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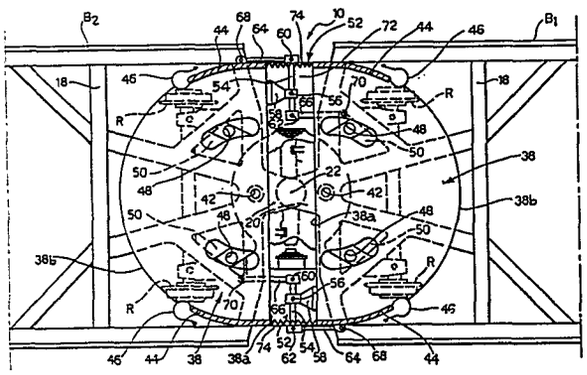
(54) Communicating passage between the bodies of two coaches of a railway or tramway vehicle, and a railway or tramway vehicle using this communicating passage.

(57) A communicating passage (10) between the bodies (B1, B2) of two coaches of a railway or tramway vehicle comprises two rotating passage members (30, 32) including two substantially semicircular lower platforms (38) articulated to the ends (12, 20) of the two bodies (B1, B2) about respective vertical pivots (40, 42), an intermediate connecting member (34) between the two passage members, and lateral centering means (52, 80) which interconnect the two lower platforms (38) with the lower ends of the bodies in order to keep the transverse axis (A) of the communicating passage (10) constantly oriented substantially in conformity with the bisector of the angle formed between the longitudinal axes of the two bodies (B1, B2).



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Communicating passage between the bodies of two coaches of a railway or tramway vehicle, and a railway or tramway vehicle using this communicating passage.

The present invention relates in general to railway or tramway vehicles comprising two coaches with bodies which are articulated together at the bottom about a central articulation and communicate with each other through a communicating passage.

The object of the present invention is to provide a communicating passage shaped so as to allow the best possible utilisation of the space available for the passengers in the area of passageway between the two bodies, while ensuring convenient and easy movement of passengers through this passageway area, as well as permitting the vehicle the greatest adaptability to vertical differences in the level of the track (inclines, etc.).

In order to achieve this object, the present invention has as its subject a communicating passage between the bodies of two coaches of a railway or tramway vehicle, which are articulated together at the bottom about a central joint, characterised in that it comprises:

- two spaced-apart rotating passage members including an upper horizontal plate and a lower horizontal platform, which are substantially semicircular and are supported by the facing ends of the two bodies with their respective straight sides facing each other, the upper plates and lower platforms being articulated to the ends of the two bodies about respective upper and lower vertical pivots adjacent the median zones of their straight sides and situated on opposite sides with respect to the articulation between the two bodies, and vertical walls

which interconnect the ends of the curved sides of the lower platform and of the upper plate of each passage member,

- an intermediate connecting member between the two passage members, including a base wall, two side walls and an upper wall, which are elastically deformable and interconnect the edges of the two passage members, and
- lateral centering means which interconnect one end of the straight side of the lower platform of one of the passage members and the opposite end of the straight side of the lower platform of the other passage member with the lower ends of the two bodies in order to keep the transverse axis of the communicating passage constantly oriented substantially in conformity with the bisector of the angle formed between the longitudinal axes of the two bodies.

According to the invention, sliding bearing means are interposed between the lower platforms of the two passage members and the lower ends of the two bodies.

Moreover, the invention provides for a particularly advantageous application of the communicating passage defined above to a railway or tramway vehicle having a pair of bogies situated close the ends of the two bodies opposite to the articulation, and an intermediate bogie carrying the central articulation joint between the two bodies.

In this application, the communicating passage according to the invention ensures a better and more gradual connection between the two bodies when the vehicle is travelling round a bend, while ensuring a better

adaptation of the vehicle to any irregularities of the tracks, as a result of the independence of each body with respect to pitching and rolling movements.

The invention will now be described in detail with reference to the attached drawings, provided purely by way of non-limitating example, in which:

Figure 1 is a diagrammatic side elevational view of a railway or tramway vehicle provided with a communicating passage according to the invention,

Figure 2 is a diagrammatic plan view of the lower part of the communicating passage,

Figure 3 is a diagrammatic, partially-sectioned side elevational view of Figure 2,

Figures 4 to 6 illustrate diagrammatically the behaviour of the communicating passage when the vehicle is in motion.

Figure 7 illustrates a variant of Figure 2,

Figure 8 is a diagrammatic, partially-sectioned side elevational view of Figure 7, and

Figures 9 to 11 illustrate diagrammatically the behaviour of the communicating passage according to the variant of Figures 7 and 8 during the movement of the vehicle.

Referring first to Figure 1, a railway or tramway vehicle, generally indicated V, is formed by two coaches C1, C2 articulated to each other and connected by a central communicating passage 10 between the bodies B1, B2 of the coaches.

As may be seen in Figure 1, the vehicle V is provided close to the front end of the body B1 and the rear end of the body B2 with two conventional motor-bogies,

schematically indicated M1, M2.

The vehicle V is also provided with an intermediate support bogie P situated below the communicating passage 10. This support bogie P is of the type which is the subject of the Italian Patent Application No.67828-A/83 filed on the same date by the same Applicant and, for the sake of brevity, will not therefore be described in what follows. For the purposes of the present invention it is sufficient to say that the bogie P is provided with wheels R of a small diameter equal to approximately half (35 cm) the diameter of the wheels of the motor-bogies M1, M2, and with a secondary suspension constituted by a single central air spring S bearing above it a load-bearing base T. The shape of the support bogie P makes it possible to produce the vehicle V with a floor, generally indicated F in Figure 1, completely lowered along the entire length between the two bogies M1, M2, usually at a height of between 45 and 50 cm with respect to the level of the rails, thereby ensuring easier and more convenient access of the passengers through the doors D of the vehicle V.

Referring now in detail to Figures 2 and 3, each of the bodies B1, B2 comprises an upper wall 12, side walls 14 and a base wall 16 supporting a floor or walking level 18.

