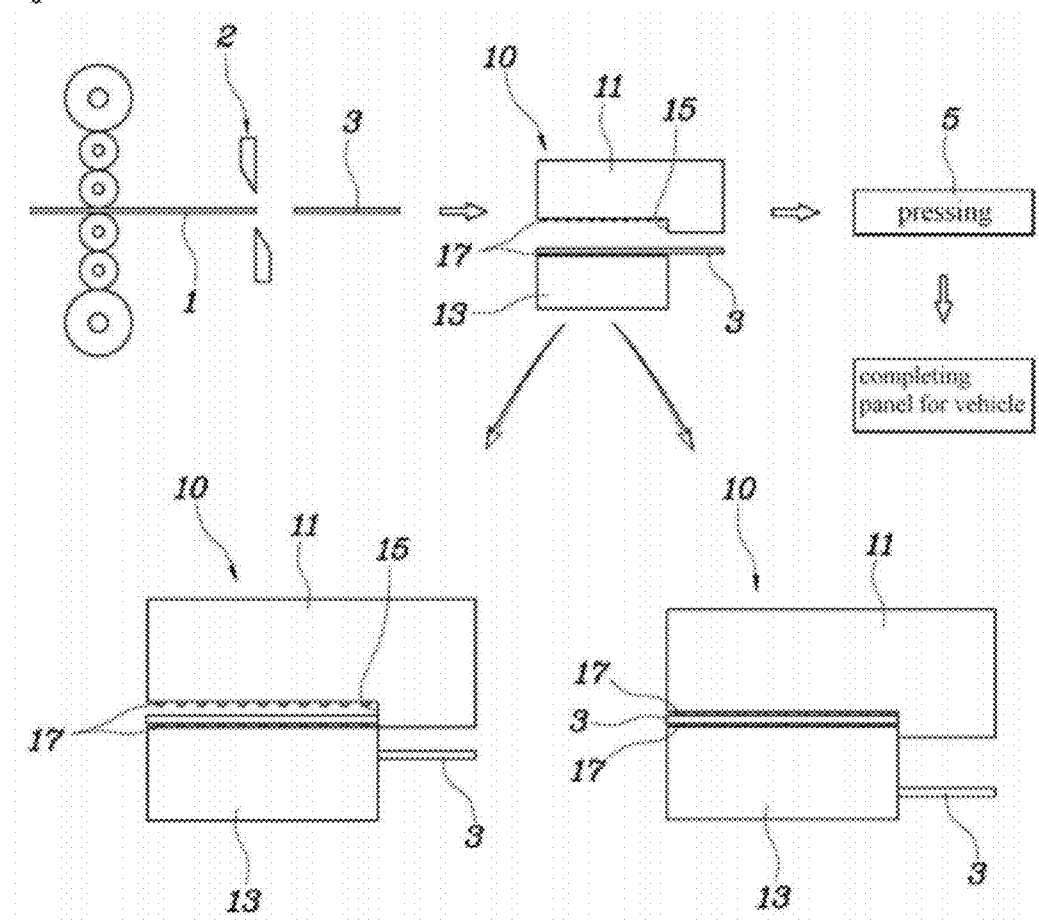
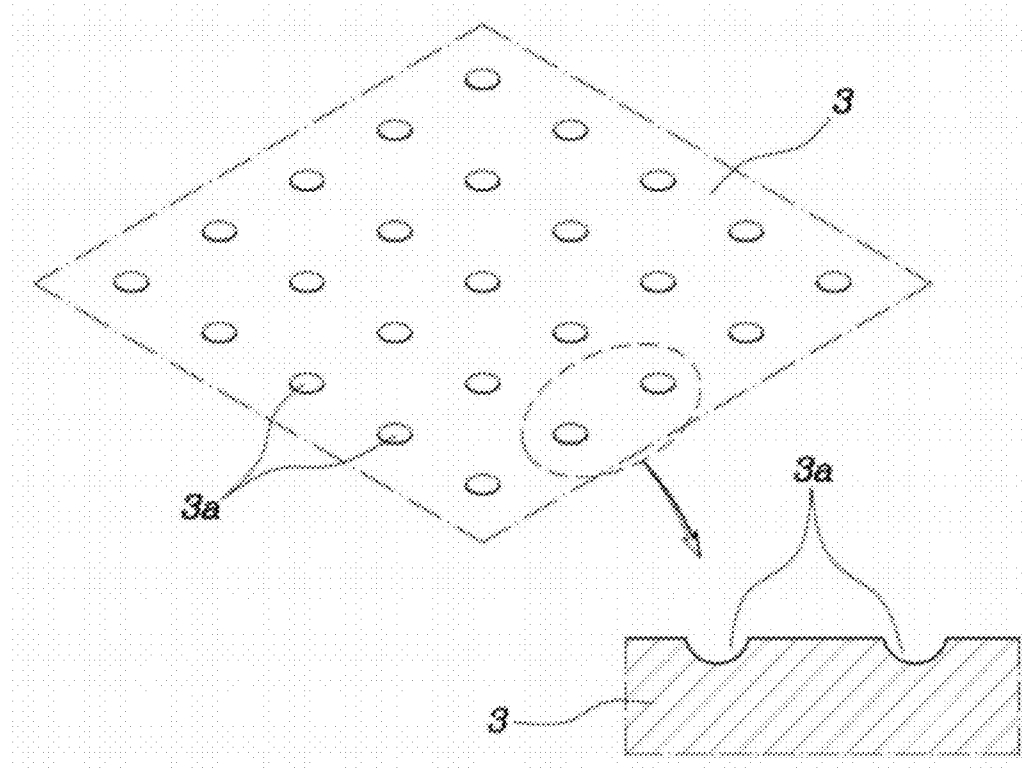


