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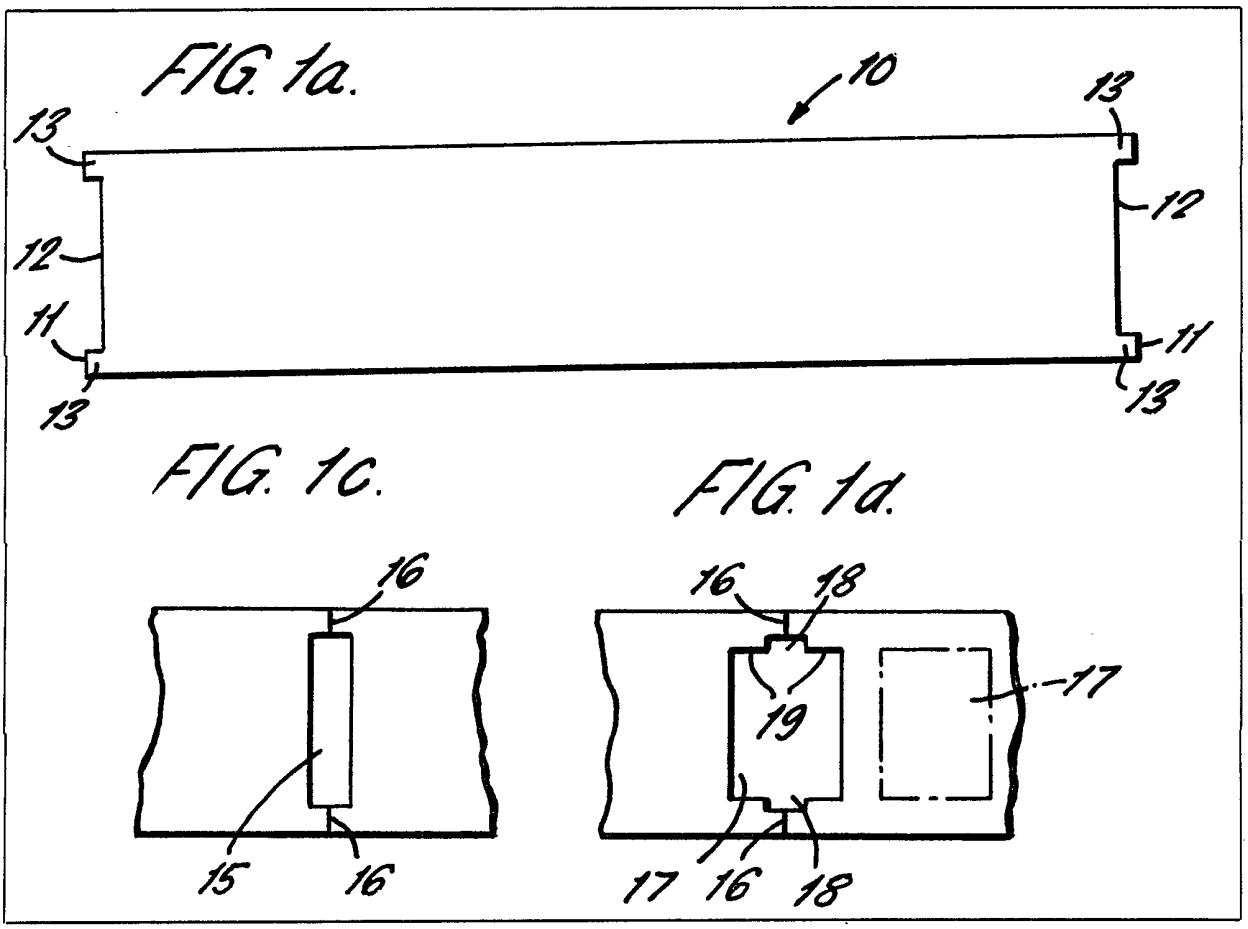
(54) Rolling bearing cage

(57) In the method of producing a rolling bearing cage a strip of metal (10) having recesses (12) at its ends is bent to form a ring and the abutting edges (11) are welded together to form joints (16). The recesses (12) form one or more apertures (15). Pockets (17) to receive rollers or balls are then punched out from the ring, the punch tool and the weld joints (16) not contacting each other since the pocket adjacent the joints has recesses (18) which previously formed part of the aperture(s) (15). Thus only short weld joints (16) are required.