The base walls 16 have lowered ends 20 which project towards each other beyond the respective floors 18 beneath the communicating passage 10 and are articulated to each other about a central ball-and-socket joint 22.

The central joint 22 is formed by a terminal bearing part 24 integral with the lowered end 20 of the base wall 16 of the body B2 and defining a housing seat with a spherical surface 26 in which there is engaged a complementary articulation member with a spherical surface 28 supported by the lowered end 20 of the base wall 16 of the other body B1. The terminal bearing part 24 is arranged so as to rest on the load-bearing base T supported by the central pneumatic spring S of the support bogie P. The details of construction of the ball-and-socket joint 22 are described and illustrated in greater detail in the previously mentioned Patent Application in the name of the same Applicant.

The communicating passage 10 is formed essentially by a passage member 30 supported rotatably by the articulation end of the body B1, by a passage member 32 supported rotatably by the articulation end of the other body B2, and by an intermediate connecting member 34 between the two passage members 30, 32.

Each rotating passage member 30, 32 includes an upper horizontal plate 36 and a lower horizontal platform 38, which are substantially semicircular and are arranged with their respective straight sides 36a, 38a facing each other, that is, facing the intermediate connecting member 34.

The upper plate 36 and the lower platform 38 of each of the passage members 30, 32 are articulated adjacent the median zone of their straight sides 36a, 38a to the end of the upper wall 12 and to the lowered end 20 of the base wall 16 of the respective body B1, B2 about respective vertical pins 40, 42 which are aligned

with each other.

The ends of the curved sides 36b, 38b of the upper plate 36 and lower platform 38 of each connecting member 30, 32 are connected to each other by means of curved vertical walls 44 the external faces of which are connected to the corresponding side walls 14 of the bodies B1, B2 by means of flexible covers 46.

As is clearly shown in Figure 3, the two platforms 38 are situated at the same level as the walking levels 18 of the two bodies B1, B2 and rest on the lowered ends 20 of the base walls 16 of the bodies by means of respective pairs of vertical sliding shoes 48 supported by the lowered ends 20 and cooperating with arcuate sliding members 50 carried by the undersides of the platforms 38 laterally and on opposite sides with respect to the pivot pins 42.

Two centering units 52 interconnect laterally and in an articulated manner the two lower platforms 38 with the lowered ends 20 of the base walls 16 of the two bodies B1, B2. In the embodiment illustrated in Figures 2 to 6, the two centering units 52 comprise two horizontal rocker arms 54 articulated about vertical pins 56, one to a support 58 projecting from one end of the straight side 38a of one of the platforms 38 and the other to a similar support 58 projecting from the opposite end of the straight side 38a of the other platform 38.

The ends of each rocker arm 54 are articulated by means of elastic joints 60, 62 to two connecting rods, external 64 and internal 66 respectively, facing in opposite directions and articulated in turn, at 68 and 70 respectively, to the lowered ends 20 of the base walls 16 of the two bodies B1, B2.

The intermediate connecting member 34 includes an elastically deformable base wall 72 which interconnects the straight sides 38a of the two lower platforms 38, two elastically deformable or flexible side walls 74 which interconnect the facing edges of the vertical walls 44, and an elastically deformable or flexible upper wall 76 which interconnects the straight sides 36a of the two upper plates 36.

The above-described structure of the communicating passage 10 clearly allows, during movement of the vehicle V, the relative displacements between the two coaches C1, C2 about the three axes - longitudinal, transverse and vertical - necessary to ensure the correct adaptation to any track irregularities. The communicating passage 10 according to the invention advantageously permits the maximum utilisation of the space between the two bodies B1, B2 by producing a progressive and gradual connection between them, with every advantage of convenience and safety of movement of passengers between the bodies. In fact, the two lateral centering units 52 act to constantly orient the transverse axis A of the communicating passage 10 substantially in conformity with the bisector of the angle formed between the longitudinal axes X1, X2 of the two bodies B1, B2. This behaviour is illustrated diagrammatically in Figures 4, 5 and 6.

Figure 4 shows the condition of movement of the two bodies B1, B2 in a straight line with their axes X1, X2 aligned with each other, the transverse axis A of the communicating passage 10 directed perpendicularly

to these axes, and the two rocker arms 54 of the two centering units 52 having the same orientation as the axis A.

Figure 5 shows the condition of movement of the body B2 in a straight line and movement of the body B1 on a bend, with the axis X1 forming an angle Y of 10° with respect to the axis X2. In this case, the transverse axis A of the communicating passage 10 is situated in conformity with the bisector of the angle formed between the axes X1, X2 and forms, with respect to its position in the condition of movement in a straight line, an angle Z substantially equal to half the angle Y, that is, about 5 degrees. The two centering units 52 assume the configuration illustrated in this drawing.

Figure 6 illustrates the condition of movement of both the bodies B1, B2 on a bend, with their longitudinal axes X1, X2 forming equal angles Y with their positions of straight-line movement. The two centering units 52 assume the configuration illustrated in the drawing, and the transverse axis A of the communicating passage 10 is aligned as in the position of straight-line movement.

The variant illustrated in Figures 7 to 11 is generally similar to the embodiment described above, and parts identical or similar to those already described are indicated by the same reference numerals in these drawings.

This variant differs from the embodiment of Figures 2 to 6 solely in the different configuration of the two lateral

centering units of the communicating passage 10, indicated 80. Each of these units is, in fact, formed by a caliper structure comprising two substantially horizontal connecting rods 82, 84 articulated by joints 86, 88 at one end to the corresponding sides of the lowered ends 20 of the two bodies B1, B2, and articulated by joints 90, 92 at the opposite ends to a slider 94. The slider 94 of one of the two units 80 slides along a transverse guide 96 projecting from one end of the straight side 38a of the platform 38 of the connecting member 30, while the slider 94 of the other unit 80 slides along a similar transverse guide 96 projecting from the opposite end of the straight side 38a of the platform 38 of the connecting member 32.

