(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 February 2005 (17.02.2005)

PCT

(10) International Publication Number
WO 2005/014267 A1

(51) International Patent Classification[7]: B29D 30/54, B24B 5/36

(21) International Application Number: PCT/IB2004/002533

(22) International Filing Date: 6 August 2004 (06.08.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2003/6114 7 August 2003 (07.08.2003) ZA

(71) Applicant and
(72) Inventor: **JOHNSON, Wayne** [ZA/ZA]; 6 Le Village, Mont Blanc Place, Verdun Avenue, Lorraine, Port Elizabeth, 6001 Eastern Cape Province (ZA).

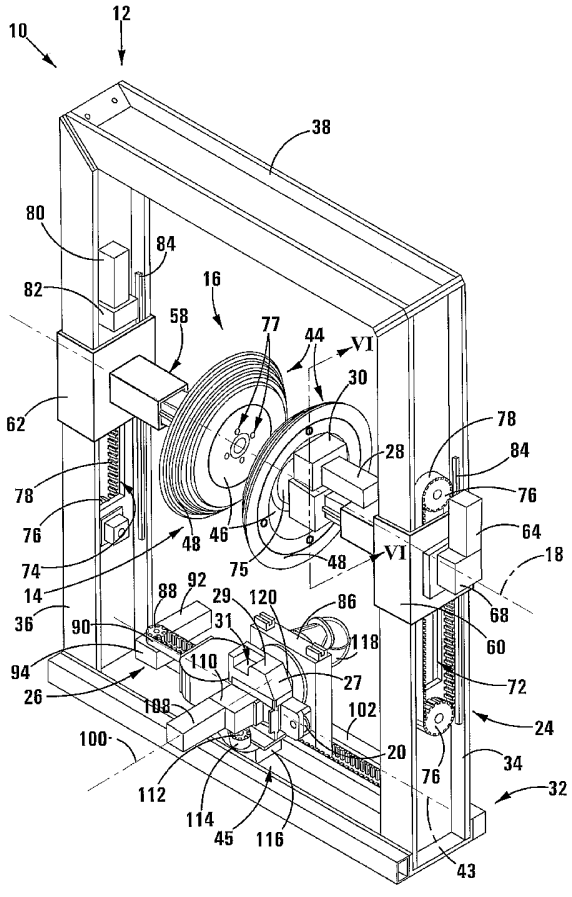
(74) Agent: **LEWIS, Alan**; c/o Adams & Adams (Johannesburg), 3rd Floor, 23 Wellington Road, Parktown, Johannesburg, 2193 Gauteng Province (ZA).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: RETREADING OF TYRES



(57) Abstract: This invention relates to an assembly (10) for profiling the tread of a tyre. The assembly includes a framework (12) which defines a workspace (14). Tyre retaining means (16) are mounted on the framework for retaining a tyre in an inflated condition in the workspace. The tyre retaining means are rotatable about a tyre retaining means rotation axis (18) extending through the workspace, so that a tyre retained thereby is rotatable about its axis. At least one tread profiling tool (20, 22) is mounted on the framework to project into the workspace. Each tread profiling tool is laterally spaced from the tyre retaining means rotation axis for engaging and profiling the tread of a tyre retained and rotated by the tyre retaining means. A tyre retaining means displacement arrangement (24) is mounted on the framework for displacing the tyre retaining means and a tyre retained thereby within the workspace and relative to the framework. The invention extends to an installation for retreading a tyre, and to tyre retaining means.

WO 2005/014267 A1

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

RETREADING OF TYRES

THIS INVENTION relates to retreading of tyres. It more particularly relates to an assembly for profiling the tread of a tyre, to an installation for retreading a tyre, and to tyre retaining means.

In accordance with one aspect of the invention there is provided an assembly for profiling the tread of a tyre, which assembly includes:

a framework defining a workspace;

tyre retaining means mounted on the framework for retaining a tyre in an inflated condition in the workspace, the tyre retaining means being rotatable about a tyre retaining means rotation axis extending through the workspace, so that a tyre retained thereby is rotatable about its axis;

at least one tread profiling tool mounted on the framework to project into the workspace, each tread profiling tool being laterally spaced from the tyre retaining means rotation axis for engaging and profiling the tread of a tyre retained and rotated by the tyre retaining means; and

a tyre retaining means displacement arrangement mounted on the framework for displacing the tyre retaining means and a tyre retained thereby within the workspace and relative to the framework.

The assembly may include a carriage arrangement including a tool mount on which each tread profiling tool is mounted, the tool mount being transportable relative to the framework, to permit displacement of each tread profiling tool relative to the tyre retaining means and to a tyre retained thereby.

The carriage arrangement may include an elongated bed defining a transport axis extending across the workspace, the transport axis being laterally spaced from and parallel to the tyre retaining means rotation axis, and a carriage on which the tool mount is mounted, the carriage being mounted on the elongated bed and being guidably transportable along the transport axis, so that each tread profiling tool is displaceable parallel to the tyre retaining means rotation axis across the workspace and across the tread of a tyre retained by the tyre retaining means.

The assembly may include guide formations mounted on the framework for guiding displacement of the tyre retaining means in the workspace in a lateral direction relative to the transport axis, to permit, in accordance with the size of a particular tyre and the tread profiling required, the displacement of the tyre retaining means and a tyre retained thereby relative to each tread profiling tool.

The assembly may include a tyre retaining means rotary drive operatively connected to the tyre retaining means for rotatingly driving the tyre retaining means and a tyre retained thereby.

Two tread profiling tools may be mounted on the tool mount, the two tread profiling tools being spaced from each other about a tool mount axis transverse to the transport axis, with the tool mount being rotatable about the tool mount axis, to permit, by rotating the tool mount, rotation of a selected one of the tread profiling tools into an operative position to engage the tread of a tyre retained by the tyre retaining means, and to permit adjustment of an angle of the selected tread profiling tool relative to the tread of the tyre.

The tyre retaining means may include an axially splittable rim constituted by two parts, each part being coaxial with and rotatable about the tyre retaining means rotation axis, with the two parts defining between them at least one annular seat for seating a tyre, one of the parts being provided with an inlet valve *via* which air under pressure can be introduced into a tyre retained between the two parts, to inflate the tyre, the assembly including two said guide formations respectively for guiding displacement of each of the parts in said lateral direction relative to the transport axis. Each part may be in the form of

a stepped flat-topped generally frustum-shaped retaining shell, the steps being concentrical about the tyre retaining means rotation axis, with each step of one retaining shell together with a corresponding step of the other retaining shell forming one annular seat, the two retaining shells thus defining between them a series of differently sized annular seats for seating differently sized tyres.

The assembly may include retaining shell displacement means for guidingly displacing the two retaining shells relative to each other along the retaining means rotation axis, to permit location of a tyre between the two retaining shells and to permit removal of a tyre retained between the two retaining shells.

The tyre retaining means displacement arrangement may include two displacement mechanisms, each of the displacement mechanisms being operatively connected to one of the guide formations, with the retaining shell displacement means being connected to the guide formations, such that the displacement mechanisms displace the retaining shell displacement means and, accordingly, the retaining shells in said lateral direction relative to the transport axis along the workspace.

The retaining shell displacement means may include two elongated motor-driven extensible and retractable formations, one end of each formation being fast with one of the retaining shells and the other end of each formation being fast with one of said guide formations.

Each said displacement mechanism may be in the form of a motor-driven belt-and-pulley system, with each guide formation being fast with the belt of its associated belt-and-pulley system, so that each retaining shell displacement means and its associated retaining shell are displaceable along the workspace in response to operation of the motor of its associated displacement mechanism.

The carriage arrangement may include transport means for transporting the carriage along the transport axis.

The assembly may include rotation means for rotating the tool mount about the tool mount axis.

The retaining means rotary drive may include a motor operatively connected to one of the two retaining shells, operation of the motor thus driving both shells when the shells are engaged with a tyre.

The transport means for transporting the carriage along the transport axis may be in the form of a motor-driven belt-and-pulley system, the carriage being secured to the belt so that it is transported along the transport axis in response to operation of the motor.

The rotation means for rotating the tool mount may include a motor mounted on the carriage, the motor being operatively connected to the tool mount, so that the tool mount is rotated about the tool mount axis in response to operation of the motor.

One of the tread profiling tools may be in the form of a cutter provided with a cutting edge for operatively engaging the tread of a tyre retained by the tyre retaining means, to remove material from the tread of the tyre, the other tread profiling tool being in the form of a roller rotatable about an axis substantially parallel to the transport axis, the roller being provided with an abrading annular surface for engaging the tread of the tyre, to smoothen the tread of the tyre from which material has been removed by the cutter.

The assembly may include a roller drive mounted on the tool mount for rotating the roller.

The assembly may include a housing within which the roller is rotatably housed, the housing being provided with an opening through which part of the annular surface of the roller projects, to permit engagement of the annular surface of the roller with the tread of a tyre retained by the tyre retaining means, the housing being in flow communication with a conduit *via* which material loosened from the tread of the tyre can be fed away from the assembly.

The roller drive may be in the form of a motor-driven pulley-and-belt system.

Each retaining shell may include a base portion which is connected to the retaining shell displacement means, and a cap portion coaxial with and releasably secured to the base portion, the base portion and the cap portion both being in the form of stepped flat-topped generally frustum-shaped shells, with the cap portion being received over the base portion, the steps of the cap portion being bigger than the steps of the base portion, so that the series of differently sized annular seats defined between the steps of the two cap portions can seat bigger tyres than the series of annular seats defined between the steps of the base portions.

The tool mount rotation axis may be normal to and intersects the transport axis, with the two tread profiling tools being diametrically opposed relative to the tool mount rotation axis.

The tyre retaining means rotation axis and the transport axis may be located in a plane normal to the tool mount rotation axis.

The assembly may include measuring means mounted on the framework for measuring the dimensions of a tyre retained by the tyre retaining means.

In accordance with another aspect of the invention there is provided an installation for retreading a tyre, which installation includes:

an assembly for profiling the tread of a tyre as hereinbefore described; and

a feeder assembly for feeding and urging a strip of material onto the tread of a tyre retained by the tyre retaining means and whose tread has been profiled by the tread profiling assembly, to retread the tyre, the feeder assembly having a feeding end substantially aligned with the tyre retaining means and locatable in the workspace in close proximity to the tread of the tyre, so that said strip of material fed onto the profiled tread of the tyre, as the tyre is rotated, is urged onto the profiled tread by the feeding end of the feeder assembly.

The feeding end of the feeder assembly may be displaceable between a feeding condition in which a free end thereof is located in the workspace in close proximity to the

tread of a tyre retained by the tyre retaining means, to permit said urging of a strip of material onto the profiled tread of the tyre, and a profiling condition in which the feeding end is displaced away from the tyre, to permit profiling of the tread of the tyre.

The feeder assembly may include a base and an elongated, substantially flat feeding bed aligned with the tyre retaining means, the feeding bed including a feeder framework and a plurality of laterally spaced feed rollers mounted on the feeder framework for rotation about axes more or less parallel to the tyre retaining means rotation axis, the feeder framework being guidably displaceably mounted on the base, so that displacement of the feeding end of the feeder assembly between its feeding condition and its profiling condition is effected by displacing the feeding bed along the base. In use, a strip of material to be fed onto the profiled tread of a tyre retained by the tyre retaining means can be laid flat on the feeding bed and can be fed conveyor-fashion, when the feeding end of the feeder assembly is in its feeding condition, onto the profiled tread of the tyre, as the tyre is rotated.

