METHODOLOGY FOR FORMING AN U-SHAPED METAL FRAME

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ABSTRACT

A method for forming an U-shaped metal frame includes a preparing means: bend forming a straight tube in a continuous curve shape to be a billet including a spaced section and a first and a second side segments twisted toward opposite directions individually; a forming means: placing the billet into a cavity of a forming mold, closing two ends of the billet, and feeding a high-pressure fluid into the billet; a cutting means: cutting the billet into the first and the second pipes, the first pipe including a first connecting portion formed in a first cut position thereof, the second pipe including a second connecting portion formed in a second cut position thereof; a connecting means: twisting the first side segment and the second side segment toward the same direction, and connecting the first connecting portion and the second connecting portion together to obtain the U-shaped metal frame.
providing another straight tube

providing a plate

providing a straight tube

punching a second side segment

punching a spaced section

punching a first side segment

welding the spaced section

welding the spaced section and the first side segment together

FIG. 2

PRIOR ART
providing a straight tube

bending the straight tube in an U shape

fluid forming

forming a first side segment

forming a second side segment

FIG. 3 PRIOR ART
providing a metal straight tube

preparing means

forming means

cutting means

connecting means

FIG. 4
METHOD FOR FORMING AN U-SHAPED METAL FRAME

BACKGROUND OF THE PRESENT INVENTION

[0001] 1. Field of Invention
[0002] The present invention relates to a method for forming an U-shaped metal frame that can simplify its forming process.

[0003] 2. Description of Related Arts
[0004] U-shaped frame, such as a horizontal main frame, an engine holder, or seat support of a car, made of a metal tube is used in vehicle and aerospace industries to connect with other parts.

[0005] Referring to FIGS. 1 and 2, an U-shaped metal frame 10 is used in a seat support of a car and includes a spaced section 11 and a first and a second side segments 12, 13, wherein the spaced section 11 includes a larger-diameter expanding portion 111 disposed on a central portion thereof, and the first and the second side segments 12, 13 include a first and a second recessed parts 121, 131 mounted on one sides thereof respectively, the first and second recessed parts 121, 131 include curve or convex cross section formed thereon individually. During the processes of forming the metal frame 10, two plates are provided to be punched by a punching die and then welded together to form the spaced section 11, and two straight tubes are provided to be punched by another punching die to form the first and the second side segments 12, 13, thereby the first and the second segments 12, 13 are welded together to form the metal frame 10. However, such a punching method has the following disadvantages:

[0006] 1. Plural punching dies are used to punch the spaced section 11, the first and the second side segments 12, 13 individually, and then the spaced section 11, the first and the second side segments 12, 13 are welded together, thus increasing die cost and having complicate forming processes.

[0007] 2. A number of connecting positions of the spaced section 11, the first and the second side segments 12, 13 are welded together, increasing production cost.

[0008] 3. The spaced section 11, the first and the second side segments 12, 13 are welded together after being punched, lowering rigidity and strength of the metal frame.

[0009] Referring to FIGS. 1 and 3, the metal frame 10 is made by using a fluid forming method, wherein a straight tube is bent by a tube bending machine to form a U shape, the U-shaped tube is placed into a cavity of a forming mold, and then a punching head is used to close two ends of the U-shaped tube, a high-pressure fluid is fed into the U-shaped tube so that the U-shaped tube is inflated in the cavity to form a concave or convex cross section on a first and a second recessed parts 121, 131 of the first and the second side segments 12, 13 individually, however, if a low-cost mold is applied to form the first and the second recessed parts 121, 131, the first and the second side segments 12, 13 are not removed from the mold easily to form the first and second recessed parts 121, 131, accordingly another molds have to be used to form the concave or convex cross section on the first and the second recessed parts 121, 131, increasing production cost and having tedious forming processes.

[0010] The present invention has arisen to mitigate and/or obviate the afore-described disadvantages.

SUMMARY OF THE PRESENT INVENTION

[0011] The primary object of the present invention is to provide a method for forming an U-shaped metal frame that can simplify its forming process.

[0012] Secondary object of the present invention is to provide a method for forming an U-shaped metal frame that can lower production cost.