The configuration of the two centering units 80 performs the same function as the units 52 described above, and thus makes it possible to keep the transverse axis A of the communicating passage 10 constantly oriented substantially in conformity with the bisector of the angle formed between the longitudinal axes X1, X2 of the two bodies B1, B2.

The diagrams of Figures 9 to 11 illustrate the operation of the two units 80 and the resulting behaviour of the communicating passage 10 in the condition of movement of the two bodies B1, B2 in a straight line, in that of movement of the body B1 on a bend and movement of the body B2 in a straight line, and movement of both bodies B1, B2 on a bend, respectively.

In the first case, the two longitudinal axes X1, X2

of the two bodies B1, B2 are aligned with each other, with the transverse axis A of the communicating passage 10 directed perpendicularly to them and with the two centering units 80 arranged in an identical, partially-opened-out configuration.

In the second case, in which the axis X1 of the body B1 on the bend forms an angle Y of 15° with its position of straight-line movement or with the axis X2 the axis A is directed in conformity with the bisector of the angle formed between the axes X1, X2 and forms, with its position corresponding to straight-line movement illustrated in Figure 9, an angle Z substantially equal to 7° 30'. The centering unit 80 situated on the inner side of the curve is partially closed with respect to the position of Figure 9, while the other unit 80 is further opened out with respect to the position of Figure 9.

In the case of Figure 11, both the axes X1, X2 form identical angles Y of 15° with the corresponding positions of straight-line movement, and the axis A is oriented as in the position of straight-line movement of Figure 9. In this case, the unit 80 situated on the inside of the bend moves to an almost completely closed position, while the other unit 80 is disposed in an almost fully-opened-out position.

Naturally, without prejudice to the principle of the invention, the particulars of construction and the forms of embodiment may be varied widely with respect to what has been described and illustrated, without thereby departing from the scope of the present invention.

Claims:

1. Communicating passage (10) between the bodies (B1, B2) of two coaches (C1, C2) of a railway or tramway vehicle (V), which are articulated to each other at the bottom about a central articulation (22) characterised in that it comprises:
- two spaced-apart rotating passage members (30, 32) including an upper horizontal plate (36) and a lower horizontal platform (38), which are substantially semicircular and are supported by the facing ends (12, 20) of the two bodies (B1, B2) with their respective straight sides (36a, 38a) facing each other, the upper plates (36) and the lower platforms (38) being articulated to the ends (12, 20) of the two bodies (B1, B2) about respective upper and lower vertical pivots (40, 42) adjacent the median zones of their straight sides (36a, 38a) and situated on opposite sides with respect to the articulation (22) between the two bodies (B1, B2), and vertical walls (44) which interconnect the ends of the curving sides (36b, 38b) of the upper plate (36) and lower platform (38) of each passage member (30, 32);
- an intermediate connecting member (34) between the two passage members (30, 32), including a base wall (72), two side walls (74) and an upper wall (76) which are elastically deformable and interconnect the facing edges of the two passage members (30, 32), and
- lateral centering means (52, 80) which interconnect the end of the straight side (38a) of the lower platform (38) of one of the passage members (30) and the opposite end of the straight side (38a) of the lower platform (38) of the other passage member (32) with the lower articulation ends (20) of the two bodies (B1, B2) in order to keep the transverse axis (A) of the communicat-
-ing passage (10) constantly oriented substantially in

conformity with the bisector of the angle formed between the longitudinal axes (X1, X2) of the two bodies (B1, B2).

2. Communicating passage according to Claim 1, characterised in that sliding bearing means (48, 50) are interposed between the lower platforms (38) of the two passage members (30, 32) and the lower articulation ends (20) of the two bodies (B1, B2).

3. Communicating passage according to Claim 1 or Claim 2, characterised in that the lateral centering means (52) comprise two substantially horizontal rocker arms (54) each of which is articulated about a vertical pivot (56) to a support (58) projecting from the lower platform (38) of the respective passage member (30, 32), the ends of each rocker arm (54) being connected by a joint to the lower articulation ends (20) of the two bodies (B1, B2) by means of a pair of opposing connecting rods (64, 66).

4. Communicating passage according to Claim 1 or Claim 2, characterised in that the lateral centering means comprise two caliper structures (80) each of which comprises a pair of substantially horizontal connecting rods (82, 84) articulated at one end to the sides of the lower ends (20) of the two bodies (B1, B2) and at their other ends to a slider (94) slidable along a transverse guide (96) projecting from the lower platform (38) of the respective passage member (30, 32).

5. Railway or tramway vehicle (V) including two articulated coaches (C1, C2) and a communicating passage (10) between the bodies (B1, B2) of the coaches (C1, C2) according to any of Claims 1 to 4.

6. Railway or tramway vehicle (V) including two articulated coaches (C1, C2) the bodies (B1, B2) of which communicate with each other through a communicating passage (10), and a pair of bogies (M1, M2) situated near the ends of the two bodies (B1, B2) opposite those which are articulated together, characterised in that the two bodies (B1, B2) have respective lower articulation ends (20) lowered and projecting beneath the respective floors (F) and articulated to each other by means of a central ball-and-socket joint (22) which rests on an intermediate support bogie (P), and in that the communicating passage (10) between the two bodies (B1, B2) comprises:

- two spaced-apart rotating passage members (30, 32) including an upper horizontal plate and a lower horizontal platform (36, 68), which are substantially semicircular and are supported by facing ends (12, 20) of the two bodies (B1, B2) with their respective straight sides (36a, 38a) facing each other, the upper plates (36) and the lower platforms (38) being articulated to the ends of the two bodies about respective upper and lower vertical pivots (40, 42) adjacent the median zone of their straight sides (36a, 38a) and situated on the opposite sides with respect to the central ball-and-socket joint (22), and vertical walls (44) which interconnect the ends of the curved sides (36b, 38b) of the lower platform (38) and the upper plate (36) of each passage member (30, 32);
- an intermediate connecting member (34) between the passage members (30, 32), including a base wall, two side walls and an upper wall (72, 74, 76), which are elastically deformable and interconnect the edges of the two passage members (30, 32), and
- lateral centering means (52, 80) which interconnect one end of the straight side (38a) of the lower platform

(38) of one of the passage members (30) and the other end of the straight side (38a) of the lower platform (38) of the other passage member (32) with said lowered lower ends (20) of the two bodies (B1, B2) in order to keep the transverse axis (A) of the communicating passage (10) constantly oriented substantially in conformity with the bisector of the angle formed between the longitudinal axes (X1, X2) of the two bodies (B1, B2).

