



(51) International Patent Classification:
B65G 17/38 (2006.01) **F16G 13/06** (2006.01)

(21) International Application Number:
PCT/GB2010/001860

(22) International Filing Date:
5 October 2010 (05.10.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0917494.7 7 October 2009 (07.10.2009) GB
1011561.6 9 July 2010 (09.07.2010) GB

(71) Applicant (for all designated States except US):
RENOLD PLC [GB/GB]; Styal Road, Wythenshawe,
Manchester M22 5WL (GB).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **PYPER, Torquill Edmund Meredith** [GB/GB]; Holmoak, Lincombe Lane, Boars Hill, Oxford OX1 5DU (GB). **CHRISTMAS, Michael Charles** [GB/GB]; Holly House, 12A Beswicks Road, Northwich, Cheshire CW8 1AP (GB). **LODGE, Christopher James** [GB/GB]; 12 Highbank, Tintwistle, Glossop, Derbys SK13 1LP (GB).

(74) Agent: **EVERY, Dave**; Marks & Clerk LLP, Sussex House, 83-85 Mosley Street, Manchester M2 3 LG (GB).

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

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

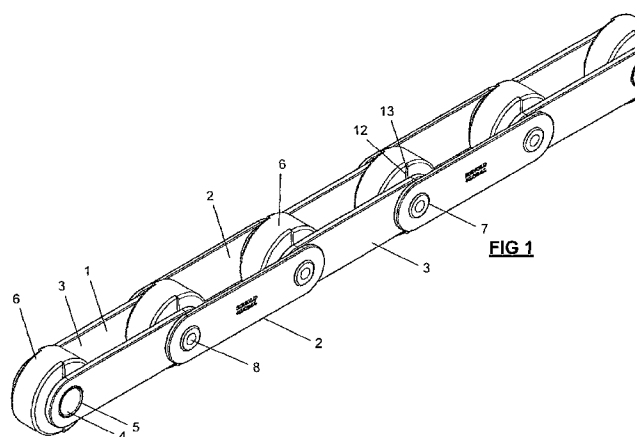
Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

Published:

— with international search report (Art. 21(3))

(54) Title: A ROLLER CHAIN



(57) Abstract: A chain (1) having a longitudinal axis and comprising a plurality of interconnected chain link members. The link members are arranged along the longitudinal axis of the chain into inner link members (3) that are flanked by outer link members (2). The outer link members extend between adjacent pairs of inner link members. Two apertures (5, 7) are defined in each of the link members and spaced apart in the direction of the axis, and the inner and outer link members (3, 2) are arranged such that one of the apertures in each of the outer and inner link members are in alignment. The inner and outer link members are interconnected by transverse pins (8) that are received in the aligned apertures. The chain further comprises a roller (6) which is pivotally mounted adjacent one of the link members (3). The roller (6) has a side surface (6B) facing a surface of the adjacent link member (3) so as to define an interface region between the roller and the link member, and at least one wiper element (13) is provided at the interface region and defining a wiping edge (13) that contacts, and is movable relative to, at least one of the surfaces in the interface region.



A ROLLER CHAIN

The present invention relates to a roller chain, and more particularly, but not exclusively, to a conveyor roller chain.

5

Roller bush chains used as conveyor chains comprise interleaved inner and outer link plates connected together along a longitudinal axis of the chain. Pairs of laterally parallel inner link plates are provided adjacent to one another along the longitudinal axis, with pairs of outer link plates flanking the inner link plates. Each inner and outer link plate defines two apertures which are positioned along the plate substantially parallel to the longitudinal axis of the chain. Each pair of inner link plates is connected by a pair of annular cylindrical bushes which pass through, and are fixed within, corresponding apertures in the plates. Similarly, each pair of outer link plates is connected by a pair of pins which pass through, and are fixed within, corresponding apertures in the plates. Each pin passes through one of the bushes connecting the inner plates together, thus rotatably mounting the outer link plates to a pair of inner link plates. Rotatably mounted on each bush, between the inner link plates, is a roller.

Roller bush chains are advantageous in conveying applications in that the rollers on the roller bush chain roll so as to reduce friction with surfaces into which the chain comes into contact so as to reduce the amount of wear on the surfaces. If the rollers in a roller bush chain become jammed and cease to rotate relative to the chain then the chain starts to drag on the surfaces, causing wear to the surface and/or the chain. A problem of roller chains is therefore that they need to be regularly maintained so as to remove dirt and debris from the spaces between the rollers and their mountings or the inner link plates.

In one particular sugar mill application, when a roller bush conveyor chain is used to convey sugarcane (or a sugarcane by-product, such as bagasse) the fibres of the sugarcane can easily become lodged between the rollers and the inner link plates of the chain. Subsequent lateral movement of the rollers relative to the inner link plates, exacerbated by the heat of a production line environment, results in the sugar cane material becoming compressed and releasing sugar sap. This residue coats the surfaces of the chain components. As a result the rollers tend to stick to the inner link

30

plates and, unable to rotate, they skid along any surfaces over which the chain is trained, wearing the surfaces and/or the rollers.

5 It is an object of the present invention to obviate or mitigate at least one of the aforesaid disadvantages and/or to provide for an alternative or improved chain.

10 According to the present invention there is provided a chain having a longitudinal axis and comprising a plurality of interconnected chain link members, the link members being arranged along the longitudinal axis of the chain into inner link members that are flanked by outer link members, the outer link members extending between adjacent pairs of inner link members, two apertures defined in each of the link members and spaced apart in the direction of the axis, and the inner and outer link members are arranged such that one of the two apertures in each of the outer and inner link members are in alignment, the inner and outer link members being interconnected by
15 transverse pins that are received in the aligned apertures, the chain further comprising a roller which is mounted adjacent to one of the link members, the roller having a side surface facing a surface of the adjacent link member so as to define an interface region between the roller and the link member, and at least one wiper element is provided at the interface region and defining a wiping edge that contacts, and is movable relative to, at least one of the surfaces in the interface region.
20

Such a chain is advantageous in that debris, which would otherwise be worked into the rotational mounting between the inner link members and cause the roller to jam, is wiped away by the wiper element. This extends the life both of the chain and any
25 surface which engages with the chain during operation, since the rotationally mounted rollers reduce friction and therefore wear when they are not jammed.

The side surface of the roller and the surface of the link member are able to come into direct contact at the interface region.
30

The wiping edge may be defined by the side surface of the roller or the surface of the link member, preferably an inner link member.

35 The roller may be mounted between a pair of laterally adjacent inner link members, at least one of the inner link members being the adjacent link member. The roller may be

mounted for rotation around one of the transverse pins. A bush may be provided between the inner link members around the pin, the roller being supported on the bush for rotation.

- 5 The wiper element may be defined by part of the adjacent inner link member or the roller. This offers simplicity of construction and assembly of the chain, together with providing improved robustness for the chain because there are fewer parts and there is no join between the wiper element and the adjacent inner link member and the roller.
- 10 The wiper element may comprise a protrusion on one of the surfaces at the interface region. Alternatively, the wiper element may comprise a groove defined in one of the surfaces at the interface region. In either case, the protrusion or groove may define the wiping edge.
- 15 The protrusion or groove may comprise one or more steps which may provide changes in the thickness of either the roller or the adjacent inner link member.

20 The protrusion or groove may extend over the surface of either the roller or the adjacent inner link member. It may extend from a location adjacent to the pivotal mounting of the roller in the inner link member towards a peripheral edge of the surface or it may be offset from the rotational axis of the roller. This enables the wiping edge to push debris radially outwardly right to an exterior edge of the chain.

25 There may be a wiper element on each side face of the roller. The elements on each side may be at radially offset locations.

30 The protrusion or groove may generally extend radially outwardly from the pivotal mounting of the roller, and may extend substantially tangentially outwardly from a location adjacent the pivotal mounting. Tangential extension of the protrusion or groove provides a wiping edge which, during rotation of the roller, encounters debris at an oblique angle. Provided that the roller is rotating in an appropriate direction, the oblique angle will be such that the wiping edge pushes the debris outwards of the chain link member, and perhaps radially outwardly in a direction from the transverse pin.

The protrusion or groove may extend within the interface region to form an annular projection. A radially innermost border of the annular projection may be located immediately adjacent to the rotatable mounting. In some cases, a radially outermost border of the annular projection does not extend beyond the radially outermost extent of the adjacent inner link member. The edges of the annular projection may comprise a step. The annular projection may be eccentric with respect to the pivotal mounting around which it extends. The annular projection may be substantially elliptical.

The annular projection may have a lobe which may define an apex and/or a finger. The lobe may be tapered inwardly towards the periphery of the roller. In embodiments where there is an annular projection provided on each side of the roller the lobes may extend in opposite directions such that the apices or fingers point in opposite directions.

The roller may define a conduit between an opening defined in the side surface of the roller and a further opening defined by a portion of the exterior circumferential surface of the roller outside the interface region. This is particularly advantageous in that debris which might otherwise arrive at the apertures.