The free end of the feeding end of the feeder assembly may include an urging roller connected to the feeder framework and rotatable about an axis substantially parallel to the tyre retaining means rotation axis. A strip of material in use being fed onto the profiled tread of a tyre retained by the retaining means thus passes over the urging roller and is urged thereby onto the profiled tread of the tyre.

The urging roller may be connected to the feeder framework by means of two laterally spaced arms which are pivotally secured to the feeder framework for pivoting about an axis substantially parallel to the tyre retaining means rotation axis, so that the urging roller is displaceable relative to the tread of a tyre retained by the tyre retaining means, to permit adjustment of a force with which a strip of material being fed onto the profiled tread of the tyre is urged onto the tyre by the urging roller, the feeder assembly also including urging roller displacement means mounted on the feeder framework for displacing the urging roller relative to the tread of the tyre.

The installation may include a feeding bed displacement mechanism for displacing the feeding bed relative to the base, to effect displacement of the feeding end of the feeder assembly between its feeding condition and its profiling condition.

The feeding bed displacement mechanism may be in the form of a hydraulically operated piston-and-cylinder assembly, the piston being secured to one of the base and the feeder framework, and the cylinder being secured to the other one of the base framework and the feeder framework.

The urging roller displacement means may include a hydraulically operated piston-and-cylinder assembly, the piston being secured to one of the feeder framework and said arms, and the cylinder being secured to the other one of the feeder framework and said arms.

The tread profiling assembly may be located in a pit in the floor of a retreading plant, with that part of the framework defining the workspace and an operative tread profiling tool projecting upwardly from the pit above floor level, the tread profiling assembly including a cover for covering the pit, the cover being provided with an opening through which the tread profiling tool and said part of the framework project.

The base of the feeder assembly may be anchored adjacent the tread profiling assembly to the floor of the retreading plant, the base being shaped so that the feeding bed slopes upwardly away from the workspace, to facilitate feeding of a strip of material located on the feeding bed.

In accordance with a further aspect of the invention there is provided tyre retaining means for use with an assembly for profiling the tread of a tyre as hereinbefore described, the tyre retaining means being in the form of an axially splittable rim constituted by two parts which are provided with securing formations for securing them to the tread profiling assembly, the two parts, when operative, defining between them at least one annular seat for seating a tyre, one of the two parts being provided with an inlet valve *via* which air under pressure can be introduced into a tyre retained between the two parts, so that a tyre can be retained in an inflated condition between the two parts.

Each of the two parts may be in the form of a stepped flat-topped generally frustum-shaped retaining shell, each step of one retaining shell together with a corresponding

step of the other retaining shell forming one annular seat when the two shells are operative, the two retaining shells thus defining between them a plurality of annular seats for seating differently sized tyres.

Each retaining shell may include a base portion for securing to the tread profiling assembly, and a cap portion coaxial with and releasably secured to the base portion, the base portion and the cap portion both being in the form of stepped flat-topped generally frustum-shaped shells, with the cap portion being received over the base portion, the steps of the cap portion being bigger than the steps of the base portion, so that the series of differently sized annular seats defined between the steps of the two cap portions can seat bigger tyres than the series of annular seats defined between the steps of the base portions.

The invention is now described, by way of example, with reference to the accompanying diagrammatic drawings.

In the drawings:

Figure 1 shows, schematically, a three-dimensional view of part of an assembly for profiling the tread of a tyre in accordance with the invention;

Figure 2 shows, schematically, an end elevation of that part of the assembly shown in Figure 1;

Figure 3 shows, schematically, a side elevation of that part of the assembly shown in Figure 1;

Figure 4 shows, schematically, a sectional plan view of that part of the assembly shown in Figure 1, the section being taken at IV – IV in Figure 2;

Figure 5 shows, schematically, an end elevation of a carriage arrangement forming part of the tread profiling assembly in accordance with the invention;

Figure 6 shows, schematically, a cross-sectional elevation of part of a tyre retaining means in accordance with the invention, the cross-section being taken at VI – VI in Figure 1;

Figure 7 shows, schematically, in part, a three-dimensional view of an installation for retreading a tyre in accordance with the invention;

Figure 8 shows, schematically, a three-dimensional view of a feeder assembly forming part of the installation shown in Figure 7; and

Figure 9 shows, schematically, a side elevation of the installation shown in Figure 7.

With reference to the drawings, an assembly for profiling the tread of a tyre in accordance with the invention is generally designated by reference numeral 10. Only part of the assembly 10 is shown in Figures 1 – 3, but for ease of reference that part of the assembly 10 shown in the figures in question is also designated by reference numeral 10.

The assembly 10 includes a framework 12 defining a workspace 14. The assembly 10 further includes tyre retaining means 16 mounted on the framework 12 for retaining a tyre (not shown) in an inflated condition in the workspace 14. The tyre retaining means 16 is rotatable about a tyre retaining means rotation axis 18 extending through the workspace 14, and is mounted on the framework 12 so that a tyre retained by the tyre retaining means 16 is rotatable about its axis, the retained tyre thus being coaxial with the tyre retaining means rotation axis 18. The assembly 10 also includes two tread profiling tools 20, 22 mounted on the framework 12 to project into the workspace 14 for engaging and profiling, one at a time as hereinafter described, the tread of the retained tyre, as the tyre is rotated.

The assembly 10 also includes a tyre retaining means displacement arrangement 24 mounted on the framework 12 for displacing the tyre retaining means, and

hence the tyre retained thereby, in the workspace 14 (as hereinafter described) relative to the framework 12. A carriage arrangement 26 is mounted on the framework 12 below the tyre retaining means 16. The carriage arrangement 26 includes a tool mount 27 on which the two tread profiling tools 20, 22 are mounted, the carriage arrangement 26 being transportable, as hereinafter described, relative the framework 12 and, accordingly, relative to the tyre retaining means 16, so that the two tread profiling tools 20, 22 are transportable relative to the tyre retaining means 16 and to the retained tyre.

The assembly 10 also includes a tyre retaining means rotary drive in the form of a servomechanism including an electric rotary motor 28 and a gearbox arrangement 30 for rotatingly driving the tyre retaining means 16 and, hence in use, the retained tyre. The motor 28, the gearbox arrangement 30, and all the other motors and gearbox arrangements which will hereinafter be described are, so as not unnecessarily to complicate the drawings, shown as box-shaped blocks.

More particularly, the framework 12 includes a base in the form of an operatively laid-flat elongated rectangular steel beam arrangement 32, and two steel I-beams 34, 36 respectively fast with and projecting perpendicularly operatively upwardly from respective ends of the beam arrangement 32. A further steel I-beam 38 connects upper ends of the I-beams 34, 36, the I beam 38 being parallel to the beam arrangement 32. The carriage arrangement 26 is mounted on the beam arrangement 32. The framework 12 further includes a generally box-shaped steel carcass (not visible) around the carriage arrangement 26. Sides and a bottom of the carcass are covered by flat steel plates, only two of which are visible and are designated by reference numerals 40, 42 (Figure7), so that the carriage arrangement 26 is more or less encased, as will become more apparent hereinafter.

The carriage arrangement 26 includes an elongated bed which is constituted by the beam arrangement 32, the elongated bed defining a transport axis 43 parallel to and operatively below the tyre retaining means rotation axis 18. The tool mount 27 is mounted on a carriage 45 which forms part of the carriage arrangement 26. The carriage 45 is guidably transportable along the transport axis 43, so that the two tread profiling tools 20, 22 are guidably transportable, in a direction parallel to the tyre retaining means rotation axis 18, across the workspace 14 and, hence, across the tread of the retained tyre.

The tyre retaining means 16 (see in particular Figure 6) is in the form of an axially splittable rim constituted by two composite stepped flat-topped dome- or frustum-shaped retaining shells 44 (only one of the shells 44 is shown in Figure 6). Each shell 44 includes a base portion 46 and a cap portion 48, the base portion 46 being connected to the framework 12 as hereinafter described, and the cap portion 48 being releasably secured to the base portion 46. The cap portions 48 are received over and are coaxial with their respective associated base portions 46.

Each of the base portions 46 and the cap portions 48 define a plurality of steps, the steps of the base portions 46 being designated by reference numerals 50, and the steps of the cap portions 48 being designated by reference numerals 52. One step 50 of one of the base portions 46 together with a corresponding step 50 of the other base portion 46 define an annular seat for seating a tyre. The steps 50 of each base portion 46 are differently sized, so that a range of differently sized annular seats are defined between the base portions 46 when they operatively located, a range of differently sized tyres thus being retainable between the two base portions 46. Likewise, the steps 52 of each of the cap portions 48 are differently

sized, so that a range of differently sized annular seats are defined between the two cap portions 48 when they are operatively located, a range of differently sized tyres thus being retainable between the cap portions 48. The steps 52 of the cap portions 48 are bigger, both in width and in diameter, than the steps 50 of the base portions 46, so that bigger tyres are retainable between the cap portions 48.

The cap portions 48 are secured to the base portions 46 by means of bolts (not shown) received in holes 54 extending through the base portions 46 and into the cap portions 48. Thus, when a relatively smaller tyre is to be retreaded, the cap portions 48 are released from their securement to the base portions 46 by unscrewing the bolts. The particular construction of the retaining shells 44 thus permit relatively easy seating of a wide range of differently sized tyres.

One of the retaining shells 44 is provided with an inlet valve (not shown) via which air under pressure can be introduced into a tyre retained between the two retaining shells 44, to inflate the tyre.

The assembly 10 also includes retaining shell displacement means in the form of two telescopically extensible and retractable screw-jacks 56, 58 for displacing the retaining shells 44 relative to each other along the tyre retaining means rotation axis 18, to enable location of a tyre between the shells 44 and removal of a tyre retained between the shells 44. The screw-jacks 56, 58 are conventional screw-jacks and, accordingly, are not described in any further detail. Extensible and retractable ends of the screw-jacks 56, 58 are respectively connected to the base portions 46 of the retaining shells 44, and opposing ends of the screw-jacks 56, 58 are respectively connected to guide formations in the form of sleeves 60, 62.

The sleeves 60, 62 are of rectangular cross-section and are slidably received over the respective I-beams 34, 36. The screw-jacks 56, 58 are driven by means of servomechanisms which respectively include electric rotary motors 64, 66 and gearbox arrangements 68, 70, the servomechanisms respectively being mounted on operatively outer sides of the respective sleeves 60, 62. To this end, the I-beams 34, 36 are respectively provided with longitudinally extending slots 72, 74 for passing moving parts of the servomechanisms connected to the screw-jacks 56, 58.

Flanges 75 (only one of which is visible) are mounted on free ends of the extensible and retractable ends of the screw-jacks 56, 58, and the base portions 46 of the retaining shells 44 are, in turn, secured to the flanges 75. The base portions 46 are secured to the flanges 75 by means of bolts (not shown) received through apertures 77 provided in the base portions 46. If desired, the retaining shells 44 can be provided with complementary connection formations, e.g. a spigot-and-socket formation, for connecting them together when they are operatively located.

