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(54) Title: TRANSFER RING ASSEMBLY FOR SUPPORTING BELT AND TREAD PACKAGES

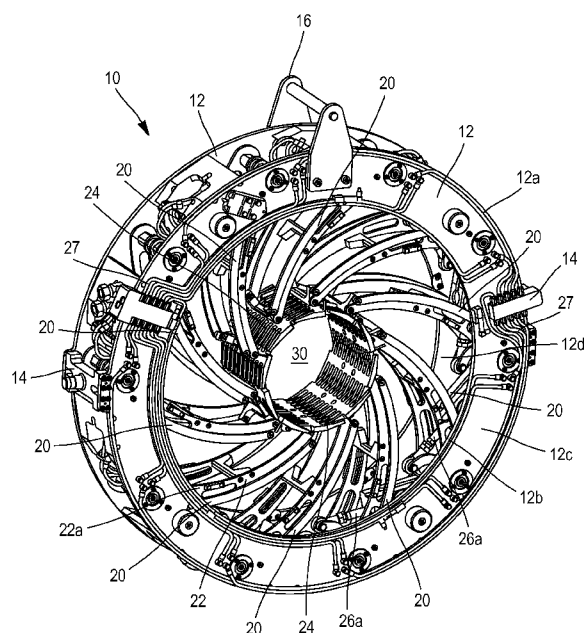


FIG. 1

(57) Abstract: A transfer ring assembly (10) is provided for support-
ing a belt and tread package during a tire manufacturing process. A
method of assembling tire components in a tire production facility
is also provided that incorporates at least one transfer ring assembly
(10) as disclosed.



TRANSFER RING ASSEMBLY FOR SUPPORTING
BELT AND TREAD PACKAGES

TECHNICAL FIELD

The invention relates generally to tire production and more particularly to a
5 transfer ring for constructing various tire sizes and types.

BACKGROUND

In the tire industry, production of a tire commonly includes assembly of
separately produced carcass and belt and tread package (or “package”)
components. A transfer ring typically supports the package during its transfer to a
10 carcass that is already positioned upon an inflatable forming drum. Inflation of the
tire carcass urges engagement between the carcass’ outer surface and the package’s
interior surface, thereby forming a tire assembly (or “precursor”) for subsequent
placement in a mold.

Transfer rings often utilize a pair of stationary outer rings with an actuator
15 ring disposed therebetween. The outer rings and the actuator ring support a
plurality of arcuately disposed shoes via a linkage system (for example, one using
one or more pneumatic cylinders). The linkage system effects simultaneous radial
actuation of the shoes such that an arcuate surface of each shoe engages a
circumferential outer periphery of the package during transfer to the
20 complementary carcass surface. Upon their radial extension toward the package,
the shoes delineate an inner diameter of the transfer ring. This inner diameter is
adjustable so as to accommodate a maximum range of vehicle tire sizes.

It is understood that a compressive force imparted on the package by the
shoes should sufficiently engage the package without causing damage thereto. It is
25 further understood that the package must be positioned with its center axis
coincident with a center axis of the carcass to ensure the balance of the tire. The
presently disclosed invention preserves these requirements while accommodating a
broad range of tire diameters.

SUMMARY

A transfer ring assembly is provided for supporting a belt and tread package during a tire manufacturing process. The transfer ring assembly includes an annular frame having a pair of symmetric concentric rings with each ring having a predefined outer diameter and a predefined inner diameter. The rings are in parallel registry and spaced apart by a constant predetermined distance between opposed inner planar surfaces thereof. A plurality of radially articulating shoe assemblies are evenly and circumferentially disposed between the opposed inner planar surfaces and supported by the rings. Each shoe assembly includes an arm that is pivotably affixed to the frame along a pivot axis at a fixed extent thereof while an opposed free extent rotatably supports an arcuate shoe thereat. Between the fixed and free extents, the arm presents a concave profile between a leading edge and a trailing edge of the arm. A predetermined chord length between the leading and trailing edges delineates the boundaries of an engagement region. Each shoe assembly also includes a shoe for grasping the belt and tread package for conveyance to a position about a tire carcass, the shoe being pivotably affixed to the arm along a pivot axis at the free extent thereof. Each shoe has an arcuate contour such that an engagement surface of the shoe correspondingly engages a corresponding contour of a forming drum supporting the tire carcass. Each shoe assembly includes an actuator that effects movement of a corresponding arm between positions of engagement and non-engagement with the belt and tread package.

