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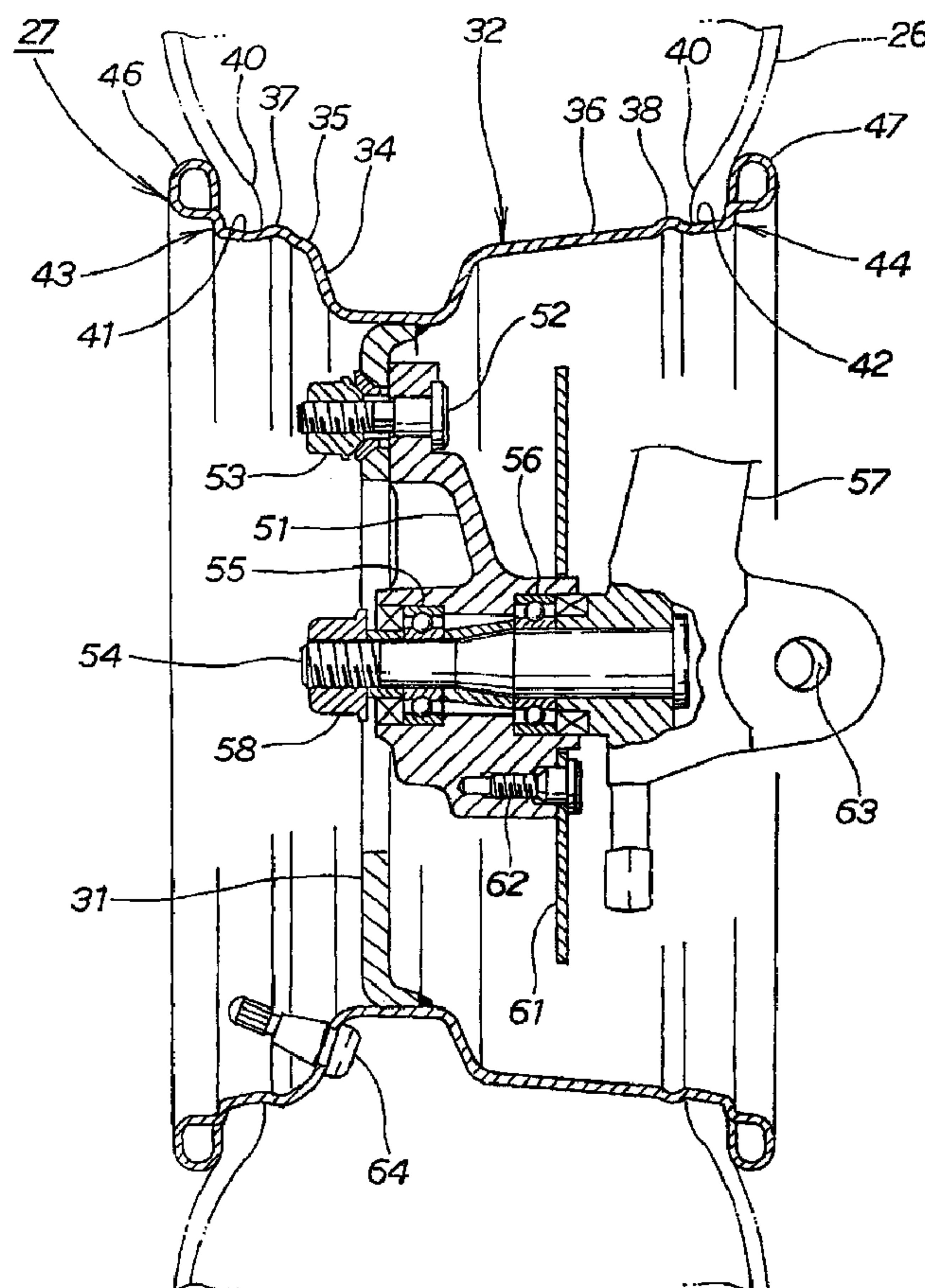
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(54) Title: WHEEL STRUCTURE



(57) Abrégé/Abstract:

A large-diameter part 72 the diameter of which is larger than the diameter in the center is provided at the edges of a rim 32 via parts having difference in a level 43, 44, curled parts 46, 47 are provided to both edges of the rim by curling the large-diameter part 72

(57) **Abrégé(suite)/Abstract(continued):**

and each end face 73 of the curled parts 46, 47 is touched to the parts having difference in a level 43, 44. The rigidity of the side of the edge of the rim can be enhanced by providing the parts having difference in a level to the rim, as a result, the rigidity of the whole wheel can be more enhanced and in addition, as a disc and the rim are not required to be thickened, the weight of the wheel can be prevented from being increased.

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ABSTRACT OF THE DISCLOSURE

A large-diameter part 72 the diameter of which is larger than the diameter in the center is provided at the edges of a rim 32 via parts having difference in a level 43, 44, curled parts 46, 47 are provided to both edges of the rim by curling the large-diameter part 72 and each end face 73 of the curled parts 46, 47 is touched to the parts having difference in a level 43, 44. The rigidity of the side of the edge of the rim can be enhanced by providing the parts having difference in a level to the rim, as a result, the rigidity of the whole wheel can be more enhanced and in addition, as a disc and the rim are not required to be thickened, the weight of the wheel can be prevented from being increased.

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TITLE: WHEEL STRUCTUREFIELD OF THE INVENTION

The present invention relates to wheel
5 structure favorable for further enhancing the rigidity.

BACKGROUND OF THE INVENTION

For the wheel structure of a vehicle,
10 particularly an all-terrain vehicle, for example,
Japanese utility model publication No. Sho 62-71003,
"Minor-diameter and wide wheel" is known.