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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

FIG. 1a.

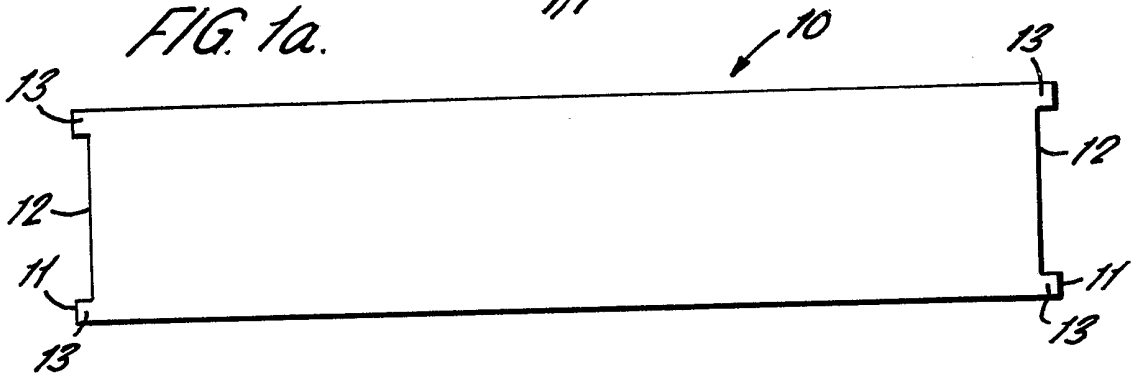


FIG. 1b.

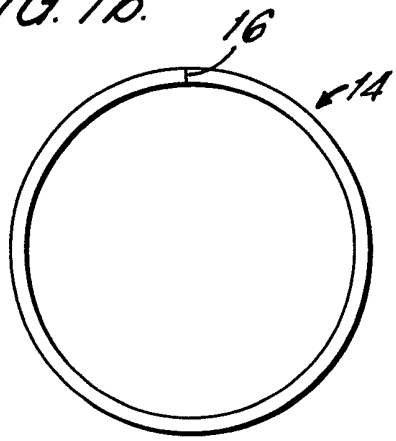


FIG. 1c.

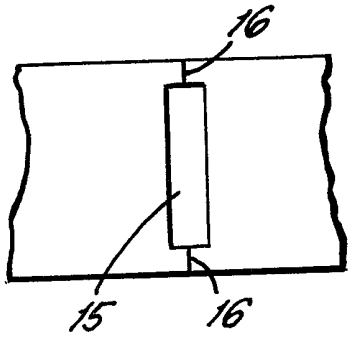


FIG. 1d.

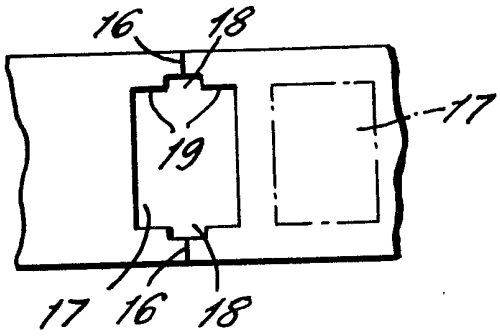
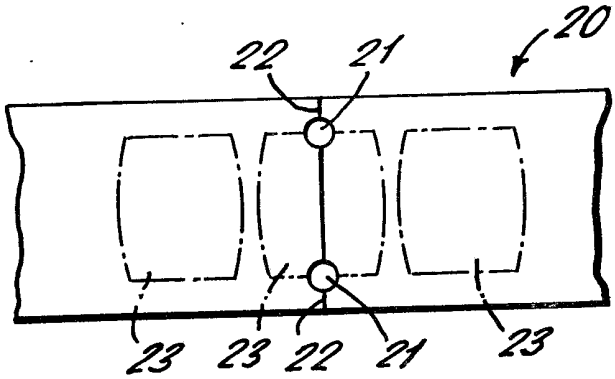


FIG. 2.