In certain embodiments, the concave profile of arm has a center of concavity that faces a center axis of rings when the arms are in the fully retracted position and faces an adjacent concave profile when the arms are in the fully extended position.

In certain embodiments, the shoe includes integral digits that cooperate with the digits of an adjacent shoe such that the cooperating digits render continuous a perimeter of the engagement region delineated by adjacent engagement surfaces during extraction and contraction of the forming drum.

In certain embodiments, the actuator comprises a piston-cylinder assembly having a reciprocable piston rod actuated thereby.

In certain embodiments, the transfer ring assembly includes a linkage having a motion input extent in operable communication with the piston rod and a motion transfer extent proximate which the linkage is coupled with arm at its fixed extent. Each piston rod may extend and retract along a path having limits that are selectively adjustable.

In certain embodiments, the piston-cylinder assembly is in fluid communication with a source of pressurized fluid that delivers the fluid via one or more conduits. In such embodiments, commensurate actuation of each piston rod corresponds to actuation of the corresponding linkage and independent extension and retraction of each corresponding arm.

A method of assembling tire components for the manufacture of tires is also provided that includes providing at least one transfer ring assembly as disclosed.

Other aspects of the presently disclosed invention will become readily apparent from the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The nature and various advantages of the presently disclosed invention will become more apparent upon consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which like reference characters refer to like parts throughout, and in which:

FIG. 1 shows a front perspective view of an exemplary transfer ring assembly in a fully engaged position.

FIG. 2 shows a front perspective view of the transfer ring assembly of FIG. 1 in a fully retracted position.

FIG. 3 shows a front view of the transfer ring assembly of FIG. 1 without its frames.

DETAILED DESCRIPTION

Referencing now the figures, wherein the same numbers identify the same elements, FIGS. 1 and 2 shows a transfer ring assembly 10 for use in manufacturing vehicle tires. Transfer ring assembly 10 may be included in a work station that is one of several work stations in a tire production facility.

Transfer ring assembly 10 is arranged relative to an existing belt and tread package (“package”) that is positioned on a tire-forming drum (not shown).

Transfer ring assembly 10 is actuatable between a fully engaged position, in which
5 the assembly engages the belt and tread package (see FIG. 1) and a fully retracted position, in which the assembly accommodates full carcass inflation (see FIG. 2).

Transfer ring assembly 10 includes an annular frame having a pair of symmetric, concentric rings 12 each having a predefined outer diameter 12a and a predefined inner diameter 12b. Each ring 12 has a predetermined thickness
10 delineated between an external planar surface 12c and an internal planar surface 12d. One or more circumferentially located clamping supports 14 sustain rings 12 in registry and keep the rings spaced apart by a constant predetermined distance between opposed inner planar surfaces 12d. An optional mount 16 may be provided for mounting transfer ring assembly 10 as is known in the art. Rings 12,
15 clamping supports 14 and optional mount 16 are desirably fabricated from rigid material such as steel, although it is understood that comparable materials may be employed that are amenable to practice of the invention.

In the space between opposed inner planar surfaces 12d, the frame supports a plurality of radially articulating shoe assemblies 20 that are evenly and
20 circumferentially disposed between opposed inner planar surfaces 12d. The number of shoe assemblies 20 is variable, and thus, while the exemplary embodiment shows ten such shoe assemblies, it is understood that more or fewer shoe assemblies may be utilized without departing from the scope of the invention.

Each shoe assembly 20 includes an arm 22 that is pivotably affixed to the
25 frame at a fixed extent 22a thereof while an opposed free extent 22b rotatably supports an arcuate shoe 24 thereat. Between internal planar surfaces 12b, arm 22 pivots along a pivot axis defined by a suitable fastener such as fastener 25 (although other fasteners may be substituted therefor). Fastener 25 connects fixed extent 22a to rings 12 between the rings’ predefined inner and outer diameters 12a,
30 12b, thereby permitting successive arms to collapse within the frame when shoe assemblies 20 are fully retracted.