The tyre retaining means displacement arrangement 24 includes two toothed belt-and-pulley systems respectively mounted on operatively outer sides of the I-beams 34, 36. The systems are respectively associated with the respective retaining shells 44. Each system comprises two rotatably mounted toothed pulleys 76 which are longitudinally spaced along an associated one of the I-beams 34, 36, and a complementary toothed belt 78 received around the pulleys 76. A servomechanism including an electric rotary motor 80 and a gearbox 82 is mounted on an operatively inner side of each of the I-beams 34, 36, each servomechanism being operatively connected to the upper one of the pulleys 76 of each of the belt-and-pulley systems for driving the pulleys 76.

The sleeves 60, 62 are respectively secured to the belts 78 of their associated belt-and-pulley systems, so that operation of the electric motors 80 displace the sleeves 60, 62 along the I-beams 34, 36. Furthermore, displacement of the sleeves 60, 62 are guided along the I-beams 34, 36 by means of elongated guide rails 84 secured to the I-beams 34, 36, the sleeves having guide formations (not visible) secured thereto, with the guide formations being slidable along the guide rails 84.

The carriage 45 includes a box-shaped base 86 on which the tool mount 27 is mounted. The carriage arrangement 26 further includes transport means for transporting the carriage 45 along the transport axis 43. The transport means includes a toothed belt-and-pulley system comprising two toothed pulleys 88 respectively rotatably mounted, adjacent opposite ends thereof, on the beam arrangement 32 for rotation about operatively upwardly extending axes, and a toothed belt 90 received over the pulleys 88. A servomechanism including an electric rotary motor 92 and a gearbox arrangement 94 is operatively connected to one of the pulleys 88 for driving it.

The base 86 of the carriage 45 is provided with guide formations 96 engaging guide rails, only one of which is visible and is indicated by reference numeral 98, extending parallel to the transport axis 43, so that displacement of the carriage 45 is guided along the transport axis 43. The visible guide rail 98 is mounted on the beam arrangement 32 and is thus engaged by two of the guide formations 96 which are located on an underside of the base 86. The other guide rail which is not visible is mounted on the carcass and is located above the base 86, so that it is engaged by two of the guide formations 96 which are located on an upper side of the base 86.

The assembly 10 also includes measuring means (not shown) mounted on the framework 12 for measuring the width and radius of a tyre retained between the retaining shells 44.

The tool mount 27 is mounted on the base 86 for rotation thereof about a tool mount rotation axis 100 transverse to and intersecting the transport axis 43, with the two tread profiling tools 20, 22 being located on opposite sides of the tool mount rotation axis 100, i.e. they are diametrically opposed relative to the too mount rotation axis 100. In use, the tool mount 27 is thus rotated about the tool mount rotation axis 100 to select an operative tread profiling tool 20, 22, i.e. the tool to project into the workspace 14 for engaging and profiling the tread of the retained tyre. A servomechanism including an electric rotary motor 102 and a gearbox arrangement 104 is mounted on the base 86 and is operatively connected to the tool mount 27 for rotatingly displacing the tool mount 27 about the tool mount rotation axis 100, to permit, by rotating the tool mount 27, selective engagement of either one of the two tread profiling tools 20, 22 with the tread of the retained tyre. Rotation of the tool mount 27 thus also enables adjustment of an angle of the operatively engaging or selected tread profiling tool 20, 22 relative to the tread of the tyre. Normally, when not in use, the tool mount 27 will be located as shown in Figures 1 – 4 and 7, so that neither of the tread profiling tools 20, 22 project into the workspace 14. The tool mount 27 defines, between the two tread profiling tools 20, 22 a flat planar surface 29 which, as can be seen in Figures 1 – 4 and 7 faces operatively upwardly and is parallel to the tyre retaining means rotation axis 18 when the assembly 10 is not in use. When operative, the tool mount 27 will be located as shown in Figure 4, so that one of the tread profiling tools 20, 22 project into the workspace 14. Thus when the assembly 10 is not in use, the tool mount 27 is completely clear from the workspace

14, to permit unhindered location or loading of a tyre onto the tyre retaining means 16. When the tyre is located in the workspace 14 to be located or loaded onto the tyre retaining means 16, it will rest with its tread on the surface 29. To this end, the tool mount 27 is provided with a recess 31 within which a sensor forming part of the sensing means is located in use. Said sensor can thus, when the tyre is located on the surface 29 measure the thickness of the tread or any required layer of the tread of the tyre.

The tread profiling tool 20 is in the form of a cutter having a semi-circular cutting surface for engaging the tread of the retained tyre to remove, substantially in bulk, material from the tread of the tyre. The tread profiling tool 20 is mounted on one end of the tool mount 27. The tread profiling tool 22 is mounted on the other end of the tool mount 27, and is in the form of a roller (hereinafter, for ease of reference, also referred to as the roller 22) rotatably mounted on the tool mount 27 to rotate, in operation, about an axis which extends, bearing in mind that the angle of the tools 20, 22 are adjustable relative to the tread of a retained tyre, parallel to the tyre retaining means rotation axis 18. The roller 22 is provided with an annular abrasive profiling surface 106. An electric rotary motor 108 and a gearbox arrangement 110 are mounted on the tool mount 27 for rotatingly driving the roller 22, the gearbox arrangement being drivingly connected to the roller 22 by means of an axle 113 and a toothed belt-and-pulley system. The belt-and-pulley system includes two toothed pulleys, one of which is not visible and is connected to the roller 22, the other pulley 112 being drivingly connected to the gearbox 110 *via* the axle 113 , and a toothed belt 114 received over the the pulleys.

When the shells 44 are operatively located, operatively inner faces thereof abut each other. An imaginary axis (not shown), normal to the transport axis 43 and the tool mount rotation axis 100, which imaginary extends vertically upwardly from the point of

intersection of the transport axis 43 and the tool mount rotation axis 100, is normal to and intersects the tyre rotating means rotation axis 18, and is located in a plane formed between the abutting operatively inner faces of the shells 44 when the tool mount 27 is located as shown in the drawings. The imaginary axis, the transport axis 43 and the tool mount rotation axis 100 are thus normal to one another, and furthermore intersect in a common point when the tool mount 27 is located along the transport axis 43 in a position as shown in the drawings, i.e. when the assembly 10 is not in use or at the beginning of a tread profiling process.

As hereinbefore mentioned, when the assembly 10 is not in use, the tool mount 27 is located so that the surface 29 faces upwardly. In this position, a center of the tread profiling tool 20, when the assembly 10 is seen in end elevation, is spaced 90° clockwise relative to the tool mount rotation axis 100 from said upright imaginary axis, and a center of the tread profiling tool 22 is spaced 90° anti-clockwise from said imaginary axis. The centers of the two tread profiling tools 20, 22 are intersected by the transport axis 43.

The roller 22 is housed in a housing 116 provided with an opening through which that part of the roller 22 which engages the tread of the retained tyre in use projects. The housing 116 also partially covers the pulley 112 and the belt 114. The housing 116 is, *via* the base 86 in communication with a conduit system 118 forming part of a duct system connectable to a vacuum pump (not shown and not forming part of the assembly 10) for sucking particles removed from the tread of the retained tyre, away from the assembly 10. A further conduit system 120 connects the housing 116 and the base 86. Although not visible, the base 86 is provided with an opening providing flow communication between the two pipes 118, 120.

A rim-like bristle base 122 from which a multiplicity of bristles 124 project is mounted on that end of the housing 116 from which the roller 22 projects (the bristle base 122 and the bristles 124 are shown only in Figure 5). The bristle base 122 has an opening complemental to the opening of the housing 116, to permit projection of the roller 22 therethrough. The bristles 124 are mounted on the bristle base 122 such that they surround the projecting part of the roller 22. In use, free ends of the bristles 124 thus engage the tread of the retained tyre, to provide a seal between the roller 22 and the surroundings of the assembly 10, thus resisting liberation of particles removed from the tread into the surroundings of the assembly 10.

Operation of the assembly 10 will be described hereinafter.

With reference to Figures 7 and 9, an installation for retreading a tyre in accordance with the invention is generally designated by reference numeral 130. The installation 130 includes a tread profiling assembly 10 in accordance with the invention, and a feeder assembly generally designated by reference numeral 150 for feeding a strip of material (not shown) onto the profiled tread of a retained tyre, to retread the tyre. Selected reference numerals are omitted from Figure 7.

In operation, as shown in Figure 9, the installation 130 is mounted on the floor 132 of a retreading plant. More particularly, that part of the assembly 10 which is substantially encased by the plates 40, 42 and the other plates which are not visible is located in a box-shaped pit 134 in the floor 132 of the plant. Thus, when operatively installed, part of the framework 12 and the retaining shells 44 together with their associated components are

located above floor level, and the carriage arrangement 26 is located in the pit 134 with only a part of the tool mount 27 and either one of the profiling tools 20, 22 projecting from the pit 134 into the workspace 14 when the assembly 10 is in operation. Naturally, the floor 132 is provided with a passage or the like (not shown) leading into the pit 134 and in which a conduit connecting the conduit 118 and the vacuum pump is located.

The assembly 10 yet further includes a cover for covering the pit 134. The cover is constituted by a plurality of rectangular panels 136 mounted on a frame 137 (Figures 7 and 8), and is mounted on the floor 132, so that it covers the carriage arrangement 26 and other components of the assembly 10 located in the pit 134. The cover is more or less flush with floor level. The panels 136 are arranged such that an elongated opening 138 is defined in the cover, the opening 138 being substantially aligned with the carriage arrangement 26, to permit passing of part of the tool mount 27 and the operative or selected tool 20, 22 therethrough.

The electric motors 28, 64, 66, 80, 92, 102 and 108 and the measuring means are in use connected to a control system (not shown and not forming part of the invention) for controlling, in accordance with values measured by the measuring means and inputs from an operator, operation of the electric motors 28, 64, 66, 80, 92, 102 and 108. The control system will thus typically include input means via which an operator controls operation of assembly 10.

Figure 8 shows a three-dimensional view of the feeder assembly 150. The feeder assembly 150 includes a base 152 comprising a flat top 154 and four legs 156 for supporting the top 154 above the floor 132 of the plant. Each leg 156 is provided with a

rectangular mounting plate 158 provided with apertures 160 (Figure 8) for receiving bolts (not shown) by means of which the assembly 150 is anchored to the floor 132. The assembly 150 further includes a flat feeding bed 162 longitudinally displaceably mounted on the top 154. To this end, the top 154 is provided with two elongated guide rails 164 extending longitudinally therealong, and the feeding bed 162 is provided with guide formations 166 (Figure 9) engaging the guide rails 164. Displacement of the feeding bed 162 relative to the top 154 is thus guided.

The feeding bed 162 includes an elongated rectangular feeder framework 168, and a plurality of laterally spaced feed rollers 170 mounted on the feeder framework 168 for rotation about axes normal to a longitudinal axis of the feeder framework 168. The assembly 150 includes a hydraulically operated piston-and-cylinder assembly 172 for displacing the feeding bed 162 relative to the top 154. The cylinder 174 of the piston-and-cylinder assembly 172 is mounted on an underside of the base 154, and the piston 176 of the piston-and-cylinder assembly 172 is mounted *via* a mounting bracket 178 to an underside of the feeder framework 168.