In Figs. 1 and 2 of the above-mentioned publication,
the minor-diameter and wide wheel in which discs 15a, 15b
15 which are the respective bottoms of two cup-shaped rim
halves 2A, 2B (characters and reference numbers used in
the publication are used as they are) are united, the
edges of these rim halves 2A, 2B are respectively curled
in the reverse shape of U and ears 11a, 11b are formed is
20 disclosed.

The minor-diameter and wide wheel is a wheel the
width, that is, the rim width of which (distance between
the inner surface 23 of the ear 11a and the inner surface
23 of the ear 11b) is large, compared with the diameter,
25 for example, the outside diameters of beads 12a, 12b.

For such a wheel, it is estimated that when external
force acts upon the wheel from a tire, the flexure of the
side of each ear 11a, 11b becomes larger, compared with
the flexure of the side of each disc 15a, 15b because
30 distance from each disc 15a, 15b respectively attached to
the side of a vehicle body to each bead 12a, 12b for
holding a tire is large. Therefore, it is desirable that
the rigidity of the side of the ears 11a, 11b is higher.
However, in case the rim halves 2A, 2B are thickened to
35 enhance the rigidity, the weight is increased.

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Then, the object of the invention is to provide wheel structure the rigidity of which is more enhanced without increasing the weight.

5 SUMMARY OF THE INVENTION

To achieve the object, the present invention is based upon a wheel formed by a disc and a rim and is characterized in that a larger-diameter part the diameter of which is larger than the diameter in the center is
10 provided at the edge of the rim via a part having difference in a level, a curled part is provided to both edges of the rim by curling the larger-diameter part and the end of the curled part is touched to the part having difference in a level.

15 As the part having difference in a level is provided to the rim, the rigidity of the side of the edge of the rim can be enhanced and as a result, the rigidity of the whole wheel can be more enhanced.

An aspect of the invention is characterized in that
20 a protrusion for reinforcement protruded inside a curled part is formed.

As the protrusion for reinforcement is formed, the rigidity of a wheel can be more enhanced by a part having difference in a level and a protrusion.

25 Another aspect of the invention is based upon a wheel formed by a disc and a rim and is characterized in that a protrusion for reinforcement is formed at both edges of a rim and a curled part is formed there.

As the protrusion for reinforcement is formed in
30 the rim, the rigidity of both edges of the rim can be enhanced by simple structure and as a result, the rigidity of the whole wheel can be enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

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Preferred embodiments of the invention are shown in the drawings, wherein:

Fig. 1 is a perspective view showing a vehicle adopting wheel structure (a first embodiment) according to the invention;

Fig. 2 is a sectional view viewed along a line 2-2 in Fig. 1;

Figs. 3 are sectional views for explaining the main part of the wheel structure (the first embodiment) according to the invention;

Figs. 4 are explanatory drawings for explaining the action of the wheel structure (the first embodiment) according to the invention;

Figs. 5 are explanatory drawings for comparing the action of wheel structure; and

Fig. 6 is a sectional view showing wheel structure (a second embodiment) according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to attached drawings, embodiments of the invention will be described below. The orientation of a reference number denotes that of the drawing.

Fig. 1 is a perspective view showing a vehicle adopting wheel structure according to the invention (a first embodiment), and a buggy 10 as a vehicle is composed of a handlebar 12 attached to a vehicle body 11 so that the handlebar can be turned, front wheels 13, 13 coupled to the handlebar 12 via a steering system not shown so that the front wheels can be steered, a seat 14 attached on the body 11, a power unit 15 including an engine and a transmission respectively arranged below the seat 14 and rear wheels 16, 16 driven by the power unit 15. A reference number 17 denotes a bumper, 18, 18 denote a front suspension unit, 21 denotes a head lamp, 22 denotes a front fender, 23 denotes a rear fender and

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24 denotes a muffler.

The front wheel 13 is composed of a tire 26 and a front wheel 27 having the wheel structure according to the invention and made of a light alloy or a steel plate.

5 The rear wheel 16 is composed of a tire 28 and a rear wheel 29 having the wheel structure according to the invention and made of a light alloy or a steel plate.

The front wheel 27 and the rear wheel 29 may be also the same or may be also different in off-set, the
10 diameter and the width of a rim, however, they shall be identical in the basic structure according to the invention.

Therefore, the front wheel 27 will be mainly described below.

15 The buggy 10 is a vehicle classified into an all terrain vehicle (ATV) and as it has a small turning circle and the operation is easy because it is light and compact, it is an off-road dedicated vehicle suitable for movement in agriculture, cattle breeding, hunting and
20 security guard and leisure.

Fig. 2 is a sectional view viewed along a line 2-2 in Fig. 1 and the front wheel 27 is a two-piece wheel composed of a disc 31 for attaching to the body side and a rim 32 substantially cylindrical and attached to the
25 periphery of the disc 31.

The rim 32 is composed of a rim drop part 34 provided in the approximate center, tapered parts 35, 36 provided on both sides of the rim drop part 34, humps 37, 38 built at each end of these tapered parts 35, 36, bead
30 seats 41, 42 respectively formed outside the humps 37, 38 to hold the inside of a bead 40 of the tire 26, parts having difference in a level 43, 44 respectively raised from these bead seats 41, 42, increasing the diameter of the rim and respectively extended in a direction of an
35 axle and curled parts 46, 47 acquired by curling each end

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of these parts having difference in a level 43, 44.

The rim drop part 34 is a part for fitting the bead 40 of the tire 26 when the tire 26 is attached or detached.

5 The humps 37, 38 are an annular convex portion for preventing the tire 26 from respectively slipping from the bead seats 41, 42.

10 The curled parts 46, 47 are a part provided to enhance the rigidity of the end of the front wheel 27 and the parts having difference in a level 43, 44 are a part provided to further enhance the rigidity of the end of the front wheel 27.