Fig. 4



METHOD AND APPARATUS FOR MANUFACTURING PANELS FOR VEHICLES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims under 35 U.S.C. §119(a) priority to Korean Application No. 10-2011-0050085, filed on May 26, 2011, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates generally to methods and apparatuses for manufacturing panels for vehicles and, more particularly, to a method and apparatus for manufacturing a panel for vehicles in which when a steel sheet is machined by blanking to form the panel for vehicles, surface of the steel sheet can be textured along with the blanking.

[0004] 2. Description of the Related Art

[0005] Generally, as shown in FIG. 1, manufacturing panels for vehicles includes cutting a steel sheet 1 in a shearing process 2 into a predetermined size, machining the cut steel sheet 3 by performing a blanking process 4 into a shape corresponding to a vehicle panel to be produced, and machining the steel sheet 3 with a pressing process 5. However, because the surface of the steel sheet 3 machined by the blanking process 4 is excessively smooth, friction between the steel sheet 3 and a press punch is increased when the pressing process is conducted because the lubricant used to reduce the coefficient of friction is not easily retained on the excessively smooth surface. Accordingly, the increase in friction reduces the formability of the steel sheet 3.

[0006] Although lubricant is supplied to the steel sheet 3 during the pressing process to reduce the coefficient of friction between the steel sheet 3 and the press punch, the supplied lubricant cannot be sufficiently retained by and stored in the steel sheet 3, because the surface of the steel sheet 3 is excessively smooth. Thus, the lubricant cannot effectively prevent the coefficient of friction between the steel sheet 3 and the press punch from increasing. As a result, there is the disadvantage of a reduction in the formability of the steel sheet.

[0007] In an effort to overcome the above disadvantage, as shown in FIG. 2, a technique has been proposed in which before the pressing process 5 is executed, a rolling process 6 is conducted to form embossments 3a on the surface of the steel sheet 3.

[0008] In detail, rollers used in the rolling process are plated with chrome. Embossments 3a are formed on the surface of the steel sheet 3 by passing the steel sheet 3 between the rollers. When this technique is used, the lubricant supplied to the steel sheet 3 during the pressing process is easily retained and stored in spaces between the embossments 3a, thus reducing the coefficient of friction between the steel sheet 3 and the press punch, thereby enhancing the formability of the steel sheet 3.

[0009] However, in the above-mentioned conventional solution, the shapes of the embossments 3a are often rendered different depending on the rpm of the rollers and the abrasion loss of the chrome that the surface of the steel sheet 3 was plated with. Hence, the embossments 3a formed on the surface of the steel sheet 3 are not uniform. In particular, during the pressing process, the coefficient of friction between the

steel sheet 3 and the press punch cannot be consistently maintained. Thus, the formability of the steel sheet is still not satisfactory. Moreover, the production cost is increased by conducting the rolling process 6 before the pressing process 5 and by plating the rollers with chrome.