At free extents 22b of arms 22, shoes 24 are extended and used to grasp the belt and tread package for conveyance to a position about a tire carcass. Each shoe 24 is affixed by a suitable fastener (such as a hinge pin) that defines a pivot axis for

the shoe. Each shoe 24 incorporates an arcuate contour such that an engagement surface 24a of the shoe sufficiently engages a corresponding contour of the drum. Each shoe may include integral digits that cooperate with the digits of an adjacent shoe such that the cooperating digits render continuous a perimeter of an engagement region 30 delineated by adjacent engagement surfaces (24a) during extraction and contraction of the forming drum. One or more shoes may include optional magnetic, vacuum or other features as is known in the art.

Between its fixed and free extents, each arm 22 is bound by a concave profile between a leading edge 22c and a trailing edge 22d of the arm (i.e., the arm does not form a parallelogram). The concave profile of arm 22 has a center of concavity that faces a center axis of rings 12 when arms 22 are in the fully retracted position and faces an adjacent concave profile when the arms are in the fully extended position. A predetermined chord length 22L between the leading and trailing edges delineates the boundaries of engagement region 30 that accommodates an extended range of tire diameters, although transfer ring assembly 10 can assume multiple positions of engagement and non-engagement with the belt and tread package.

Still referring to FIGS. 1 and 2 and referring further to FIG. 3, each shoe assembly 20 includes an actuator 26 that effects movement of a corresponding arm 22 between positions of engagement and non-engagement with the belt and tread package (including the fully extended and the fully retracted positions). Actuator 26 incorporates a piston-cylinder assembly that can include any amenable actuation means, including but not limited to a pneumatic actuator, a hydraulic actuator and complements and equivalents thereof. The selected piston-cylinder assembly, having a reciprocable piston rod 26a actuated thereby, is in operative communication with a respective linkage 33 and more particularly with a motion input extent 33a thereof. Linkage 33a also includes a motion transfer extent 33b proximate which the linkage is coupled with arm 22 at fixed extent 22a thereof. Coupling between linkage 33 and arm 22 is effected along the arm's pivot axis and may be facilitated by known interactive linkage elements (for example, one or more complementary detent and interlock combinations). Each piston rod 26a extends and retracts along a path having limits that are selectively adjustable in

accordance with a desired radial extent through which each shoe 24 moves upon actuation of the piston rod.

5 The piston-cylinder assembly is in fluid communication with a source of pressurized fluid (air, water, etc.) that delivers the fluid via one or more conduits 27. Commensurate actuation of piston rod 26a corresponds to actuation of linkage 33 and independent extension and retraction of each arm 22. Each piston rod 26a is independently actuatable so as to ensure each arm's independent movement until each shoe 24 engages the belt and tread package. In this configuration, engagement
10 of the belt and tread package by all of the shoes prevents their subsequent displacement (for example, due to possible variations in the belt and tread package). The initial movement of shoes 24 is limited to an extent that is sufficient to engage the circumferential periphery of the belt and tread package without causing damage thereto. Upon reaching this limit, the delivery of pressurized fluid
15 terminates.

Each actuator 26 enables radial extension and retraction of shoes 24 with all shoes maintaining identical degrees of rotation about their respective hinge axes. Each shoe 24 moves both radially inwardly and outwardly of rings 12 and circumferentially toward and away from one another in an arcuate path. Because
20 each shoe is independently hinged to its respective support, the shoes maintain concentricity with rings 12 throughout the transfer process. Relatively little force is therefore required to effect movement of shoes 24 between positions of engagement and non-engagement with the belt and tread package.

In operation, transfer ring assembly 10 is positioned about a belt and tread package as it resides on a corresponding forming drum (not shown). For each actuator 26, the introduction of pressurized fluid to each piston-cylinder assembly extends each piston rod 26a. This extension is transferred through motion input extent 33a of linkage 33a with commensurate movement effected by the correspondence between motion transfer extent 33b and arm 22. Resultant pivoting of arm 22 along its pivot axis effects radial extension of the arm and commensurate radial outward movement of corresponding shoe 24. While piston rods 26a are not interconnected for simultaneous movement, the piston-cylinder assemblies can be programmed to effect such simultaneous movement.

While shoes 24 engage the belt and tread package, and prior to inflation of the tire carcass, transfer ring assembly 10 positions and centers the belt and tread package about the tire carcass. The tire carcass is subsequently inflated and an outer circumferential surface thereof is urged against a complementary inner circumferential surface of the belt and tread package, forming a precursor thereby. During carcass inflation, outwardly-directed forces urge shoes 24 radially inwardly toward inner diameter 12b of rings 12. With the belt and tread package firmly engaged by shoes 24, transfer ring assembly 10 can transfer the precursor to a subsequent station in a tire production facility.