15 A reference number 51 denotes a hub for attaching the front wheel 27 with a bolt 52 and a nut 53, 54 denotes an axle that supports the hub 51 via bearings 55 and 56 so that the hub can be turned, 57 denotes a knuckle to which the axle 54 is attached, 58 denotes a nut screwed on the axle 54 to fix the bearings 55, 56, 61 denotes a disc for a disc brake, 62 denotes a bolt for
20 attaching the disc 61 to the hub 51, 63 denotes a hole for attaching a swing shaft of the knuckle 57, 64 denotes a tire valve and 65 denotes a washer for a nut for receiving the nut 53.

25 Figs. 3A to 3F are sectional views for explaining the main part of the wheel structure (the first embodiment) according to the invention, Fig. 3A shows this embodiment and Figs. 3B to 3F show transformed examples. In Figs. 3A to 3F, the structure on one curled side of the rim is respectively shown, the sectional form
30 of the structure on the other curled side is symmetrical with that of the structure on one curled side and the description is omitted.

35 As shown in Fig. 3A, the part having difference in a level 43 is composed of a flanged rising part 71 outside the radius from the bead seat 41 and a large-diameter

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part 72 as a part the diameter of which is made larger than that of the bead seat 41 by extending in a direction of the axle (left in Fig. 3A) on the way of the rising part 71.

5 A curled part 46 is an annular part the end face 73 of which is touched to or located close to a part close to the rising part 71 of the large-diameter part 72 first by bending the side of the end of the large-diameter part 72 outside the radius and next by bending it so that it
10 makes a U-turn. A reference number 74 denotes a straight part provided to the curled part 46 and the straight part is a part touched to the side of the bead 40 of the tire. A reference number 75 denotes a scupper for draining rainwater in the curled part 46.

15 In Fig. 3B, an example that a protrusion 77 for reinforcement protruded outside the radius is annularly formed in the large-diameter part 72 shown in Fig. 3A is shown.

 In Fig. 3C, an example that a curled part 46 is
20 formed by curling the side of the end of the bead seat 41 and a protrusion 77 protruded outside the radius is formed in an extended part 78 of the bead seat 41 is shown.

 In Fig. 3D, an example that a first flanged rising
25 part 81 is formed by making the bead seat 41 rise outside the radius, a second rising part 82 is formed by bending the outside of the first rising part 81 on the side distant from the mounted tire 26 and extending the outside outside the radius, a curled part 83 is formed by
30 bending the second rising part 82 on the side further distant from the tire 26 until the second rising part makes a U-turn and next bending the second rising part on the side of the tire 26 and the end face 73 is touched to or located close to the first rising part 81 is shown.

35 An uneven part 84 is formed in the first rising part

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81 and the second rising part 82.

In Fig. 3E, an example that a protrusion 77 protruded inside and outside the radius is formed in the curled part 83 shown in Fig. 3D is shown.

5 In Fig. 3F, an example that a flanged rising part 85 is formed by making the bead seat 41 rise outside the radius, a curled part 86 is formed by bending the rising part 85 on the side distant from the tire until it makes a U-turn and next by bending the rising part on the side
10 of the tire, a protrusion 77 is formed in the curled part 86 and the end face 73 is touched to or located close to the rising part 85 is shown.

Next, the action of the wheel structure described above will be described.

15 Figs. 4A and 4B are explanatory drawings for explaining the action of the wheel structure (the first embodiment) according to the invention.

Fig. 4A shows a state in which a tie rod end 91 and a tie rod 92 respectively on the side of a handlebar are
20 coupled to the front wheel 27 via the hub 51 and the knuckle 57 to steer the front wheel.

As shown in Fig. 4B, when the handlebar is turned by a predetermined angle, the tie rod 92 and the tie rod end 91 respectively coupled to the handlebar are pulled in a
25 direction shown by an arrow ① and as a result, the knuckle 57 is swung in a direction shown by an arrow ② with a hole 63 for a shaft in the center.

As a result, the front wheel 27 attached to the hub 51 is tilted.

30 Figs. 5A and 5B are explanatory drawings for comparing the action of the wheel structure, Fig. 5A is an enlarged view showing the main part of the invention shown in Fig. 4B and Fig. 5B shows a comparative example.

As shown in Fig. 5A, C1 shows distance between the
35 rim of the front wheel 27 and the tie rod end 91.

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As shown in Figs. 5A and 5B, assuming that distance between a curled part 202 formed at the rim 201 of a wheel 200 and a tie rod end 203 when the handlebar is turned by the same angle (a predetermined angle) as the angle shown in Fig. 4B is $C2$, $C1 > C2$.

That is, in this embodiment, as the large-diameter part 72 is displaced outside the radius because the parts having difference in a level 43, 44 (see Fig. 2) are provided to the rim of the front wheel 27, the distance $C1$ can be larger than the distance $C2$ between the curled part 202 in which no part having difference in a level is provided as in the comparative example of the wheel 200 and the tie rod end 203 when the handlebar is turned by the predetermined angle.

Therefore, in this embodiment, the handlebar can be further turned until the distance $C2$ is increased up to the distance $C1$ and hereby, the maximum steering angle of the front wheel can be increased. Therefore, the minimum turning radius of the vehicle can be reduced and a small turning circle of the vehicle can be reduced.

Fig. 6 is a sectional view showing wheel structure (a second embodiment) according to the invention, and a front wheel 100 is a three-piece wheel composed of a cup-shaped outer wheel 101, a cup-shaped inner wheel 102 connected to the outer wheel 101 by welding, a center plate 103 provided between the outer wheel 101 and the inner wheel 102, a washer for a nut 105 (only one is shown) for connecting the outer wheel 101, the center plate 103 and the inner wheel 102 and receiving a nut 104 (only one is shown), a center cap 106 fitted into center holes 101a, 103a, 102a made in the respective centers of the outer wheel 101, the center plate 103 and the inner wheel 102 and a tire valve 107.

The outer wheel 101 is composed of an outer disc 111 as a disc and an outer rim 112 connected to the outer

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disc 111 as a substantially cylindrical rim.