A feeding end 179 of the feeding bed 162, and accordingly a feeding end of the assembly 150, includes an urging roller 180 rotatably mounted on the feeder framework 168 *via* two laterally spaced arms 182, the urging roller 180 being rotatable about an axis parallel to the rotation axes of the feed rollers 170. The arms 182 are pivotally mounted on the feeder framework 168 to pivot about an axis parallel to the rotation axes of the feed rollers 170 and that of the urging roller 180, to enable displacement of the urging roller 180 for purposes which will become more apparent hereinafter. A hydraulically operated piston-and-cylinder assembly 184 effects pivoting of the arms 182 and, accordingly, displacement of the urging roller 180. The cylinder 186 of the assembly 184 is mounted on the feeder framework 168 *via* a mounting bracket 188, and the piston 190 of the assembly 184 is connected to the arms 182 *via* a connecting rod 192 mounted on and extending between the two arms 182.

As can be seen in Figures 7 and 9, the feeder assembly 150 is anchored to the floor 132 adjacent the tread profiling assembly 10, so that the feeding bed 162 is aligned with the tyre retaining shells 44, and the urging roller 180, which consequentially is also aligned with the tyre retaining shells 44, is located proximate the workspace 14. The base 152 slopes upwardly away from the workspace 14.

In use, an elongated strip of material (not shown) to be fed onto and bonded to the profiled tread of a tyre retained by the tyre retaining means 16, is laid flat onto the feed rollers 170, so that it extends longitudinally along the feeding bed 162. The strip of material is then fed over the urging roller 180 and urged thereby onto the profiled tread of the tyre, as will be described hereinafter.

The displaceability of the feeding bed 162 along the base 152, permits displacement of the feeding end 179, and accordingly the urging roller 180, between a feeding condition in which a the urging roller 180 is located in the workspace 14 in close proximity of the tread of a tyre retained by the tyre retaining means, to permit the aforementioned urging of the strip of material onto the profiled tread of the tyre, and a profiling condition in which the urging roller 180 is displaced away from the tyre, to permit profiling of the tread of the tyre.

Retreading of a tyre by making use of the installation 130 is thus a two-step process, the first comprising profiling the tread of the tyre, and the second comprising securing of a strip of material on the profiled tread of the tyre. Although the retreading is a two-step process, it is important to note that the tyre is retained by the tyre retaining means 16 during the entire retreading process, so that no excessive handling of the tyre is required.

In use, during the first step of the retreading process, the electric rotary motors 64, 66 are energised to displace the retaining shells 44 away from each other. A tyre is then located between the retaining shells 44 and the electric rotary motors 64, 66 are again energised to displace the retaining shells 44 towards each other so that they define the

annular seat between them and engage the tyre, so that the tyre is retained between them. The annular seats defined between the retaining shells 44 are sized so that the retaining shells 44 abut each other when the tyre is retained between them. The tyre is then inflated by introducing air under pressure, *via* the inlet valve, thereinto. The measuring means then measures the width and the radius of the retained tyre, which measurements are then processed by the control system and, in accordance therewith, energises the electric rotary motors 80 to displace the sleeves 60, 62 and the retaining shells 44 and, hence, the tyre retained therebetween to a suitable height relative to the tool mount 27. The desired tread profiling tool 20, 22 is selected by an operator and is operatively located by energising the electric rotary motor 108 to rotate the tool mount 27 through 90° to a suitable orientation relative to the tread of the tyre.

The electric rotary motor 28 is then energised to cause rotation of the retaining shells 44 and the tyre held therebetween. Naturally, as hereinbefore mentioned, the cap portions 48 of the retaining shells 44 can be removed when a relatively smaller sized tyre is to be retreaded.

When bulk removal of material from the tread of the retained tyre is required, the profiling tool 20 will be selected. The electric motor 92 is energised to displace the carriage 45 longitudinally along the transport axis 43, thus effecting displacement of the tread profiling tool 20 across the width of the tread of the tyre, to remove material from the tread of the tyre, as the tyre is rotated. The control system will, typically, be pre-programmed, in accordance with the values measured by the measurement means, so that the tool mount 27 is slightly rotated in a suitable direction when the profiling tool 20 engages or approaches a side or an

edge of the tread of the tyre, so as to remove the tread in accordance with a desired profile of the tyre.

Once bulk removal of the tread of the tyre has taken place, the retaining shells 44 and, hence, the tyre will be displaced operatively upwardly away from the profiling tool 20, the motor 28 will be de-energised, and the tool mount 27 will be rotated through 180°, by energizing the motor 102, so that the profiling tool or roller 22 is in the operative position. The electric rotary motor 108 is now energised so that the roller 22 rotates in a direction opposite to that of the tyre, and the profiling process as hereinbefore described is now repeated. Because of the nature of the annular profiling surface of the profiling tool 22, the tread of the tyre is now given a smooth surface finish.

Once the tread of the tyre has been profiled to a predetermined or required finish, the electric rotary motors 28 and 108 are de-energised and the retaining shells 44 are displaced operatively away from the profiling tool 22.

During the second step of the retreading process, a strip of material to be secured to the profiled tread of the retained tyre is, as hereinbefore mentioned, laid flat onto the feeding bed 162, so that one end of the strip is closely spaced from the urging roller 180. That face of the strip of material which will abut the tread of the tyre, and optionally the tread of the tyre, is then treated with a bonding agent, e.g. an adhesive agent. The urging roller 180 is then displaced towards its feeding condition, and said end of the strip of material is located between the urging roller 180 and the tread of the tyre. The urging roller 180 is then displaced towards the tread of the tyre by means of the piston-and-cylinder assembly 184, so that said end of the strip of material is urged onto the profiled tread of the tyre. The piston-

and-cylinder assembly 184 thus permits adjustment of the force with which the strip of material is urged onto the profiled tread of the retained tyre. The tyre retaining means and, accordingly, the tyre is then rotated relatively slowly, with the strip of material being fed and urged onto the profiled tread of the tyre as it rotates. The fact that the base 152 of the feeder assembly 150 slopes upwardly away from the workspace 14 thus facilitates feeding of the strip of material.

When the strip of material has been fed onto the profiled tread of the tyre, the tyre is deflated and the retaining shells 44 are displaced away from each other, whereafter the tyre is removed. The tyre will then be treaded in accordance with conventional retreading profile procedure.

The invention as described and illustrated thus provides an installation for retreading, within a certain size range, a variety of differently sized tyres. The installation further has the advantage that a retreading process executed by making use of the installation can to a large extent be automised.

CLAIMS:

1. An assembly for profiling the tread of a tyre, which assembly includes:

a framework defining a workspace;

tyre retaining means mounted on the framework for retaining a tyre in an inflated condition in the workspace, the tyre retaining means being rotatable about a tyre retaining means rotation axis extending through the workspace, so that a tyre retained thereby is rotatable about its axis;

at least one tread profiling tool mounted on the framework to project into the workspace, each tread profiling tool being laterally spaced from the tyre retaining means rotation axis for engaging and profiling the tread of a tyre retained and rotated by the tyre retaining means; and

a tyre retaining means displacement arrangement mounted on the framework for displacing the tyre retaining means and a tyre retained thereby within the workspace and relative to the framework.

2. An assembly as claimed in Claim 1, which includes a carriage arrangement including a tool mount on which each tread profiling tool is mounted, the tool mount being transportable relative to the framework, to permit displacement of each tread profiling tool relative to the tyre retaining means and to a tyre retained thereby.

3. An assembly as claimed in Claim 2, in which the carriage arrangement includes an elongated bed defining a transport axis extending across the workspace, the transport axis being laterally spaced from and parallel to the tyre retaining means rotation axis, and a carriage on which the tool mount is mounted, the carriage being mounted on the elongated bed and being guidably transportable along the transport axis, so that each tread profiling tool is displaceable parallel to the tyre retaining means rotation axis across the workspace and across the tread of a tyre retained by the tyre retaining means.

4. An assembly as claimed in Claim 3, which includes guide formations mounted on the framework for guiding displacement of the tyre retaining means in the workspace in a lateral direction relative to the transport axis, to permit, in accordance with the size of a particular tyre and the tread profiling required, the displacement of the tyre retaining means and a tyre retained thereby relative to each tread profiling tool.

5. An assembly as claimed in Claim 4, which includes a tyre retaining means rotary drive operatively connected to the tyre retaining means for rotatingly driving the tyre retaining means and a tyre retained thereby.

6. An assembly as claimed in Claim 5, in which two tread profiling tools are mounted on the tool mount, the two tread profiling tools being spaced from each other about a tool mount axis transverse to the transport axis, with the tool mount being rotatable about the tool mount axis, to permit, by rotating the tool mount, rotation of a selected one of the tread profiling tools into an operative position to engage the tread of a tyre retained by the tyre retaining means, and to permit adjustment of an angle of the selected tread profiling tool relative to the tread of the tyre.

7. An assembly as claimed in Claim 6, in which the tyre retaining means includes an axially splittable rim constituted by two parts, each part being coaxial with and rotatable about the tyre retaining means rotation axis, with the two parts defining between them at least one annular seat for seating a tyre, one of the parts being provided with an inlet valve *via* which air under pressure can be introduced into a tyre retained between the two parts, to inflate the tyre, the assembly including two said guide formations respectively for guiding displacement of each of the parts in said lateral direction relative to the transport axis.

8. An assembly as claimed in Claim 7, in which each part is in the form of a stepped flat-topped generally frustum-shaped retaining shell, the steps being concentrical about the tyre retaining means rotation axis, with each step of one retaining shell together with a corresponding step of the other retaining shell forming one annular seat, the two retaining shells thus defining between them a series of differently sized annular seats for seating differently sized tyres.

9. An assembly as claimed in Claim 8, which includes retaining shell displacement means for guidingly displacing the two retaining shells relative to each other along the retaining means rotation axis, to permit location of a tyre between the two retaining shells and to permit removal of a tyre retained between the two retaining shells.

10. An assembly as claimed in Claim 9, in which the tyre retaining means displacement arrangement includes two displacement mechanisms, each of the displacement mechanisms being operatively connected to one of the guide formations, with the retaining shell displacement means being connected to the guide formations, such that the displacement mechanisms displace the retaining shell displacement means and, accordingly, the retaining shells in said lateral direction relative to the transport axis along the workspace.

11. An assembly as claimed in Claim 10, in which the retaining shell displacement means includes two elongated motor-driven extensible and retractable formations, one end of each formation being fast with one of the retaining shells and the other end of each formation being fast with one of said guide formations.

12. An assembly as claimed in Claim 11, in which each said displacement mechanism is in the form of a motor-driven belt-and-pulley system, with each guide formation being fast with the belt of its associated belt-and-pulley system, so that each retaining shell displacement means and its associated retaining shell are displaceable along the workspace in response to operation of the motor of its associated displacement mechanism.

13. An assembly as claimed in any one of Claim 9 to Claim 12 inclusive, in which the carriage arrangement includes transport means for transporting the carriage along the transport axis.

14. An assembly as claimed in any one of Claim 9 to Claim 13 inclusive, which includes rotation means for rotating the tool mount about the tool mount axis.

15. An assembly as claimed in any one of Claim 9 to Claim 14 inclusive, in which the retaining means rotary drive includes a motor operatively connected to one of the two retaining shells, operation of the motor thus driving both shells when the shells are engaged with a tyre.