7. Vehicle according to Claim 6, characterised in that sliding bearing means (48,50) are interposed between the lower platforms (38) of the two passage members (30, 32) and the said lowered lower ends (20) of the two bodies (B1, B2).

8. Vehicle according to Claim 6 or Claim 7, characterised in that the lateral centering means (52) comprise two substantially horizontal rocker arms (54) each of which is articulated about a vertical pivot (56) to a support (58) projecting from the lower platform (38) of the respective passage member (30, 32), the ends of each rocker arm (54) being connected by a joint to the corresponding sides of the lowered ends (20) of the two bodies (B1, B2) by means of a pair of respective opposing connecting rods (64, 66).

9. Vehicle according to Claim 6 or Claim 7, characterised in that the lateral centering means comprise a pair of caliper structures (80) each of which comprises a pair of substantially horizontal connecting rods (82, 84) articulated by joints at one end to the corresponding sides of the lowered ends (20) of the two bodies (B1, B2) and at their other ends to a slider (94) slidable along a transverse guide (96) projecting from the lower platform (38) of the respective passage member (32, 34).

10. Vehicle according to any of Claims 6 to 9, characterised in that the lower platforms (38) of the two passage members (30, 32) and the base wall (72) of the intermediate connecting member (34) of the communicating passage (10) are situated at the level of the floors (18) of the two bodies (B1, B2) to define a lowered walking level (F) which extends without any change in level for the whole length of the vehicle (V) between the two end bogies (M1, M2).

