The present invention provides a track apparatus for mounting to a vehicle. The track apparatus includes a flexible track 20 and a drive wheel 2 for driving engagement with the track 20 and for retrofitting to a driven axle RA of a vehicle. The track apparatus also includes at least one pair of idler wheels (12 see fig 1). A first support assembly is provided on one side of the drive wheel 2 and includes a support member 4, a first bearing structure 6 for mounting the drive wheel 2 and an axle (10a see fig 1) for mounting one of the idler wheels (12). A similar assembly comprising a support member 4' is provided on the other side of the drive wheel 2. Cross members may be provided to further improve strength and rigidity.
TITLE
Track apparatus

DESCRIPTION

Technical Field
The present invention relates to a track apparatus, and in particular to a modular track apparatus that is fitted to a vehicle in place of a wheel.

Background Art
It is known to replace the wheels of a vehicle (and in particular an agricultural vehicle such as a tractor or combine harvester) with a modular track apparatus. All four wheels can be replaced with a modular track apparatus but it is often possible for just one pair (normally, but not exclusively, the rear pair) of wheels to be replaced. In the case where the vehicle has front and rear driven axles, the rolling circumference of each track apparatus must be exactly the same as the wheel it replaces. Otherwise, the speed of the track apparatus mounted for rotation with, for example, the rear driven axle of the vehicle will not match the speed of the wheels on the front driven axle. An example of a modular positive drive track apparatus that is suitable for use in place of just one pair of wheels is disclosed in European Patent Application 1262398 and includes a drive wheel, a flexible track and a carriage for supporting the drive wheel, a pair of front end idler wheels, a pair of rear end idler wheels and at least one pair of intermediate idler wheels. The drive wheel is supported above, rather than alongside, the idler wheels and is fastened directly to the driven axle of the vehicle by a suitable mounting arrangement. The drive wheel extends at least partially into a drive wheel recess well that is provided between the individual axially spaced idler wheels. The drive wheel includes a number of circumferentially spaced drive bars around its outer periphery. The track is normally made of a rubber material and has a number of chevron-shaped cleats on its outer surface to improve grip. The inner surface of the track is formed with a number of spaced apart drive lugs defining a number of drive recesses for receiving the drive bars of the drive wheel. The track extends all the way around the drive wheel and the front and rear end idler wheels. The at least one pair of intermediate idler wheels and the front and rear end idler wheels support the part of
the track that contacts the ground. Rotation of the drive wheel by the driven axle of the vehicle brings the drive bars into positive contact with the inwardly-extending drive lugs of the track to drive the track.

A conventional modular track apparatus normally incorporates a mechanism to maintain a minimum amount of tension in the track and to accommodate variations in the tension as the track apparatus travels over an uneven surface, for example. If the tension cannot be maintained then there is a risk that the track might disengage itself from the drive wheel. On the other hand, if there is no way to accommodate transient increases in tension then there is a risk that the track might fail. A typical track tensioning mechanism might involve mounting the front end idler wheels so that they can translate or pivot relative to the drive wheel, the rear end idler wheels and the one or more intermediate idler wheels in such a way as to alter the total length around which the track must extend. The front end idler wheels can be biased outwardly during normal operation to maintain a minimum amount of tension in the track. Unexpected and sudden increases in the track tension can be easily accommodated by allowing the front end idler wheels to translate or pivot inwardly against the bias to shorten the total length around which the track must extend.

In a friction drive track apparatus, such as a rubber track crawler, the periphery of a drive wheel is provided with a friction member. The friction member can be made of a rubber material, for example. A carriage supports the drive wheel alongside one or more pairs of idler wheels. A flexible track is tensioned around the drive wheel and the idler wheels to bring its inner surface into friction contact with the friction member on the periphery of the drive wheel. The track can be made of a rubber material and has a number of chevron-shaped cleats on its outer surface to improve grip. Rotation of the drive wheel is transmitted through the friction contact between the friction member and the inner surface of the track to drive the track. One advantage of a friction drive track apparatus is that it allows for a small amount of "slippage" between the drive wheel and the track. This can help to reduce track fatigue. Friction drive tracks have been used extensively on agricultural rubber track crawlers but the use of friction drive has never been contemplated for a modular track.
apparatus of the type mentioned above where the drive wheel is supported above the idler wheels.