The roller preferably extends radially outwards beyond the periphery of the link members such that in use the roller contacts a guide surface such as a track.

The roller chain is preferably a conveyor chain. The invention also provides for a conveyor system comprising a conveying roller chain as defined above that is supported on a guide surface such as a track.

Specific embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a perspective view of a first embodiment of a conveyor roller chain in accordance with the present invention;

Figure 2 shows a perspective view of a roller from the chain of Figure 1;

Figure 3 shows a perspective view of a second embodiment of a chain in accordance with the present invention;

Figure 4 shows a perspective view of a roller from the chain of Figure 3;

Figure 5 shows a perspective view of a third embodiment of a chain in accordance with the present invention;

Figure 6 shows a perspective view of the inner surface of an inner link plate of the chain of Figure 5;

5 Figure 7 shows a perspective view of an inner link plate which replaces the inner link plate shown in Figure 6 in a chain such as that shown in Figure 5 to form a fourth embodiment of a chain in accordance with the present invention;

Figure 8 shows a side view of the inner surface of the inner link plate of Figure 7;

10 Figure 9 shows a perspective view of a fifth embodiment of a chain in accordance with the present invention;

Figure 10 shows a perspective view of a roller of the chain of Figure 9;

Figure 11 shows a perspective view of a sixth embodiment of a chain in accordance with the present invention;

15 Figure 12 shows a perspective view of a roller of the chain of Figure 11;

Figure 13 shows a perspective view of a seventh embodiment of a chain in accordance with the present invention;

Figure 14 shows a perspective view of a roller from the chain of Figure 13;

20 Figure 15 shows a perspective view of an eight embodiment of a chain in accordance with the present invention;

Figure 16 shows a perspective view of a roller from the chain of figure 15;

Figure 17 shows a perspective view of a ninth embodiment of a chain in accordance with the present invention;

Figure 18 shows a perspective view of a roller from the chain of figure 17;

25 Figure 19 shows a perspective view of a tenth embodiment of a chain in accordance with the present invention;

Figure 20 shows a perspective view of a roller from the chain of figure 19;

Figure 21 shows a perspective view of an eleventh embodiment of a chain in accordance with the present invention; and

30 Figure 22 shows a perspective view of the a roller from the chain of figure 21.

In each of the exemplary embodiments the conveyor roller chain has a plurality of inner link assemblies 1 arranged along the length of the chain so as to define a longitudinal chain axis and interconnected by alternate outer link plates 2 in such a manner that
35 they can articulate relative to each other and the outer link plates. In practice such a

chain would generally be configured into an endless loop and driven by at least one toothed sprocket, neither of which is shown in the figures. The chain may be provided with attachments used for securing slats, buckets or other conveying features to the outer links plates 2. Such attachments may be integrally formed with the outer link plates or may be discrete components fixed to the outer link plates.

Each inner link assembly 1 comprises a pair of opposed spaced inner link plates 3 connected together by a pair of bushes 4 extending perpendicularly to the plates. Each of the inner link plates 3 has a pair of spaced apertures 5 in which the ends of the pair of bushes 4 are received. Each of the opposed inner link plates 3 is mounted in a friction or interference fit on the ends of the bushes 4 in a fixed relationship and a rotatable, generally cylindrical roller 6 is supported on each bush 4 between the inner link plates 3.

The outer link plates 2 are of similar configuration to the inner link plates 3 but with smaller apertures 7 and are arranged to connect together adjacent inner link assemblies 1. A given outer link plate 2 overlaps with adjacent inner link assemblies 1 such that each of its apertures 7 is aligned with a corresponding aperture 5 in the inner link assembly 1 and is connected to the inner link assemblies 1 by pins 8 that pass through the aligned apertures 5, 7 and are received in the bushes 4. The bushes 4 in the inner link assemblies 1 are sized such that the assemblies are free to rotate on the pins 8 but the outer link plates 2 are fixed to the pins 8. More specifically, the apertures 7 in the outer link plates 2 are sized such that the edge of the plate around them is an interference or friction fit with the pins 8 or, alternatively, the ends of the pins are riveted or otherwise deformed over the outer link plates.

Each roller 6 is of a generally cylindrical shape, having an inner bore 9 and a circumferential outer surface 10 and a pair of annular side walls 11. The rollers of each of a diameter that is greater than the height of the link plates 2, 3 so that it projects above and below the plates. In use, when the chain is trained over a supporting surface such as a track or the like, it is the outer surface 10 of each roller 6 which is in rolling contact with the supporting surface. The roller 6 rotates on the bush 4 and is substantially free to move laterally of the bush 4 by a small distance that is restricted by the spacing of the inner link plates 3 on each side.

In the embodiment of figures 1 and 2 each side wall 11 of the roller 6 is stepped at 12 along a diameter of the roller 6. The steps 12 each define wiping edges 13 which face in the same axial direction and are interrupted by the inner bore 9. They serve to divide the roller 6 into two hemi-cylindrical sections 6A,6B, a first section 6A being thinner (measured in the dimension parallel to the bore 9) than a second section 6B. In use the wiping edges 13 serve to wipe or scrape clean the inwardly facing surface of the inner link plates 3 in the region around the bush 4 as the roller 6 rotates relative to the bush 4. The fact that the wiping edges 13 all face in the same direction means that in whichever direction the roller rotates, a first portion of each wiping edge 13 will be travelling in a direction which causes it to scrape against the inner link plate 3, collecting debris against the step 12. When the direction of rotation is reversed, a second portion of each of the two wiping edges (diametrically opposite the first portion) scrapes the inner link plate 3. Continued wiping as the rollers 6 rotate on the bushes 4 relative to the inner link plate 3 causes debris to be expelled from the radially outermost point of the step 12. This ensures that the region around the bush 4 of the inwardly facing surface of the inner link plate 3 is substantially clear of any deposits, dirt or sludge that would otherwise prevent the roller 6 from operating in the desired manner. In the specific case of the use of the chain to convey sugarcane or bagasse, the steps 12 serve to keep the chain substantially clear of bagasse or sugarcane residue.

It will be appreciated that the wipers may take any suitable form and some examples are shown in the following embodiments. It may, for example, be achieved by adding or removing material from or to the roller or the inner link plates at the appropriate region. For convenience and ease of understanding the components of the roller bush chains that are common to each embodiment (including that of figure 1) are labelled with the same reference numbers.

In the embodiment of figures 3 and 4 the wiper is provided by four equi-angularly spaced channels 14 machined into (or otherwise formed in) the annular side walls 11 of the roller 6. The two elongate edges 15 of each channel 14 extend outwardly in from the bore 9 in the roller 6 to the circumferential outer face 10 such that the channel extends substantially radially. In operation, the edges 15 serve as wipers to remove the deposits as described above. In some applications, lubricant may be conveniently directed to the bush/roller interface via the channel 14. It is to be understood that any

suitably shaped groove may be adopted as the channel and any number of channels or grooves may be provided at any suitable spacing on each side wall.

5 In the embodiment of figures 5 and 6, the wiping edges are provided by steps 16 formed on the inner surface (i.e. the surface facing the rollers 6) of the inner link plate 3. Each aperture 5 in the inner link plate 3 has a pair of steps 16 extending from it. Each step 16 extends substantially in a direction that is radial (relative to the aperture 5) and perpendicular to the longitudinal axis of the chain from the apertures 5 to the periphery of the inner link plate 3. The steps 16 function in substantially the same way as the steps 12 of the first embodiment except that they do not rotate with the rollers 6. 10 As the rollers 6 rotate and the inner links articulate relative to one another the annular side walls 11 of the roller 6 scrape against the steps 16.

15 In the embodiment of figures 7 and 8 steps 17, 18 are formed on the inner link plates 3 around each aperture 5 as for the embodiment of figures 3 and 4. The difference in this embodiment is that one of the steps 17 adjacent to each aperture 5 extends substantially along the longitudinal axis of the chain to the periphery of the inner link plate 3 and the other step 18 extends approximately tangentially from the aperture 5 to the periphery of the inner link plate 3. In this way, the tangential steps 18 scrape 20 against the side walls 11 of the rollers 6 at an oblique angle and the effect is that debris on the rollers 6 is directed by the steps away from the bore 9 and towards the outer face 10 of the roller 6.

25 In general terms, the preceding embodiments define wiping edges for each roller which extend from innermost points adjacent to one of the apertures 5 or the bore 9 outwardly towards outermost points at the periphery of the inner link plates 3 or the roller 6. In the following embodiments, wiping edges are formed by generally annular projections on the annular side walls 11 of the roller 6. It will be appreciated that in each case the projections may be replaced by projections on the inner surface of the inner link plates 3. 30

In the embodiment of figures 9 and 10, a partially annular projection 19 is formed on each side wall 11 of the roller 6 around the bore 9. Each partially annular projection 19 extends radially over less than half of the surface of the side wall 11 and defines a 35 partially circular exterior edge 20. The projection 19 is not fully annular as a quarter

portion is absent such that two radially extending wiping edges 21 at right angles to one another are defined. Advantageously, the radial extension of the annular projection 19 is such that it does not extend further than the radial extent of the inner link plate 3, which prevents the wiping edges from catching on material outside the chain. The presence of the annular projection 19 between the inner link plate 3 and the side wall 11 of the roller 6, affords a gap 22 between the portion of each inner link plate 3 and the facing side wall 11 of the roller 6 radially exterior of the annular projection 19. In operation, the wiping edges 21 serve to wipe or scrape material away from the area of the inner link plates 3 adjacent to the apertures 5. The circular exterior edge 20, while providing no wiping effect, serves to hold debris in the gap 22 away from the bore 9 and the bush 4.