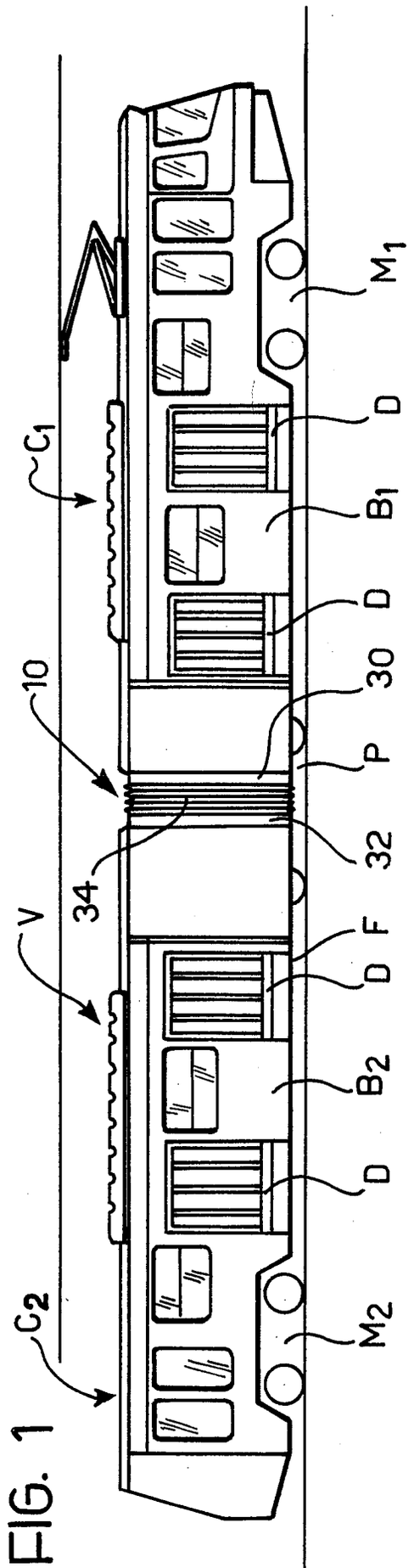

C1
10
V
C2
M1
D
B1
D
30
P
32
34
F
D
B2
D
M2

FIG. 1

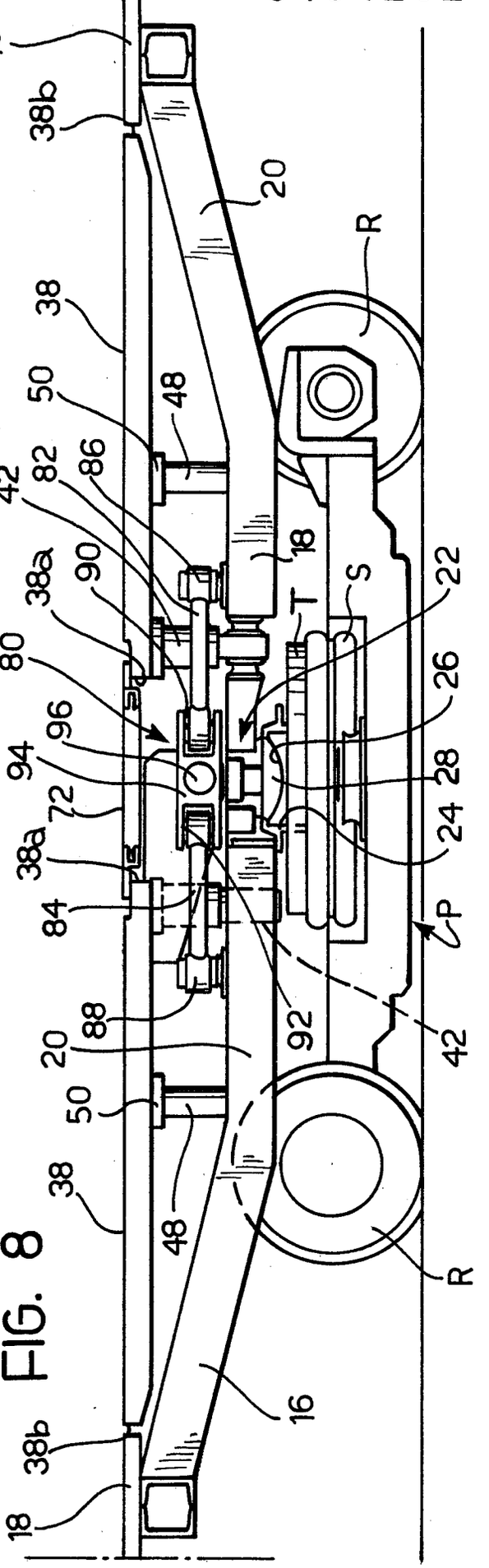

18
38b
20
R
38
50
48
42
82
86
18
38a
90
T
S
22
80
26
96
94
28
72
24
38a
84
P
88
92
42
20
50
38
48
R
16
38b
18

FIG. 8

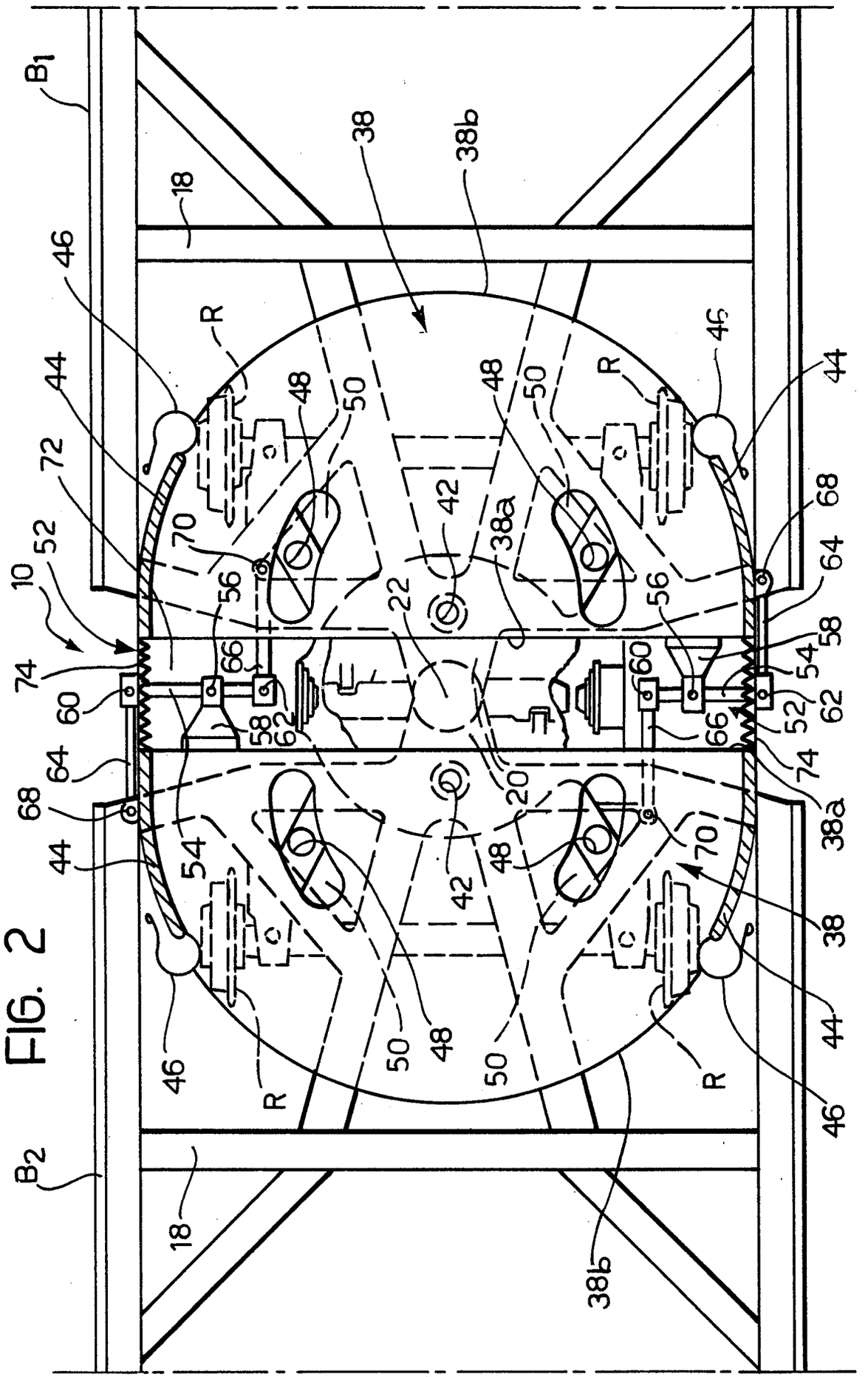

B1
B2
38
38b
38a
18
46
44
48
50
42
22
20
R
C
72
70
52
10
74
60
56
66
58
62
64
68
54