[0013] Further object of the present invention is to provide a method for forming an U-shaped metal frame that can decrease connecting portions of the U-shaped metal frame to enhance strength and smooth surface.

[0015] In accordance with the present invention, there is provided a method for forming an U-shaped metal frame which includes:

[0016] a preparing means: bend forming a straight tube in a continuous curve shape to be a billet of the metal frame, and the billet including a spaced section and a first and a second side segments twisted toward opposite directions individually;

[0017] a forming means: placing the billet of the metal frame into a cavity of a forming mold, and closing two ends of the billet, and then feeding a high-pressure fluid into the billet so that a concave or convex cross section is formed on the billet;

[0018] a cutting means: cutting the billet into the first and the second pipes, and the first pipe including a first connecting portion formed in a first cut position thereof, and the second pipe including a second connecting portion formed in a second cut position thereof;

[0019] a connecting means: twisting the first side segment of the first pipe and the second side segment of the second pipe toward the same direction, and connecting the first connecting portion of the first pipe and the second connecting portion of the second pipe together to obtain the U-shaped metal frame.

[0020] The present invention will become more obvious from the following description when taken in connection with the accompanying drawings, which show, for purpose of illustrations only, the preferred embodiment in accordance with the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] FIG. 1 is a perspective view showing a conventional U-shaped metal frame;

[0022] FIG. 2 is a process for forming the conventional U-shaped metal frame;

[0023] FIG. 3 is another process for forming the conventional U-shaped metal frame;

[0024] FIG. 4 is a process for forming an U-shaped metal frame according to a first embodiment of the present invention;

[0025] FIG. 5 is a cross sectional view showing a preparing means of a method for forming the U-shaped metal frame according to the first embodiment of the present invention;

[0026] FIG. 6 is a cross sectional view showing a forming means of the method for forming the U-shaped metal frame according to the first embodiment of the present invention;

[0027] FIG. 7 is a cross sectional view showing a fluid forming of a forming means of the method for forming the U-shaped metal frame according to the first embodiment of the present invention;
FIG. 8 is a cross sectional view showing a heat treating of a forming means of the method for forming the U-shaped metal frame according to the first embodiment of the present invention;

FIG. 9 is a cross sectional view showing a cutting means of the method for forming the U-shaped metal frame according to the first embodiment of the present invention;

FIG. 10 is a cross sectional view showing a connecting means of the method for forming the U-shaped metal frame according to the first embodiment of the present invention;

FIG. 11-1 is a side plan view showing the connecting means of the method for forming the U-shaped metal frame according to the first embodiment of the present invention;

FIG. 11-2 is another side plan view showing the connecting means of the method for forming the U-shaped metal frame according to the first embodiment of the present invention;

FIG. 12-1 is another side plan view showing the connecting means of the method for forming the U-shaped metal frame according to the first embodiment of the present invention;

FIG. 12-2 is another side plan view showing the connecting means of the method for forming the U-shaped metal frame according to the first embodiment of the present invention;

FIG. 12-3 is another side plan view showing the connecting means of the method for forming the U-shaped metal frame according to the first embodiment of the present invention;

FIG. 13 is a cross sectional view showing a preparing and a forming means of a method for forming the U-shaped metal frame according to a second embodiment of the present invention;

FIG. 14 is a cross sectional view showing a cutting means of the method for forming the U-shaped metal frame according to the second embodiment of the present invention;

FIG. 15 is a cross sectional view showing a connecting means of the method for forming the U-shaped metal frame according to the second embodiment of the present invention;

FIG. 16 is a cross sectional view showing a preparing means of a method for forming the U-shaped metal frame according to a third embodiment of the present invention;

FIG. 17 is a cross sectional view showing a forming means of a method for forming the U-shaped metal frame according to the third embodiment of the present invention;

FIG. 18 is a cross sectional view showing a cutting means of the method for forming the U-shaped metal frame according to the third embodiment of the present invention;

FIG. 19 is a cross sectional view showing a connecting means of the method for forming the U-shaped metal frame according to the third embodiment of the present invention;

FIG. 20 is a cross sectional view showing a preparing means of a method for forming the U-shaped metal frame according to a fourth embodiment of the present invention;