Summary of the Invention

The present invention provides a track apparatus for mounting to a vehicle, the track apparatus comprising:

- a flexible track;
- a drive wheel for engaging with the track to drive the track and connectable to a driven axle of the vehicle;
- at least one pair of idler wheels;
- a first support member on one side of the drive wheel including a first bearing structure for mounting the drive wheel and an axle for mounting one of the idler wheels; and
- a second support member on the other side of the drive wheel including a second bearing structure for mounting the drive wheel and an axle for mounting the other one of the idler wheels.

Unlike in a conventional modular track apparatus where the drive wheel is only supported on one side, the drive wheel of the track apparatus of the present invention is fully supported on both sides. This improves the strength and rigidity of the track apparatus as a whole and improves the reliability of the mechanical support and connection between the driven axle of the vehicle and the drive wheel.

The driven axle of the vehicle is preferably received through the first bearing structure of the first support member. In some cases, the driven axle may also project or extend in the axial direction beyond the drive wheel such that it is received partially or completely through the second bearing structure of the second support member.

The track apparatus preferably further comprises a pair of front end idler wheels, a pair of rear end idler wheels and a pair of intermediate idler wheels. The drive wheel, the pair of front end idler wheels, the pair of rear end idler wheels and the pair of
intermediate idler wheels can be mounted on the first and second support members in a fixed relationship to each other.

The first support member preferably further includes an axle for mounting one of the pair of front end idler wheels, an axle for mounting one of the pair of rear end idler wheels and an axle for mounting one of the pair of intermediate idler wheels, and the second support member preferably includes an axle for mounting the other one of the pair of front end idler wheels, an axle for mounting the other one of the pair of rear end idler wheels and an axle for mounting the other one of the pair of intermediate idler wheels.

The axles for mounting the idler wheels are preferably stub axles that extend axially in opposite directions from the first and second support members and which do not extend into a drive wheel receipt well between the first and second support members for receiving the drive wheel.

The first support member is preferably formed in two parts with an upper member that includes the first bearing structure and a lower member that includes the axle for mounting one of the idler wheels. Similarly, the second support member is preferably formed in two parts with an upper member that includes the second bearing structure and a lower member that includes the axle for mounting the other one of the idler wheels. The upper and lower members can be welded together or releasably or permanently secured together using mechanical fixings such as bolts.

The maximum axial distance from an outer surface of the lower member of the first support member to an outer surface of the lower member of the second support member is preferably less than, or equal to, the maximum axial width of the drive wheel. This means that the support structure for the drive wheel and the mounting of the various idler wheels is still preferably within the overall width of the drive wheel. This is important because of the size constraints that are often encountered when a modular track apparatus is attached to the driven axle of the vehicle in place of a conventional wheel.
The first support member and the second support member are preferably joined together at front and/or rear locations by cross members. The cross members can be integrally formed as part of one or both of the first and second support members. However, it is generally preferred that the cross members are releasably secured together using mechanical fixings (such as bolts, for example) to allow the track apparatus to be divided for access to the drive wheel.

**Drawings**

Figure 1 is a side view of a modular positive drive track apparatus according to the present invention;

Figure 2 is a cross section view along line A-A of Figure 1;

Figure 3 is a detailed side view of a lower region of the track apparatus of Figure 1 showing the locating of the drive bars of the drive wheel in the space between adjacent drive lugs of the track;

Figure 4 is a side view of the track apparatus of Figure 1 without the idler wheels;

Figure 5 is a cross section view of the two-part rear end idler wheels;

Figures 6A to 6F are a series of side views showing how the rear end idler wheels are manipulated during the fitting of the track to the track apparatus;

Figure 7 is a side view of a first embodiment of a modular friction drive track apparatus according to the present invention;

Figure 8 is a cross section view along line B-B of Figure 7;

Figure 9 is a detailed side view of a lower region of the track apparatus of Figure 7;

Figure 10 is a side view of a second embodiment of a modular friction drive track apparatus according to the present invention;

Figure 11 is a cross section view along line C-C of Figure 10;

Figure 12 is a detailed side view of a lower region of the track apparatus of Figure 10 showing the individual drive members of the drive wheel; and

Figure 13 is a detailed end view of an individual drive member.