FIG. 2

FIG. 3

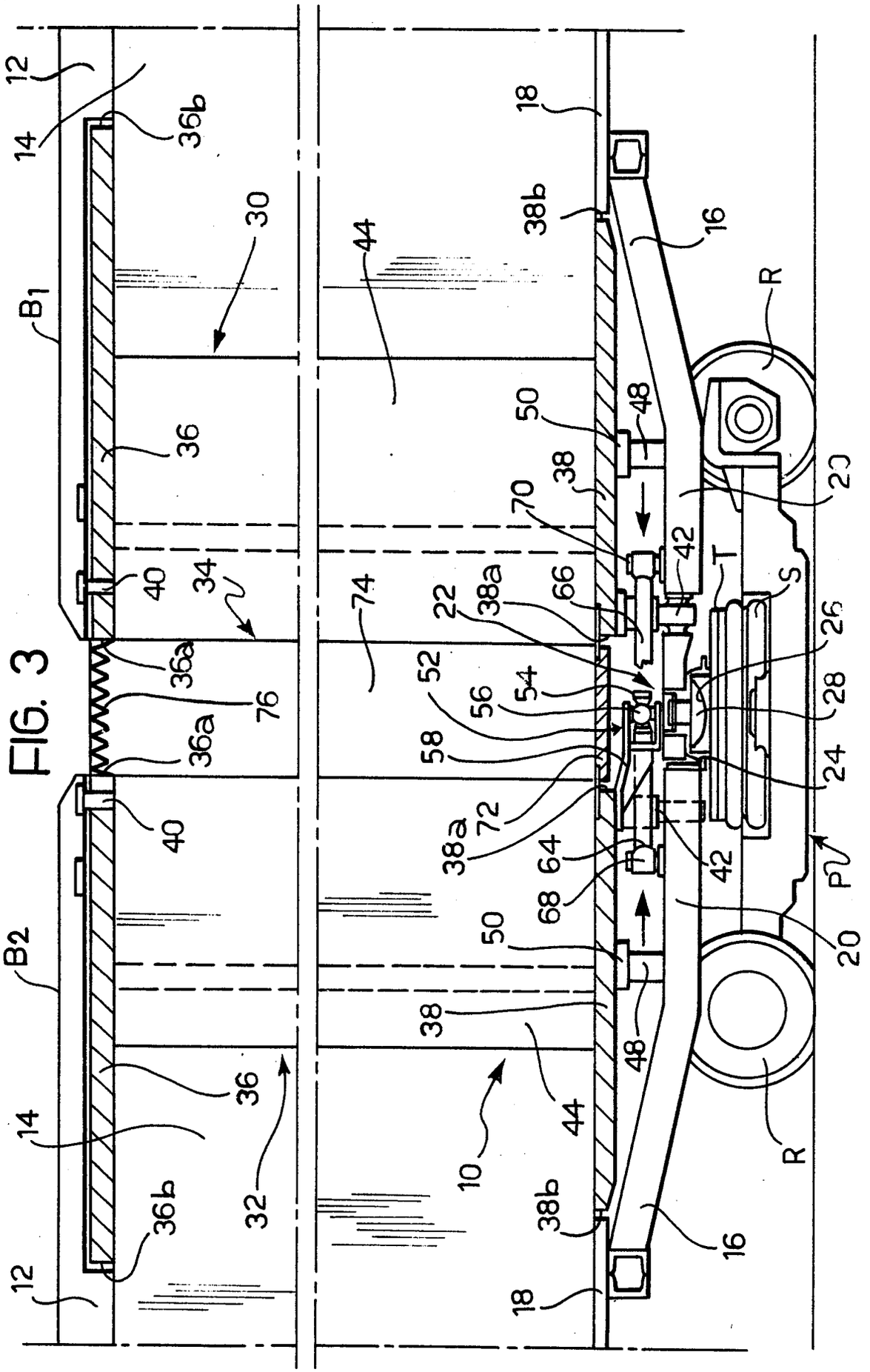

12
14
36b
30
B1
36
40
34
36a
76
36a
40
B2
14
36
36b
12
32
10
44
38b
18
16
R
50
48
38
70
42
T
S
22
38a
66
74
26
52
54
56
28
58
24
72
38a
64
68
42
P
50
20
38
48
44
38b
16
R
18