The outer rim 112 has a curled part 46 and a part having difference in a level 43 as in the first embodiment.

5 The inner wheel 102 is composed of an inner disc 115 as a disc and an inner rim 116 connected to the inner disc 115 as a substantially cylindrical rim.

10 The inner rim 116 has a curled part 47 and a part having difference in a level 44 as in the first embodiment.

A reference number 120 denotes a wheel attaching bolt, 121 denotes a brake drum, 122 denotes a hub, 123 denotes a drive shaft, 124 denotes a bearing and 125 denotes a knuckle.

15 As described in relation to Figs. 2 and 3A, the first embodiment of the invention is based upon the front wheel 27 and the rear wheel 29 (see Fig. 1) respectively formed by the disc 31 and the rim 32 and is characterized in that the large-diameter part 72 the diameter of which
20 is larger than the diameter in the center is provided to the edges of the rim 32 respectively via parts having difference in a level 43, 44, the curled parts 46, 47 are provided to both edges of the rim 32 by curling the large-diameter part 72 and the respective end faces 73 of
25 the curled parts 46, 47 are touched to the parts having difference in a level 43, 44.

30 The rigidity of the side of the edge of the rim 32 can be enhanced by providing the parts having difference in a level 43, 44 to the rim 32, as a result, the rigidity of the whole front wheel 27 and the whole rear wheel 29 can be enhanced and in addition, as the disc 31 and the rim 32 are not required to be thickened, the weight of the front wheel 27 and the rear wheel 29 can be prevented from being increased.

35 Also, a tire the aspect ratio of which is larger can

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be mounted on the front wheel 27 and the rear wheel 29 the respective rigidity of which is enhanced by providing the parts having difference in a level 43, 44.

Further, a small turning circle of the vehicle can
5 be reduced by providing the parts having difference in a level 43, 44 as described above.

The second embodiment of the invention is characterized in that a protrusion for reinforcement 77 respectively protruded inside curled parts 46, 47, 83, 86
10 is formed.

The rigidity of a front wheel 27 and a rear wheel 29 can be more enhanced by the parts having difference in a level 43, 44 and the protrusion 77 because the protrusion for reinforcement 77 is formed.

15 A third embodiment of the invention is based upon a front wheel 27 and a rear wheel 29 respectively formed by a disc 31 and a rim 32 and is characterized in that a protrusion for reinforcement 77 is formed at the edges of the rim 32 and curled parts 46, 47 are formed there.

20 The rigidity of both edges of the rim 32 can be more enhanced with simple structure because the protrusion for reinforcement 77 is formed at the rim 32 and as a result, the rigidity of the whole front wheel 27 and the whole rear wheel 29 can be enhanced.

25 The shape of the curled part in the invention is not limited to the reverse shape of U and may be also circular, rectangular, triangular, semicircular or elliptic.

The invention produces the following effect owing to
30 the above-mentioned configuration.

In the wheel structure according to the present invention, as the larger-diameter part the diameter of which is larger than the diameter in the center is provided to the edges of the rim via the parts having
35 difference in a level, the curled part is provided to

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both edges of the rim by curling the larger-diameter part and the end of the curled part is touched to the part having difference in a level, the rigidity of the side of the edge of the rim can be enhanced by providing the
5 parts having difference in a level to the rim and as a result, the rigidity of the whole wheel can be more enhanced. Also, as the disc and the rim are not required to be thickened, the weight of the wheel can be prevented from being increased.

10 In the wheel structure according to an embodiment of the invention, as the protrusion for reinforcement protruded inside the curled part is formed, the rigidity of the wheel can be more enhanced by the parts having difference in a level and the protrusions.

15 In the wheel structure according to another embodiment of the invention, as the protrusion for reinforcement is formed at the edges of the rim and the curled part is formed there, the rigidity of both edges of the rim can be more enhanced by the protrusions and
20 the curled parts with simple structure and as a result, the rigidity of the whole wheel can be enhanced.

Although various preferred embodiments of the present invention have been described herein in detail,
25 it will be appreciated by those skilled in the art, that variations may be made thereto without departing from the spirit of the invention or the scope of the appended claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A wheel structure comprising:

a rim including a central portion, an inner portion and an outer portion;

an inner curled portion formed on a terminal end of said inner portion joined to said central portion by a diameter extending segment; and

an outer curled portion formed on a terminal end of said outer portion joined to said central portion by a diameter extending segment;

said central portion being of a diameter less than the diameter of said inner and outer curled portions;

said inner curled portion including a terminating end surface in abutment with said associated diameter extending segment such that said inner curled portion forms an aligned extension of said diameter extending segment to stiffen said wheel structure;

and said outer curled portion including a terminating end surface in abutment with said associated diameter extending segment such that said outer curled portion forms an aligned extension of said diameter extending segment to stiffen said wheel.

2. A wheeled structure as claimed in claim 1 wherein said inner curled portion includes an inwardly extending deformation to reinforce said inner curled portion.

3. A wheeled structure as claimed in claim 1 or claim 2 wherein said outer curled portion includes an inwardly extending deformation to reinforce said outer curled portion.

4. The wheel structure according to claim 1, wherein a protrusion for reinforcement is formed within said outer curled portion, said protrusion for reinforcement protruding inside the outer curled portion of said outer portion.

5. The wheel structure according to claim 1 or 4, wherein a protrusion for reinforcement is formed within said inner curled portion, said protrusion for reinforcement protruding inside the inner curled portion of said inner portion.

6. The wheel structure according to claim 1, and further including an opening formed in said outer curled portion for providing drainage for water.

7. The wheel structure as claimed in any of the claims 1 to 6 wherein said inner portion is of a diameter greater than said outer portion.