Upon termination of delivery of the pressurized fluid to actuators 26, piston rod 26a retracts and this retraction is transferred through motion input extent 33a of linkage 33. Resultant pivoting of arm 22 along its pivot axis effects radial retraction of the arm and commensurate radial inward movement of shoe 24 toward the fully retracted position (see FIG. 2). In this fully retracted position, subsequent transfer of a different belt and tread package is facilitated without altering the circumferential extent of engagement region 30. It is understood that such alteration may be effected at least in part by selectively actuating one or more arms 22 in accordance with differences in the peripheral extents of different tires. Transfer ring assembly 10 therefore relieves any constraint between the dimensional span of engagement region 30 and the overall dimensions of the frame.

The terms "at least one" and "one or more" are used interchangeably. Ranges that are described as being "between a and b" are inclusive of the values for "a" and "b."

While particular embodiments of the disclosed apparatus have been illustrated and described, it will be understood that various changes, additions and modifications can be made without departing from the spirit and scope of the present disclosure. Accordingly, no limitation should be imposed on the scope of the presently disclosed invention, except as set forth in the accompanying claims.

WHAT IS CLAIMED IS:

1. A transfer ring assembly (10) for supporting a belt and tread package during a tire manufacturing process, comprising:
 - 5 an annular frame having a pair of symmetric concentric rings (12) with each ring (12) having a predefined outer diameter (12a) and a predefined inner diameter (12b), and the rings (12) being in parallel registry and spaced apart by a constant predetermined distance between opposed inner planar surfaces (12d) of the rings;
 - 10 a plurality of radially articulating shoe assemblies (20) that are evenly and circumferentially disposed between the opposed inner planar surfaces (12d) and supported by the rings (12), wherein each shoe assembly (20) includes:
 - an arm (22) that is pivotably affixed to the frame along a pivot axis at a fixed extent (22a) thereof while an opposed free extent (22b) rotatably supports an arcuate shoe (24) thereat, and between the fixed and free
15 extents (22a, 22b) the arm (22) presents a concave profile between a leading edge (22c) and a trailing edge (22d) of the arm and a predetermined chord length (22L) between the leading and trailing edges (22c, 22d) delineates the boundaries of an engagement region (30);
 - 20 a shoe (24) for grasping the belt and tread package for conveyance to a position about a tire carcass, the shoe being pivotably affixed to the arm along a pivot axis at the free extent (22b) thereof, with each shoe (24) having an arcuate contour such that an engagement surface (24a) of the shoe correspondingly engages a corresponding contour of a forming drum
25 supporting the tire carcass; and
 - an actuator (26) that effects movement of a corresponding arm (22) between positions of engagement and non-engagement with the belt and tread package.
- 30 2. The transfer ring assembly (10) of claim 1, wherein the concave profile of arm (22) has a center of concavity that faces a center axis of rings (12) when the arms (22) are in the fully retracted position and faces an adjacent concave profile when the arms (22) are in the fully extended position.

3. The transfer ring assembly of claim 1 or claim 2, wherein each shoe (24) includes integral digits that cooperate with the digits of an adjacent shoe (24) such that the cooperating digits render continuous a perimeter of the engagement region (30) delineated by adjacent engagement surfaces (24a) during extraction and contraction of the forming drum.

4. The transfer ring assembly (10) of any preceding claim, wherein actuator (26) comprises a piston-cylinder assembly having a reciprocable piston rod (26a) actuated thereby.

5. The transfer ring assembly (10) of claim 4, further comprising a linkage (33) having a motion input extent (33a) in operable communication with the piston rod (26a) and a motion transfer extent (33b) proximate which the linkage is coupled with arm (22) at its fixed extent (22a).

6. The transfer ring assembly of claim 4 or claim 5, wherein each piston rod (26a) extends and retracts along a path having limits that are selectively adjustable.

7. The transfer ring assembly (10) of any of claims 4 to 6, wherein the piston-cylinder assembly is in fluid communication with a source of pressurized fluid that delivers the fluid via one or more conduits (27) and effects commensurate actuation of each piston rod (26a) that corresponds to actuation of the corresponding linkage (33) and independent extension and retraction of each corresponding arm (22).