16. An assembly as claimed in Claim 13, in which the transport means for transporting the carriage along the transport axis is in the form of a motor-driven belt-and-

pulley system, the carriage being secured to the belt so that it is transported along the transport axis in response to operation of the motor.

17. An assembly as claimed in Claim 14, in which the rotation means for rotating the tool mount includes a motor mounted on the carriage, the motor being operatively connected to the tool mount, so that the tool mount is rotated about the tool mount axis in response to operation of the motor.

18. An assembly as claimed in any one of Claim 9 to Claim 17 inclusive, in which one of the tread profiling tools is in the form of a cutter provided with a cutting edge for operatively engaging the tread of a tyre retained by the tyre retaining means, to remove material from the tread of the tyre, the other tread profiling tool being in the form of a roller rotatable about an axis substantially parallel to the transport axis, the roller being provided with an abrading annular surface for engaging the tread of the tyre, to smoothen the tread of the tyre from which material has been removed by the cutter.

19. An assembly as claimed in Claim 18, which includes a roller drive mounted on the tool mount for rotating the roller.

20. An assembly as claimed in Claim 19, which includes a housing within which the roller is rotatably housed, the housing being provided with an opening through which part of the annular surface of the roller projects, to permit engagement of the annular surface of the roller with the tread of a tyre retained by the tyre retaining means, the housing being in flow communication with a conduit *via* which material loosened from the tread of the tyre can be fed away from the assembly.

21. An assembly as claimed in Claim 19 or Claim 20, in which the roller drive is in the from of a motor-driven pulley-and-belt system.

22. An assembly as claimed in any one of Claim 9 to Claim 21 inclusive, in which each retaining shell includes a base portion which is connected to the retaining shell displacement means, and a cap portion coaxial with and releasably secured to the base portion, the base portion and the cap portion both being in the form of stepped flat-topped

generally frustum-shaped shells, with the cap portion being received over the base portion, the steps of the cap portion being bigger than the steps of the base portion, so that the series of differently sized annular seats defined between the steps of the two cap portions can seat bigger tyres than the series of annular seats defined between the steps of the base portions.

23. An assembly as claimed in any one of Claim 6 to Claim 22 inclusive, in which the tool mount rotation axis is normal to and intersects the transport axis, with the two tread profiling tools being diametrically opposed relative to the tool mount rotation axis.

24. An assembly as claimed in any one of Claim 6 to Claim 23 inclusive, in which the tyre retaining means rotation axis and the transport axis are located in a plane normal to the tool mount rotation axis.

25. An assembly as claimed in any one of the preceding claims, which includes measuring means mounted on the framework for measuring the dimensions of a tyre retained by the tyre retaining means.

26. An installation for retreading a tyre, which installation includes:

an assembly for profiling the tread of a tyre as claimed in any one of Claim 1 to Claim 25 inclusive; and

a feeder assembly for feeding and urging a strip of material onto the tread of a tyre retained by the tyre retaining means and whose tread has been profiled by the tread profiling assembly, to retread the tyre, the feeder assembly having a feeding end substantially aligned with the tyre retaining means and locatable in the workspace in close proximity to the tread of the tyre, so that said strip of material fed onto the profiled tread of the tyre, as the tyre is rotated, is urged onto the profiled tread by the feeding end of the feeder assembly.

27. An installation as claimed in Claim 26, in which the feeding end of the feeder assembly is displaceable between a feeding condition in which a free end thereof is located in the workspace in close proximity to the tread of a tyre retained by the tyre retaining means, to permit said urging of a strip of material onto the profiled tread of the tyre, and a profiling condition in which the feeding end is displaced away from the tyre, to permit profiling of the tread of the tyre.

28. An installation as claimed in Claim 27, in which the feeder assembly includes a base and an elongated, substantially flat feeding bed aligned with the tyre retaining means, the feeding bed including a feeder framework and a plurality of laterally spaced feed rollers mounted on the feeder framework for rotation about axes substantially parallel to the tyre retaining means rotation axis, the feeder framework being guidably displaceably mounted on the base, so that displacement of the feeding end of the feeder assembly between its feeding condition and its profiling condition is effected by displacing the feeding bed along the base.

29. An installation as claimed in Claim 28, in which the free end of the feeding end of the feeder assembly includes an urging roller connected to the feeder framework and rotatable about an axis substantially parallel to the tyre retaining means rotation axis.

30. An installation as claimed in Claim 29, in which the urging roller is connected to the feeder framework by means of two laterally spaced arms which are pivotally secured to the feeder framework for pivoting about an axis substantially parallel to the tyre retaining means rotation axis, so that the urging roller is displaceable relative to the tread of a tyre retained by the tyre retaining means, to permit adjustment of a force with which a strip of material being fed onto the profiled tread of the tyre is urged onto the tyre by the urging roller, the feeder assembly also including urging roller displacement means mounted on the feeder framework for displacing the urging roller relative to the tread of the tyre.

31. An installation as claimed in Claim 30, which includes a feeding bed displacement mechanism for displacing the feeding bed relative to the base, to effect displacement of the feeding end of the feeder assembly between its feeding condition and its profiling condition.

32. An installation as claimed in Claim 31, in which the feeding bed displacement mechanism is in the form of a hydraulically operated piston-and-cylinder assembly, the piston being secured to one of the base and the feeder framework, and the cylinder being secured to the other one of the base framework and the feeder framework.

33. An installation as claimed in any one of Claim 30 to Claim 32 inclusive, in which the urging roller displacement means includes a hydraulically operated piston-and-cylinder assembly, the piston being secured to one of the feeder framework and said arms, and the cylinder being secured to the other one of the feeder framework and said arms.

34. An installation as claimed in any one of Claim 28 to Claim 33 inclusive, in which the tread profiling assembly is located in a pit in the floor of a retreading plant, with that part of the framework defining the workspace and an operative tread profiling tool projecting upwardly from the pit above floor level, the tread profiling assembly including a cover for covering the pit, the cover being provided with an opening through which the tread profiling tool and said part of the framework project.

35. An installation as claimed in Claim 34, in which the base of the feeder assembly is anchored adjacent the tread profiling assembly to the floor of the retreading plant, the base being shaped so that the feeding bed slopes upwardly away from the workspace, to facilitate feeding of a strip of material located on the feeding bed.

36. Tyre retaining means for use with an assembly for profiling the tread of a tyre as claimed in any one of Claim 1 to Claim 25 inclusive, the tyre retaining means being in the form of an axially splittable rim constituted by two parts which are provided with securing formations for securing them to the tread profiling assembly, the two parts, when operative, defining between them at least one annular seat for seating a tyre, one of the two parts being provided with an inlet valve *via* which air under pressure can be introduced into a tyre retained between the two parts, so that a tyre can be retained in an inflated condition between the two parts.

37. Tyre retaining means as claimed in Claim 36, in which each of the two parts is in the form of a stepped flat-topped generally frustum-shaped retaining shell, each step of one retaining shell together with a corresponding step of the other retaining shell forming one annular seat when the two shells are operative, the two retaining shells thus defining between them a plurality of annular seats for seating differently sized tyres.

38. Tyre retaining means as claimed in Claim 37, in which each retaining shell includes a base portion for securing to the tread profiling assembly, and a cap portion coaxial with and releasably secured to the base portion, the base portion and the cap portion both being in the form of stepped flat-topped generally frustum-shaped shells, with the cap portion being received over the base portion, the steps of the cap portion being bigger than the steps of the base portion, so that the series of differently sized annular seats defined between the steps of the two cap portions can seat bigger tyres than the series of annular seats defined between the steps of the base portions.

39. An assembly for profiling the tread of a tyre as claimed in Claim 1, substantially as herein described and illustrated.

40. An installation as claimed in Claim 26, substantially as herein described and illustrated.

41. Tyre retaining means as claimed in Claim 36, substantially as herein described and illustrated.

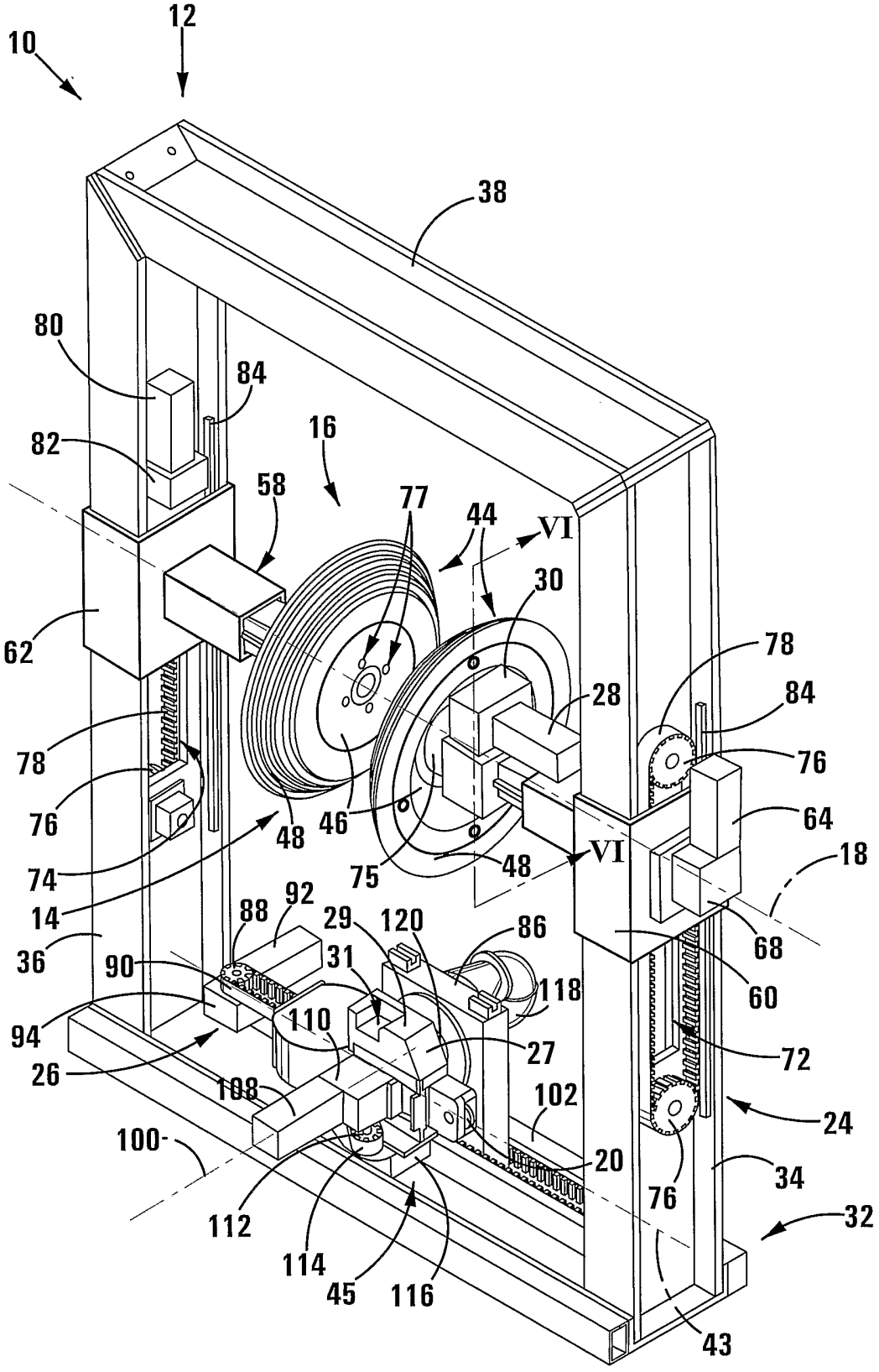

10
12
38
80
84
82
16
58
77
44
VI
30
62
78
84
28
78
76
76
64
48
46
74
75
48
VI
18
14
92
88
29
120
86
36
90
31
68
60
118
94
110
27
72
26
108
102
24
100
20
34
76
32
112
114
45
116
43