Fig. 1

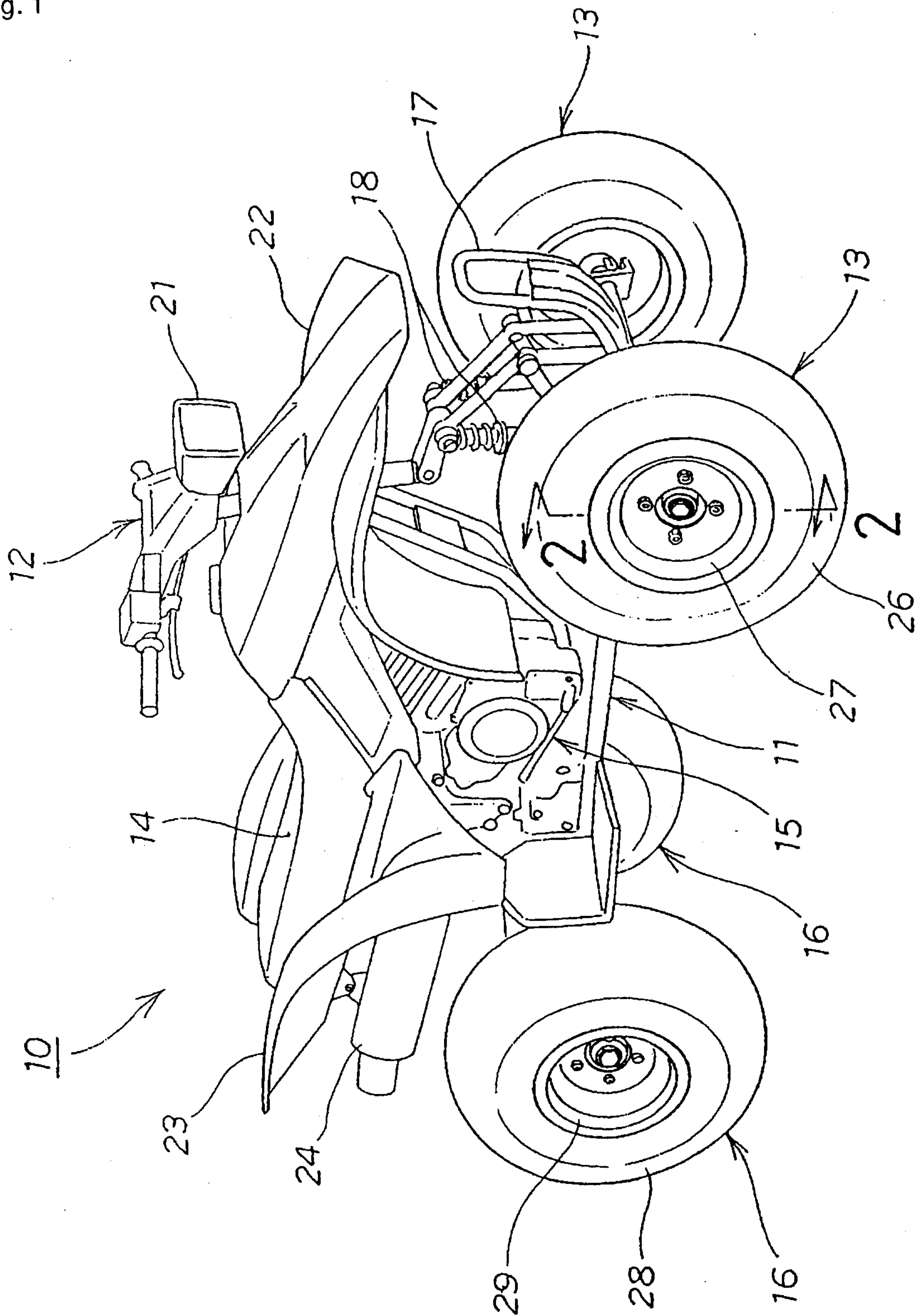


Fig. 2

