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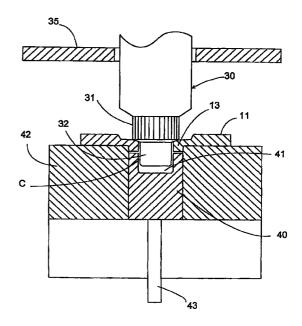
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(54) METHOD OF MANUFACTURING LATCH PLATE

(57) A process of making a ring-shaped metal latch plate 10 having an internal ratchet teeth 20 arranged around an inner periphery thereof with the use of a punch 30 provided with a toothed forging edge 31 for shaping the internal ratchet teeth and a pilot 32 formed axially forwardly of the toothed edge. Firstly with this process, a metal plate 11 is formed to have a prepared hole 12. Then, the punch 30 is placed to register the pilot 32 with the prepared hole 12 for engaging the said toothed forging edge 31 with a peripheral portion 13 of the prepared hole 12. Thereafter, the toothed forging edge 31 is driven to extrude the peripheral portion 13 by cold-forging in order to shape the internal ratchet teeth 20 around the prepared hole.





Description

TECHNICAL FIELD

[0001] The present invention is related to a process of making a latch plate having an internal ratchet teeth.

BACKGROUND ART

[0002] As shown in FIG. 1, a latch plate 10 employed in a retractable seat belt of an automobile is made to have an internal ratchet teeth 20. As the internal ratchet teeth 20 meshes with a corresponding pawl to lock the seat belt in response to an impact load, the ratchet teeth is required to have a great accuracy with respect to the shape and phase of the teeth. Conventional latch plates 10 are fabricated by a press shaving to have the internal ratchet teeth. However, there remains a problem that the one processed by shaving of a metal plate such as a carbon steel is insufficient in its finished quality as well as the strength. Therefore, it is demanded to provide the latch plate of improved quality. In view of this problem, the present invention has been accomplished and has an object of providing a process of making a latch plate capable of easily fabricating the latch plate of high quality.

DISCLOSURE OF THE INVENTION

[0003] The process in accordance with the present invention is for making a ring-shaped latch plate 10 having an internal ratchet teeth 20 with the use of a punch 30 provided with a toothed forging edge 31 for shaping the internal ratchet teeth and a pilot 32 formed axially forwardly of the toothed forging edge. Firstly, a prepared hole 12 is formed in a metal plate 11. Then, the punch 30 is placed to register the pilot 32 with the prepared hole 12 for engaging the toothed forging edge 31 with a peripheral portion 13 of the prepared hole 12. Thereafter, the toothed forging edge 31 is driven to extrude the peripheral portion 13 by cold-forging in order to shape the internal ratchet teeth 20 around the prepared hole 12.

[0004] Since the internal ratchet teeth 20 is shaped by the cold-forging with the use of the punch 30 provided at its end with the pilot 32 for insertion into the prepared hole 12 and also provided around its periphery with the toothed forging edge 31, it is possible to make the internal ratchet teeth 20 of high accuracy in a less costly manner as compared to shaping the internal ratchet by cutting. Also, since the internal ratchet teeth is made by the cold-forging, the internal ratchet teeth can be given thickness greater than the thickness of the metal plate for increased strength of the ratchet teeth. Further, by regulating the amount of the cold-extrusion, it is possible to make the ratchet teeth of a desired thickness within an extent of the extrusion amount.

[0005] Additionally, with the process in which the

toothed forging edge 31 is driven to extrude the peripheral portion 13 to shape the internal ratchet teeth 20 around the prepared hole 12, while leaving a thin fin 15 extending along a toothed edge of the internal ratchet teeth 20 in such a manner as to bridge individual teeth 21 of the internal ratchet teeth 20 at one surface of the metal plate, and thereafter the thin fin 15 is removed, a part of the metal plate can be free to escape into the thin fin 15 when cold-forging the metal plate with the punch, making it possible to shape the internal ratchet teeth of improved accuracy as well as to prolong an operating life of a die.

[0006] Further, the die 40 is prepared to support thereon the peripheral portion 13 of the metal plate 11 around the prepared hole 12. The die is provided with a cavity 41 which receives the pilot 32 when the punch 30 is driven to shape the internal ratchet teeth 20. The cavity 41 has an inside diameter slightly larger than that of the pilot to define therebetween a small clearance for allowing a part of the peripheral portion 13 to be extruded into the small clearance, forming thereat a thin burr 16 extending from the thin fin in a thickness direction of the metal plate. By removing the thin burr 16 together with the thin fin 15, a part of the metal plate can be free to escape into the small clearance C at the coldextrusion by the punch, making it possible to obtain the internal ratchet teeth of improved accuracy.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

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FIG. 1 is a plan view of a latch plate obtained according to a process of the present invention;

FIGS. 2A to 2D are sectional views illustrating steps of the process of the present invention;

FIG. 3 is a rough sectional view illustrating a punch and a die employed in the process of the present invention; and

FIG. 4 is a perspective view of the latch plate in a step of the process.