SPECIFICATION

A method of producing a rolling bearing cage and a cage produced by the method

This invention is concerned with a method of producing a cage for a rolling bearing and a cage produced by the method.

Specification US 33 65 775 discloses a method of producing a cage for a rolling bearing in which a strip of metal is punched with apertures in order to produce pockets, a recess providing half a pocket being formed at each end of the strip; the strip is bent to form a ring with the ends abutting each other; and the ends are welded together. This method has the advantage that only two short weld joints are necessary, one each end of the recesses forming one pocket. However welding the ends together after the pockets are formed can lead to distortion of that one pocked formed by the two recesses, and there can be inaccuracies in the spacing of the pockets by forming the pockets before bending the strip. Also weld material can project into that one pocket.

Utility model specification DE 73 22 195 discloses a similar method. In this method, to prevent weld material projecting into that one pocket, at each end the corners where the transverse edge of the free end of the strip meets the longitudinal edges of the recess at that end are parallel.

Specification US 3699793 discloses also a method in which a strip of metal is bent to form a ring, the abutting ends are welded and then the pockets are punched from the ring. This sequence of steps does have advantages in terms of accuracy of the spacing of the pockets and the shape and size of the pockets. However problems can arise if the punch tool hits the weld joint. Since the weld joint is stronger and thicker than the rest of the strip metal, the punch tool can be damaged and fail prematurely. To avoid this the weld joint is arranged between two adjacent pockets. This means however that the weld joint extends all the way axially along the cage with a consequent increase in labour and material.

The subject of this invention is a method of producing a cage for a rolling bearing and a cage produced by the method in which there are relatively short weld joints, in which the punch tool does not hit a weld joint and in which material of the weld joint does not project into the pocket.

In one aspect the invention provides a method of producing a cage for a rolling bearing comprising the steps of:

i) providing an elongate strip of metal with recesses at its ends;

ii) bending the strip to form a ring with the ends of the strip abutting each other;

iii) welding the ends together to provide two weld joints extending from the opposite circumferentially extending edges of the ring axially toward each other; and

iv) punching radial apertures in the ring to provide pockets; all such that one pocket has two recesses each extending axially away from the other and from an edge of the pocket nearer the adjacent circumferentially extending edge of the ring toward that circumferentially extending edge, the recesses of the one pocket being provided by the recesses at the ends of the strip, and each weld joint stops at the nearer edge of the adjacent recess.

In another aspect the invention provides a method of producing a sheet metal cage for a rolling bearing comprising the steps of:

i) providing an elongate strip of sheet metal, each free end of which has an edge extending across the length of the strip and one or more recesses spaced from the longitudinally extending side edges of the strip and extending lengthwise of the strip from the edge of the free end;

ii) bending the strip about an axis extending across the length of the strip to form a ring with the edges of the free ends abutting each other, the one or more recesses of each end together forming one or more radial apertures;

iii) welding the abutting edges together to form two joints extending from the opposite circumferentially extending edges of the ring toward each other and to the nearer edge of the or the adjacent radial aperture; and

iv) punching further radial apertures in the ring in order to produce pockets for rolling bodies such that one pocket has two recesses provided by the first said radial aperture or apertures, each recess extending axially and away from the other and from an edge of the pocket nearer the adjacent circumferentially extending edge of the ring towards that circumferentially extending edge, and the two weld joints each stop at the nearer edge of the adjacent recess.

The recesses at the ends of the metal strip are advantageously formed at the same time as the strip is cut to shape and length. Wide enough strips are left between the longitudinally extending side edges of the strip and the nearer edge of the or the adjacent recess so that the ring is strong enough when it is formed for its intended purpose. The transverse dimension of the single recess or the transverse distance between the further edges of two or more recesses is longer than the length of the pocket to be punched in the ring so that the punch tool will not contact the weld joint and also so that material of the weld joint will not project into the pocket proper.