SUMMARY OF THE INVENTION

[0010] Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a method and apparatus for manufacturing a panel for vehicles in which when a steel sheet that has been cut through a shearing process is machined by blanking to form the panel for a vehicle, a plurality of depressions are formed in the surface of the steel sheet so that lubricant supplied to the steel sheet during a pressing process is reliably retained by and stored in the depressions, thus reducing the coefficient of friction between the steel sheet and a press punch during the pressing process, and maintaining the coefficient of friction constant, thereby enhancing the formability of the steel sheet, and reducing the production cost.

[0011] In order to accomplish the above object, in an aspect, the present invention provides a method for manufacturing a panel for a vehicle, including: blanking-texturing a steel sheet in such a way that when the steel sheet is cut by blanking into a shape corresponding to the panel for the vehicle, a plurality of depressions are formed in a surface of the steel sheet and then the steel sheet having the depressions is pressed to form the panel for the vehicle.

[0012] The depressions may be formed in either of both sides of the steel sheet, and may be formed in both sides of the steel sheet. Each of the depressions may have a size ranging from about 50 μm to 200 μm . A density of the depressions with respect to a surface area of one side of the steel sheet may range from about 1% to 20%.

[0013] In another aspect, the present invention provides an apparatus for manufacturing a panel for a vehicle, including: a blanking-texturing machine comprising: a cutting surface for cutting a steel sheet into a shape corresponding to the panel for the vehicle; and a depression forming portion for forming depressions in a surface of the steel sheet when the steel sheet is cut; and a press machining the steel sheet having the depressions to form the panel for the vehicle.

[0014] The blanking-texturing machine may include an upper (top/first) mold and a lower (bottom/second) mold. The cutting surface may be provided on the upper mold. The depression forming portion may be provided on either the upper mold or the lower mold. Alternatively, the depression forming portion may be provided on each of the upper and lower molds.

[0015] The depression forming portion may have protrusions for forming the depressions, and each of the protrusions may have a particle size ranging from about 50 μm to 200 μm . A density of the protrusions of the depression forming portion with respect to a surface area of one side of the steel sheet may range from about 1% to 20%.

[0016] In the present invention, when machining a steel sheet to form a panel for vehicles, a blanking-texturing machine conducts a blanking process for cutting the steel sheet and a texturing process for forming depressions in the steel sheet at the same time. Therefore, the present invention

reduces the number of manufacturing processes, thus enhancing the productivity. Moreover, the production cost can be markedly reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The above and other objects, features and advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

[0018] FIGS. 1 and 2 are views illustrating a conventional method for manufacturing a panel for vehicles;

[0019] FIG. 3 is a view illustrating method and apparatus for manufacturing a panel for vehicles, according to an exemplary embodiment of the present invention; and

[0020] FIG. 4 is a view showing depressions formed in a steel sheet by blanking-texturing, according to the exemplary embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] Hereinafter, a preferred embodiment of the present invention will be described in detail with reference to the attached drawings.

[0022] It is understood that the term “vehicle” or “vehicular” or other similar term as used herein is inclusive of motor vehicles in general such as passenger automobiles including sports utility vehicles (SUV), buses, trucks, various commercial vehicles, watercraft including a variety of boats and ships, aircraft, and the like, and includes hybrid vehicles, electric vehicles, plug-in hybrid electric vehicles, hydrogen-powered vehicles and other alternative fuel vehicles (e.g., fuels derived from resources other than petroleum). As referred to herein, a hybrid vehicle is a vehicle that has two or more sources of power, for example both gasoline-powered and electric-powered vehicles.

[0023] Panels for vehicles are manufactured by the following processes. As shown in FIGS. 3 and 4, a steel sheet 1 produced from a steel mill is cut to have a predetermined size through a shearing process 2. Thereafter, the cut steel sheet 3 is machined by a blanking-texturing machine 10 according to the present invention so that the steel sheet 3 is formed in a shape corresponding to a vehicle panel to be manufactured and, simultaneously, a plurality of depressions 3a are formed in the steel sheet 3 during this blanking process in the blanking-texturing machine. Subsequently, the steel sheet 3 having these depressions 3a is machined during a pressing process 5, thus completing the vehicle panel.

[0024] The blanking-texturing machine 10 includes an upper (top/first) mold 11 and a lower (bottom/second) mold 13. The upper mold 11 has a cutting surface 15 which is provided to cut the steel sheet 3. Depression forming portions 17 are respectively formed on a lower surface of the upper mold 11 and an upper surface of the lower mold 13. The cutting surface 15 may be formed on the lower mold 13 rather than on the upper mold 11. However, this may make the operation of cutting the steel sheet 3 difficult. Therefore, to facilitate the operation of cutting the steel sheet 3, it is preferable that the cutting surface 15 be formed on the upper mold 11.