BEST MODE FOR CARRYING OUT THE INVENTION

[0008] The present invention will be now discussed with reference to an embodiment. As shown in FIG. 1, a latch plate 10 obtained by the process of the present invention is ring-shaped to have an internal ratchet teeth 20 along an inner periphery of the plate and to have a plurality of mount holes 22 and a plurality of fixed positioning pins 23. The inner periphery having the ratchet teeth 20 has a thickness T2 greater than a thickness T1 of the outer periphery.

[0009] The latch plate 10 is made of a metal plate 11, for example, a carbon steel S45C according to JIS (Japanese Industrial Standards) to have a prepared hole 12 and is press-forged. As shown in FIG. 3, a forging-press is made of a punch 30, and a lower die 42 pro-

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vided with an insert die 40 receiving thereon the periphery 13 of the prepared hole 12 in the metal plate 11. Formed around the tip of the punch 30 are toothed forging edge 31 for cold extrusion from which an integral pilot 32 projects. The insert die 40 of the lower die 42 is formed with a cavity 41 into which the pilot 31 of the punch 30 fits at the press-forging.

FIGS. 2A to 2D and FIG. 3 show steps of the process of making the latch plate 10. Firstly, the metal plate 11 is processed to have the prepared hole 12, as shown in FIG. 2A. Then, the periphery 13 of the prepared hole 12 is processed to protrude on one surface of the plate to form an annular rib 14, as shown in FIG. 2B. Thereafter, the metal plate 11 is held on the lower die 42 to place the annular rib 13 in correspondence to the upper surface of the insert die 40. At this condition, the pilot 32 of the punch 30 is made to project through the prepared hole 12 into the cavity 41 of the insert die 40. By driving the punch 30, the toothed forging edge 31 gives a plastic deformation to the periphery **13**, whereby the internal ratchet teeth 20 is extruded at the periphery 13 by the cold-forging, as shown in FIG. 2C. As the periphery 13 forming the internal ratchet teeth 20 is deformed plastically mainly in the thickness direction of the metal plate 11, the internal ratchet teeth 20 has the thickness T2 which is greater the thickness T1 of the outer periphery of the metal plate 11 and that of the annular rib before the forging.

[0011] The driving of the punch 30 is limited to such an extent that the axial end of the toothed forging edge 31 reaches away from the upper surface of the insert die 40. That is, the lowest position of the punch 30 is set to make a small clearance between the axial end of the toothed forging edge 31 and the upper surface of the insert die 40. With this result, as the periphery 13 is cold-forged to form the internal ratchet teeth 20, a portion of the periphery 13 is caused to escape into the small clearance, thereby leaving a thin fin 15 extending along a whole circumference of the toothed edge of the internal ratchet teeth 20 in such a manner as to bridge individual teeth of the ratchet teeth 20 at one surface of the metal pate 11, as shown in FIGS. 2C and 4.

[0012] Also, the inside diameter of the cavity 41 of the insert die 40 is made slightly smaller than an inscribed circle of the ratchet teeth 20, while the outside diameter of the pilot 32 is made slightly smaller than the inside diameter of the cavity 41 so as to make a small clearance C between the pilot 32 and the cavity 41. Thus, as the periphery 13 is cold-forged by the punch 30 to form the internal ratchet teeth 20, a portion of the periphery 13 is also caused to escape into the small clearance, forming a thin burr 16 depending continuously from the inner periphery of the thin fin 15, as shown in FIGS. 2C and 4. By positively forming the thin 15 and the thin burr 16, the internal ratchet teeth 20 formed through the cold-forging extrusion by the teeth 31 of the punch **30** can be accurately shaped free from blurring. The thin fin 15 and the thin burr 16 are formed

along the entire periphery of the prepared hole.

[0013] After the ratchet teeth 20 is shaped by the cold-forging as above, a knock-out pin 43 raises the insert die 40 and the metal plate 11 held to the punch 30 is removed therefrom by a stripper plate 35 disposed around the punch 30.