FIG 1

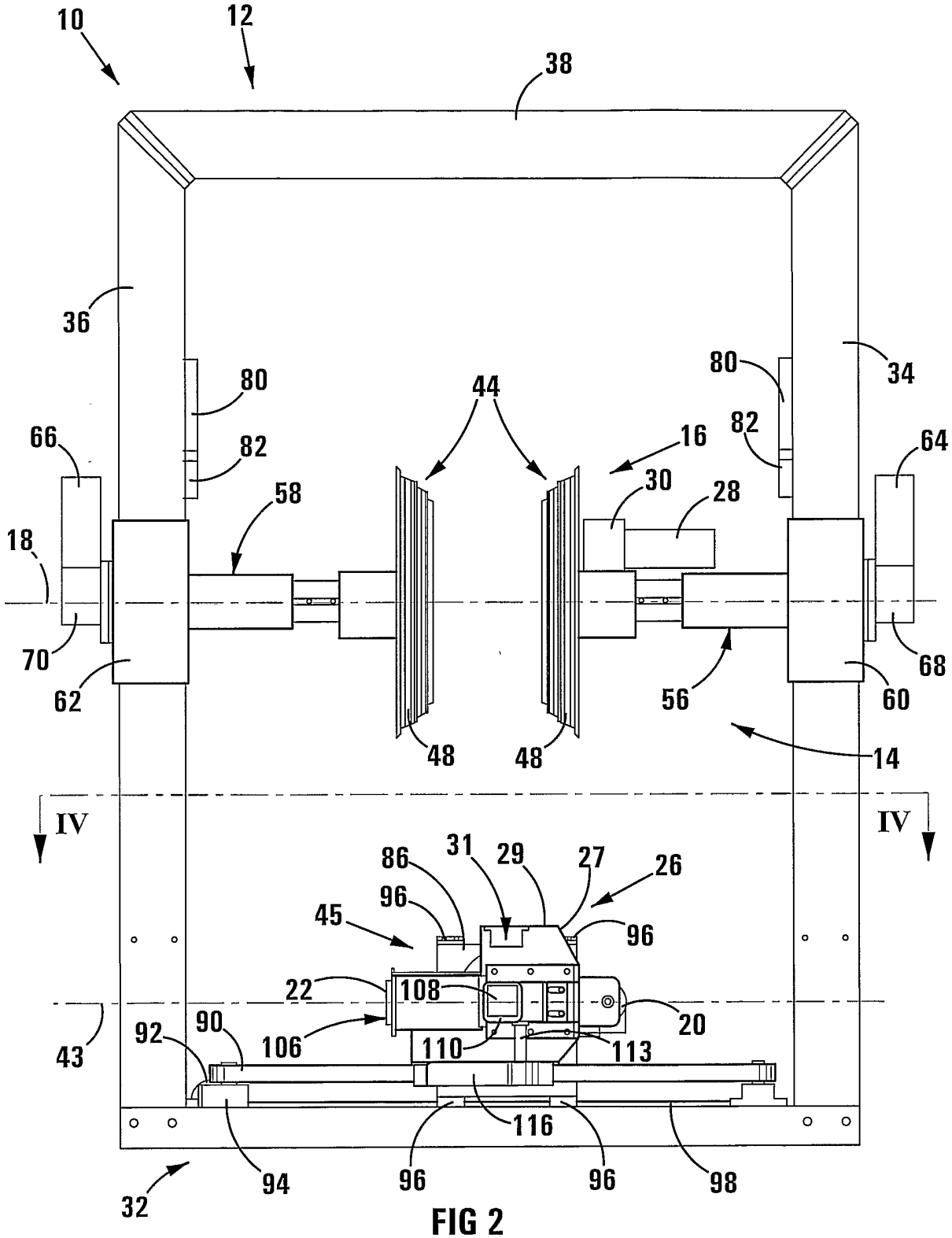

10
12
38
36
80
82
66
58
18
70
62
44
48
48
80
82
34
64
16
30
28
68
56
60
14
IV
IV
86
31
29
27
26
96
45
96
22
108
20
43
92
90
106
110
113
116
94
96
96
98
32

FIG 2

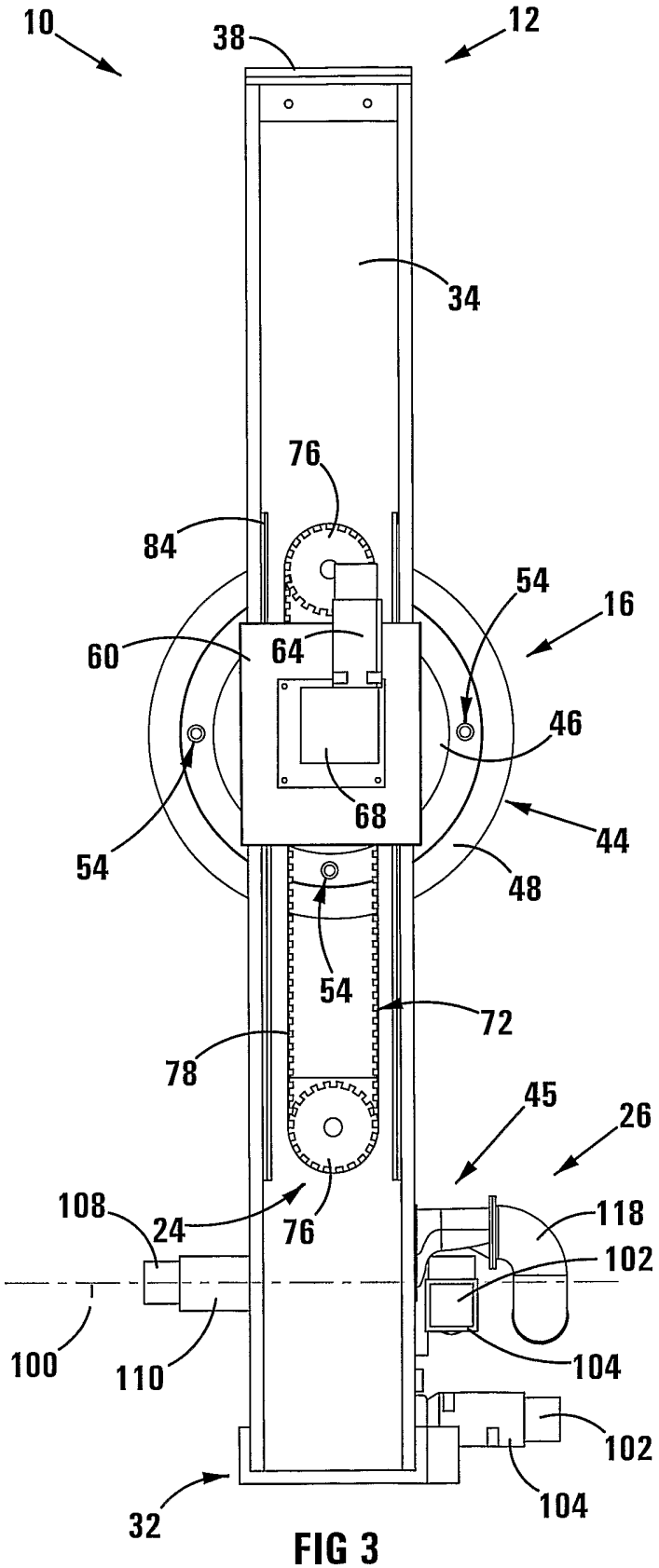

10
38
12
34
76
84
54
16
60
64
46
68
44
54
48
54
72
78
45
26
108
24
76
118
102
100
110
104
102
32
104

FIG 3

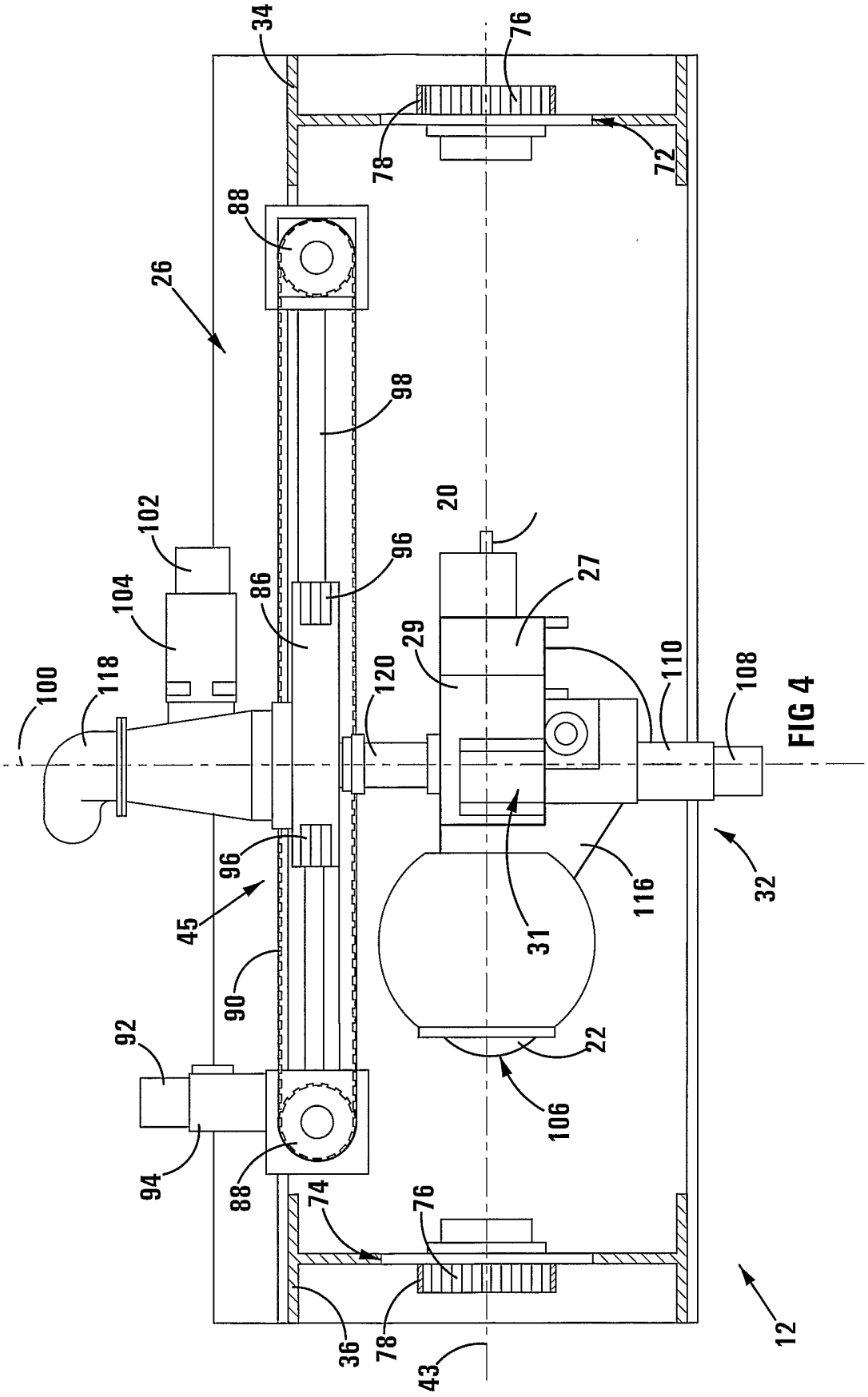

34
76
78
72
88
26
98
102
20
96
104
86
27
29
100
118
120
110
108
96
45
31
116
32
90
92
22
106
94
88
74
76
36
78
43
12