FIG. 21 is a cross sectional view showing a forming means of a method for forming the U-shaped metal frame according to the fourth embodiment of the present invention;

FIG. 22 is a cross sectional view showing a cutting means of the method for forming the U-shaped metal frame according to the fourth embodiment of the present invention;

FIG. 23 is a cross sectional view showing a connecting means of the method for forming the U-shaped metal frame according to the fourth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 4 and 5, a method for forming an U-shaped metal frame 20 in accordance with a first embodiment of the present invention comprises the step of providing a metal straight tube in a preparing means, wherein the straight tube is bent formed in a continuous curve shape to be a billet of the metal frame 20, the billet includes a spaced section 201 and a first and a second side segments 202, 203 twisted toward opposite directions individually. In this embodiment, the straight tube is bent by a tube bending machine to form a continuous curve shape. As shown in FIGS. 4, 6 and 7, the billet is placed into a cavity of a forming mold, and the forming mold is split along a curved axial line of the billet, the cavity includes two punching heads disposed on two sides thereof respectively to close two ends of the billet, and a high-pressure fluid is fed into the billet so that the billet is inflated in the cavity to form a concave or convex cross section on the spaced section 201 and the first and the second side segments 202, 203 individually, wherein the spaced section 201 of the billet includes an expanding portion 204 formed thereon, and the first side segment 202 includes a first recessed part 205 formed thereon, and the second side segment 203 includes a second recessed part 206 formed thereon. In this embodiment, the concave or convex cross section is formed on the spaced section 201 by using a fluid forming or a heat treating method. As illustrated in FIG. 7, the fluid forming method includes placing the billet of the metal frame 20 into the cavity of the forming mold, and the punching heads of the cavity are used to close the two ends of the billet, the high-pressure fluid is fed into the billet directly so that the billet of the metal frame 20 is inflated in the cavity by using a pressure of the high-pressure fluid, and then the concave or convex cross section is formed on the billet. With reference to FIG. 8, the heat treating method includes pre-heating the billet of the metal frame 20 to a suitable thermoplastic temperature and then placing the billet into the cavity of the forming mold, the forming mold is heated to be at the suitable thermoplastic temperature, and the punching heads of the cavity are applied to close the two ends of the billet, a high-pressure air is further fed into the billet so that the billet of the metal frame 20 is inflated by a pressure of the high-pressure air, hence the concave or convex cross section is formed on the billet. Referring further to FIGS. 4 and 9, the billet of the frame 20 is cut in a cutting means, wherein rest materials of the first and the second side segments 202, 203 are cut, and then the spaced section 201 is cut as well so that the billet of the metal frame 20 is separated into a first pipe 20a and a second pipe 20b. In this embodiment, the expanding portion 204 of the spaced section 201 is cut so that the billet of the metal frame 20 is separated into the first pipe 20a and a second pipe 20b, the first pipe 20a includes a first connecting portion 207 formed in a first cut position thereof, and the second pipe 20b includes a second connecting portion 208 formed in a second cut position thereof. As shown in FIGS. 4 and 10, the first pipe 20a and the second pipe 20b are connected together in a connecting means, the first side segment 202 of the first pipe 20a and the second side segment 203 of the second pipe 20b are twisted toward the same direction,
then the first connecting portion 207 of the first pipe 20a and the second connecting portion 208 of the second pipe 20b are connected with each and coupled together to obtain the U-shaped metal frame 20. In this embodiment, the first and the second pipes 20a, 20b include an equal diameter or different diameters respectively to be connected together. As illustrated in FIGS. 11-1 and 11-2, when the first and the second connecting portions 207, 208 include the same diameter, the first connecting portion 207 of the first pipe 20a and the second connecting portion 208 of the second pipe 20b are connected together to form a connection therebetween, and then the connection of the first and the second connecting portions 207, 208 is welded, then a first weld head 21 is used to fix the first and the second pipes 20a, 20b or a connector 22 is fixed to the connection of the first and the second connecting portions 207, 208, and the first and the second connecting portions 207, 208 are fixed by first screw elements 23 individually. Referring to FIGS. 12-1, 12-2, when the first and the second connecting portions 207, 208 include different diameters respectively, the punching head is used to punch a hole with an increased diameter on the first connecting portion 207 of the first pipe 20a, and the first connecting portion 207 of the first pipe 20a is fitted with the second connecting portion 208 of the second pipe 20b, then a fitting position of the first and the second connecting portions 207, 208 is welded, thereafter a second weld head 24 is applied to fix the first and the second pipes 20a, 20b together or a second screw element 25 is screwed into the fitting position of the first and the second connecting portions 207, 208. With reference to FIG. 12-3, a bonding agent is applied onto the fitting position of the first and the second connecting portions 207, 208 so that the first and the second pipes 20a, 20b are adhered together.