With reference to Figure 1, a modular positive drive track apparatus includes a drive wheel 2 mounted between a pair of support members 4 or carriages (only one of
which is shown in Figure 1). The track apparatus is for use with an agricultural vehicle such as a tractor or combine harvester, for example. Two identical track apparatus are secured to opposite sides of a vehicle in place of the rear wheels, which are temporarily removed to expose the driven rear axle of the vehicle. The drive wheel 2 of each track apparatus is attached to opposite ends of the driven rear axle of the vehicle using an appropriate fixing so that they are rotated by the driven rear axle.

Each support member 4 includes a radial bearing structure 6 for supporting the drive wheel 2 so that it can rotate relative to the rest of the track apparatus. The bearing structure 6 includes radially inner bearing races 8a mounted to the each side surface of the drive wheel 2 and radially outer bearing races 8b mounted to the respective support members 4. Each support member 4 also includes three stub axles 10a, 10b and 10c arranged below the bearing structure 6. A front end idler wheel 12 is rotatably mounted on a front stub axle 10a, an intermediate idler wheel 14 is rotatably mounted on a middle stub axle 10b and a rear end idler wheel 16 is rotatably mounted on a rear stub axle 10c. The space 18 between the axially separated support members 4 defines a drive wheel receipt well for receiving the drive wheel 2. The positions of the bearing structure 6 and the front, middle and rear stub axles 10a, 10b and 10c are fixed such that the drive wheel 2 and the various idler wheels 12, 14 and 16 on both sides of the drive wheel receipt well 18 are mounted in a fixed relationship with each other.

A flexible rubber track 20 is arranged around the outside of the drive wheel 2 and the idler wheels 12, 14 and 16 of each support member 4. A series of spaced drive lugs 22 are provided on an inner surface 24 of the track. A series of cleats 26 or tread patterns are provided on an outer surface of the track 20 for providing grip as the track apparatus travels along the ground. The idler wheels 12, 14 and 16 of each support member 4 run along the inner surface 24 of the flexible track 20 and support the track in the region where it contacts the ground. Unlike in a conventional modular track apparatus, there is no contact between the drive lugs 22 and the idler wheels 12, 14 and 16. Instead, as described in more detail below, the track 20 is guided solely by the drive wheel 2.
Figure 2 is a cross section view along line A-A of Figure 1. A rear side part of the vehicle V is shown. The driven rear axle RA of the vehicle V extends through the bearing structure 6 of the first support member 4 that is located adjacent the vehicle and is attached to a central region of the drive wheel 2 by a series of circumferentially spaced bolts 28. The driven rear axle RA extends a small way into the bearing structure 6 on the second support member 4' but it will be readily appreciated that it may extend further into the bearing structure, and even all of the way through it, depending on the construction of the driven rear axle itself. The drive wheel receipt well 18 between the first and second support members 4 and 4' is clearly shown.

An identical track apparatus is mounted to the opposite end of the driven rear axle in exactly the same manner. Until now, it has always been necessary for a left-handed modular track apparatus to be constructed for attachment in place of the left-hand wheel and for a right-handed modular track apparatus to be constructed for attachment in place of the right-hand wheel. The present invention avoids the need for different constructions because the same track apparatus can be used in place of either a left-hand or right-hand wheel. This results in ease of construction and manufacture. It also means that a supplier only needs to stock a single type of track apparatus because it can be fitted in place of a left-hand or right-hand wheel depending on the circumstances.