FIG. 4

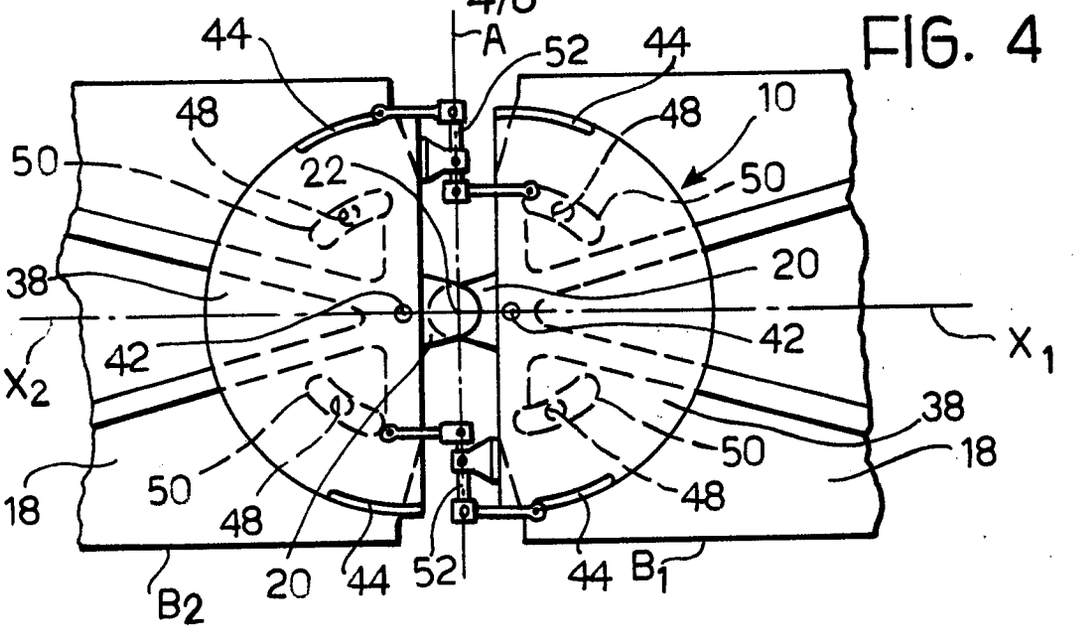


FIG. 5

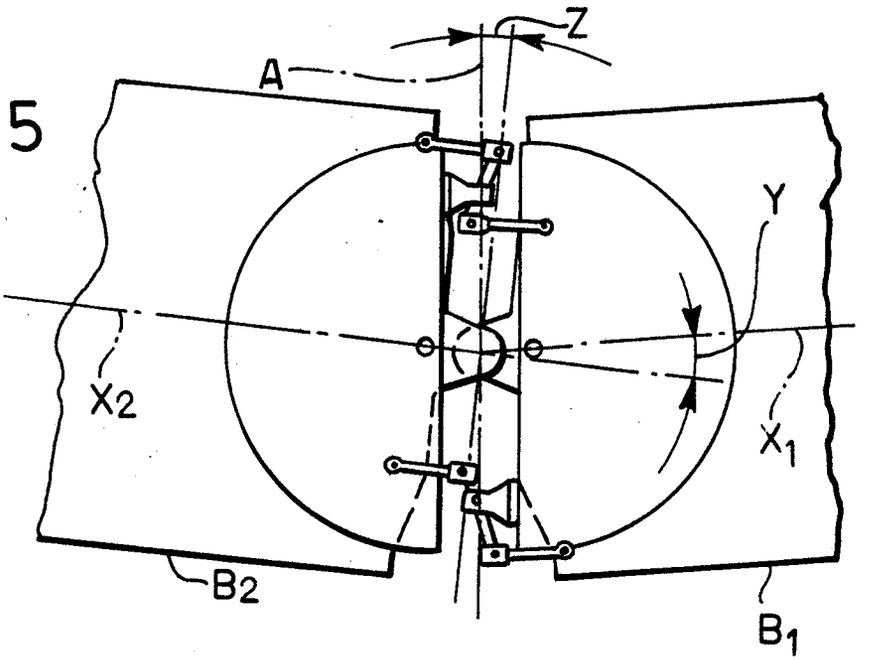
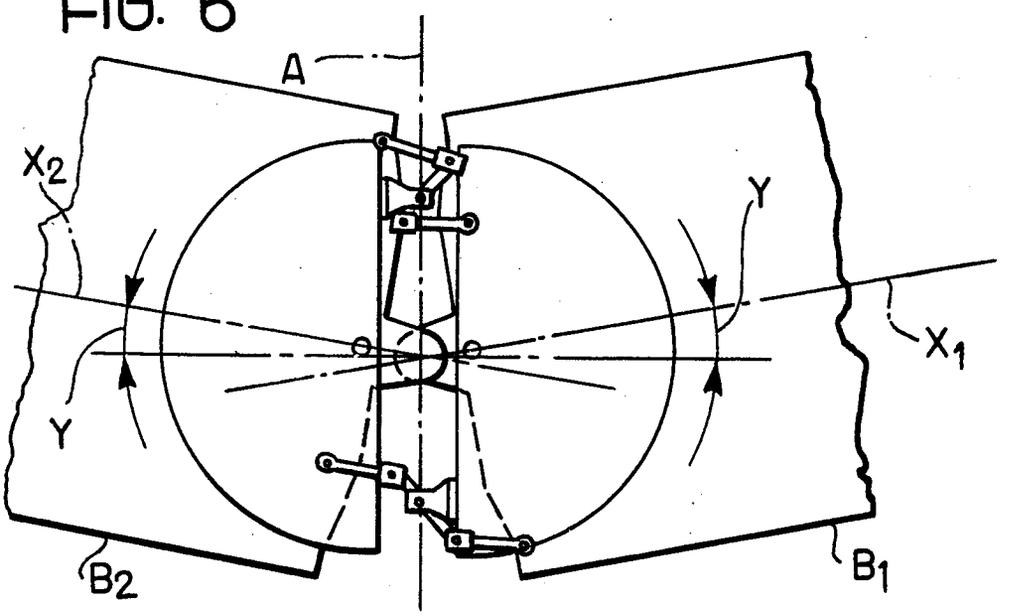


