US 20100126244A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2010/0126244 A1

(43) Pub. Date: May 27, 2010

Chien

(54) METHOD FOR FORMING HIGH TENSILE STRENGTH METAL SHEET

(76) Inventor: **Yong-Wah Chien**, Tao-Yuan Hsien (TW)

Correspondence Address:
SHOU - HSIN YIN
P.O. BOX 90-3 Taipei
TAIPEI City 10699 (TW)

(21) Appl. No.: **12/324,837**

(22) Filed: **Nov. 27, 2008**

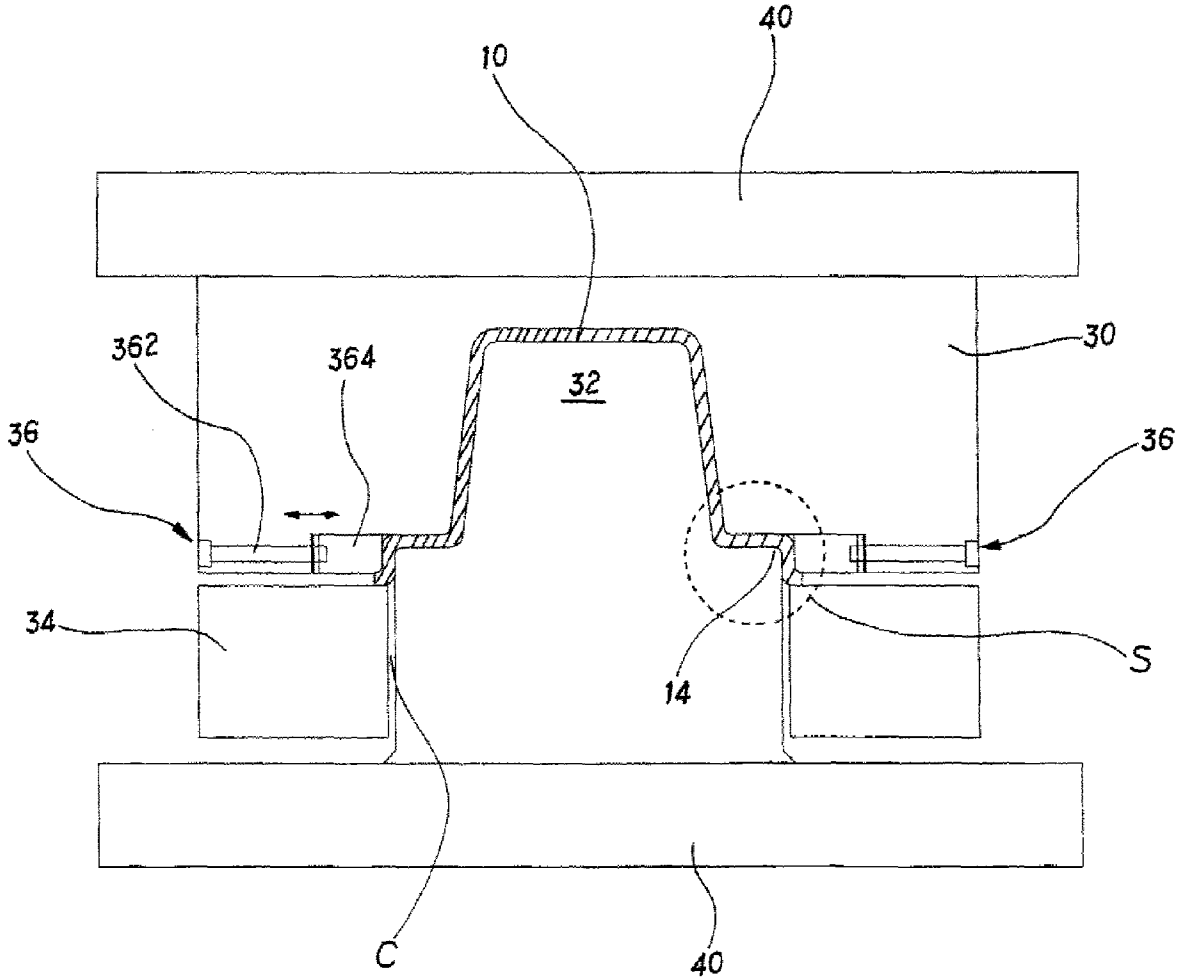
Publication Classification

(51) **Int. Cl.**
B21D 39/00 (2006.01)
B21D 22/00 (2006.01)

(52) **U.S. Cl.** **72/350**; 72/57

(57) **ABSTRACT**

A method for forming a high tensile strength metal sheet (HTSMS), which is performed in a power press machine composed of a die, a punch and a blank holder, is disclosed. The HTSMS is placed between the die and punch with blank holder. A step portion appears at both an outer side of the punch and a pressing portion of the blank holder. The step portion is corresponding to a predetermined bent portion of the HTSMS. A step will be formed at an edge of the HTSMS by progressively pressing of the step portion to avoid recoil of the HTSMS after forming process.