[0014] After shaping the internal ratchet teeth 20, a portion of the periphery 13 as shown below a dotted line of FIG. 2C including the thin fin 15 and the thin burr 16 is removed by cutting or press-punching, whereby the ratchet teeth 20 is shaped into a final configuration, as shown in FIG. 2D. The metal plate is concurrently finished to have a desired contour and is press-formed to have the mount holes 22 so as to obtain the latch plate 10 of FIG. 1. It is noted that the tooth face of the internal ratchet teeth 20 can be as it is and require no further polishing or corrections. In order to maintain a dimensional accuracy between the internal ratchet teeth 20 and the mount holes 22 as well as the positioning pins 23, it is preferred to form the contour of the metal plate, the mount holes 22, and the positioning pins 23 concurrently with reference to the internal ratchet teeth 20.

Claims

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1. A process of making a ring-shaped metal latch plate having an internal ratchet teeth arranged around an inner periphery of said latch plate, said process utilizing a punch provided with a toothed forging edge for shaping said internal ratchet teeth and a pilot formed axially forwardly of said toothed forging edge, said process comprising the steps of:

forming a prepared hole in a metal plate; placing said punch to register said pilot with said prepared hole for engaging said toothed forging edge with a peripheral portion of said prepared hole; and driving said toothed forging edge in a direction of thickness of said metal plate to extrude said peripheral portion by cold-forging in order to shape said internal ratchet teeth around said

2. The process as set forth in claim 1, wherein said toothed forging edge is driven to extrude said peripheral portion by the cold-forging in order to shape said internal ratchet teeth around said prepared hole, while leaving a thin fin extending along a toothed edge of said internal ratchet teeth in such a manner as to bridge individual teeth of said internal ratchet teeth at one surface of said metal plate, said thin fin being subsequently removed.

prepared hole.

3. The process as set forth in claim 2, wherein a die is provided to support thereon said peripheral portion of the metal plate around said prepared hole, said die being provided with a cavity which

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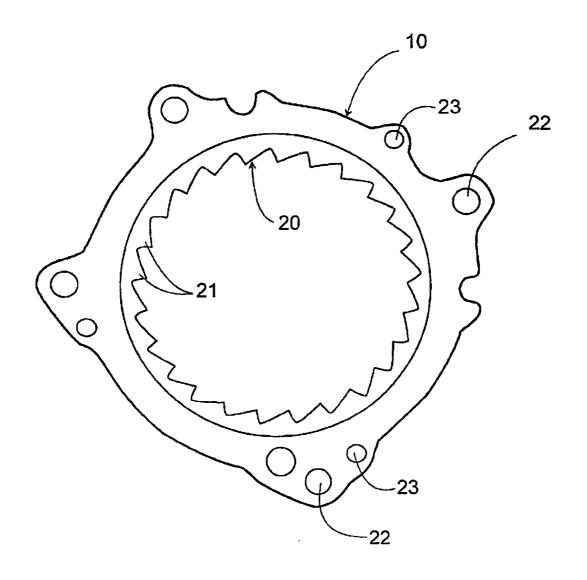
receives said pilot when said punch is driven to shape said internal ratchet teeth, said caving having an inside diameter slightly larger than that of said pilot to define therebetween a small clearance for allowing a part of said peripheral portion to be extruded into said small clearance, forming thereat a thin burr extending from said thin fin in a thickness direction of said metal plate, said thin burr being subsequently removed together with said thin fin.

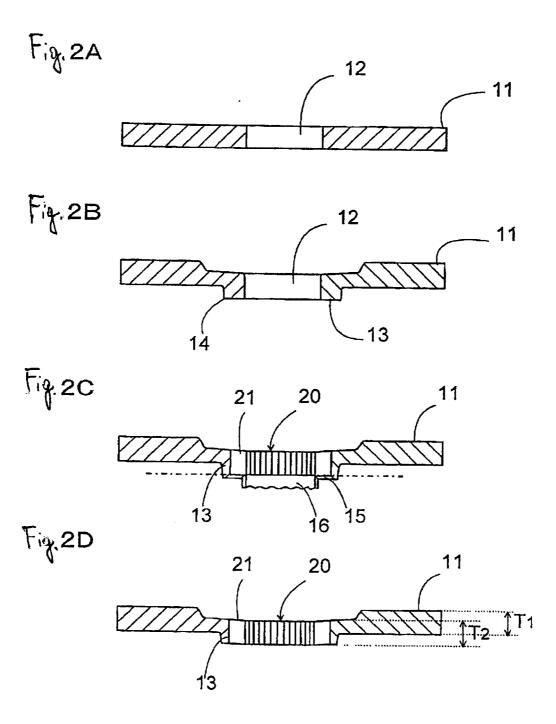
4. The process as set forth in claim 2, wherein said thin fin extends around the entire circumference of said prepared hole.