The drive wheel 2 includes a radially extending part or hub 30 that terminates in a circumferential rolled plate 32. A series of circumferentially spaced drive bars 34 (Figure 3) extend radially outwardly from the rolled plate 32. Two annular supports 36 are connected to the drive bars 34 and extend completely around the periphery of the drive wheel 2 and define a circumferential drive lug receipt well for receiving the drive lugs 22 of the track 20. At an upper region of the track apparatus, the drive bars 34 of the drive wheel 2 engage between adjacent drive lugs 22 of the flexible track 20 to drive the track around the track apparatus. However, at a lower region of the track apparatus (i.e. adjacent the idler wheels) the drive bars 34 are still located in the space between adjacent drive lugs 22. This is shown more clearly in Figure 3 where the
nearest annular support 36 is partially cut away to show the location of the drive bars 34. It will be readily appreciated that the space between adjacent drive lugs 22 is greater at a lower region of the track apparatus where the track 20 is running substantially flat against the ground than at an upper region where the track is bent around the circumference of the drive wheel 2. The location of the drive bars 34 in the space between the adjacent drive lugs 22 at a lower region of the track apparatus is not to positively engage with the drive lugs to drive the track but simply to help to guide the track 20 as it contacts the ground.

The drive lugs 22 of the track 20 are profiled in the axial direction to be substantially trapezoidal. The rolled plate 32 and the annular supports 36 are sized and shaped to correspond to the same profile such that the rolled plate 32 comes into direct contact with a distal surface 22a of the drive lugs 22 and the supports 36 come into direct contact with side surfaces 22b of the drive lugs at an upper region of the track apparatus. The rolled plate 32 and annular supports 36 therefore help to support the flexible track 20 and prevent all of the tension in the track from acting solely on the drive bars 34. As shown clearly in Figure 2, the drive lugs 22 of the track 20 are also received in the drive lug receipt well between the annular supports 36 at a lower region of the track apparatus. Thus, the drive wheel 2 guides the track 20 both at upper and lower regions of the track apparatus and prevents the track from moving in the axial direction. Although in Figure 2 the rolled plate 32 and the drive bars 34 are spaced apart from the distal surface 22a of the drive lugs 22 and the inner surface 24 of the track 20, respectively, at the lower region of the track apparatus, it will be readily appreciated that they do help to prevent the track from rising upwardly between the idler wheels in situations where the track apparatus encounters uneven ground or an obstruction, for example. In these situations, the distal surface 22a of the drive lugs 22 and/or the inner surface 24 of the track 20 will come into contact with the rolled plate 32 and/or the drive bars 34 of the drive wheel 2, respectively, and further movement in the upward direction will be prevented. Such contact between the distal surface 22a of one of the drive lugs 22 and the rolled plate 32 is shown in Figure 3.
In certain circumstances, the contact between the annular supports 36 and the side surfaces of the drive lugs 22 can be such that there is no need for the rolled plate 32 to come into contact with the distal surface 22a of the drive lugs in the upper region of the track apparatus.

Because the annular supports 36 are only joined to the drive wheel 2 by the circumferentially spaced drive bars 34, a series of circumferential spaces 38 are provided on both sides of the periphery of the drive wheel between the supports and the rolled plate 32. Any dirt or debris such as soil, mud, snow, plant material etc. is therefore able to pass out of the drive lug receipt well between the annular supports 36 through these spaces 38.

Both the front and intermediate idler wheels 12 and 14 have pneumatic tyres 40. Because the pneumatic tyre 40 on each front end idler wheel 12 is compressible, it effectively acts as a track tensioning mechanism for the flexible track 20. It will be readily appreciated that the tension in the track 20 is related to the total length around which the track has to extend. This total length can be altered by putting more or less air in the pneumatic tyres 40 of the two front end idler wheels 12. The pneumatic tyres 40 of the front end idler wheels 12 can therefore be pressurised to the correct level to maintain a minimum amount of tension in the track 20. Unexpected and sudden increases in the track tension can be easily accommodated because the pneumatic tyres 40 of the front end idler wheels 12 will be compressed to shorten the total length around which the track 20 must extend. The use of pneumatic tyres 40 with the front end and intermediate idler wheels 12 and 14 also provide suspension for the track apparatus and improves the ride characteristic of the vehicle.