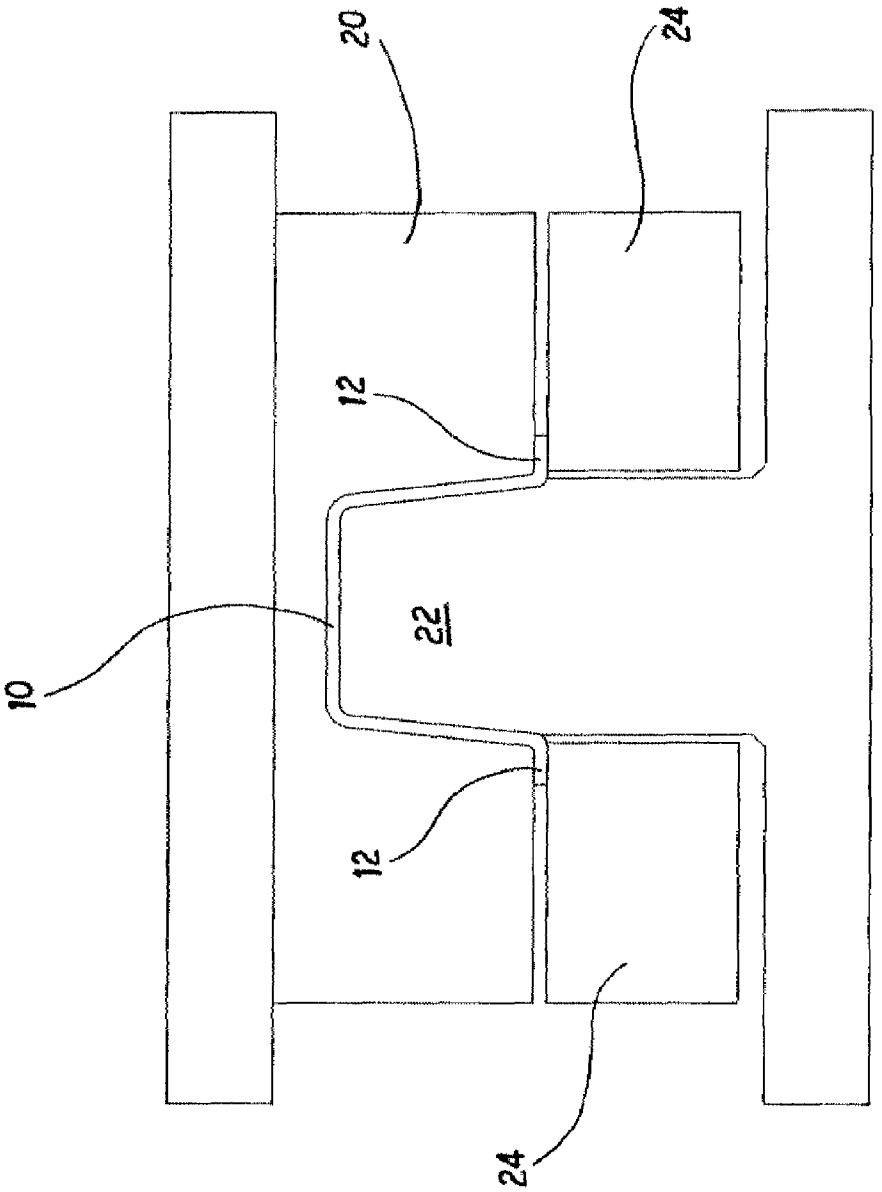


FIG. 1

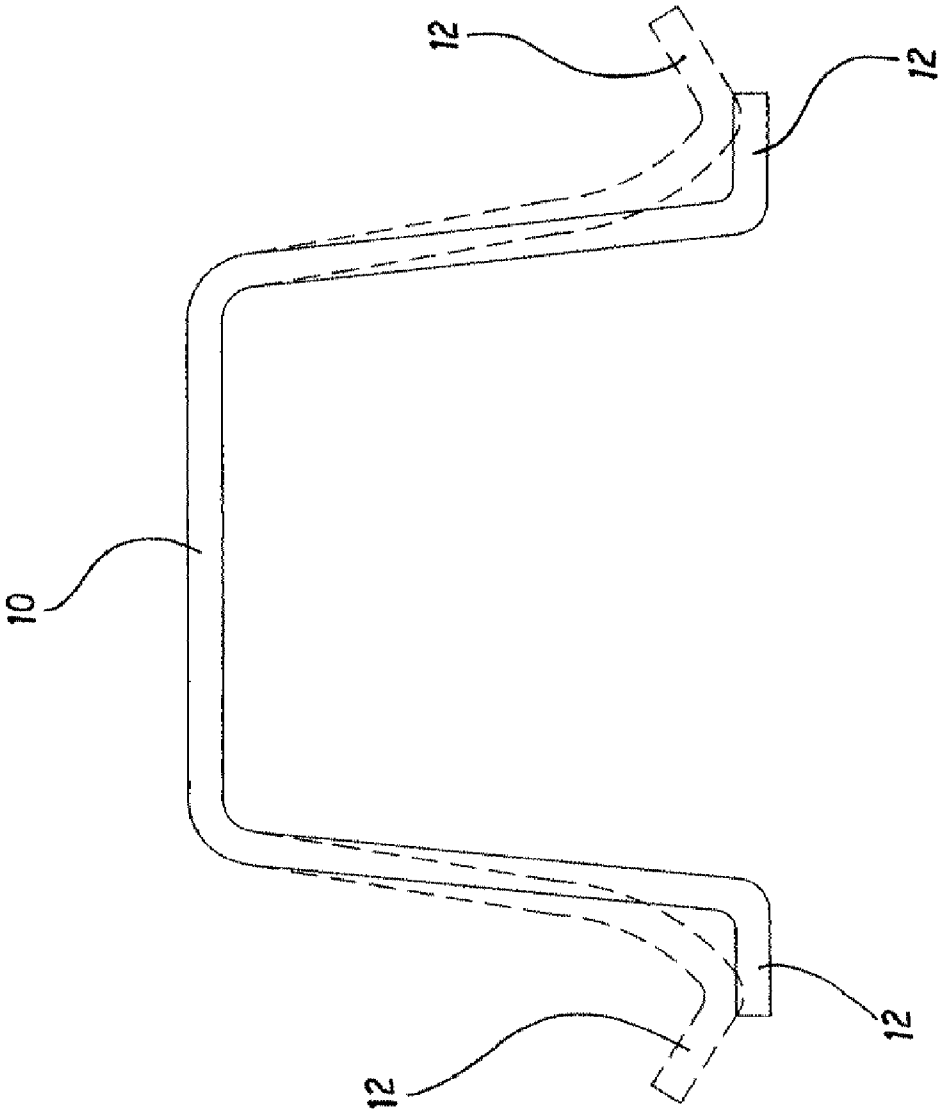


FIG. 2

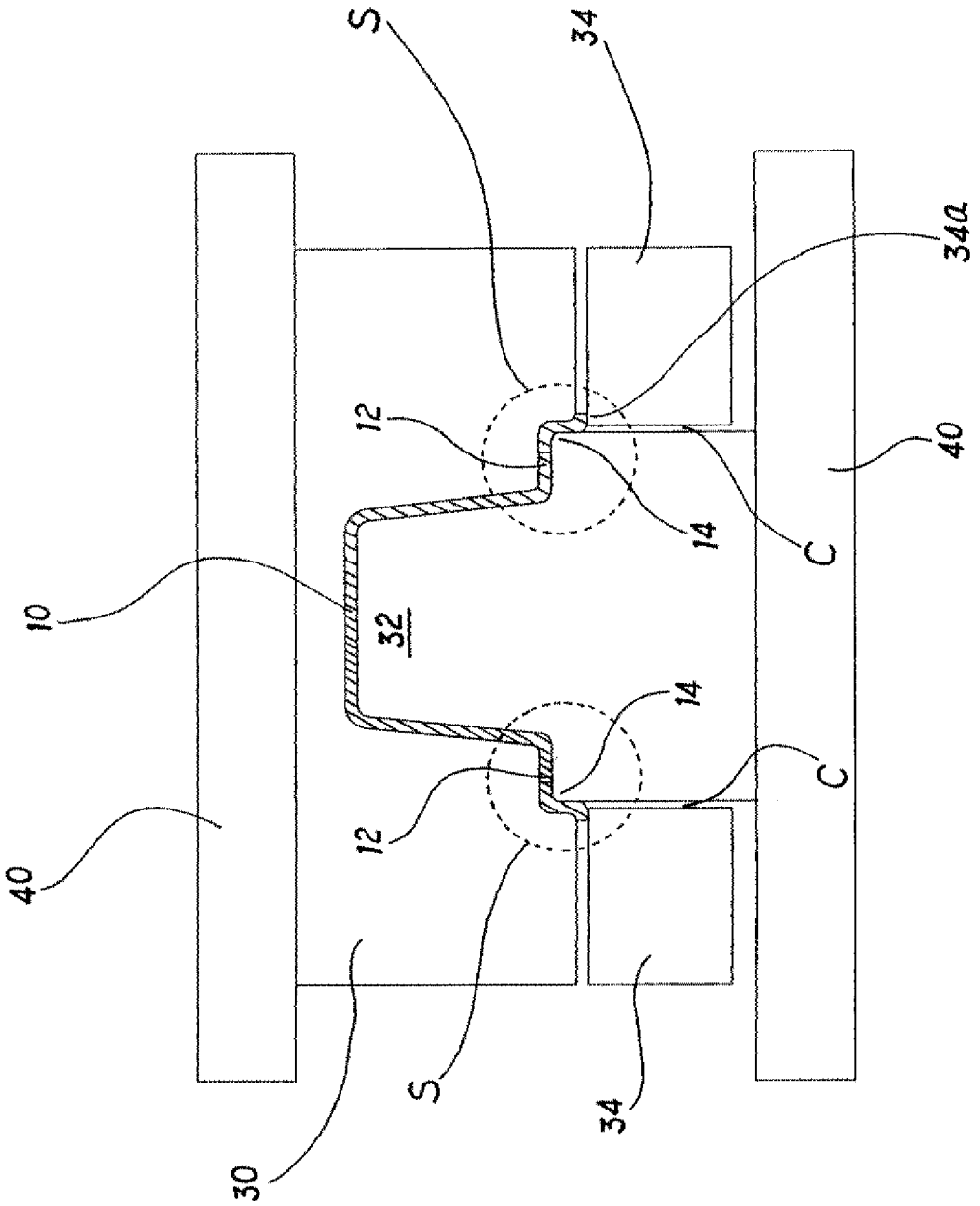


FIG. 3

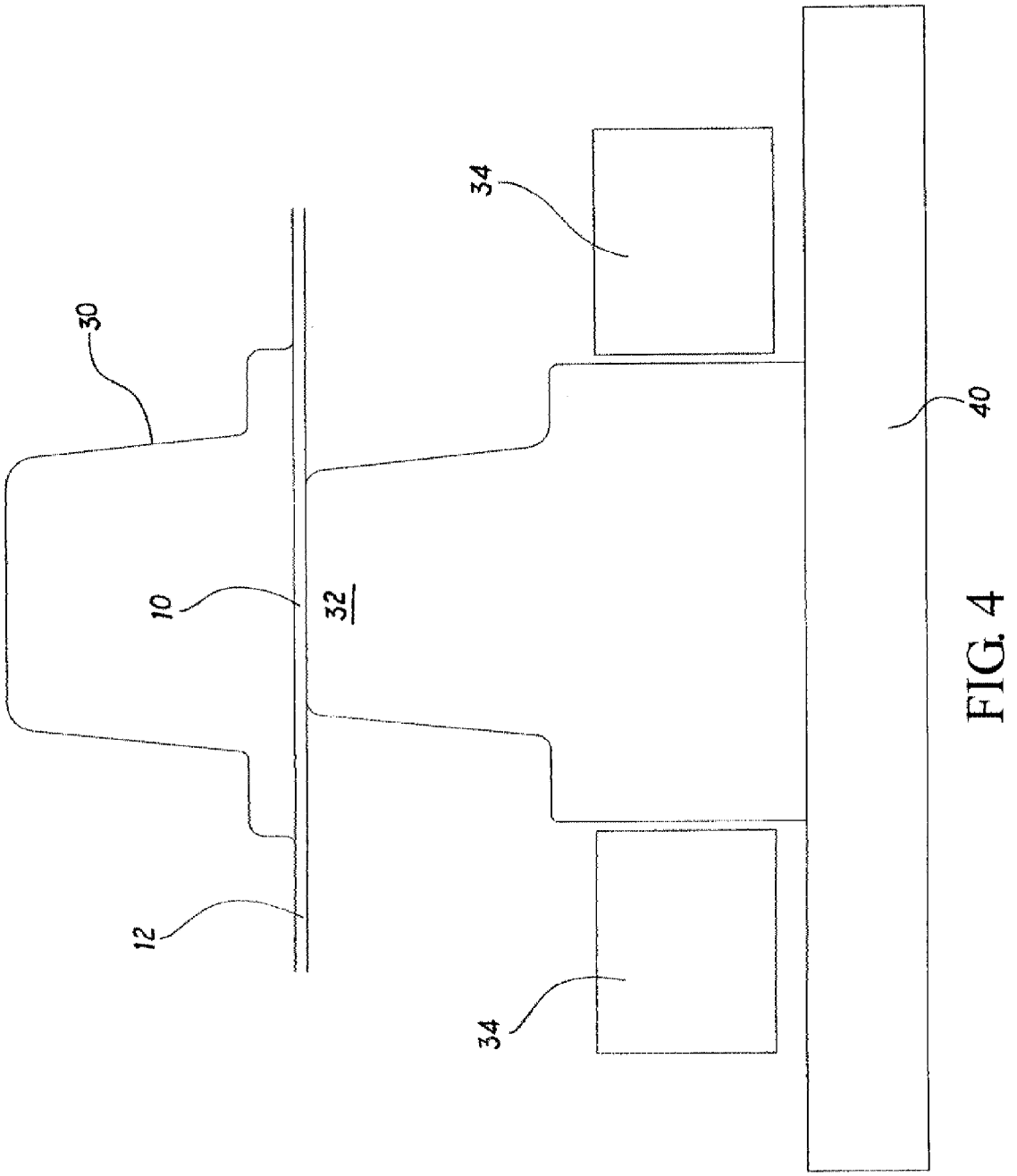


FIG. 4

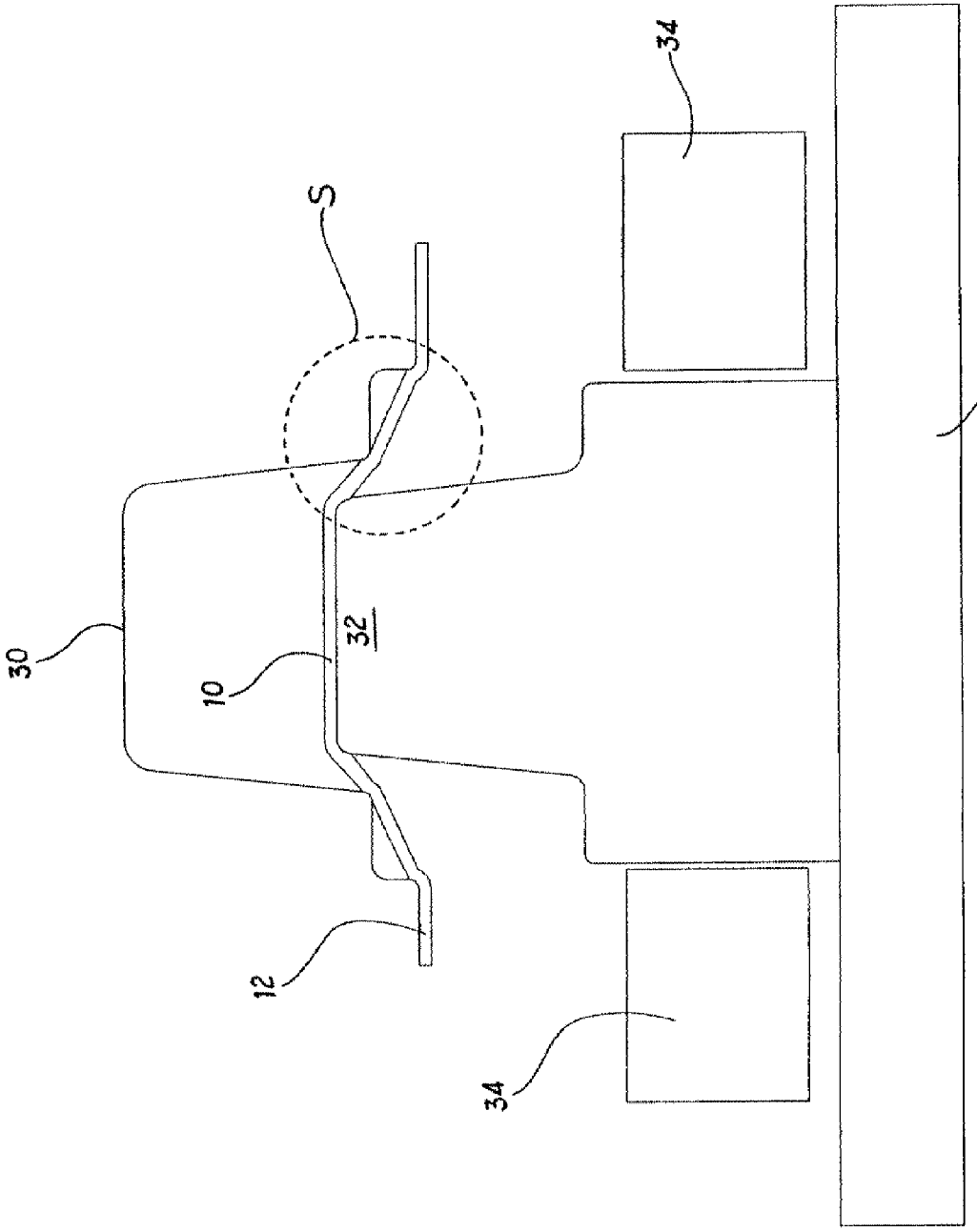


FIG. 5

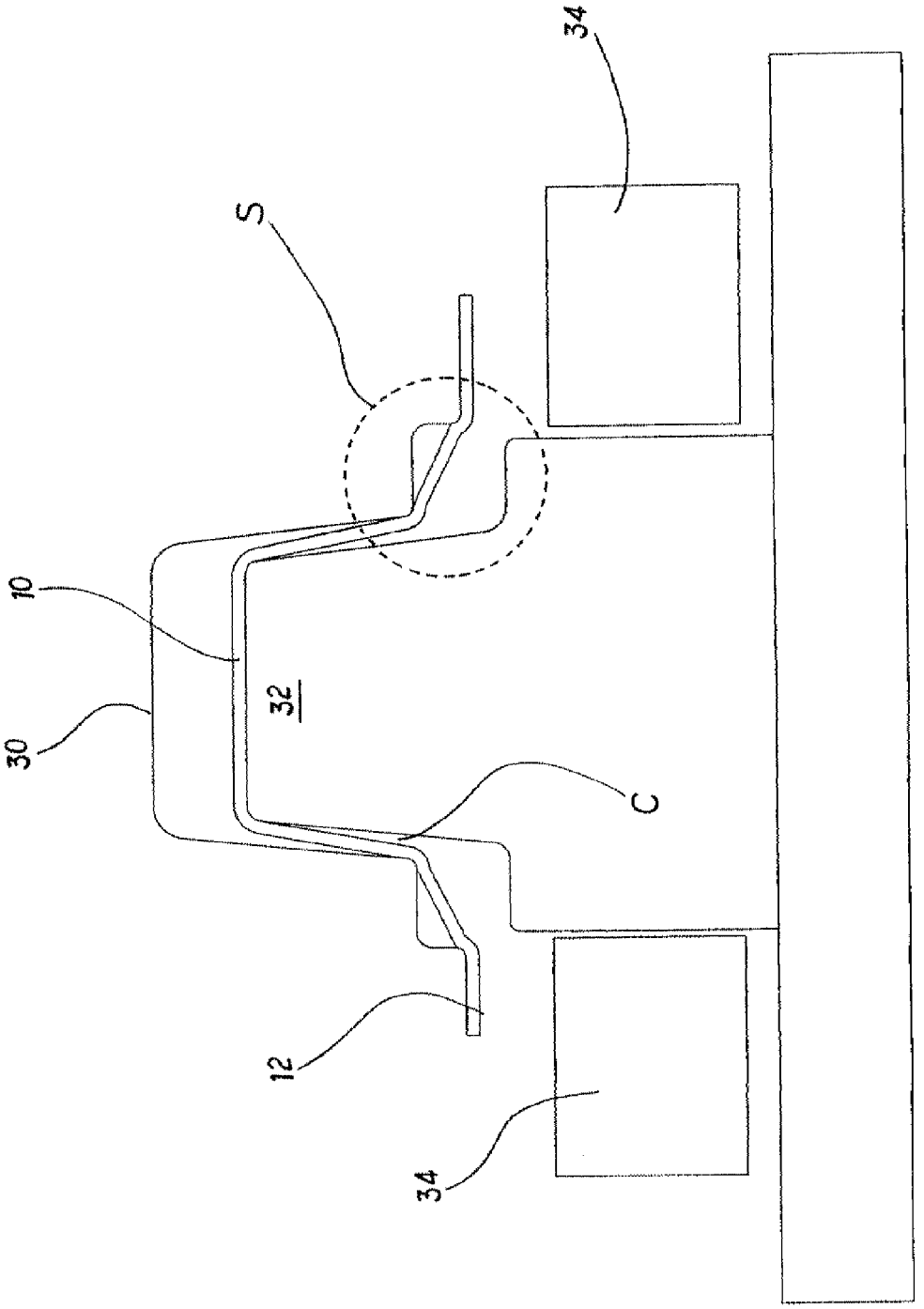


FIG. 6

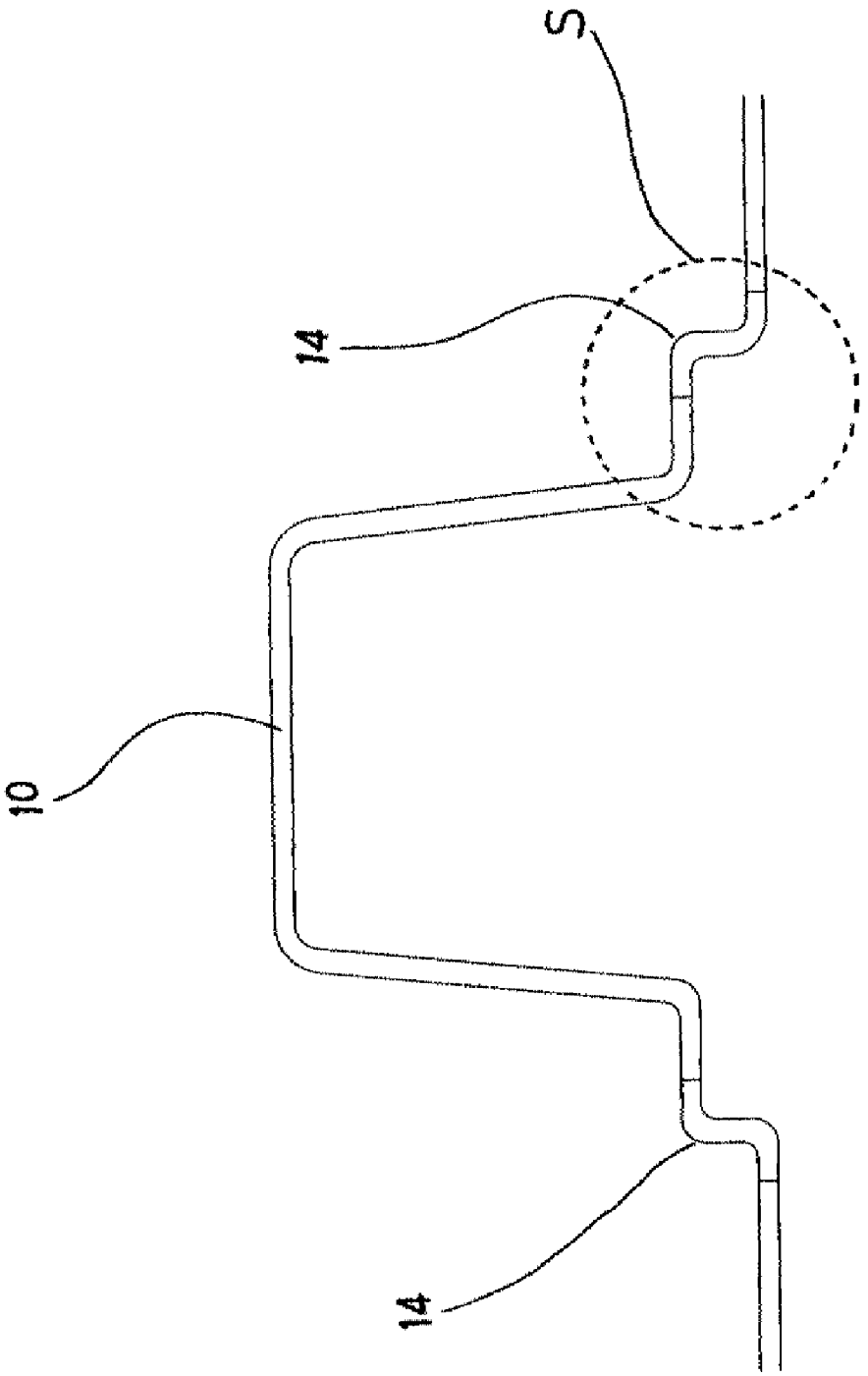


FIG. 7

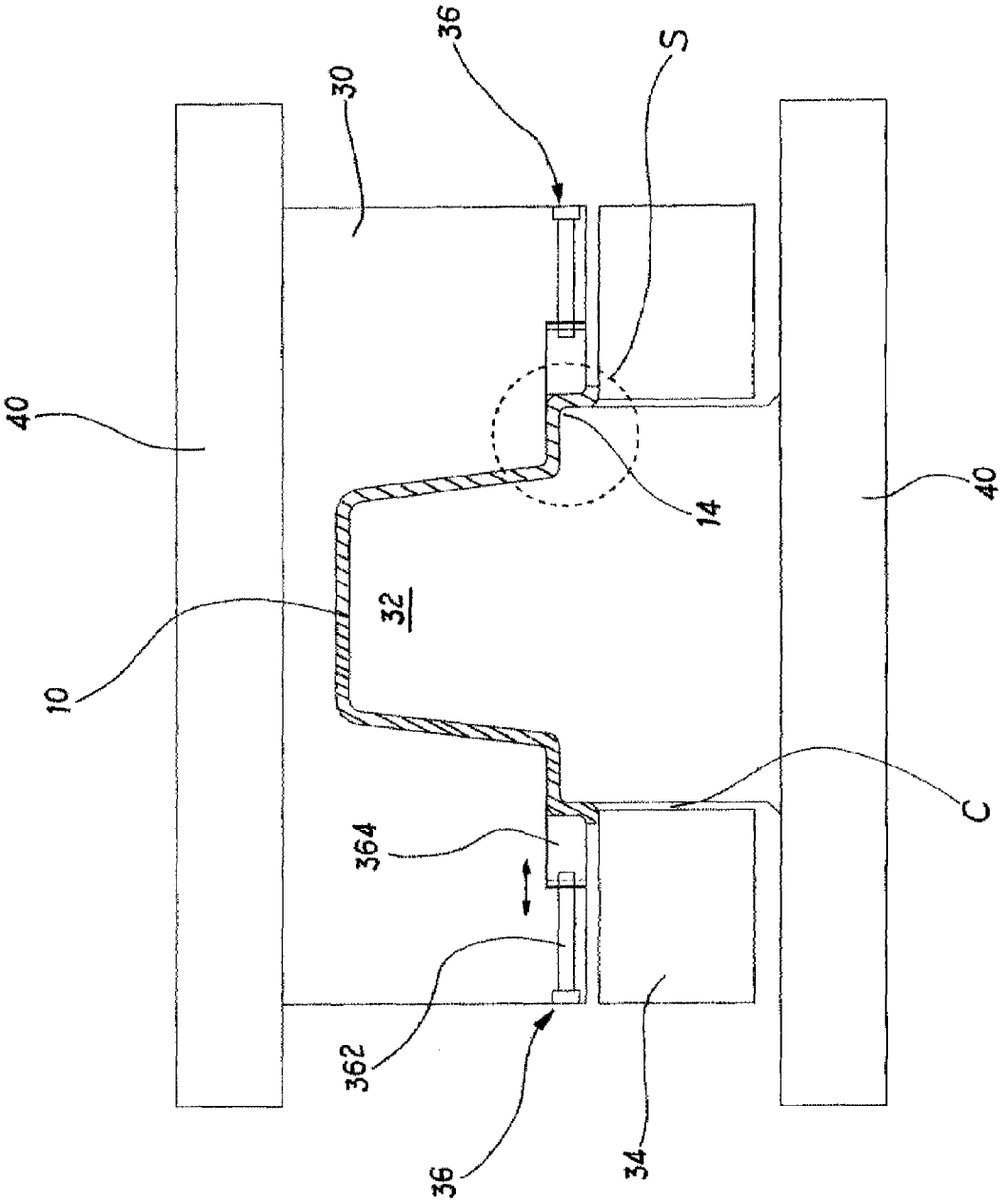


FIG. 8

METHOD FOR FORMING HIGH TENSILE STRENGTH METAL SHEET

TECHNICAL FIELD

[0001] The invention relates to metal sheet forming, more particularly to a technique of bending high tensile strength sheets.

BACKGROUND OF THE INVENTION

[0002] Because metals have good strength and flexibility, they are usually used as a structural element requiring strength. When a force applied on a unit area of metal exceeds its tensile strength, the