[0025] Furthermore, the depression forming portion 17 for forming the depressions 3a may be formed on either the upper mold 11 or the lower mold 13. Alternatively, the depression forming portions 17 may be formed on both the upper mold

11 and the lower mold 13. In the case when the depression forming portion 17 is formed on either the upper mold 11 or the lower mold 13, the depressions 3a are formed in only one of the two sides of the steel sheet 3. In the case where the depression forming portions 17 are formed on both the upper mold 11 and the lower mold 13, the depressions 3a are formed in both sides of the steel sheet 3.

[0026] It is preferable that the depressions 3a be formed in both the upper mold 11 and the lower mold 13, because the coefficient of friction between the steel sheet 3 and a press punch can be reduced as much as possible during the pressing process 5 due to their ability to retain a lubricant.

[0027] Each depression forming portion 17 has protrusions (not shown) which form the depressions 3a on the steel sheet 3. Preferably, the particle size of each protrusion of the depression forming portion 17 for forming the depressions 3a ranges from about 50 μm to 200 μm .

[0028] If the particle size of each protrusion of the depression forming portion 17 is about 50 μm or less, the size of each depression 3a formed in the steel sheet 3 is also about 50 μm or less, thus making it difficult to retain and store lubricant supplied in the depression 3a during the pressing process 5. Thus, the coefficient of friction between the steel sheet 3 and a press punch increases during the pressing process. As a result, the formability of the steel sheet 3 deteriorates. On the other hand, if the particle size of each protrusion of the depression forming portion 17 is about 200 μm or more, the size of each depression 3a formed in the steel sheet 3 is also about 200 μm or more. In this case, there is an advantage in that lubricant supplied during the pressing process 5 can be easily held and stored in the depressions 3a, but the strength of the steel sheet 3 may be reduced. Therefore, to satisfy the ability to keep and store lubricant in the depressions 3a and maintain the strength of the steel sheet 3, it is preferable that the particle size of each protrusion of the depression forming portion 17 range from about 50 μm to 200 μm so that the size of each of the depressions 3a formed by the depression forming portions 17 also ranges from about 50 μm to 200 μm .

[0029] Furthermore, the density of the protrusions of the depression forming portion 17 for forming the depressions 3a is preferably about 1% to 20% of the surface area of one side of the steel sheet 3. If the density of the protrusions of the depression forming portion 17 with respect to the surface area of one side of the steel sheet 3 is about 1% or less, the number of depressions 3a which are formed in the steel sheet 3 is not sufficient. In this case, the amount of lubricant supplied during the pressing process 5 that is held and stored in the depressions 3a is comparatively small, thus increasing the coefficient of friction between the steel sheet 3 and the press punch during the pressing process 5. As a result, the formability of the steel sheet 3 deteriorates.

[0030] On the other hand, if the density of the protrusions of the depression forming portion 17 with respect to the surface area of one side of the steel sheet 3 is about 20% or more, the depressions 3a are formed in the steel sheet 3 such that the density thereof with respect to the surface area of one side of the steel sheet 3 is also about 20% or more. In this case, although there is the advantage of an increased amount of lubricant being held and stored in the depressions 3a, the strength of the steel sheet 3 may be reduced as the number of depressions 3a increases.

[0031] Therefore, to satisfy the ability to keep and store lubricant in the depressions 3a and maintain the strength of the steel sheet 3, it is preferable that the density of the pro-

trusions of the depression forming portion 17 with respect to the surface area of one side of the steel sheet 3 ranges from about 1% to 20%. Furthermore, preferably, the density of the depressions 3a formed by the depression forming portion 17 also ranges from about 1% to 20% of the surface area of one side of the steel sheet 3.

[0032] Meanwhile, when the steel sheet 3 that is cut in the shearing process 2 is supplied to the blanking-texturing machine 10, the steel sheet 3 is first placed onto the depression forming portion 17 of the lower mold 13, and the upper mold 11 is thereafter moved downwards onto the lower mold 13. Then, the steel sheet 3 is cut by the cutting surface 15 of the upper mold 11 into a shape corresponding to the vehicle panel (at a blanking step of FIG. 3). Subsequently, when the upper mold 11 is further moved downwards, as shown in FIG. 3, the depressions 3a are formed in the surface of the steel sheet 3 by the depression forming portions 17 of the upper and lower molds 11 and 13 (at a texturing step of FIG. 3).