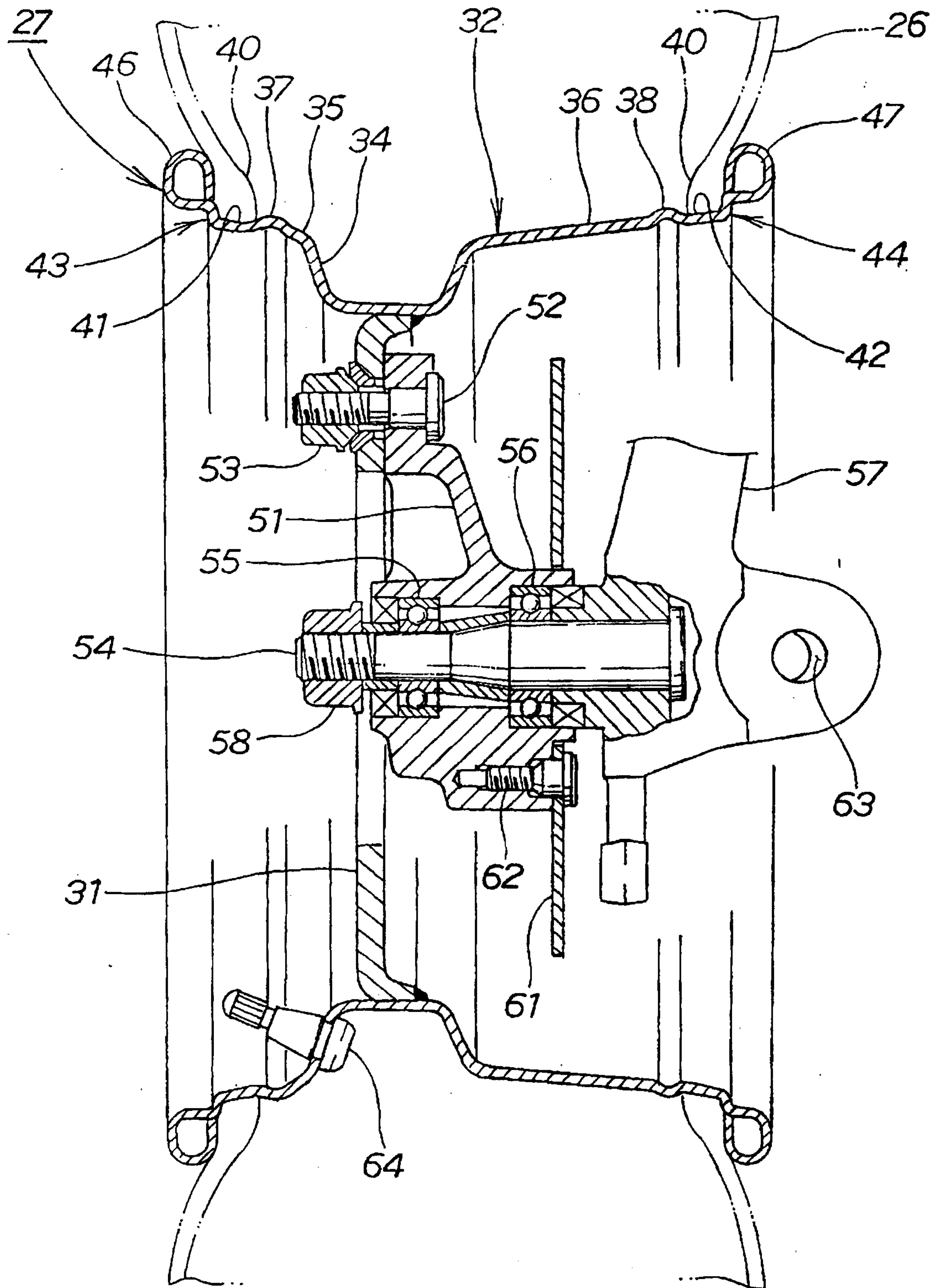


Fig. 3

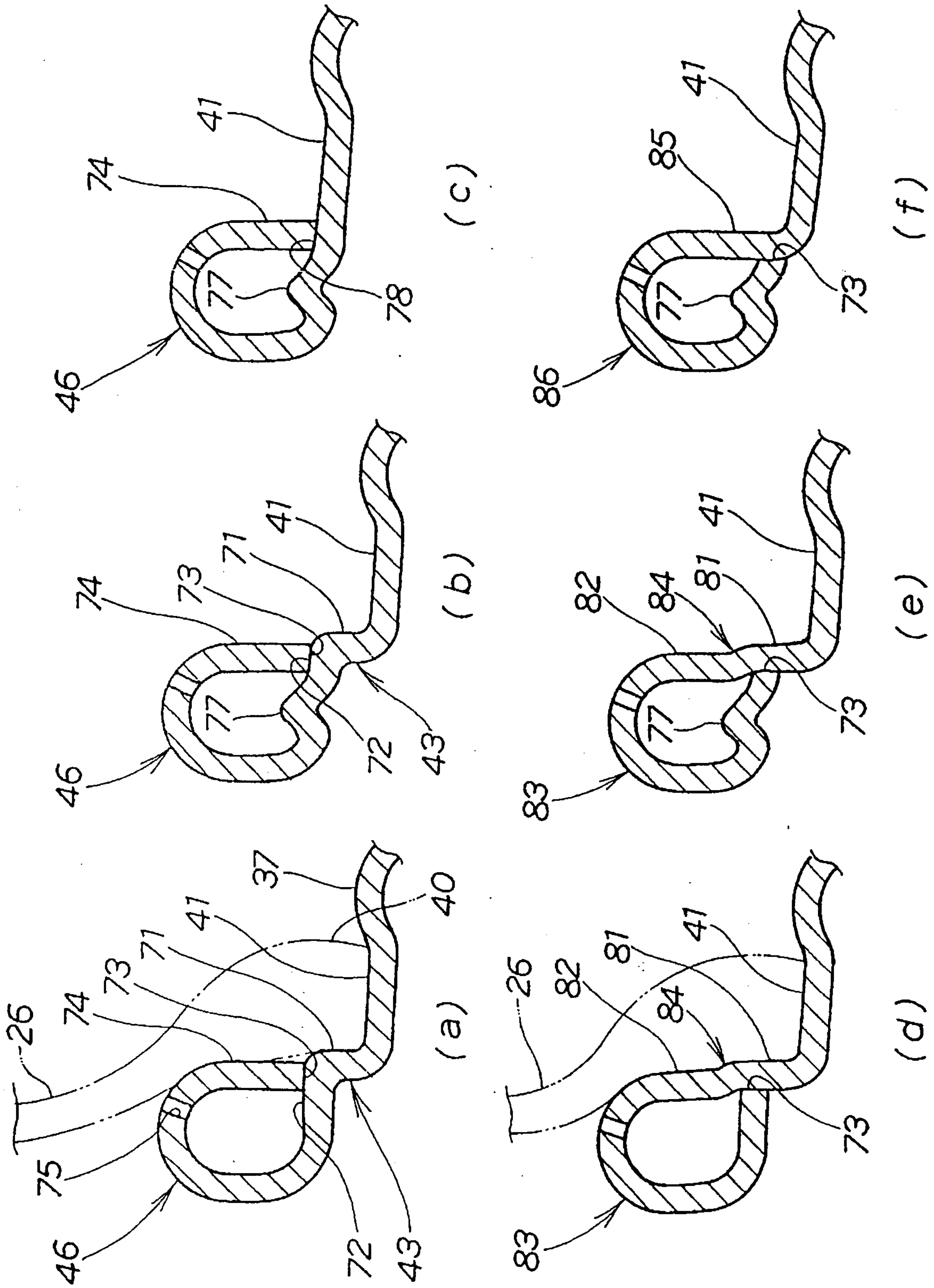


Fig. 4