The annular projections 19 are preferably formed integrally with the roller 6. However, it will be appreciated that the annular projections 19 may consist of washers which are fixed to either side of the roller 6. In this case, it will be appreciated that the provision of a three quarter washer is advantageous in that the gap in the washer is not sufficiently wide for the washer to slip radially off the bush 4, should the washer become detached from the roller 6.

In the embodiment of figures 11 and 12, an annular projection 23 is defined on the roller 6 in the same way as for the previous embodiment. The projection 23 is different in this embodiment in that it is completely circular and is defined eccentrically with respect to the bore 9. Thus, the projection 23 has a relatively narrow portion 24 and a relatively wide portion 25 (in the radial direction), the relatively wide portion 25 extending further from the bore 9 than the relatively narrow portion 24. Thus edges 26 between the relatively narrow portion 24 and the relatively wide portion 25 serve as wiping edges as described above. In use, as a roller 6 according to this embodiment rotates on the bush 4, the eccentric annular projections 23 on either side wall 11 of the roller 6 rotate relative to the inner link plates 3 such that the wiping edge 26 comes into contact with debris on the inner link plate 3 at an oblique angle, thereby pushing the debris away from the bore 9, the bush 4 and the apertures 5.

In the embodiment of figures 13 and 14, the annular projection 19, 23 of the previous embodiments is absent. Rather, a portion 27 of the roller 6 is hollowed out. The hollow portion 27 is connected to apertures 28 on the side walls 11 and an aperture 29 on the

outer face 10 of the roller 6. The edges of the side wall apertures 28 therefore provide wiping edges which, in use, wipe debris from the inner link plate 3. The debris passes into the apertures 28 and accumulates in the hollow portion 27 of the roller, from where it may escape through the outer face aperture 19.

5

The roller chain of figures 15 and 16 is similar to that of figures 1 and 2 but each side wall of the roller 6 is stepped at a location 12 that is offset from the diameter to define the wiping edges 13. The steps 12 are offset from the central bore 9 through the roller and are offset from each other. In figure 16 one wiping edge 13 is visible and it is disposed above the roller bore 9. The other edge 13 on the reverse side wall of the roller 6 is hidden from view but is disposed below the bore 9 by the same distance and is parallel to the visible edge. In use the wiping edges 13 serve to wipe or scrape clean the inwardly facing surface of the inner link plates 3 in the region around the bush 4 as the roller 6 rotates relative to the bush 4, as described above. In this embodiment the edges face in opposite directions.

10

15

The chain of figures 17 and 18 has some similarities with that of figures 11 and 12 but the annular projection 23 has a lobe 30 that extends in a generally radial direction. The lobe tapers substantially linearly to an apex 31 close to the periphery of the roller. An identical lobe (hidden) is defined on the reverse side wall of the roller but which extends in the opposite direction (i.e. the lobe points downwards in the orientation of figure 18). Again the projection 23, including the lobe 30, defines a wiping edge 26. The tapered profile of the lobe 30 serves to push the debris away from the bore 9, the bush 4 and the apertures 5. A similar design is shown in figures 19 and 20 in which the lobe 30 taper has concave edges so as to define a finger 32. As in the preceding embodiment the lobe 30 on the reverse wall is hidden from view but extends in the opposite direction such that the finger 32 points downwards. An alternative is shown in figures 21 and 22 in which the lobe 30 tapers to an apex 31 with convex edges.

20

25

30

The skilled person will appreciate that a chain according to the present invention could be fitted with one or more of any of the above cleaning arrangements in any appropriate combination.

Although the chains described in the exemplary embodiments herein are all roller bush chains it will be understood that the invention may be applied to other types of roller chains that do not necessarily have bushes.

5 It will be understood that numerous embodiments may be made to the above described designs without departing from the scope of the invention as defined in the appended claims. For example, the pins may extend laterally of the chain links for connection to conveying features. Additional rollers may be provided in-board of the chain links on the bush or outboard of the chain links on bushes or pins that extend laterally of the
10 outer link plates.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiments have been shown
15 and described and that all changes and modifications that come within the scope of the inventions as defined in the claims are desired to be protected. It should be understood that while the use of words such as preferable, preferably, preferred or more preferred utilized in the description above indicate that the feature so described may be more desirable, it nonetheless may not be necessary and embodiments lacking
20 the same may be contemplated as within the scope of the invention, the scope being defined by the claims that follow. In reading the claims, it is intended that when words such as "a," "an," "at least one," or "at least one portion" are used there is no intention to limit the claim to only one item unless specifically stated to the contrary in the claim. When the language "at least a portion" and/or "a portion" is used the item can include a
25 portion and/or the entire item unless specifically stated to the contrary.

CLAIMS

1. A chain having a longitudinal axis and comprising a plurality of interconnected chain link members, the link members being arranged along the longitudinal axis of the chain into inner link members that are flanked by outer link members, the outer link members extending between adjacent pairs of inner link members, two apertures defined in each of the link members and spaced apart in the direction of the axis, the inner and outer link members being arranged such that one of the apertures in each of the outer and inner link members are in alignment, the inner and outer link members being interconnected by transverse pins that are received in the aligned apertures; the chain further comprising a roller being rotatably mounted adjacent to one of the link members, the roller having a side surface facing a surface of the adjacent link member so as to define an interface region between the roller and the link member, and at least one wiper element being provided at the interface region and defining a wiping edge that contacts, and is movable relative to, at least one of the surfaces in the interface region.
2. A chain according to claim 1, wherein the roller is mounted between a pair of laterally adjacent inner link members, at least one of said inner link members being said adjacent link member.
3. A chain according to claim 2, wherein the wiper element is defined by part of the adjacent inner link member or the roller.
4. A chain according to claim 2, wherein the wiping element is defined by a protrusion on one of the surfaces at the interface region.
5. A chain according to claim 2, wherein the wiping element is defined by a groove defined in one of the surfaces at the interface region.
6. A chain according to claim 4 or 5 wherein the protrusion or groove comprises one or more steps in the surface of either the roller or the adjacent inner link member.

7. A chain according to any of claims 4 to 6, where the protrusion or groove extends substantially radially outwardly.
- 5 8. A chain according to claim 6 or 7, wherein the protrusion or groove extends over the surface of either the roller or the adjacent inner link member from a location adjacent to the pivotal mounting of the roller towards a peripheral edge of the surface.
- 10 9. A chain according to claim 6 or 7, wherein the protrusion or groove extends over the surface of the either the roller or the adjacent inner link member from a location that is offset from the rotational axis of the roller.
- 15 10. A chain according to claim 4 to 6 wherein the protrusion or groove extends substantially tangentially outwardly from a location adjacent a mounting on which the roller is rotatably mounted
- 20 11. A chain according to claim 4 wherein the protrusion extends around a mounting on which the roller is rotatably mounted and forms an annular or partially annular projection, the annular or partially annular projection defining the wiping edge.
- 25 12. A chain according to claim 11 wherein a radially innermost border of the annular projection or partially annular projection is located immediately adjacent to the mounting of the roller.
- 30 13. A chain according to claim 11 or 12 wherein a radially outermost border of the annular projection or partially annular projection does not extend beyond the radially outermost extent of the adjacent inner link member.
14. A chain according to any one of claims 11 to 13 wherein the edges of the annular projection comprise a step.

15. A chain according to any one of claims 11 to 14 wherein the annular projection is eccentric with respect to the pivotal mounting around which it extends.
- 5 16. A chain according to any one of claims 11 to 15, wherein the annular projection has a lobe extending in a generally radial direction.
17. A chain according to claim 16, wherein the lobe defines a finger or an apex.
- 10 18. A chain according to any preceding claim wherein the roller has a first opening defined in the side surface of the roller and a further opening defined by a portion of the exterior circumferential surface of the roller outside the interface region, the first opening defining the wiper element, and a passage in the roller providing communication between the first and
- 15 second opening.
19. A chain according to any preceding claim, wherein the roller extends radially outward to a periphery that extends beyond the periphery of the inner and outer link members.
- 20 20. A chain according to claims 9 to 17, wherein the mounting is one of the transverse pins.