When the strip is bent to form a circle and the ends of the strip abut each other and are welded together, the circumferential dimension of the single radial aperture formed or the circumferential distance between the further edges of two or more recesses must be

no greater and is preferably smaller than the circumferential dimension of the pocket. Thus the punch tool will overlap circumferentially the recess or recesses.

When the ends of the strip abut each other a rectangular radial aperture may be formed, each end of the strip having a rectangular recess. Preferably the rectangular radial aperture has rounded corners. Thus no notch effect will occur when the cage is subject to extreme loads, and in the production of the cage no stress cracks will occur during welding and cooling.

When the ends of the strip abut each other, two circular radial apertures may be formed, each end of the strip having two semi-circular recesses.

A strip having two semi-circular recesses at each end can be produced from a long strip of metal by forming circular apertures using a circular section punch and then cutting across the long strip through the centres of the circles. The semi-circular recesses are preferably so arranged side by side across the length of the strip of metal that when the pocket is punched in the ring they form semi-circular recesses in the edges of the pocket.

The invention also includes a cage produced by a method according to the invention.

In the cage the one pocket and its recesses may be symmetrical about a plane in which lie the axis of the cage and the two weld joints.

Embodiments of the invention will now be described by way of example, reference being made to the accompanying drawings, of which:

Figures 1a to 1d show steps in the production of a sheet metal cage from a strip with rectangular recesses at its ends; and

Figure 2 shows one step in the production of a sheet metal cage from a strip with semi-circular recesses at its ends.

Fig. *1a* shows an elongate strip of sheet metal 10 which may be punches from a sheet of metal or cut from a longer strip. Each free end of the strip has an edge 11 extending across the length of the strip. In the punching or cutting operation, rectangular recesses 12 are provided one at each free end of the strip 10. Each recess 12 is spaced from the longitudinally extending side edges of the strip 10 so as to leave two projections 13.

The next step in the method is to bend the strip 10 about an axis entending across the length of the strip to form a ring 14, as shown in Fig. 1*b*, with the edges 11 of the projections 13 abutting each other. The two recesses 12 at the ends of the strip 10 now form a rectangular radial aperture 15 as shown in Fig. 1*c*. The abutting edges 11 are then welded together to form two joints 16 extending from the opposite circumferentially extending edges of the ring 14 toward each other and to the nearer edge of the rectangular radial aperture 15.

The final step in the method is shown in Fig. 1*d* and comprises punching further radial apertures in the ring 14 in order to produce pockets 17 for rolling bodies. One pocket is punched so that it is symmetrical to the rectangular radial aperture 15. The rectangular radial aperture 15 is longer axially than the one pocket 17 so that the pocket has two recesses 18 provided by the rectangular radial aperture. Each recess 18 extends axially and away from the other recess and from an edge of the pocket 17 nearer the adjacent circumferentially extending edge of the ring 14 toward that circumferentially extending edge. Each weld joint 16 stops at the nearer edge of the adjacent recess 18 so that the punch tool when punching out the one pocket 17 does not contact the weld joints and material of the weld joint does not project into the pocket proper.

The circumferential dimension of the pocket 17 is greater than the circumferential dimension of the rectangular radial aperture 15 so that material of the ring 14 to the circumferential sides of the rectangular radial aperture is punched away when the pocket is being made. This ensures that overall the pocket 17 has the dimensions of the punch and so is accurately made.

The cage shown in Fig. 1*d*, comprising the ring 14 when all the pockets 17 have been punched, is for a cylindrical roller bearing. The circumferentially extending edges 19 of the one pocket 17 are only reduced in length by the small amount of the recesses 18 so that the condition where the ends of the roller contact these edges 19 is a little different from when these edges are of the full length. Weld material from the weld joint 16 does not project into the pocket 17 proper and so will not contact the ends of the roller in that pocket. Consequently, the weld material does not have to be removed and so no finishing work is necessary.

The recesses 12 in the ends of the strip 10 forming the rectangular radial aperture or slot 15 can be made relatively narrower since there purpose is to provide an edge spaced axially from the pocket 17 proper at which the weld joint 16 stops. In the drawings the width of the recesses 12 and of the rectangular radial aperture 15 is exagerated in the interests of clarity.