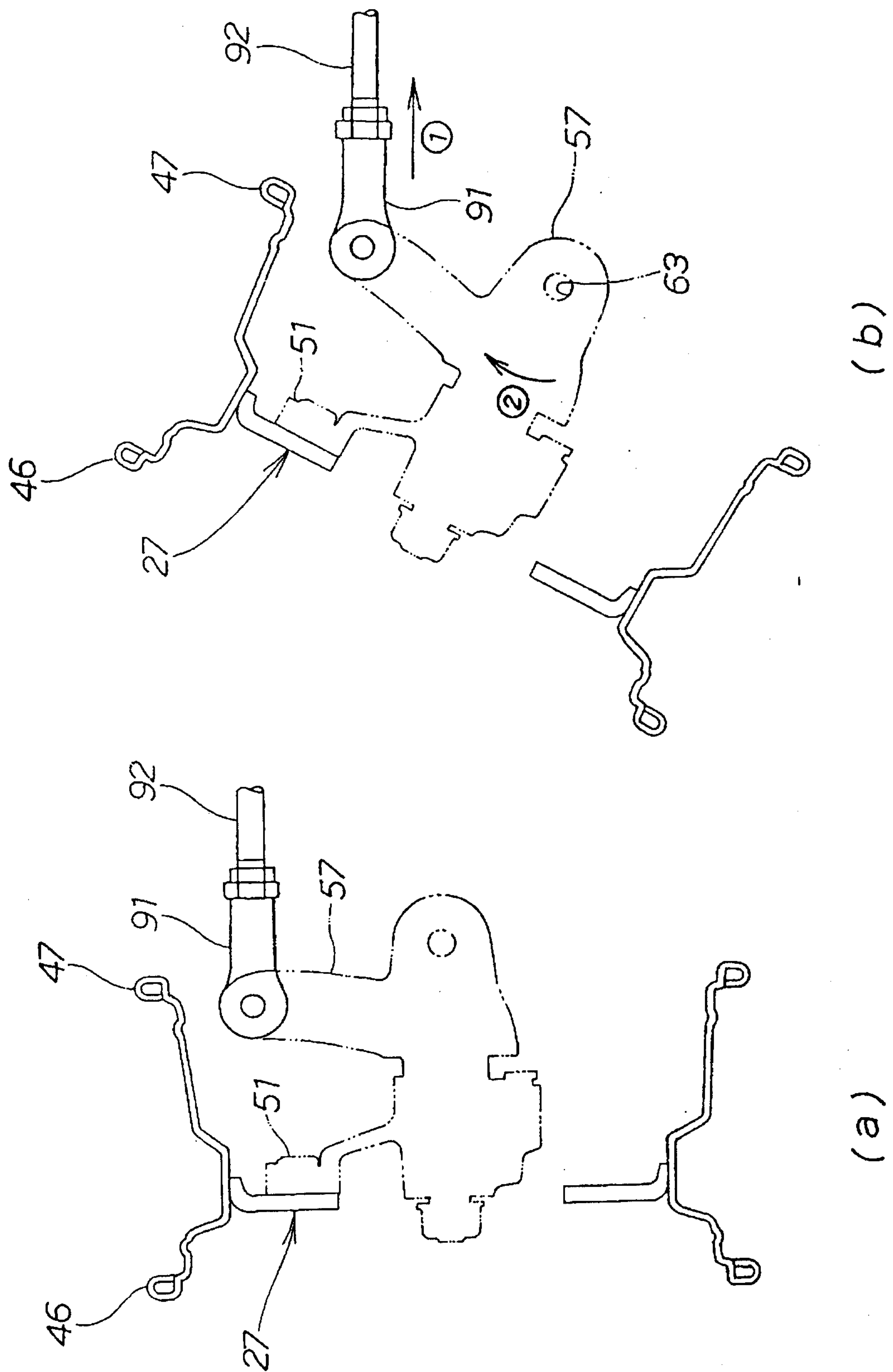
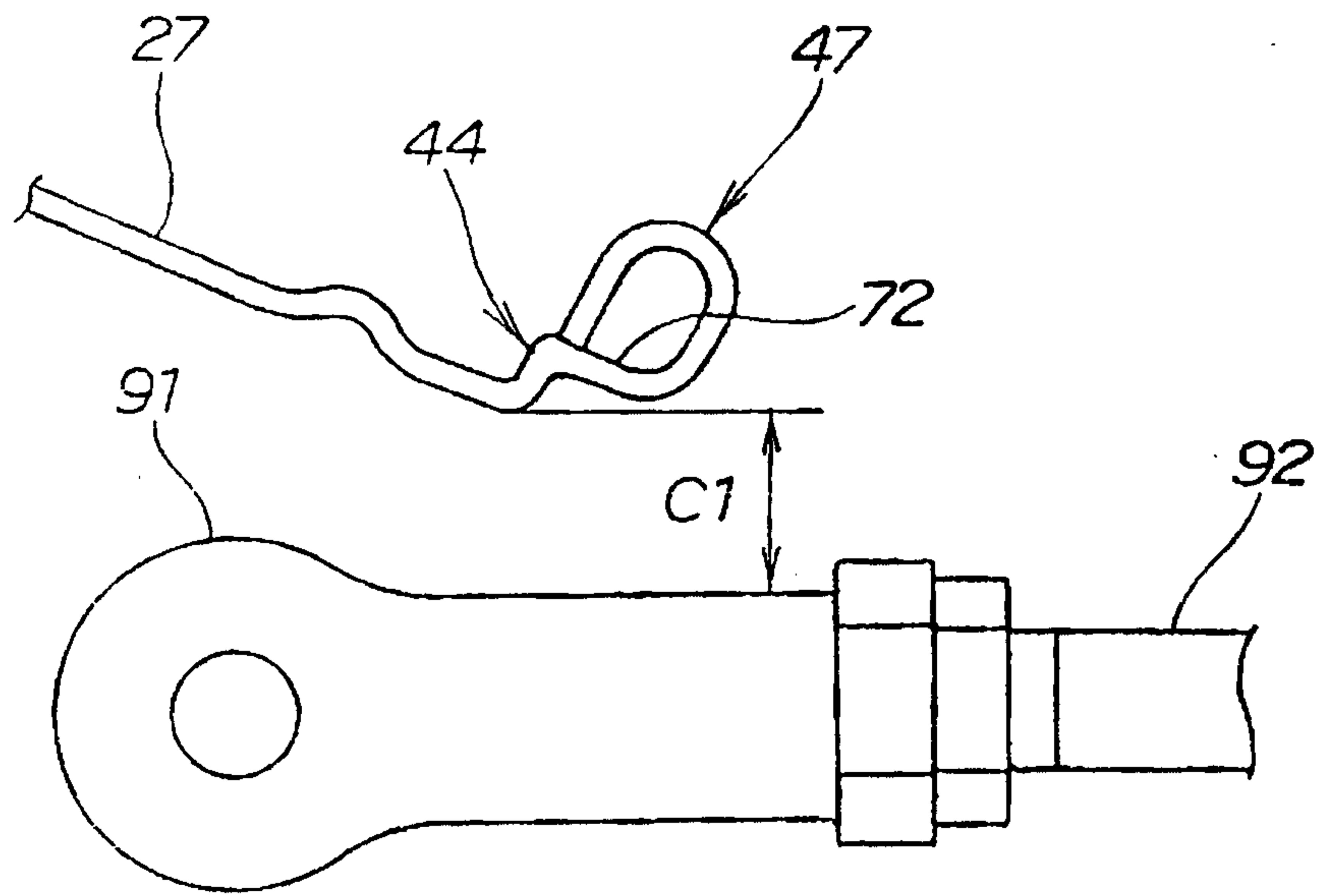