FIG 4

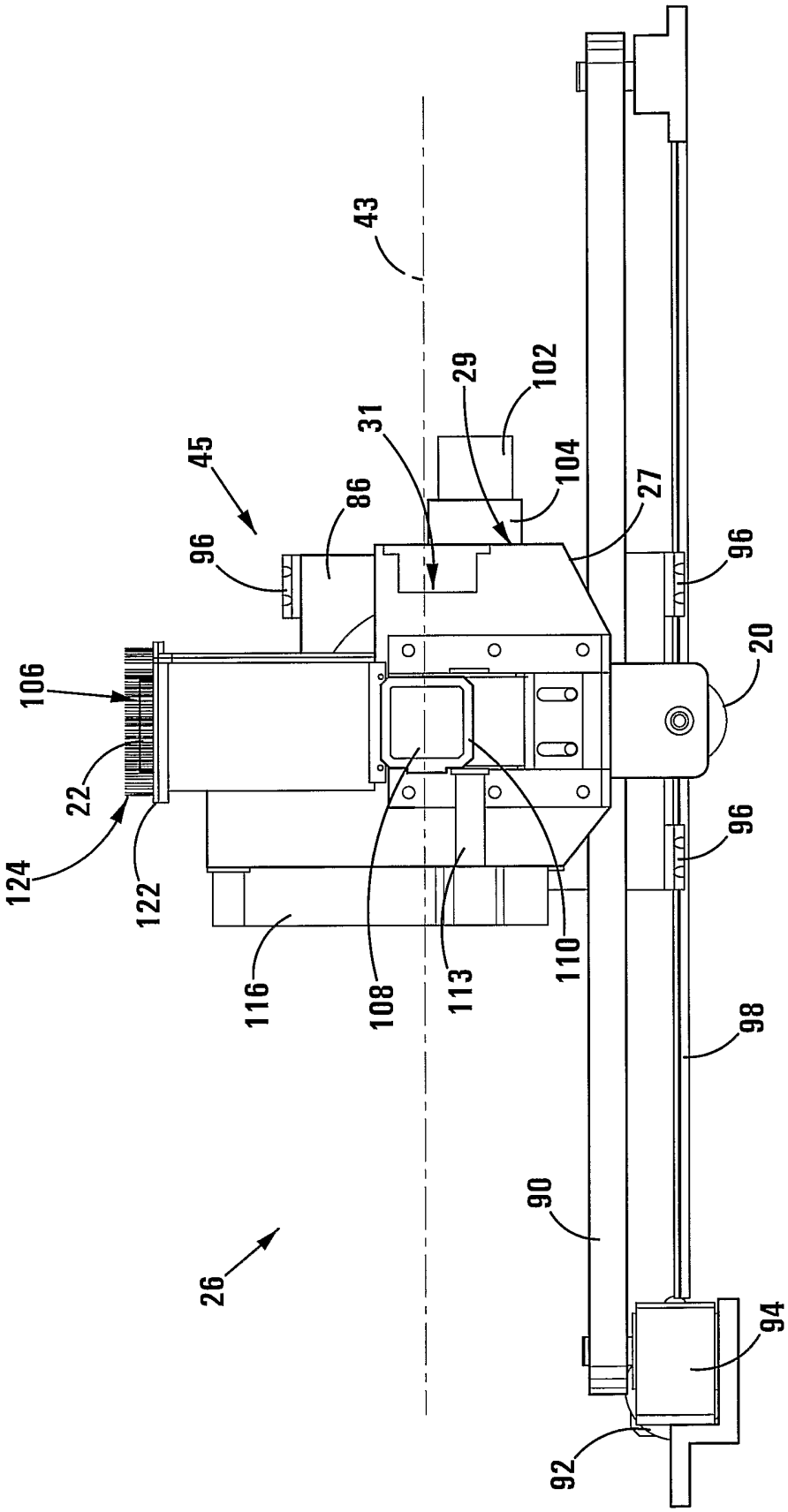

43
29
102
31
45
104
86
27
96
96
20
106
22
96
124
122
116
108
113
110
98
90
26
94
92

FIG 5

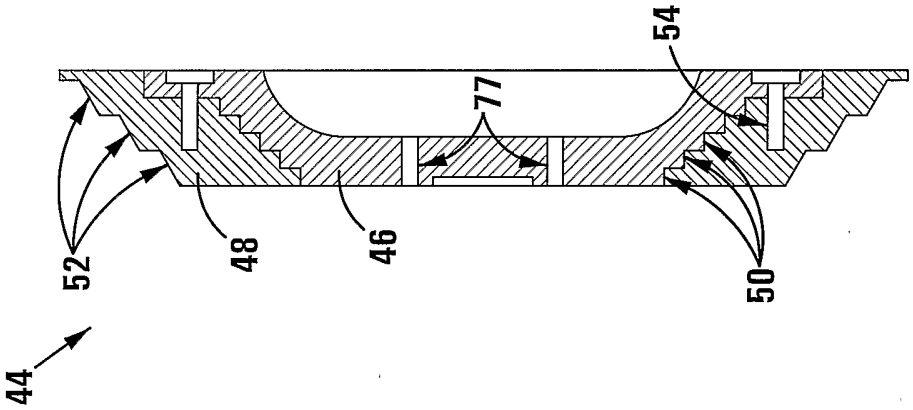


FIG 6

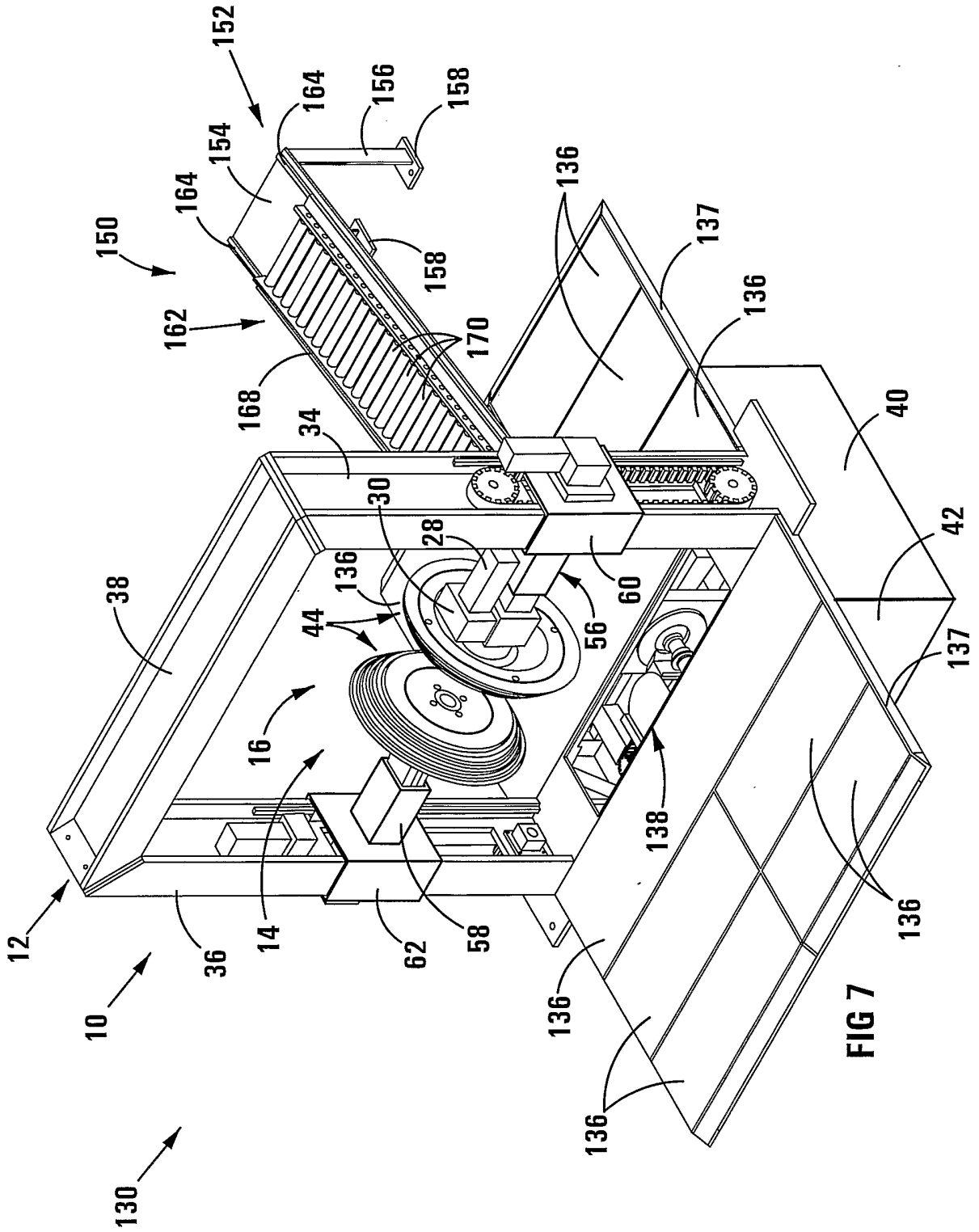

152
164
156
158
154
164
150
158
136
137
162
170
136
168
34
40
30
28
42
38
136
60
44
56
137
16
138
12
36
14
62
58
136
136
10
136
130