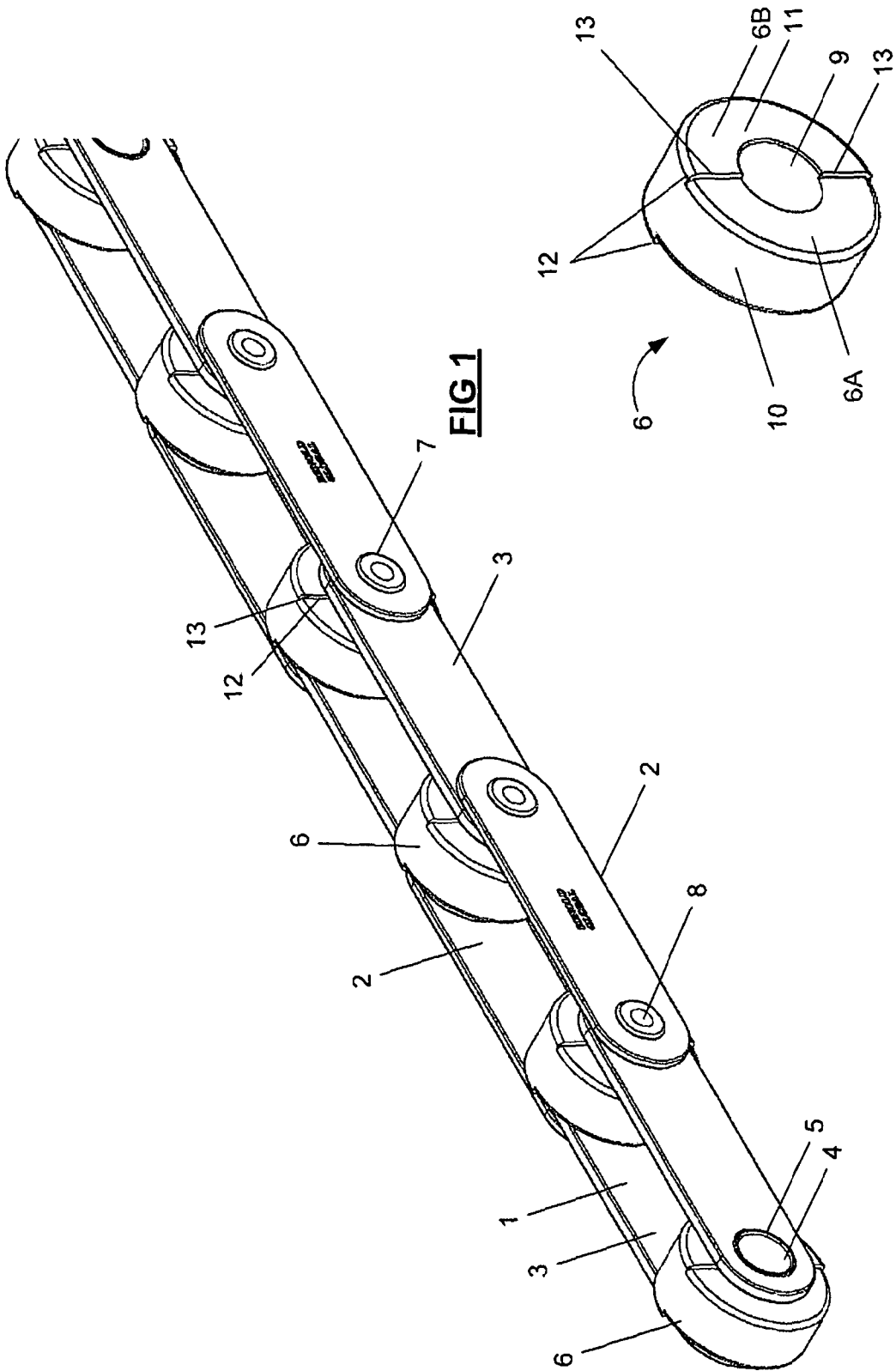


FIG 2

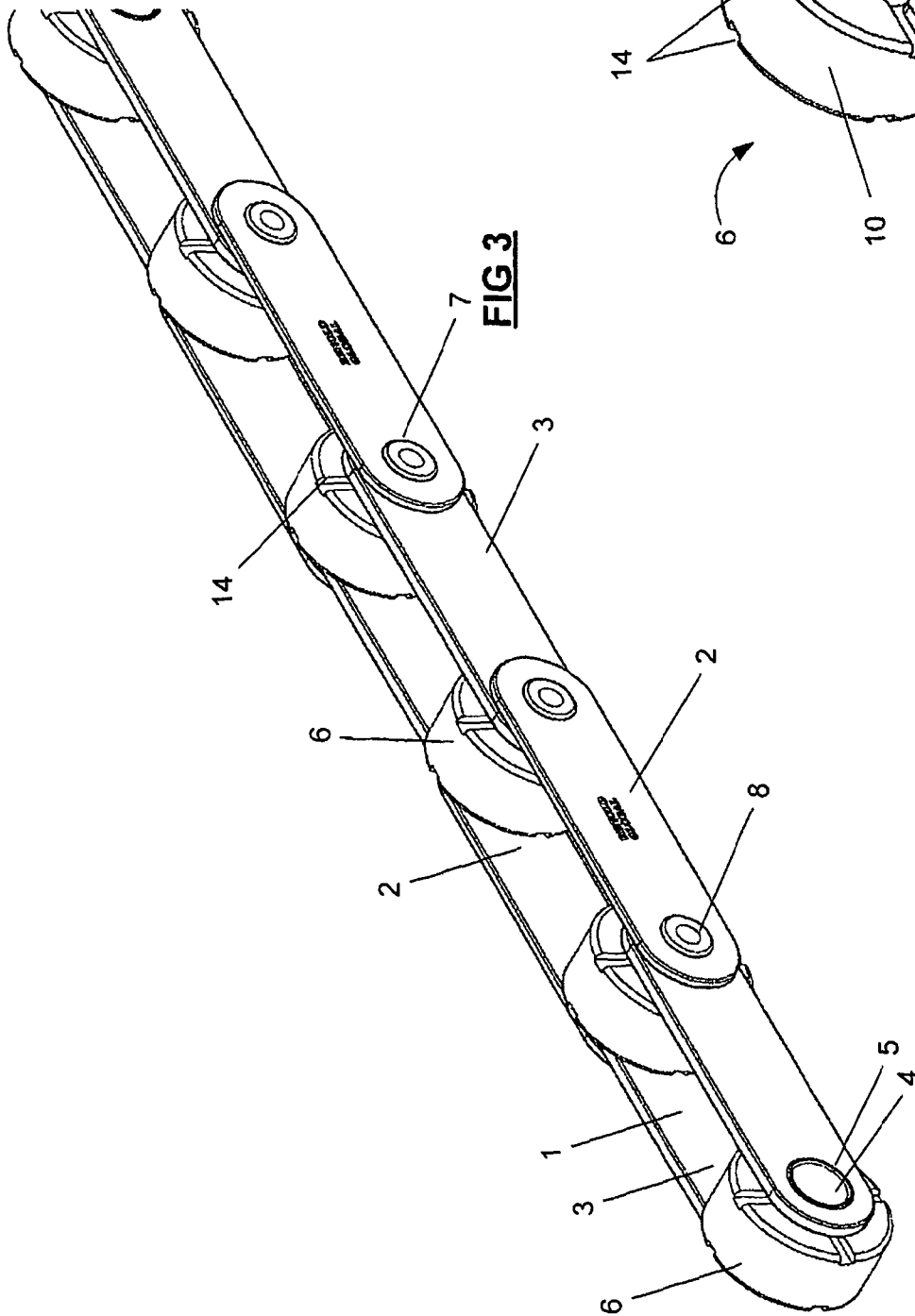


FIG 3

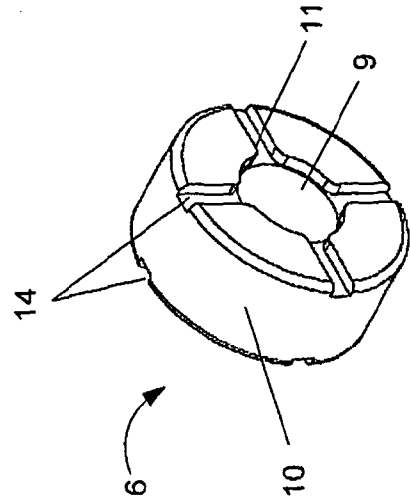
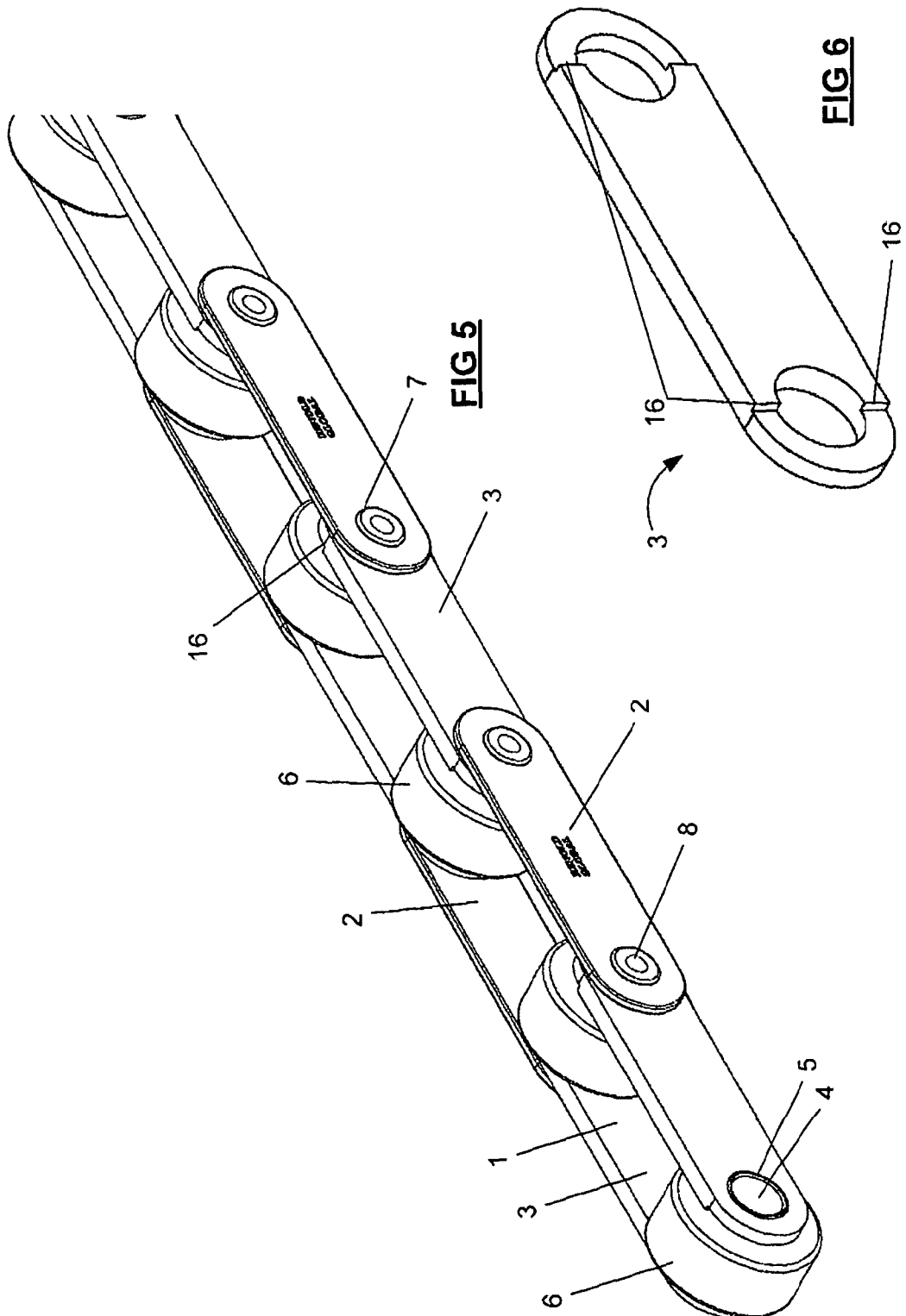
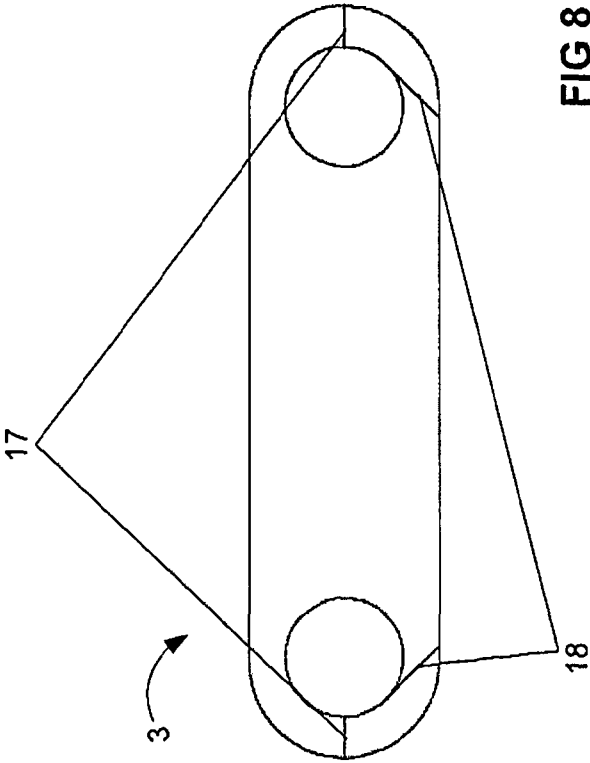