As shown in FIGS. 4 and 13, a method for forming an U-shaped metal frame 30 in accordance with a second embodiment of the present invention comprises the step of providing a metal straight tube in a preparing means and a forming means, wherein the straight tube is bend formed in a continuous curve shape to be a billet of the metal frame 30, the billet includes a spaced section 301 and a first and a second side segments 302, 303, and the spaced section 301 of the billet includes an expanding portion 304 formed thereon by using a high-pressure fluid forming or a heat treating method, the first side segment 302 includes a first recessed part 305 formed thereon, and the second side segment 303 includes a second recessed part 306 formed thereon. As illustrated in FIGS. 4 and 14, the billet of the frame 30 is cut in a cutting means, wherein rest materials of the first and the second side segments 302, 303 are cut, and then the spaced section 301 is cut as well so that the billet of the metal frame 30 is separated into a first pipe 30a and a second pipe 30b. In this embodiment, a certain position between the expanding portion 304 of the spaced section 301 and a curved corner of the spaced section 301 is cut so that the billet of the metal frame 30 is separated into the first pipe 30a and the second pipe 30b, and the first pipe 30a includes a first connecting portion 307 formed in a first cut section thereof, and the second pipe 30b includes a second connecting portion 308 formed in a second cut section thereof. As shown in FIGS. 4 and 15, the first pipe 30a and the second pipe 30b include an equal diameter or different diameters respectively and are connected together in a connecting means, wherein the first connecting portion 307 of the first pipe 30a and the second connecting portion 308 of the second pipe 30b are connected with each to obtain the U-shaped metal frame 30.

As shown in FIGS. 4 and 16, a method for forming an U-shaped metal frame 40 in accordance with a third embodiment of the present invention comprises the step of providing a metal straight tube in a preparing means, wherein the straight tube is bend formed in a continuous curve shape to be a billet of the metal frame 40, the billet includes a spaced section 401 and a first and a second side segments 402, 403. Referring to FIGS. 4 and 17, the billet of the frame 40 is fluid formed or heat treated in a forming means so that on the spaced section 401 and the first and the second side segments 402, 403 is formed a concave or convex cross section individually, wherein the spaced section 401 of the billet of the frame 40 includes a first recessed part 404 and a second recessed part 405 formed thereon, and the first side segment 402 includes an expanding portion 406 formed thereon, as illustrated in FIGS. 4 and 18, the billet of the frame 40 is cut in a cutting means, wherein rest materials of the first and the second side segments 402, 403 are cut, and then the spaced section 401 is cut as well so that the billet of the metal frame 40 is separated into a first pipe 40a and a second pipe 40b. In this embodiment, a central portion of the spaced section 401 is cut into the first pipe 40a and the second pipe 40b, and one side of the expanding portion 406 of the first pipe 40a is cut to eliminate rest material, thus forming a first connecting portion 407, and one side of the second side segment 403 of the second pipe 40b is cut to eliminate rest material, forming a second connecting portion 408. As shown in FIGS. 4 and 19, the first pipe 40a and the second pipe 40b include an equal diameter or different diameters respectively and are connected together in a connecting means, wherein the first connecting portion 407 of the first pipe 40a and the second connecting portion 408 of the second pipe 40b are connected with each to obtain the U-shaped metal frame 40.