It is not generally possible for all of the idler wheels to have pneumatic tyres because of the fact that they will be compressed by the weight of the vehicle to which the track apparatus is attached. In the case of the track apparatus of Figure 1, the rear end idler wheel 16 therefore has a solid rubber tyre 42 to provide the necessary degree of support. Other non-compressible materials could also be used. For example, the rear end idler wheels 16 could be constructed entirely of metal. Although it is generally
preferred that the front end idler wheels 12 act as the track tensioning mechanism, there is no reason why the front end idler wheels cannot be made of solid rubber and the rear end idler wheels have pneumatic tyres.

The alignment (or “tracking”) of the track can be controlled by altering the pressure in the pneumatic tyre 40 of each front end idler wheel 12. Just considering one track apparatus, the alignment can be corrected or adjusted by setting the pressure of the pneumatic tyre of say the outermost front end idler wheel (i.e. the one mounted on the second support member 4’ that is furthest away from the vehicle) to be greater than the pressure in the pneumatic tyre of the innermost front end idler wheel (i.e. the one mounted on the first support member that is closest to the vehicle. This would have the effect of moving the angular alignment of the track to be closer to vehicle. The opposite effect could be achieved by setting the pressure of the pneumatic tyre of the outermost front end idler wheel to be less than the pressure of the pneumatic tyre of the innermost front end idler wheel. Such alignment can be easily carried out by the owner of the track apparatus to get best performance and to avoid any damage being caused to the track if it does not run properly around the drive wheel and the idler wheels.

As shown in Figures 2 and 4, each support member 4 is formed in two parts with an upper part 4a that includes the bearing structure 6 for supporting the drive wheel 2 and a lower part (or carriage part) 4b that includes the front, middle and rear stub axles 10a, 10b and 10c for mounting the idler wheels. The upper parts 4a are located axially closer to the drive wheel 2 and the lower parts 4b overlap with the upper parts such that the track apparatus has a stepped construction when viewed in the cross section of Figure 2. The maximum distance D between outer facing surfaces of the lower parts 4b is less than the overall width of the peripheral part the drive wheel 2 (i.e. the rolled plate 32 the supports 36) such that the entire support or chassis can sit comfortably in the space vacated by the wheel of the vehicle. The upper and lower parts 4a and 4b are welded together but other forms of mechanical fixing can be used.
As shown in Figure 4, the first and second support members 4 are joined together by axially extending cross members 44 and 46 at front and rear locations radially outside of the extent of the drive wheel 2. It is sometimes necessary to have direct access to the drive wheel 2 and so the cross members 44 and 46 are bolted together so that the first and second support members 4 can be split apart for maintenance and repair.

Figure 4 also shows flanges 48a, 48b and 48c rotatably mounted to the stub axles 10a, 10b and 10c for the mounting of the front end, intermediate and rear end idler wheels 12, 14 and 16, respectively. In Figure 4, the nearest support 36 has been omitted so that the drive bars 34 can be seen.