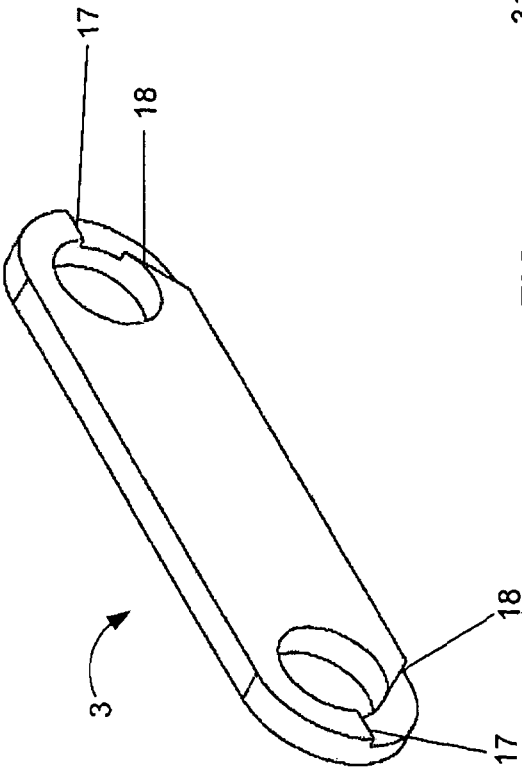
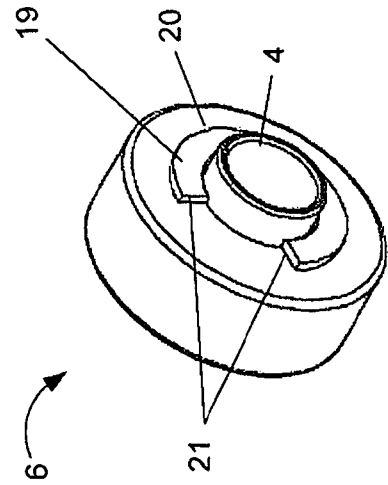
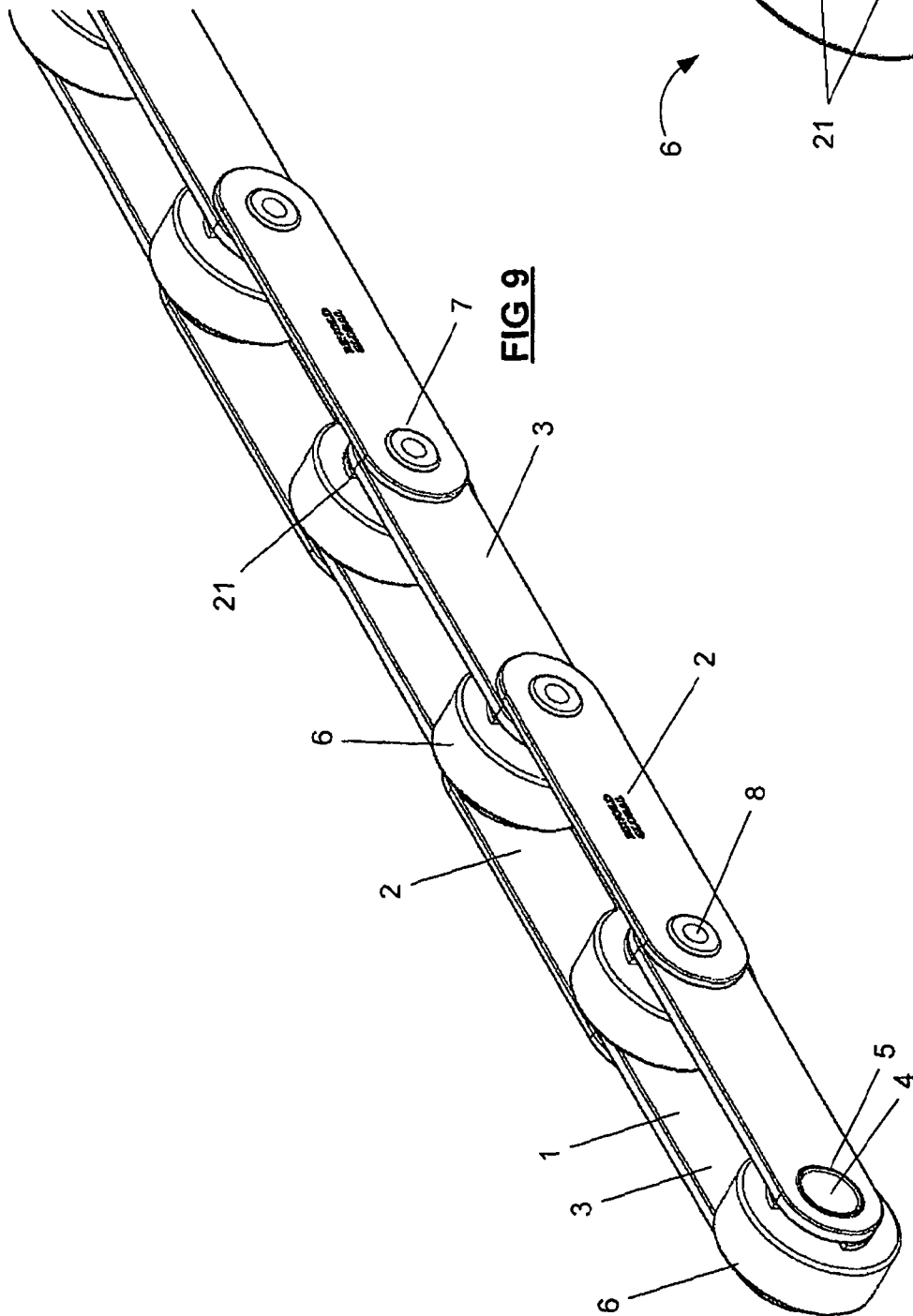
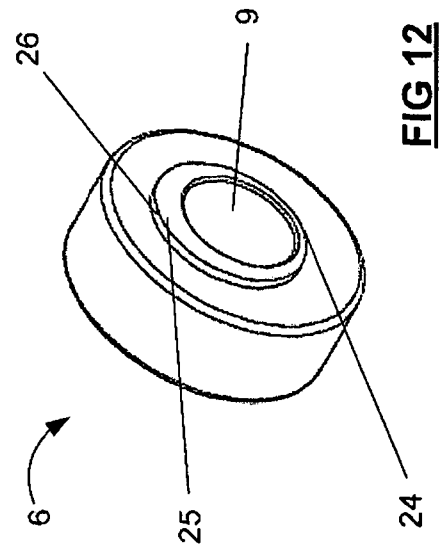
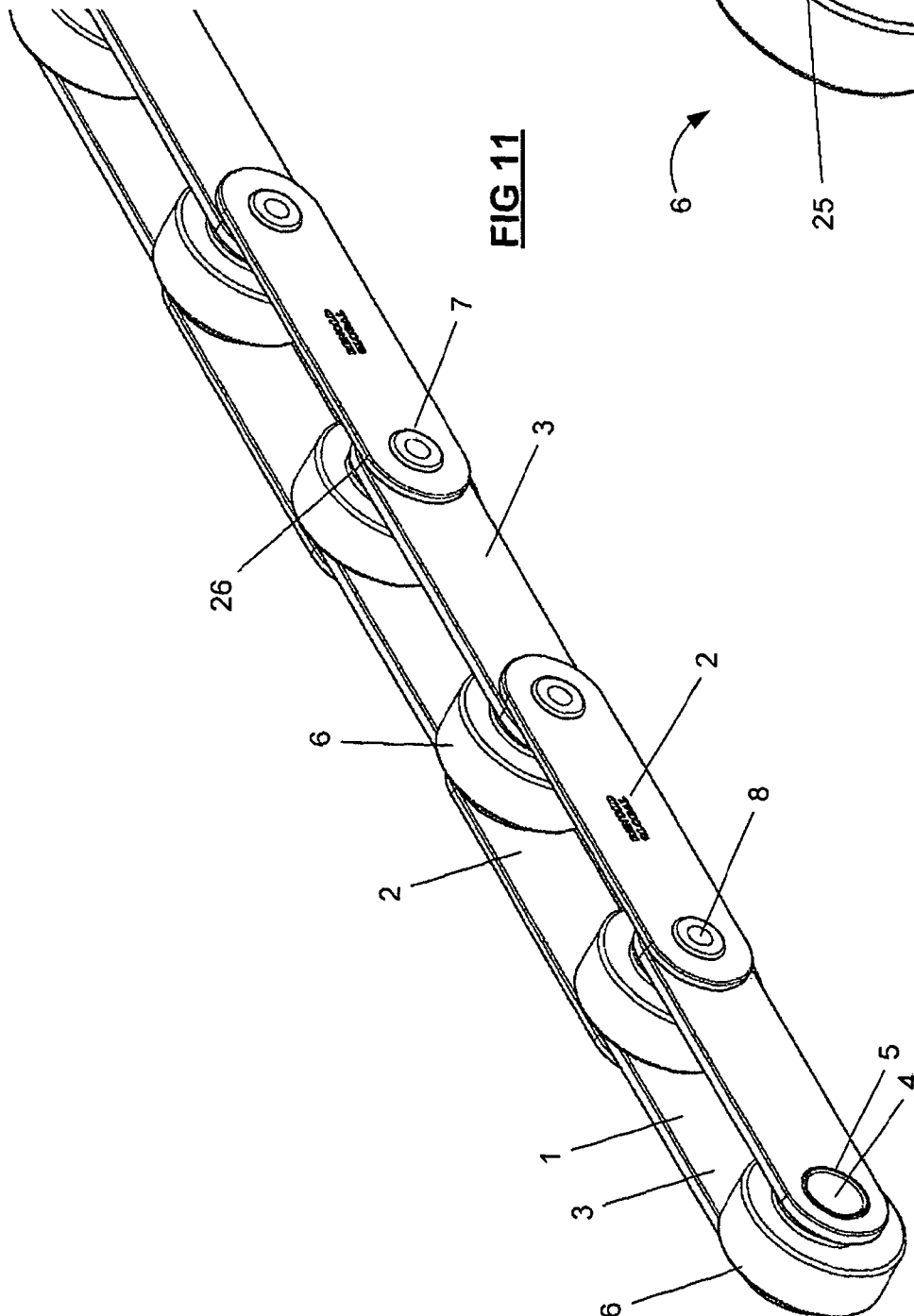