FIG 7

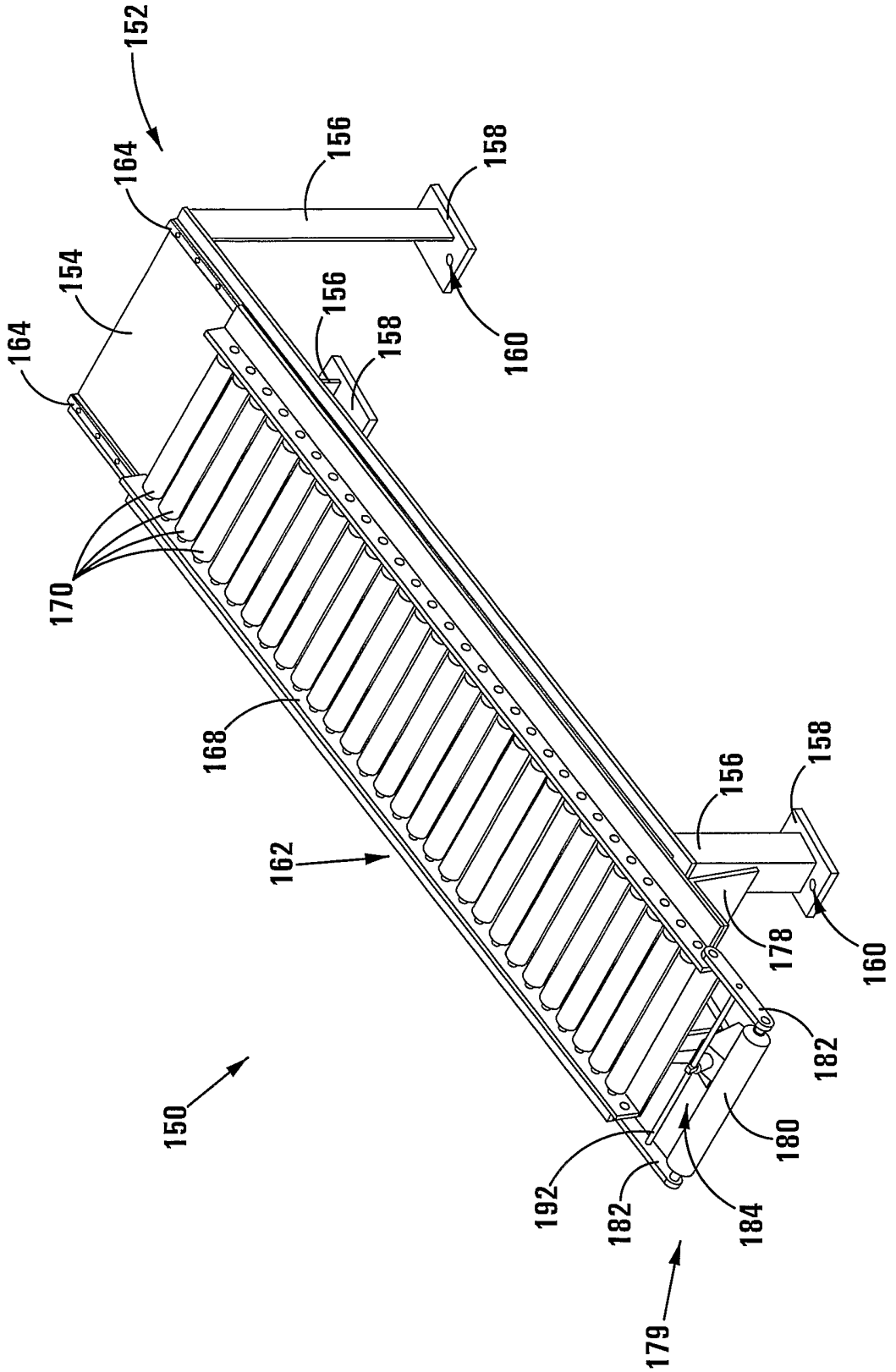

152
164
156
158
154
160
164
156
158
170
168
162
156
158
178
160
182
150
180
192
182
184
179

FIG 8

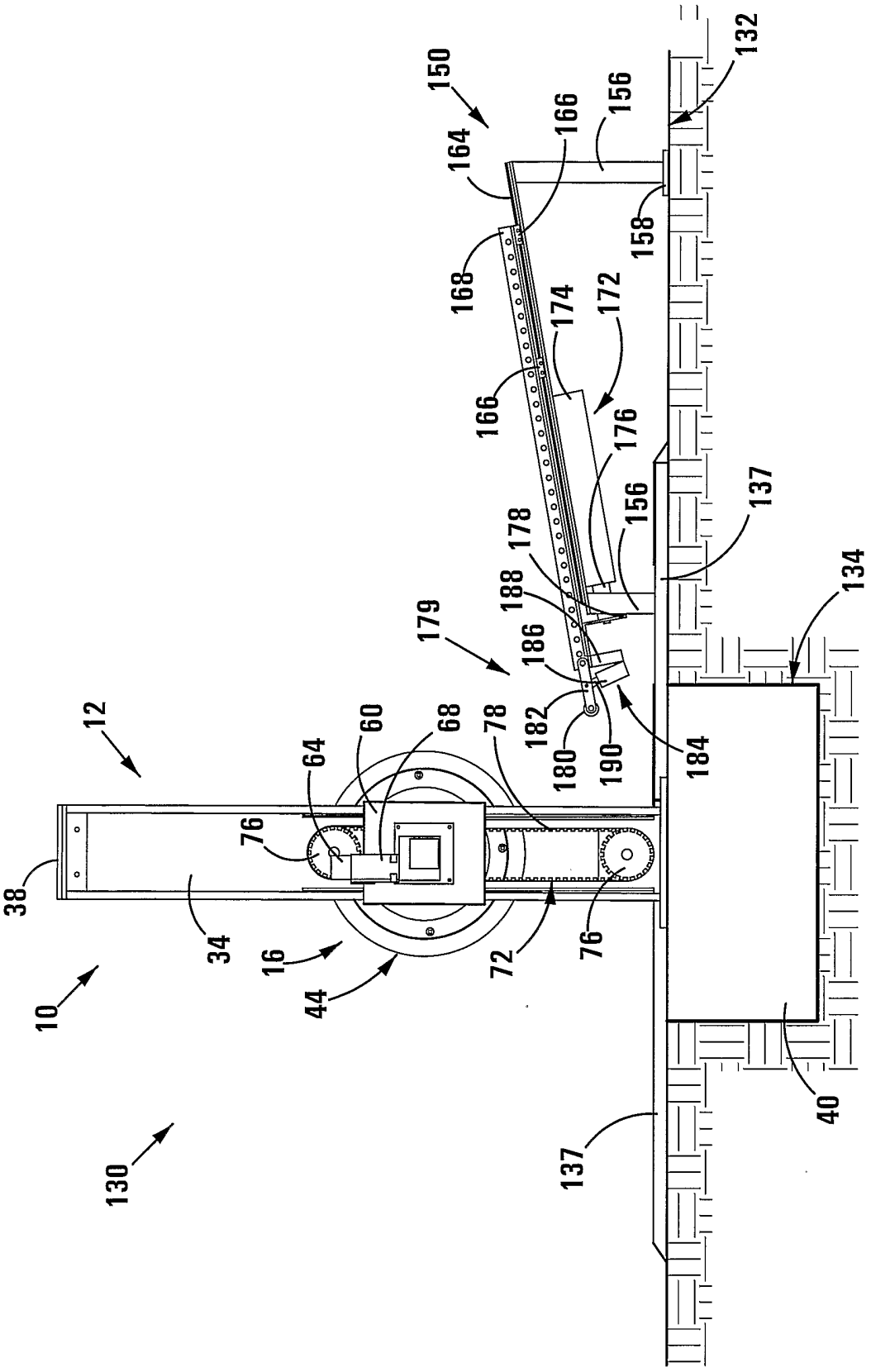

150
164
166
156
132
168
158
174
172
166
176
156
137
178
188
179
186
134
182
180
190
184
12
60
68
78
64
76
38
34
16
44
72
76
10
130
137
40

FIG 9

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB2004/002533

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B29D30/54 B24B5/36

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)
IPC 7 B24B B24D B29D B26D B29H G01M

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 practical, search terms used)
EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 626 253 A (MARANGONI MECCANICA) 30 November 1994 (1994-11-30) column 1, lines 1-10 column 2, line 20 - column 3, line 34; claims 1-5; figures 1,3	1-25, 36-41
X	GB 1 069 197 A (BENTHAM TYRE MACHINERY COMPANY) 17 May 1967 (1967-05-17) page 1, lines 1-42 page 1, line 59 - page 2, line 74; claims 1-9; figures 1,3	1-25, 36-41
X	US 2 805 699 A (READING RALPH R) 10 September 1957 (1957-09-10) column 1, line 15 - line 29 column 3, line 46 - column 8, line 13; claims 1-4; figures 1-7	1-35,39, 40

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 November 2004	23/11/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Deubler, U

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB2004/002533

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 677 848 A (FLORY THOMAS A) 7 July 1987 (1987-07-07) column 1, line 30 - line 38 column 1, line 58 - column 2, line 43; figures 1-3	36-38,41
Y	US 3 375 153 A (ROGER ANTRAIGUE) 26 March 1968 (1968-03-26) column 1, line 20 - line 27 column 3, line 32 - column 6, line 15; figures 1,4,5	1-41
Y	DE 12 69 336 B (SCHELKMANN WILHELM) 30 May 1968 (1968-05-30) column 1, lines 1-10 column 3, line 6 - column 4, line 4; claims 1-4; figures 1,2	1-41
Y	US 3 478 804 A (MEIXNER OTTO) 18 November 1969 (1969-11-18) column 2, line 15 - column 3, line 57; figure 1	1-41
Y	PATENT ABSTRACTS OF JAPAN vol. 0070, no. 74 (M-203), 26 March 1983 (1983-03-26) & JP 58 001546 A (YOKOHAMA GOMU KK), 6 January 1983 (1983-01-06) abstract; figures 1-4	1-41
A	US 4 976 141 A (CARGOULD BARRY D ET AL) 11 December 1990 (1990-12-11) the whole document	36-38,41
A	EP 1 304 212 A (GOODYEAR TIRE & RUBBER) 23 April 2003 (2003-04-23) figures 1,3A-3C,5A-5C	26-35,40
A	GB 1 027 870 A (BACON AMERICAN CORP) 27 April 1966 (1966-04-27) figure 3	26-35,40

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/IB2004/002533

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 0626253	A	30-11-1994	IT	1272443 B	23-06-1997
			AT	156060 T	15-08-1997
			BR	9402033 A	13-12-1994
			DE	69404552 D1	04-09-1997
			DE	69404552 T2	26-02-1998
			EP	0626253 A2	30-11-1994
			ES	2107738 T3	01-12-1997
			US	5466182 A	14-11-1995
GB 1069197	A	17-05-1967	NONE		
US 2805699	A	10-09-1957	NONE		
US 4677848	A	07-07-1987	AT	79954 T	15-09-1992
			DE	3686562 D1	01-10-1992
			DE	3686562 T2	04-03-1993
			EP	0225863 A2	16-06-1987
			JP	1846127 C	25-05-1994
			JP	5056802 B	20-08-1993
			JP	62133342 A	16-06-1987
US 3375153	A	26-03-1968	FR	1443061 A	24-06-1966
			DE	1299413 B	17-07-1969
			DK	119378 B	21-12-1970
DE 1269336	B	30-05-1968	NONE		
US 3478804	A	18-11-1969	DE	1282296 B	07-11-1968
			DK	127996 B	18-02-1974
			GB	1155885 A	25-06-1969
			SE	127996 B	18-02-1974
JP 58001546	A	06-01-1983	NONE		
US 4976141	A	11-12-1990	CA	2081364 A1	06-09-1991
			EP	0518886 A1	23-12-1992
			JP	5504838 T	22-07-1993
			WO	9114165 A1	19-09-1991
EP 1304212	A	23-04-2003	US	2003070742 A1	17-04-2003
			BR	0204082 A	16-09-2003
			CA	2408294 A1	15-04-2003
			CN	1411979 A	23-04-2003
			EP	1304212 A2	23-04-2003
			JP	2003127247 A	08-05-2003
GB 1027870	A	27-04-1966	DK	118309 B	03-08-1970