FIG. 6



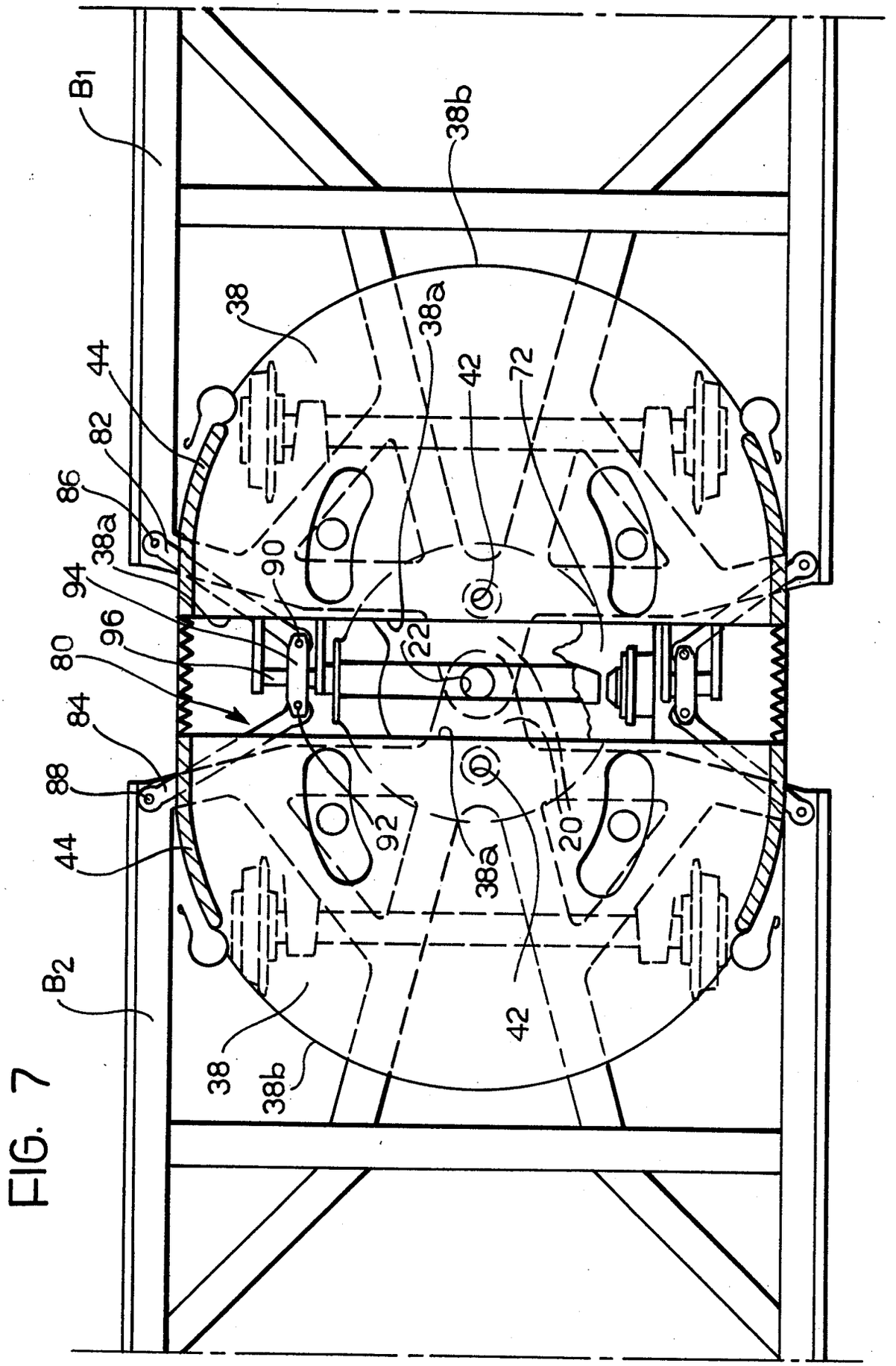

B1
38b
38
38a
42
72
44
82
86
38a
94
90
96
80
22
84
88
44
92
38a
20
B2
42
38
38b

FIG. 7

FIG. 9

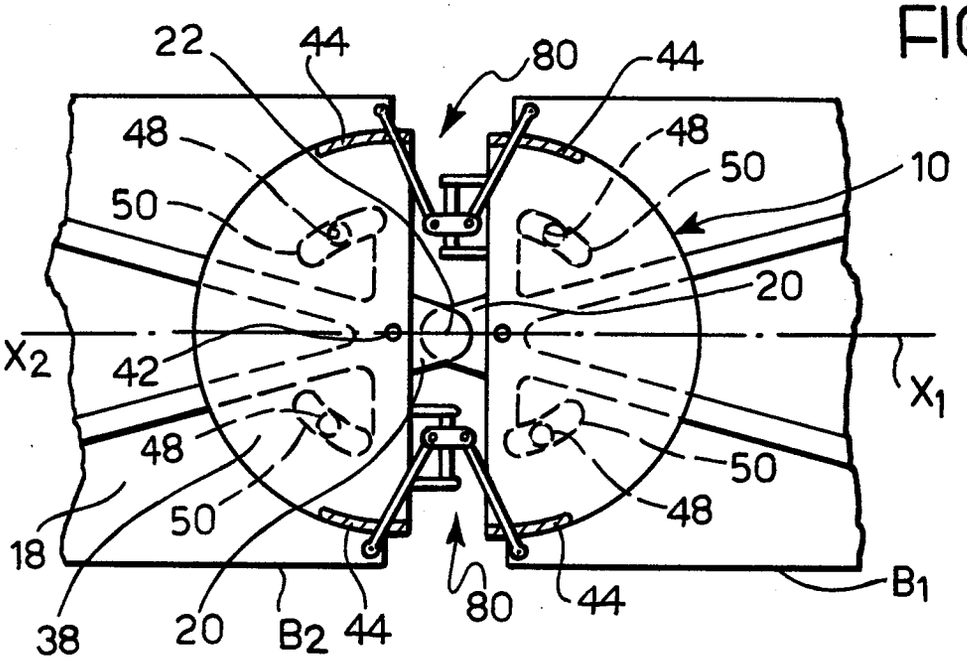


FIG. 10

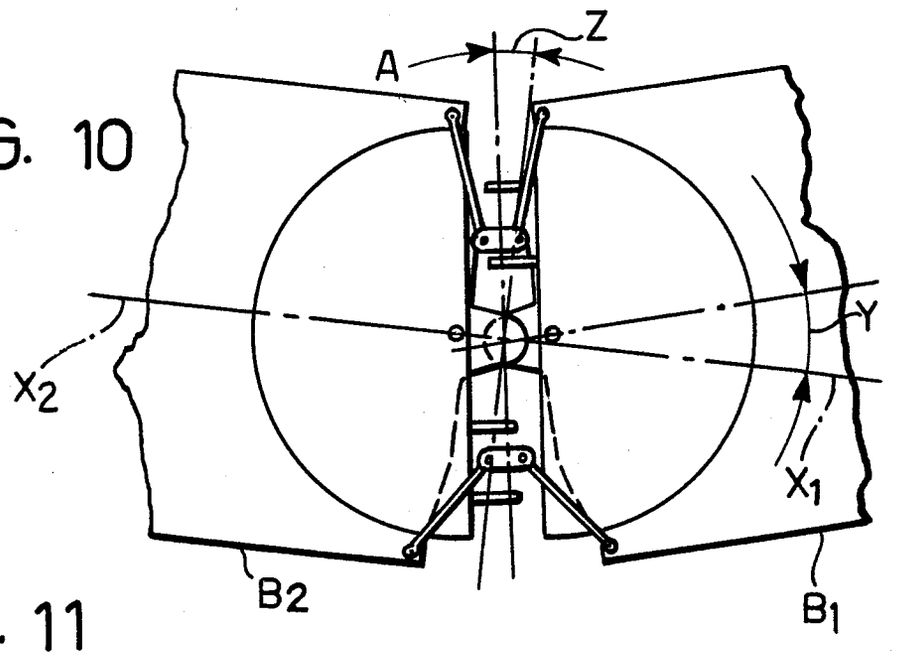


FIG. 11