[0033] As shown in FIG. 4, in an exemplary illustrative embodiment, although the depressions 3a formed in the steel sheet 3 have been illustrated as being circular, the present invention is not limited to this embodiment. In other words, as necessary, the depressions 3a may have various shapes, for example, rectangular shapes, rhombic shapes, triangular shapes, etc.

[0034] After the blanking-texturing process, the steel sheet 3 having the depressions 3a is machined by the pressing process 5 to form a vehicle panel having the desired shape. When the pressing process 5 is conducted, lubricant is supplied to the steel sheet 3. The lubricant supplied to the steel sheet 3 is held and stored in the depressions 3a of the steel sheet 3. When the steel sheet 3 is machined by the press punch, the lubricant functions to reduce the coefficient of friction between the steel sheet 3 and the press punch.

[0035] As described above, in the present invention, when the pressing process is conducted, the coefficient of friction between the steel sheet 3 and the press punch can be reduced by the lubricant that has been stored in the depressions 3a of the steel sheet 3. Furthermore, because the coefficient of friction between the steel sheet 3 and the press punch can be consistently maintained during the pressing process, the formability of the steel sheet 3 is enhanced.

[0036] In addition, in the conventional technique, the blanking process for cutting the steel sheet and the rolling process for forming the depressions in the steel sheet must be separately performed. However, in the present invention, the single blanking-texturing machine 10 conducts the blanking process for cutting the steel sheet 3 and the texturing process for forming the depressions 3a in the steel sheet 3 at the same time. Therefore, the present invention reduces the number of manufacturing processes, thus enhancing the productivity. Moreover, the production cost can be markedly reduced. Furthermore, since the depressions are all the same size, the lubricant retention is uniform across the entire surface.

[0037] Although the preferred embodiment of the present invention has been disclosed for to illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

What is claimed is:

1. A method for manufacturing a panel for a vehicle, comprising:

blanking-texturing a steel sheet in such a way that when the steel sheet is cut by blanking into a shape corresponding to the panel for the vehicle, a plurality of depressions are simultaneously formed in a surface of the steel sheet; and

pressing the resulting steel sheet having the depressions to form the panel for the vehicle.

2. The method as set forth in claim 1, wherein the depressions are formed in either of both sides of the steel sheet.

3. The method as set forth in claim 1, wherein the depressions are formed in both sides of the steel sheet.

4. The method as set forth in claim 1, wherein each of the depressions has a size ranging from about 50 μm to 200 μm .

5. The method as set forth in claim 1, wherein a density of the depressions with respect to a surface area of one side of the steel sheet ranges from about 1% to 20%.

6. An apparatus for manufacturing a panel for a vehicle, comprising:

a blanking-texturing machine configured to cut a steel sheet into a shape corresponding to the panel for the vehicle on a cutting surface, and simultaneously form, by a depression forming portion of the blanking-texturing machine, depressions in a surface of the steel sheet while the steel sheet is being cut; and

a press machining the resulting steel sheet having the depressions to form the panel for the vehicle.

7. The apparatus as set forth in claim 6, wherein the blanking-texturing machine comprises an upper mold and a lower mold,

wherein the cutting surface is provided on the upper mold, and the depression forming portion is provided on either the upper mold or the lower mold.

8. The apparatus as set forth in claim 6, wherein the blanking-texturing machine comprises an upper mold and a lower mold,

wherein the cutting surface is provided on the upper mold, and the depression forming portion is provided on each of the upper and lower molds.

9. The apparatus as set forth in claim 6, wherein the depression forming portion has protrusions for forming the depressions, each of the protrusions having a particle size ranging from about 50 μm to 200 μm .

10. The apparatus as set forth in claim 6, wherein the depression forming portion has protrusions for forming the depressions, wherein a density of the protrusions of the depression forming portion with respect to a surface area of one side of the steel sheet ranges from about 1% to 20%.

11. A steel sheet for manufacturing a panel vehicle comprising: a steel sheet cut to correspond to a particular panel for the vehicle; and

a plurality of depressions formed on one surface of the steel sheet, wherein each of the depressions is formed to be the same size which ranges from about 50 μm to 200 μm and the plurality of depressions have a density of the depressions with respect to a surface area of one side of the steel sheet ranges from about 1% to 20%, the depressions configured to retain lubricant to reduce the coefficient of friction between the steel sheet and a press.

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