As shown in FIGS. 4 and 20, a method for forming an U-shaped metal frame 40 in accordance with a fourth embodiment of the present invention comprises the step of providing a metal straight tube in a preparing means, wherein the straight tube is bend formed in a continuous curve shape to be a billet of the metal frame 50, the billet includes a spaced section 501 and a first and a second side segments 502, 503. Referring to FIGS. 4 and 21, the billet of the frame 50 is fluid formed or heat treated in a forming means so that on the spaced section 501 and the first and the second side segments 502, 503 is formed a concave or convex cross section individually, wherein the spaced section 501 of the billet of the frame 50 includes a first recessed part 504 and a second recessed part 505 formed thereon, and the second side segment 502 includes an expanding portion 506 formed thereon, and the second side segment 503 includes a second expanding portion 507 formed thereon. As illustrated in FIGS. 4 and 22, the billet of the frame 50 is cut in a cutting means, wherein rest materials of the first and the second side segments 502, 503 are cut, and then the spaced section 501 is cut as well so that the billet of the metal frame 50 is separated into a first pipe 50a and a second pipe 50b. In this embodiment, a central portion of the spaced section 501 is cut into the first pipe 50a and the second pipe 50b, and the first expanding portion 506 of the first pipe 50a and the second expanding portion 507 of the second pipe 50b are cut to eliminate rest materials, thus form a first connecting portion 508 on the first expanding portion 506 and a second connecting portion 509 on the second expanding portion 507. As shown in FIGS. 4 and 23, the first pipe 50a and the second pipe 50b include an equal diameter or different diameters respectively and are con-
nected together in a connecting means, wherein the first connecting portion 508 of the first pipe 50a and the second connecting portion 509 of the second pipe 50b are connected with each to obtain the U-shaped metal frame 50.

[0051] The invention is not limited to the above embodiment, but various modifications thereof may be made. It will be understood by those skilled in the art that various changes in form and detail may be made without departing from the scope and spirit of the present invention.

What is claimed is:

1. A method for forming an U-shaped metal frame comprising:
   a preparing means: bending forming a straight tube in a continuous curve shape to be a billet of the metal frame, and the billet including a spaced section and a first and a second side segments twisted toward opposite directions individually;
   a forming means: placing the billet of the metal frame into a cavity of a forming mold, and closing two ends of the billet, and then feeding a high-pressure fluid into the billet so that a concave or convex cross section is formed on the billet;
   a cutting means: cutting the billet into a first and a second pipes, and the first pipe including a first connecting portion formed in a first cut position thereof, and the second pipe including a second connecting portion formed in a second cut position thereof;
   a connecting means: twisting the first side segment of the first pipe and the second side segment of the second pipe toward the same direction, and connecting the first connecting portion of the first pipe and the second connecting portion of the second pipe together to obtain the U-shaped metal frame.

2. The method for forming the U-shaped metal frame as claimed in claim 1, wherein the straight tube is bent by a tube bending machine to form a continuously curved billet in preparing means.

3. The method for forming the U-shaped metal frame as claimed in claim 1, wherein the forming mold is split along a curved axial line of the billet in the forming means.

4. The method for forming the U-shaped metal frame as claimed in claim 1, wherein the cavity of the forming mold includes two punching heads disposed on two sides thereof respectively to close the two ends of the billet.

5. The method for forming the U-shaped metal frame as claimed in claim 4, wherein in the forming means, the concave or convex cross section is formed on the billet by using a fluid forming method, the fluid forming method includes placing the billet of the metal frame into the cavity of the forming mold, and the punching heads of the cavity are used to close the two ends of the billet, the high-pressure fluid is fed into the billet directly so that the billet of the metal frame is inflated in the cavity by using a pressure of the high-pressure fluid, and then the concave or convex cross section is formed on the billet.

6. The method for forming the U-shaped metal frame as claimed in claim 4, wherein in the forming means, the concave or convex cross section is formed on the billet by using a heat treating method, the heat treating method includes pre-heating the billet of the metal frame to a suitable thermoplastic temperature and then placing the billet into the cavity of the forming mold, the forming mold is heated to be at the suitable thermoplastic temperature, and the punching heads of the cavity are applied to close the two ends of the billet, a high-pressure air is further fed into the billet so that the billet of the metal frame is inflated by a pressure of the high-pressure air, hence the concave or convex cross section is formed on the billet.