metal will not split like ceramic materials, but will be deformed. That is to say, metals have a property of plasticity, i.e. plastic deformation. Usually, a power press machine is used for deforming a metal. There is an upper and lower dies in a power press machine. By means of stroke, the metal material being placed between the two dies can be deformed as the shape formed by the dies.

[0003] FIG. **1** illustrates a conventional technique of forming a high tensile strength metal sheet. The high tensile metal sheet **10** is placed between an upper die **20** and a lower die **22**. During the pressing process, a blank holder **24** is used for clamping the sheet **10**. However, after the pressing action, the ends **12** of the sheet **10** tend to form an undesired warp or curl (i.e. "recoil") because of its inner stress against the pressing force. Thus, the quality of metal sheet forming will be adversely affected. As shown in FIG. **2**, element **12** is the desired shape of sheet, but a really resultant shape is like element **12'**.

[0004] Moreover, an additional post-production is required because the desired shape can not be accomplished at a time. Therefore, the conventional forming process with post-production includes the steps of: a)forming; b)cutting; c)trimming and d)re-trimming or, a)loading; b)forming; c)re-forming; d)trimming and e)re-trimming. Any of the above processes is lengthy and tardy. The most important point is that pressing veins or scratches will be left on the sheet after various steps. Quality of the finished products will be considerably low unless a finally additional polishing step is performed.