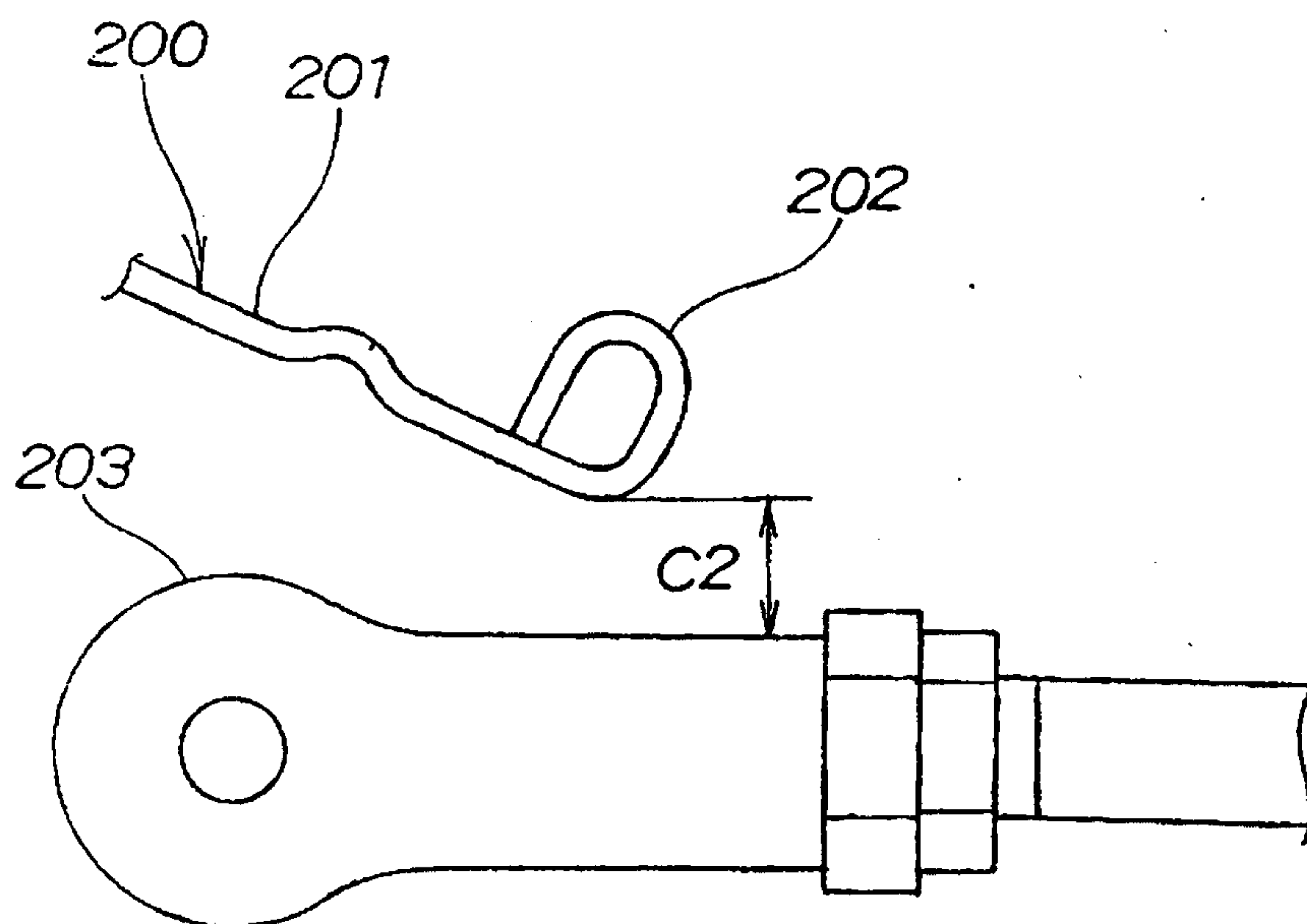


Fig. 5



(a)



(b)

Fig. 6