Fig. 2 shows a step in another embodiment of the invention. In this embodiment a strip of sheet metal is provided which at each end has two semi-circular recesses spaced from each other and from the longitudinally extending side edges of the strip.The strip may be cut from a longer strip of metal which has had two circular holes punched in it, the cut being made across the strip and through the centres of the circles to provide an end with semi-

circular recesses.

The strip is then bent round an axis extending across the length of the strip to form a ring 20 shown in Fig. 2. With the straight edges of the free ends abutting each other, the two semi-circular recesses of each end together form two circular radial apertures 21.

The abutting edges of the free ends are then welded together to form two joints 22 extending from the opposite circumferentially extending edges of the ring toward each other and to the nearer edge of the adjacent circular radial aperture 27 as shown in Fig. 2.

The next step is to punch further radial apertures in the ring 20 in order to produce pockets 23 for rolling bodies. As with the first embodiment one pocket 23 is punched so that it is symmetrical to the circular radial apertures 21. The axial dimension of the one pocket 23 and the disposition and size of the circular radial apertures 21 are such that when the one pocket is punched, the pocket has two recesses provided by the circular radial apertures 21. Each recess extends axially, and away from the other, and from an edge of the pocket nearer the adjacent circumferentially extending edge of the ring 20 toward that circumferentially extending edge of the ring. Each weld joint 22 stops at the nearer edge of the adjacent recess so that the punch tool, when punching out the one pocket 23 does not contact the weld joints and material of the weld joints does not project into the pocket proper.

The cage, when produced, is for a self-aligning roller bearing.

The method according to the invention is not limited to producing the cages illustrated and described and is equally applicable to producing cages for other bearings, such as ball bearings, taper roller bearings and needle bearings for example.

CLAIMS

1. A method of producing a cage for a rolling bearing comprising the steps of:

i) providing an elongate strip of metal with recesses at its ends;

ii) bending the strip to form a ring with the ends of the strip abutting each other;

iii) welding the ends together to provide two weld joints extending from the opposite circumferentially extending edges of the ring axially toward each other; and

iv) punching radial apertures in the ring to provide pockets; all such that one pocket has two recesses each extending axially away from the other and from an edge of the pocket nearer the adjacent circumferentially extending edge of the ring toward that circumferentially extending edge, the recesses of the one pocket being provided by the recesses at the ends of the strip, and each weld joint stops at the nearer edge of the adjacent recess.

2. A method of producing a sheet metal cage for a rolling bearing comprising the steps of:

i) providing an elongate strip of sheet metal, each free end of which has an edge extending across the length of the strip and one or more recesses spaced from the longitudinally extending side edges of the strip and extending lengthwise of the strip from the edge of the free end;

ii) bending the strip about an axis extending across the length of the strip to form a ring with the edges of the free ends abutting each other, the one or more recesses of each end together forming one or more radial apertures;

iii) welding the abutting edges together to form two joints extending from the opposite circumferentially extending edges of the ring toward each other and to the nearer edge of the or the adjacent radial aperture; and

iv) punching further radial apertures in the ring in order to produce pockets for rolling bodies such that one pocket has two recesses provided by the first said radial aperture or apertures, each recess extending axially and away from the other and from an edge of the pocket nearer the adjacent circumferentially extending edge of the ring towards that circumferentially extending edge, and the two weld joints each stop at the nearer edge of the adjacent recess.

3. A method as claimed in claim 1 or 2, wherein when the ends of the strip abut each other a rectangular radial aperture is formed, each end of the strip having a rectangular recess.

4. A method as claimed in claim 3, wherein the rectangular radial aperture has rounded corners.

5. A method as claimed in claim 1 or 2, wherein when the ends of the strip abut each other two circular radial apertures are formed, each end of the strip having two semi-circular recesses.

6. A method of producing a cage for a rolling bearing substantially as herein described with reference to and as shown in the accompanying drawings.

7. A rolling bearing cage produced by a method as claimed in any preceding claim.

8. A rolling bearing cage as claimed in claim 7, wherein the one pocket and its recesses are symmetrical about a plane in which lie the axis of the cage and the two weld joints.

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