[0005] For example, in order to avoid warps or curls, and to increase accuracy of the products formed, the steps of forming and trimming must be repeatedly performed. It is very uneconomic. Furthermore, the forming process with multiple forming and trimming steps may also reduce lifetime of the dies. Meanwhile, the formed products will be hardened. It is disadvantageous to the latter process.

SUMMARY OF THE INVENTION

[0006] A primary object of the present invention is to provide a method for forming a high tensile strength sheet, which can avoid recoil after the HTSMS is formed.

[0007] An another object of the present invention is to provide a method for forming a high tensile strength sheet, which can shorten the forming process because of avoidance of recoil.

[0008] An another object of the present invention is to provide a method for forming a high tensile strength sheet, which can improve quality of finished products being formed by means of one-time forming.

[0009] To accomplish the above-mentioned objects, the present invention provides a method for forming a high tensile strength metal sheet (HTSMS), which is performed in a power press machine composed of a die, a punch and a blank holder. The HTSMS is placed between the die and punch with blank holder. A step portion appears at both an outer side of the punch and a pressing portion of the blank holder. The step portion is corresponding to a predetermined bent portion of the HTSMS. A step will be formed at an edge of the HTSMS by progressively pressing of the step portion to avoid recoil of the HTSMS after forming process.

[0010] By means of the above machine, the method of the present invention comprises the steps of:

[0011] a) setting the blank holder at a predetermined position which is coplanar with the punch, and the high tensile strength metal sheet (HTSMS) being placed on a plane formed by the punch and the blank holder;

[0012] b) driving the punch to ascend to a first position to make the HTSMS roughly deformed;

[0013] c) driving the punch to ascend to a second position to make the HTSMS sequentially deformed; and

[0014] d) driving the punch to ascend to a third position to make the HTSMS finally deformed with a step formed by the step portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The foregoing objects, features, and advantages of the present invention will be discussed in detail in the following non-limiting description of specific embodiments in connection with the accompanying drawings.