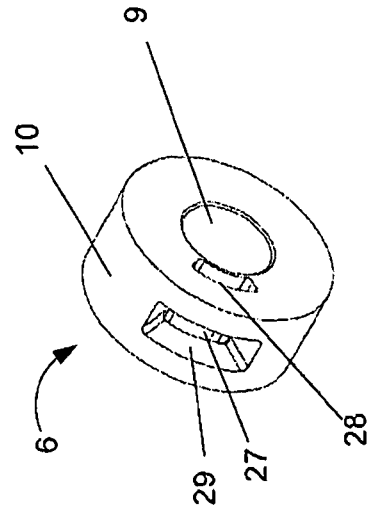
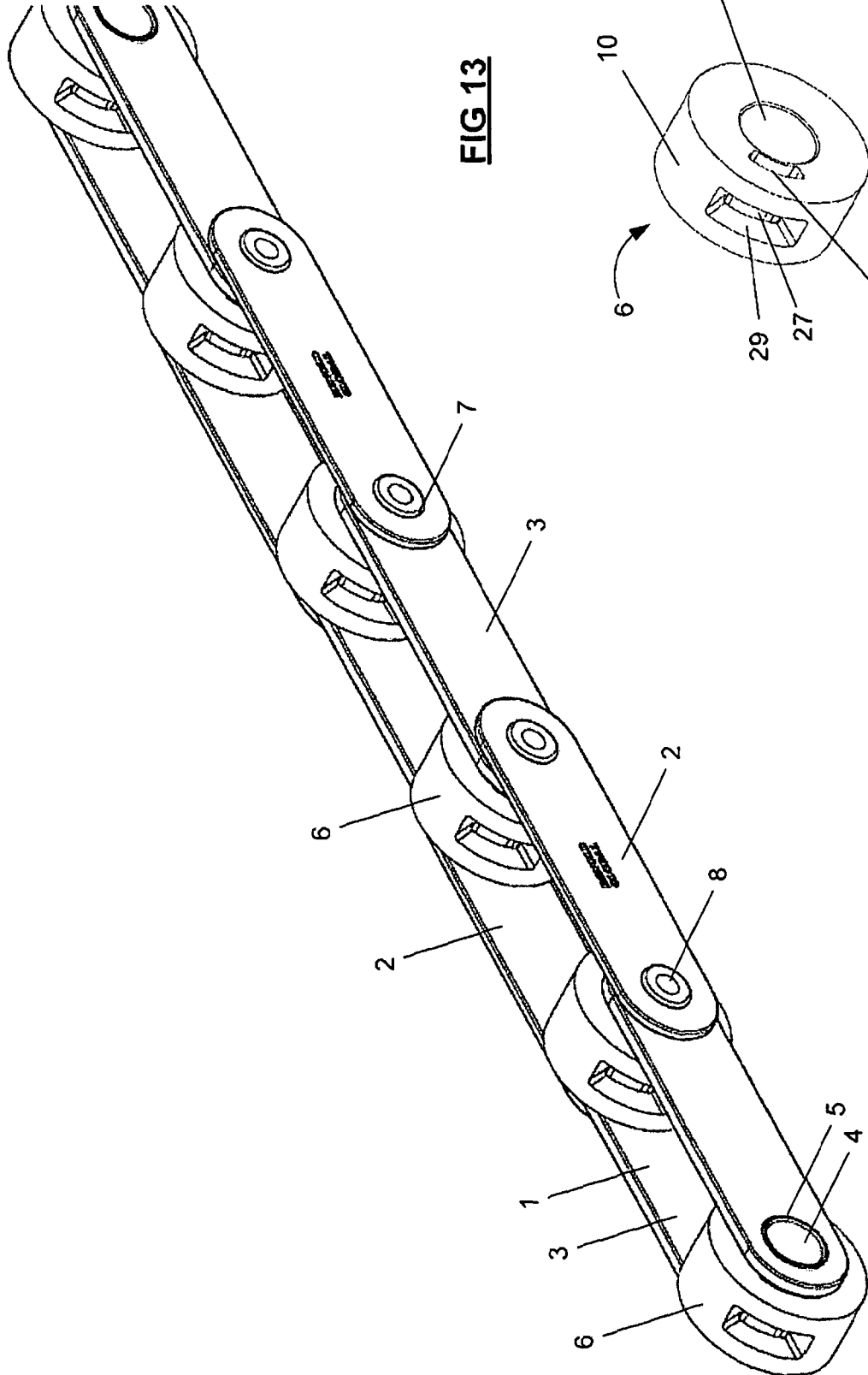
FIG 4