8. A method of assembling tire components in a tire production facility, comprising the steps of:
providing at least one transfer ring assembly (10) according to any of claims 1 to 7;
engaging a circumferential periphery of the belt and tread package with the at least one transfer ring assembly (10);

positioning and centering the belt and tread package about a tire carcass provided on a forming drum surface;

5 inflating the tire carcass to form a precursor with the belt and tread package; and

 transferring the precursor to a subsequent forming station in the tire production facility.

10 9. The method of claim 8, wherein the engaging step includes actuating the piston rod (26a).

 10. The method of claim 9, further comprising delivering pressurized fluid to the actuators (26) to actuate the piston rod.

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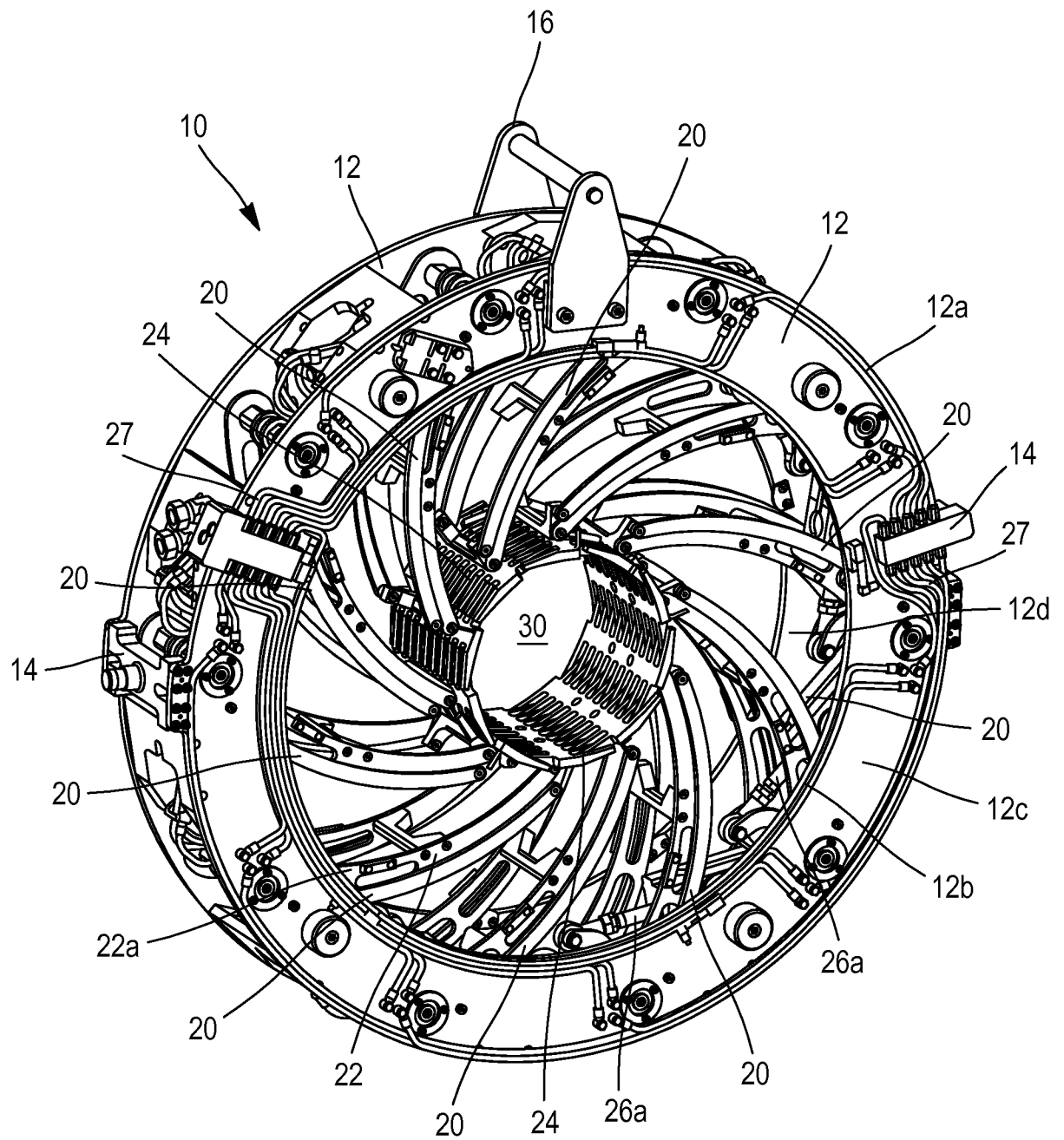