7. The method for forming the U-shaped metal frame as claimed in claim 1, wherein in the forming means, the spaced section of the billet includes an expanding portion formed thereon, the first side segment includes a first recessed part formed thereon, and the second side segment includes a second recessed part formed thereon.

8. The method for forming the U-shaped metal frame as claimed in claim 7, wherein in the cutting means, the first and the second side segments are cut, and the expanding portion of the spaced section is cut so that the billet of the metal frame is separated into the first pipe and a second pipe.

9. The method for forming the U-shaped metal frame as claimed in claim 7, wherein in the cutting means, the first and the second side segments are cut, and a certain position between the expanding portion of the spaced section and a curved corner of the spaced section is cut so that the billet of the metal frame is separated into the first pipe and the second pipe.

10. The method for forming the U-shaped metal frame as claimed in claim 1, wherein in the connecting means, the first and the second connecting portions include an equal diameter, and the first connecting portion of the first pipe and the second connecting portion of the second pipe are connected together to form a connection therebetween, and then the connection of the first and the second connecting portions is welded, thereafter a first weld head is used to fix the first and the second pipes.

11. The method for forming the U-shaped metal frame as claimed in claim 10, wherein the first connecting portion of the first pipe and the second connecting portion of the second pipe are connected together to form a connection therebetween, then a connector is fixed to the connection of the first and the second connecting portions, thereafter the first and the second connecting portions are fixed by first screw elements individually.

12. The method for forming the U-shaped metal frame as claimed in claim 10, wherein in the connecting means, the first and the second connecting portions include different diameters respectively, and the first connecting portion of the first pipe and the second connecting portion of the second pipe are connected together to form a connection therebetween, and then a connector is fixed to the connection of the first and the second connecting portions, thereafter a second weld head is used to fix the first and the second pipes together.

13. The method for forming the U-shaped metal frame as claimed in claim 13, wherein in the connecting means, the first and the second connecting portions include different diameters respectively, and the first connecting portion of the first pipe and the second connecting portion of the second pipe are connected with each.

14. The method for forming the U-shaped metal frame as claimed in claim 13, wherein in the connecting means, the first and the second connecting portions include different diameters respectively, and the first connecting portion of the first pipe and the second connecting portion of the second pipe are connected with each.

15. The method for forming the U-shaped metal frame as claimed in claim 13, wherein in the connecting means, the first and the second connecting portions include different diameters respectively, and the first connecting portion of the first pipe and the second connecting portion of the second pipe are connected with each.
second pipe, then a second screw element is screwed into the fitting position of the first and the second connecting portions.

16. The method for forming the U-shaped metal frame as claimed in claim 13, wherein a punching head is used to punch a hole with an increased diameter on the first connecting portion of the first pipe, and the first connecting portion of the first pipe is fitted with the second connecting portion of the second pipe, then a bonding agent is applied onto the fitting position of the first and the second connecting portions so that the first and the second pipes are adhered together.

17. The method for forming the U-shaped metal frame as claimed in claim 1, wherein in the forming means, the spaced section of the billet includes a first recessed part and a second recessed part formed thereon, and the first side segment includes an expanding portion formed thereon.

18. The method for forming the U-shaped metal frame as claimed in claim 17, wherein in the cutting means, a central portion of the spaced portion is cut into the first pipe and the second pipe, and one side of the expanding portion of the first pipe is cut to eliminate rest material, thus forming a first connecting portion, and one side of the second side segment of the second pipe is cut to eliminate rest material, forming a second connecting portion.

19. The method for forming the U-shaped metal frame as claimed in claim 1, wherein in the forming means, the spaced section of the billet includes a first recessed part and a second recessed part formed thereon, and the first side segment includes a first expanding portion formed thereon, the second side segment includes a second expanding portion formed thereon.

20. The method for forming the U-shaped metal frame as claimed in claim 19, wherein in the cutting means, a central portion of the spaced portion is cut into the first pipe and the second pipe, and one side of the first expanding portion of the first pipe is cut to eliminate rest material, thus forming a first connecting portion, and one side of the second expanding portion of the second pipe is cut to eliminate rest material, forming a second connecting portion.