The construction of the track apparatus necessitates a new and different method for fitting the track 20 around the outside of the drive wheel 2 and the idler wheels. To this end, and with reference to Figure 5, each of the rear end idler wheels 16 is formed with a two-part construction with a first plate 16a that is mounted on the rear stub axle 10c of the associated support member 4. A second plate 16b, having a larger outer radius than the first plate 16a, carries the solid rubber tyre 42 and is releasably secured to the first plate by a series of circumferentially spaced bolts 50 that are received through aligned apertures in the first and second plates. The method of track fitting will be described with reference to Figures 6A to 6F. The first step is to remove all of the bolts 50 except the bolt that is furthest away from the centre of the drive wheel 2 (or more particularly, the bolt that is closest to the centre of the arc of the periphery of the rear end idler 16 about which the track 20 will extend once it has been fitted). This bolt is represented in all of Figures 6A to 6F by the small cross. Once the bolts have been removed, the second plate 16b is free to pivot about this bolt relative to the first plate 16a. The rear end idler wheel 16 can then be moved upwards (a pivoting movement of the second plate 16b about the remaining bolt) and to the left (an anticlockwise rotational movement of the first plate 16a about the stub axle 10c). This movement is shown by the transition from the starting position in Figure 6A, through an intermediate position shown in Figure 6B to a final position shown in Figure 6C. This movement creates space for the track 20 to be fitted because it reduced the total length around the drive wheel and the idler wheels over which the track has to extend. During assembly of the track apparatus, it might be the case that
the second plate 16b is to be secured to the first plate 16a for the first time. In this case, the second plate 16b can be secured to the first plate 16a using a single bolt at the position shown in Figure 6C with their respective axes not coincident. As shown in Figure 6D, the track 20 is then fitted around the drive wheel 2 and the front end, intermediate and rear end idler wheels 12, 14 and 16 in the usual way with the drive bars 34 of the drive wheel being received in the space between adjacent drive lugs 22 of the track. Once the track is in position, the movement of the rear end idler wheels 16 is repeated in the opposite direction with the first plate 16a being rotated in the clockwise direction about the stub axle 10c and the second plate 16b being pivoted relative to the first plate about the remaining bolt 50. This movement is shown by the transition from the starting position in Figure 6D, through an intermediate position shown in Figure 6E to a final position shown in Figure 6F when the apertures in the first and second plates 16a and 16b come back into register. The rotation movement provides a cam action such that the total length around which the track must extend is gradually increased against the tension in the track 20. Bolts can then be passed through the open apertures and tightened to secure the first and second plates 16a and 16b together.

In the case where the rear end idler wheels act as the track tensioning mechanism then the front end idler wheels can have the above-mentioned two-part construction.

A first embodiment of a modular friction drive track apparatus is shown in Figure 7. The friction drive track apparatus is very similar to the modular positive drive track apparatus described with reference to Figures 1 to 6 and equivalent parts have been given the same reference numerals. The only technical difference is the use of friction engagement between the drive wheel 2 and the track 20 to drive the track. The features of the modular positive drive track apparatus relating to the construction of the support members 4 (including the bearing structure 6, upper and lower parts 4a and 4b), the attachment of the drive wheel 2 to the driven rear axle of the vehicle, the mounting of the front, intermediate and rear idler wheels 12, 14 and 16, the use of pneumatic tyres 40 on the front (or rear) end idler wheels to act as a track tensioning mechanism, and the two-part construction of the rear (or front) end idler wheels 16 for
the purposes of track fitting are equally applicable to the modular friction drive track apparatus and will not be described again here.

The modular friction drive track apparatus includes a drive wheel 2 mounted between a pair of support members 4 or carriages (only one of which is shown). The track apparatus is for use with an agricultural vehicle such as a tractor or combine harvester, for example. Two identical track apparatus are secured to opposite sides of the vehicle in place of the rear wheels, which are temporarily removed to expose the driven rear axle of the vehicle. The drive wheel of each track apparatus is attached to opposite ends of the driven rear axle of the vehicle using an appropriate fixing so that they are rotated by the driven rear axle.

A flexible rubber track 20 is arranged around the outside of the drive wheel 2 and the idler wheels 12, 14 and 16 of each support member 4. A series of spaced locating lugs 22 are provided on an inner surface 24 of the track 20. As described in more detail below, the locating lugs 22 enable the drive wheel 2 to guide the track 20 but they are not essential to the operation of the track apparatus. A series of cleats 26 or tread patterns are provided on an outer surface of the track 20 for providing grip. The idler wheels 12, 14 and 16 of each support member 4 run along the inner surface 24 of the flexible track 20 and support the track in the region where it contacts the ground.