FIG. 1

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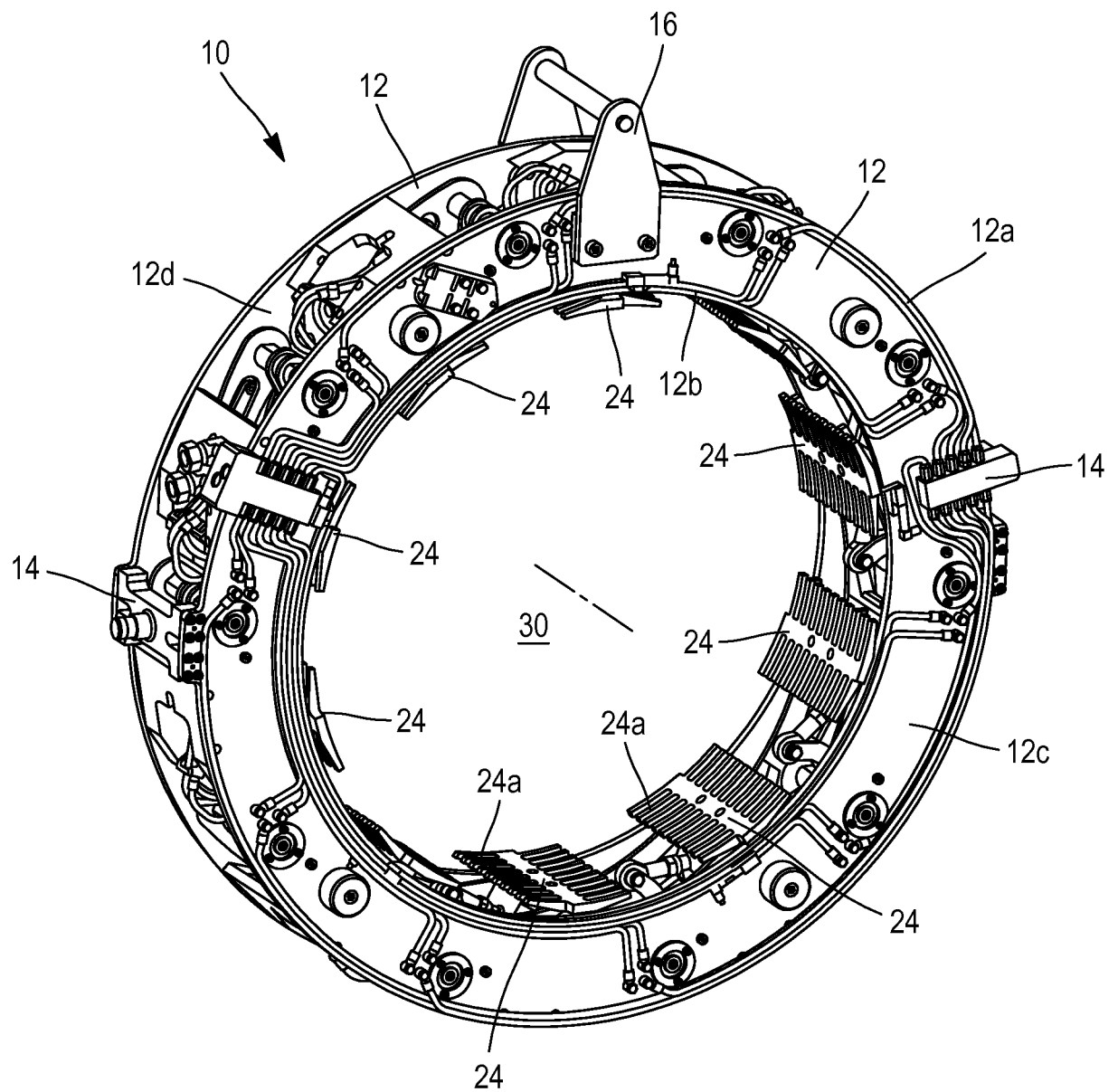