[0016] FIG. **1** illustrates a conventional forming machine for high tensile strength metal sheet (HTSMS);

[0017] FIG. **2** illustrates the HTSMS formed by the machine shown in FIG. **1**;

[0018] FIG. **3** illustrates the power press machine of the present invention;

[0019] FIGS. **4-6** illustrate a series of pressing process using the machine shown in FIG. **3**;

[0020] FIG. **7** illustrates the HTSMS which is finally formed; and

[0021] FIG. **8** illustrates another embodiment of the power press machine according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0022] The high tensile strength metal sheets mentioned in the present invention can be high tensile strength steel sheets made of steel adding several metal elements, such as, but not limited to, niobium, copper, vanadium and titanium. The high tensile strength metal sheets increasingly become popular and important for car industry because they have better properties than traditional materials.

[0023] Referring to FIG. **3**, the power press machine applied in the invention includes a punch **32**, a die **30** and a blank holder **34**. The die **30** can also be called "female die". Either the die **30** or the punch **32** is driven by a driving unit **40** to reciprocate upward and downward. The reciprocating motion of the die **30** or the punch **32** can be periodic or multi-staged by a program. The die **30** usually has a recess corresponding to the punch **32**. As shown in FIG. **3**, the die **30** and punch **32** are correspondingly recessing and projecting, respectively. The blank holder **34** can provide a pressing force onto the high tensile strength metal sheet (hereinafter "HTSMS") to clamp it when both the die **30** and punch **32** are in motion. During the forming process, the HTSMS **10** is

placed and clamped between the blank holder **34** and die **30**, and then the punch **32** moves toward the HTSMS **10** and finally into the die **30**.

[0024] A feature of the invention is that a step portion S is formed at both the outer side of punch **32** and a pressing portion **34***a* of the blank holder **34**. The step portions S are arranged near the edge sections **12** which are the predetermined positions to be bent. The distance between one of the edge sections **12** and an adjacent edge is about 5 mm-20 mm. A step **14** is formed within the edge sections **12**. A gap C is retained between the punch **32** and the blank holder **34**. The blank holder **34** shown in the drawings is of a block type. The HTSMS **10** placed on the punch **32** and blank holder **34** is pressed by the die **30** and formed by the step portions S. Therefore, the step **14** is finally formed to avoid recoil of edge of the HTSMS **10**.

[0025] Some factors are not considered by the invention, such as the friction between the blank holder **34** and die **30** or punch **32**, and the pressing force from the blank holder **34**. Referring to FIGS. **4-6**, the punch **32** connects to a driving mechanism **40**, for example an oil press, for driving punch **32** to reciprocate. FIG. **4** illustrates the beginning of the forming process. The blank holder **34** is disposed at a predetermined height which is approximately coplanar with the punch **32**. The HTSMS **10** is placed on the plane formed by coplanar punch **32** and blank holder **34**. FIG. **5** illustrates the first stage of forming. Blank holder **34** or its pressing portion **34***a* can provide a proper pressing force onto the HTSMS **10** to hold it when punch **32** and die **30** perform relative reciprocation. The driving mechanism **40** drives punch **32** to ascend to a first position so that the HTSMS **10** becomes roughly deformed. The deformed portion is driven by punch **32** to enter die **30**. FIG. **6** illustrates the second stage of forming. Driving mechanism **40** drives punch **32** to further ascend to a second position so that the HTSMS **10** is sequentially deformed. The HTSMS **10** is protruded by ascending punch **32** to progressively reach die **30**. Step portion S initially appears. FIG. **7** illustrates the third stage of forming. Driving mechanism **40** finally drives punch **32** to ascend to a third position so that the HTSMS **10** is completely deformed. Edge sections **12** of HTSMS **10** separately form the step **14** by step portions S constituted by punch **32** and blank holder **34**. Therefore, the HTSMS **10** can be sufficiently under pressure during the forming process so that the HTSMS **10** will generate a plastic deformation. After the HTSMS **10** is formed, the step **14** will overbear or offset the recoiling force from edge sections **12**. Accordingly, the formed products can be finished only after steps of cutting and trimming.

[0026] Additionally, the above-mentioned first, second and third positions are shown in separate drawings, but in fact, the ascension of punch **32** driven by driving mechanism **40** is linearly continuous.

[0027] FIG. **8** illustrates another preferred embodiment. An adjusting mechanism **36** is preferably disposed at an edge of die **30**. The adjusting mechanism **36** is composed of an adjustable screw rod **362** and a block **364**. The adjusting mechanism **36** can adjust step portions S between punch **32** and blank holder **34**. The positions of step portions S can be adjusted by rotating the screw rod **362** to make block **364** move inward or outward to a specific position. This can change a relative depth of step portions S formed by punch **32** and blank holder **34**. Thus, adjusting mechanism **36** can match requirements of different thickness, bending angles and/or properties of metal sheets so that the forming process can be preferably completed.

[0028] Such alterations, modifications, and improvements are intended to be part of this disclosure, and are intended to be within the spirit and the scope of the present invention. Accordingly, the foregoing description is by way of example only and is not intended to be limiting. The present invention is limited only as defined in the following claims and the equivalents thereto.

What is claimed is:

1. A method for forming a high tensile strength metal sheet, which is performed in a power press machine composed of a die, a punch and a blank holder, wherein a step portion appears at both an outer side of the punch and a pressing portion of the blank holder, the method comprising the steps of:

a) setting the blank holder at a predetermined position which is coplanar with the punch, and the high tensile strength metal sheet (HTSMS) being placed on a plane formed by the punch and the blank holder;

b) driving the punch to ascend to a first position to make the HTSMS roughly deformed;

c) driving the punch to ascend to a second position to make the HTSMS sequentially deformed; and

d) driving the punch to ascend to a third position to make the HTSMS finally deformed with a step formed by the step portion.

2. The method for forming a high tensile strength metal sheet as claim **1**, wherein the steps b), c) and d) are continuously performed.

* * * * *