Figure 8 is a cross section view along line B-B of Figure 7. The drive wheel 2 includes a radially extending part 30 or hub that terminates in a circumferential edge part 100. The edge part 100 includes an axially extending plate member 102 that is integrally formed with two annular supports 104. The annular supports 104 can also be separately formed and welded or secured to the plate member 102 using a suitable mechanical fixing. The annular supports 104 extend completely around the periphery of the drive wheel 2 and define a circumferential locating lug receipt well for receiving the locating lugs 22 of the track 20. The radially outer face of each support 104 includes a rubber friction member 106 (either continuous or segmented) that engages with the inner surface 24 of the track 20 to drive the track. A series of circumferentially spaced friction members (not shown) can also be formed on the face
of each support in place of the continuous or segmented friction member. Because the drive wheel 2 relies on a good friction contact between the friction members 106 and the inner surface 24 of the track 20, the tension in the track is usually greater than it would be for the modular positive drive track apparatus. One advantage of relying on friction contact instead of the positive contact between drive bars and drive lugs is that the track can “slip” relative to the drive wheel. This has the effect of reducing track fatigue. For low torque applications the amount of friction contact can be less than for high torque applications. Similarly, the amount of slippage that can be tolerated between the friction members 106 of the drive wheel 2 and the track 20 is greater for low torque applications than for high torque applications.

At an upper region of the track apparatus, the friction member 106 provided on the radially outer surface of each support 104 is in friction contact with the inner surface 24 of the track 20. However, at a lower region of the track apparatus (i.e. adjacent the idler wheels) the friction members 106 are spaced apart from the inner surface 24 of the track 20. This is shown more clearly in Figure 9 where the nearest annular support 104 is partially cut away to show the location of the locating lugs 22. Spacing the friction members 106 from the inner surface 24 of the track 20 prevents any dirt or debris that might find its way on to the lower run of the track from being picked up by the drive wheel 2 and disrupting the friction contact. In a different embodiment, the track apparatus can be arranged so that the friction members of the drive wheel are in friction contact with the inner surface of the track at both upper and lower regions of the track apparatus.

The locating lugs 22 of the track 20 are profiled in the axial direction to be substantially trapezoidal. The plate member 102 and the annular supports 104 are sized and shaped to correspond to the same profile such that the plate member 102 comes into direct contact with a distal surface 22a of the locating lugs 22 and the supports 104 come into direct contact with side surfaces of the locating lugs 22 at an upper region of the track apparatus. The plate member 102 and annular supports 104 therefore help to support the flexible track 20. Additional friction members (not shown) can be formed on the inner surface of each support to provide further friction
contact between the supports and the locating lugs of the track. As shown clearly in Figure 8, the locating lugs 22 of the track 20 are received in the locating lug receipt well between the annular supports 104 at both upper and lower regions of the track apparatus. Thus, the drive wheel 2 guides the track 20 both at upper and lower regions of the track apparatus and prevents the track from moving in the axial direction. Although the plate member 102 is spaced apart from the distal surface 22a of the locating lugs 22 at the lower region of the track apparatus, it will be readily appreciated that it does help to prevent the track from rising upwardly between the idler wheels in situations where the track apparatus encounters uneven ground or an obstruction, for example. In these situations, the distal surface 22a of the locating lugs 22 will come into contact with the plate member 102 and further movement in the upward direction will be prevented. Such contact is shown in Figure 9.

A second embodiment of a modular friction drive track apparatus is shown in Figures 10 to 13. The friction drive track apparatus is very similar to the modular positive drive track apparatus described with reference to Figures 1 to 6 and to the first embodiment of the modular friction drive track apparatus described with reference to Figure 7 to 9 and equivalent parts have been given the same reference numerals. The only technical difference is the construction of the radially outer part of the drive wheel 2. More particularly, the drive wheel 2 includes a series of circumferentially spaced drive members 200 that are bolted to a peripheral region of the radially extending part or hub 30. Each drive member 200 (one of which is shown end on in Figure 13) includes a first support 202 and a second support 204 that are secured on opposite sides of the hub 30 by a pair of bolts 206. The first and second supports 202 and 204 include an angled part 208 and an axially extending part 210 that are sized and shaped to correspond to the profile of the locating lugs 22 of the track 20 such that the axially extending part 210 of each support 202 and 204 comes into direct contact with part of a distal surface 22a of the locating lugs 22 and the angled part 208 of each support comes into direct contact with side surfaces of the locating lugs at an upper region of the track apparatus. Each drive member 200 therefore defines a locating lug receipt well W for receiving the locating lugs 22 of the track 20.
The radially outer face of the first and second supports 202 and 204 of each drive member 200 includes a rubber friction member 212 that engages with the inner surface 24 of the track 20 to drive the track. Additional friction members (not shown) can be formed on the inner surface of the angled part of each support to provide further friction contact between the supports and the locating lugs of the track.