FIG. 2

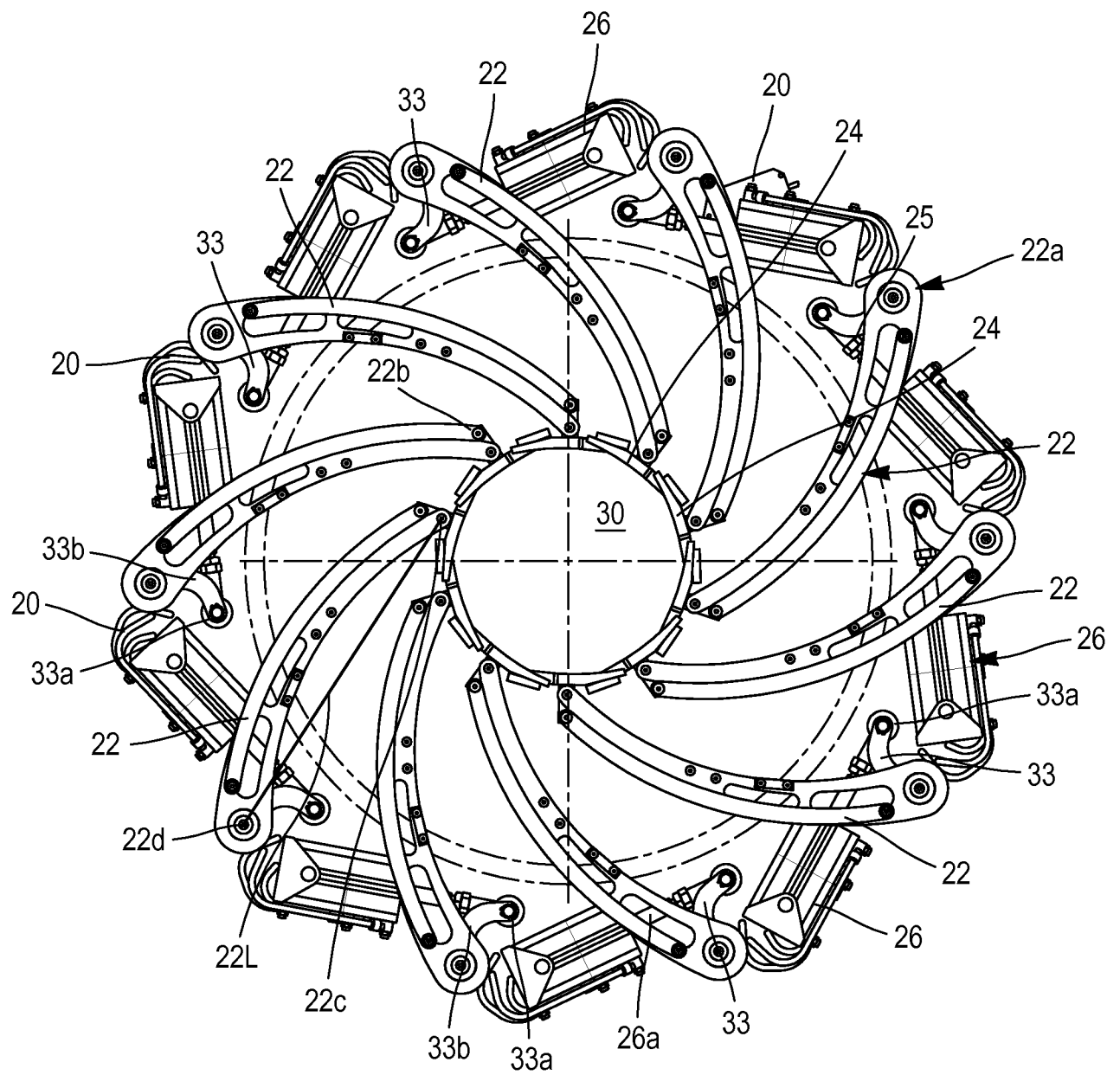


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/079856

A. CLASSIFICATION OF SUBJECT MATTER
INV. B29D30/26
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B29D B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	JP S60 119528 U (MITSUBISHI HEAVY IND LTD) 13 August 1985 (1985-08-13) the whole document ----- -/--	1-10



Further documents are listed in the continuation of Box C.



See patent family annex.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/079856

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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