5. The process as set forth in claim 3, wherein

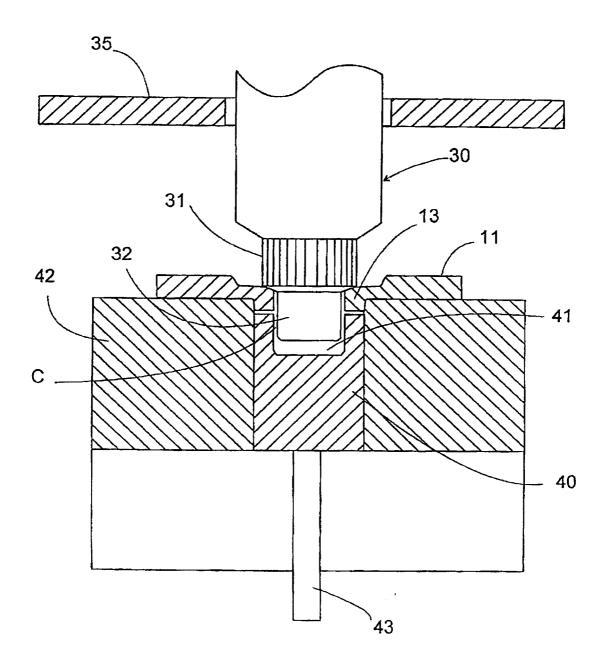
said thin burr extends around the entire circumference of said prepared hole.

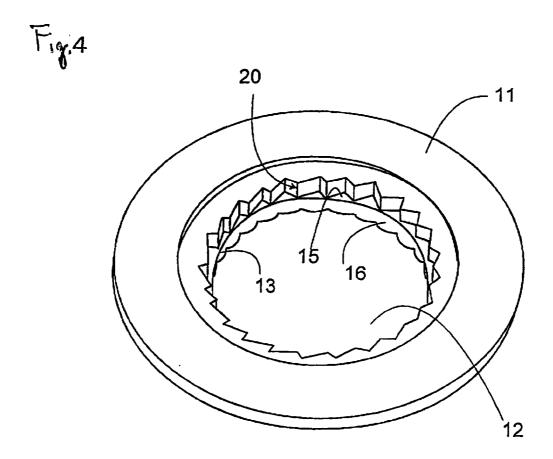
Fig. 1











INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP99/04623

A CLASSIFICATION OF SUBBECT MATTER Int.C1* B21K1/30, B21J5/06 According to International Patent Classification system followed by classification symbols) Int.C1* B21K1/30, B21J5/06, B60R2Z/48 Documentation searched chassification system followed by classification symbols) Int.C1* B21K1/30, B21J5/06, B60R2Z/48 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched J1tauyo Shinan Koho 1971-1999 Toroku J1tauyo Shinan Koho 1994-1999 Kokai J1tauyo Shinan Koho 1971-1999 J1tauyo Shinan Toroku Koho 1996-1999 Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) C DOCUMENTS CONSIDERED TO BE RELEVANT Category* Citation of document, with indication, where appropriate, of the relevant passages Relevant to claim No. 16 January, 1990 (16. 01. 90), Y Page 1, left column, lines 5 to 12; page 2, upper 1 left column, line 18 to lower right column, line 8; Pigs. 1 to 5 JP, 4-313442, A (Aisin Seiki Co., Ltd.), 5 November, 1992 (05. 11. 92), Y Par. Nos. [0006] to [0013]; Figs. 1 to 4 A 2-5 JP, 3-207546, A (Toyo Fastener K.K.), 10 September, 1991 (10. 09. 91), Y Page 1, left column, lines 5 to 15; page 3, lower right column, lines 12 to page 4, upper right column, line 9; Figs. 1 to 3 JP, 10-202329, A (Toyota Auto Body Co., Ltd.), 4 August, 1998 (04. 08. 98), A Abstract; Claims; Figs. 1 to 14 [X] Further documents are listed in the continuation of Box C Sepetial research grade for fine of source and considered to be of particular references to involve as inventors and considerate to involve as inventors and the principle of the order to inventors and the research of particular reference to involve as inventors and the principle of the order to inventors and the research and the principle of the order to i							
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP99/04623

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Category*	Citation of document, with indication, where appropriate, of the releva	int passages	Relevant to claim No
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A	Page 12, line 19 to page 13, line 5; Fig	g. 1	1-5
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