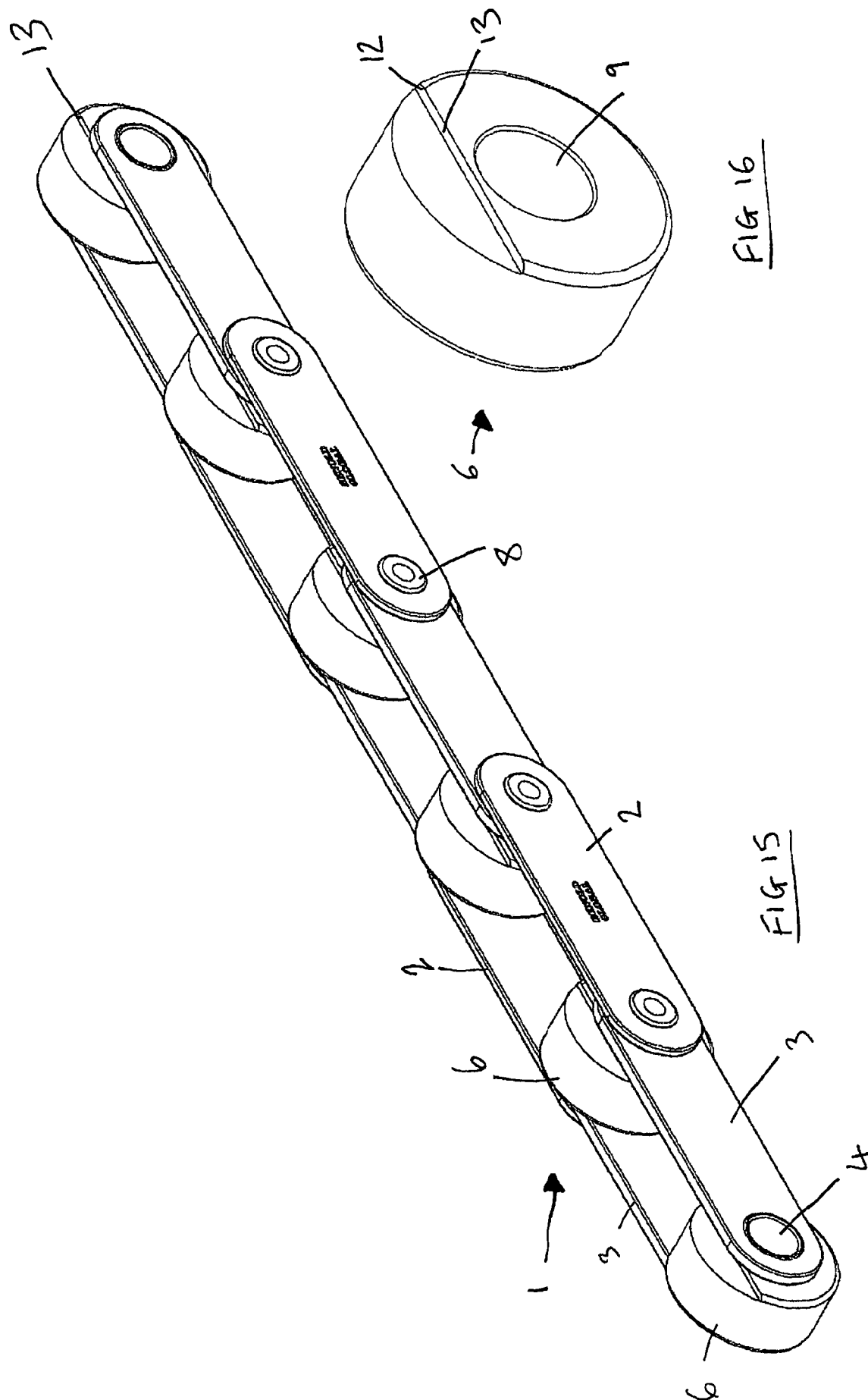




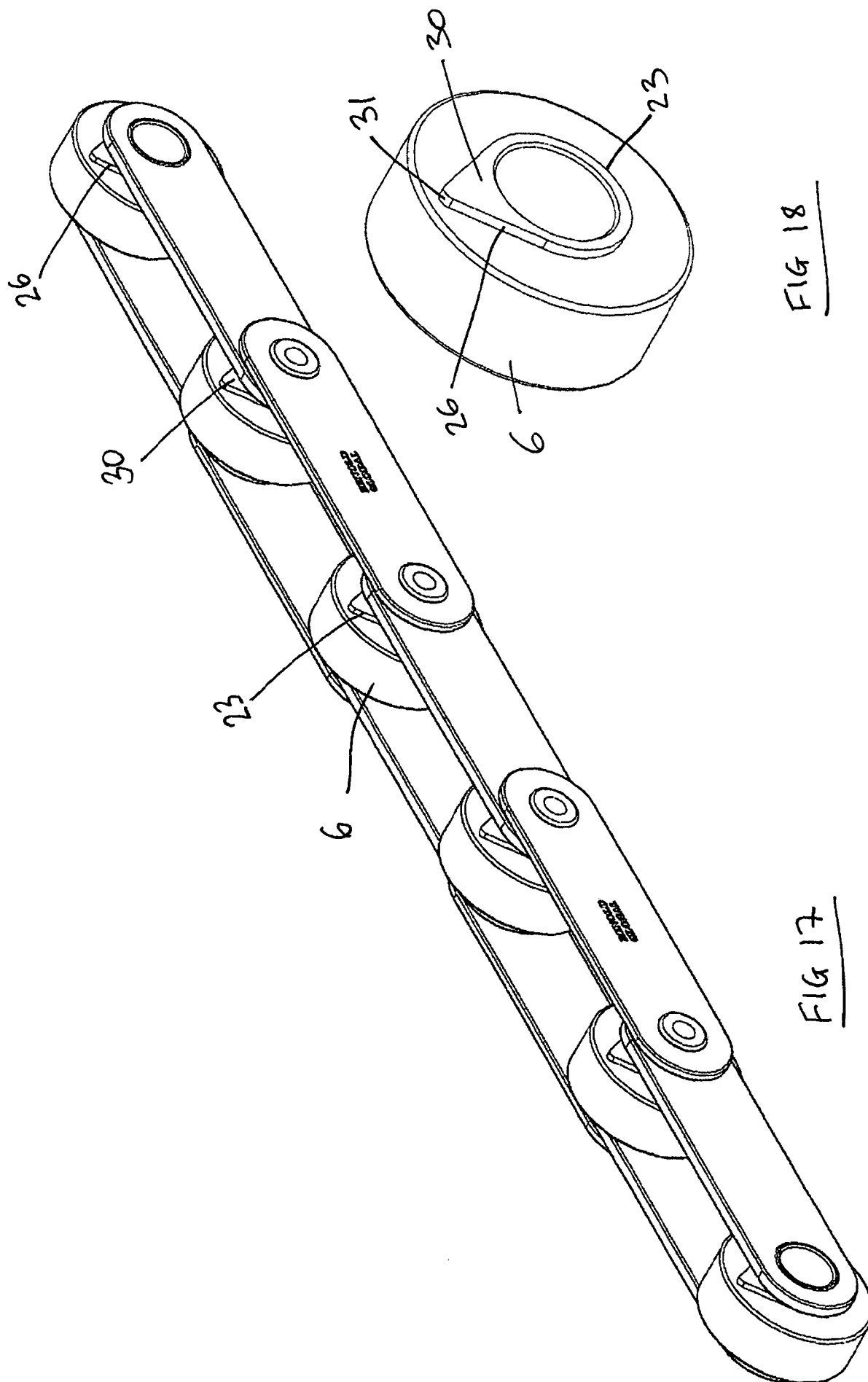








9/11



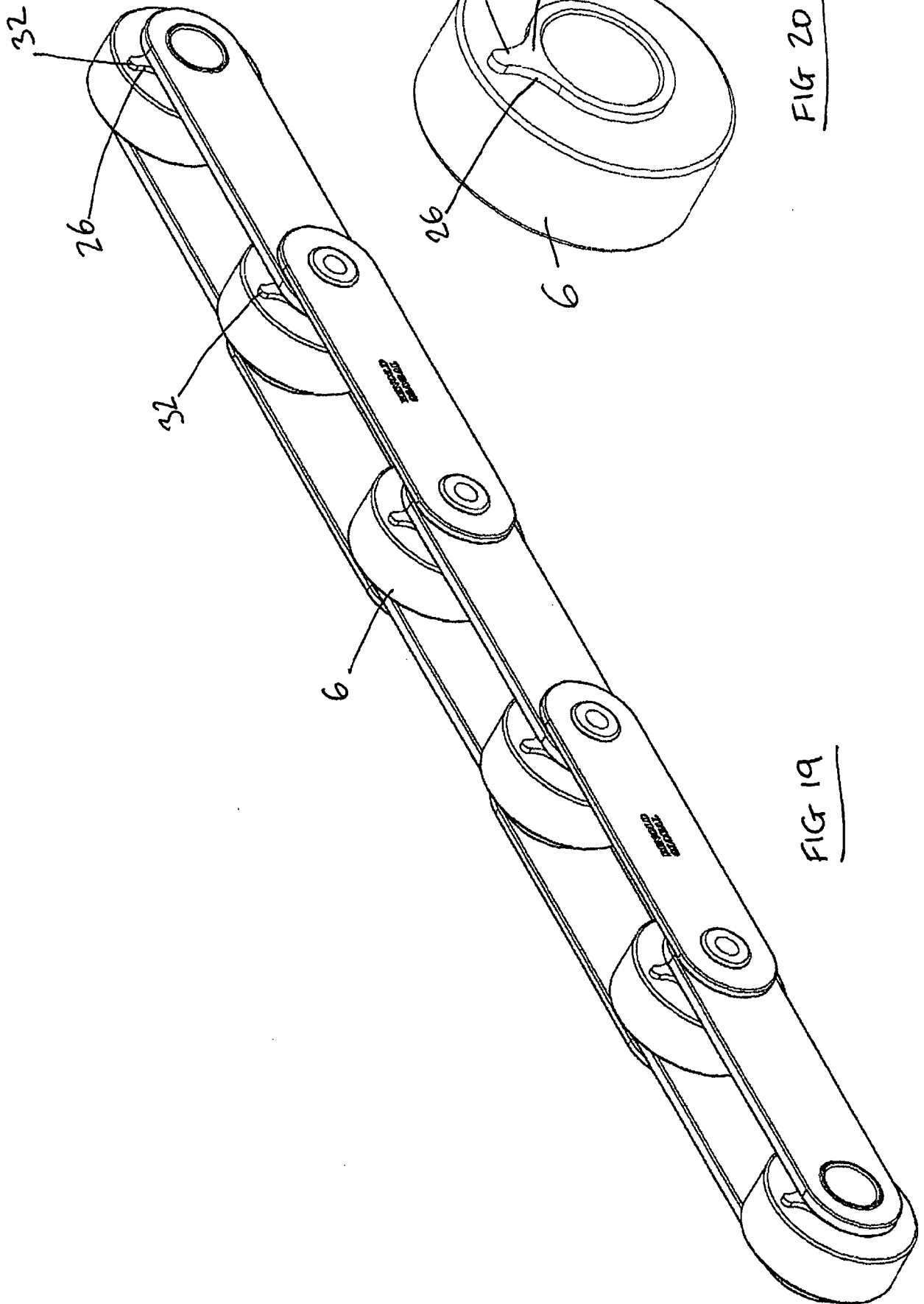
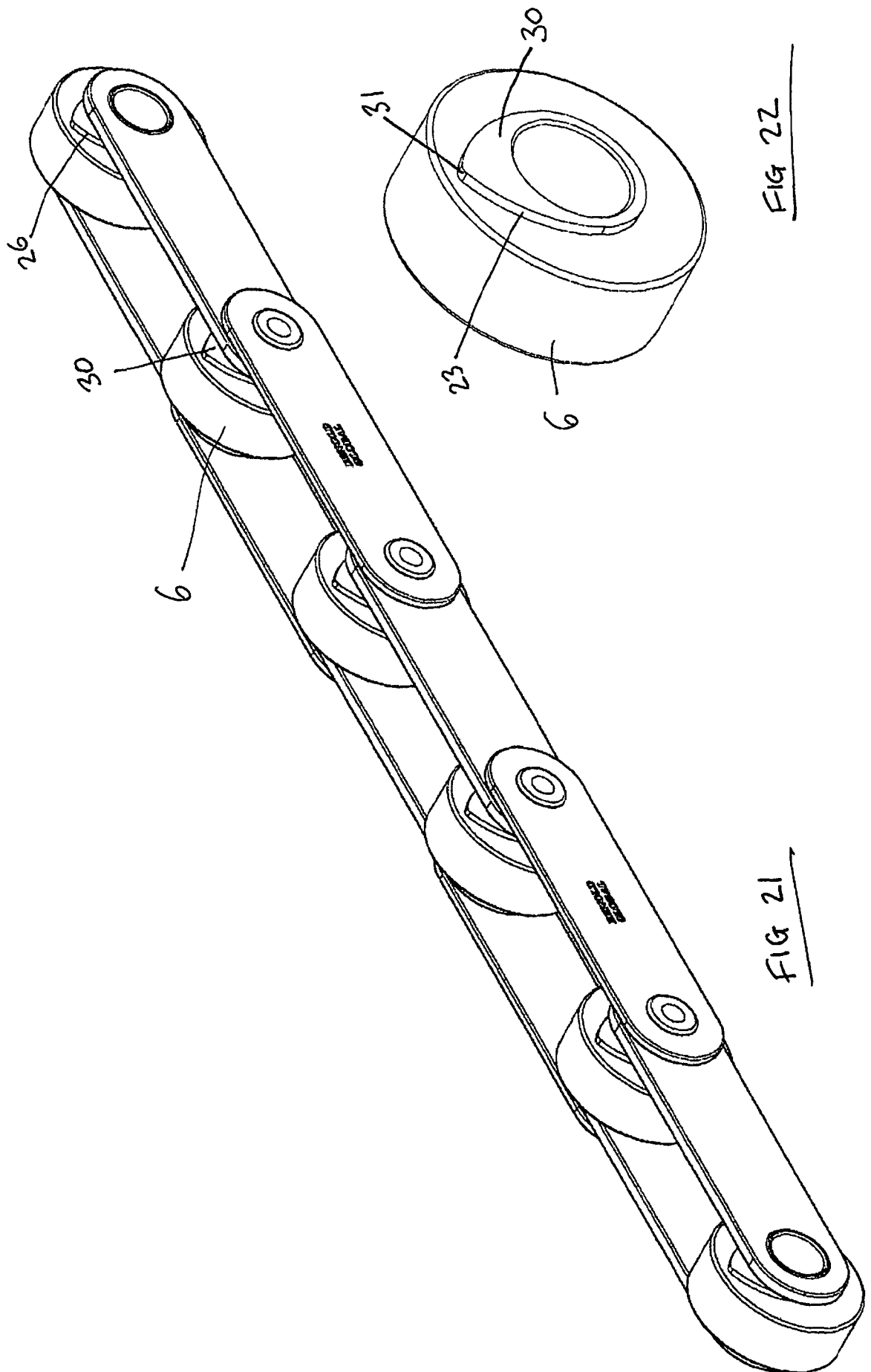


FIG 20

FIG 19



INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2010/001860

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65G17/38 F16G13/06
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)
B65G F16G

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/000758 A1 (NAKAGAWA TAKASHI [JP] ET AL) 3 January 2008 (2008-01-03) page 1, paragraph 3 page 3, paragraph 36 - page 4, paragraph 41 figures 3-4A	1-4,6-8, 11-14,20
A	DE 393 202 C (FRIEDRICH GAMPPER) 4 April 1924 (1924-04-04) the whole document	1
A	GB 830 700 A (PERRY CHAIN COMPANY LTD) 16 March 1960 (1960-03-16) page 2, line 24 - line 116 figures 1-12	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family 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

13 January 2011

Date of mailing of the international search report

21/01/2011

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Papatheofrastou, M

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2010/001860

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2008000758	A1	03-01-2008	CN 101100235 A	09-01-2008
			JP 4271213 B2	03-06-2009
			JP 2008013278 A	24-01-2008
			KR 20080003713 A	08-01-2008
DE 393202	C	04-04-1924	NONE	
GB 830700	A	16-03-1960	NONE	