The use of drive members 200 is advantageous because they can be replaced individually and the space between 214 adjacent drive members allows for the passage of dirt and debris.
CLAIMS

1. A track apparatus for mounting to a vehicle, the track apparatus comprising:
   a flexible track;
   a drive wheel for engaging with the track to drive the track and connectable to
   a driven axle of the vehicle;
   at least one pair of idler wheels;
   a first support member on one side of the drive wheel including a first bearing
   structure for mounting the drive wheel and an axle for mounting one of the idler
   wheels; and
   a second support member on the other side of the drive wheel including a
   second bearing structure for mounting the drive wheel and an axle for mounting the
   other one of the idler wheels.

2. A track apparatus according to claim 1, wherein the driven axle of the vehicle
   is received through the first bearing structure of the first support member.

3. A track apparatus according to claim 1 or claim 2, wherein the driven axle of
   the vehicle is received partially or completely through the second bearing structure of
   the second support member.

4. A track apparatus according to any preceding claim, further comprising a pair
   of front end idler wheels, a pair of rear end idler wheels and a pair of intermediate
   idler wheels.

5. A track apparatus according to claim 4, wherein the drive wheel, the pair of
   front end idler wheels, the pair of rear end idler wheels and the pair of intermediate
   idler wheels are mounted on the first and second support members in a fixed
   relationship to each other.

6. A track apparatus according to claim 4 or claim 5, wherein the first support
   member further includes an axle for mounting one of the pair of front end idler
   wheels, an axle for mounting one of the pair of rear end idler wheels and an axle for
mounting one of the pair of intermediate idler wheels, and the second support member includes an axle for mounting the other one of the pair of front end idler wheels, an axle for mounting the other one of the pair of rear end idler wheels and an axle for mounting the other one of the pair of intermediate idler wheels.

7. A track apparatus according to any preceding claim, wherein the first support member is formed in two parts with an upper member that includes the first bearing structure and a lower member that includes the axle for mounting one of the idler wheels.

8. A track apparatus according to any preceding claim, wherein the second support member is formed in two parts with an upper member that includes the second bearing structure and a lower member that includes the axle for mounting the other one of the idler wheels.

9. A track apparatus according to claim 8, wherein the maximum axial distance from an outer surface of the lower member of the first support member to an outer surface of the lower member of the second support member is less than, or equal to, the maximum axial width of the drive wheel.

10. A track apparatus according to any preceding claim, wherein the first support member and the second support member are joined together at front and/or rear locations by cross members.

11. A track apparatus according to any preceding claim, wherein the cross members are releasably secured together using mechanical fixings to allow the track apparatus to be divided for access to the drive wheel.
Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

<table>
<thead>
<tr>
<th>Category</th>
<th>Relevant to claims</th>
<th>Identity of document and passage or figure of particular relevance</th>
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<tr>
<td>X</td>
<td>1, 3-8, 10, 11</td>
<td>US4448273 A (BARBIERI) esp figs 4 &amp; 7-10</td>
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<td>X</td>
<td>1, 2</td>
<td>NL9400193 A (IND DEV HEERENVEEN) esp figs 1-3</td>
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<td>A</td>
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<td>GB2370821 A (AG-TRACKS) esp figs 1, 2 &amp; 13</td>
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Categories:

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<th>X</th>
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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC

- B7H
- Worldwide search of patent documents classified in the following areas of the IPC
- B62D
- The following online and other databases have been used in the preparation of this search report
  - Online: EPODOC & WPI