

Description

This invention relates to an endless track for a tracked vehicle, and to a track assembly for a tracked vehicle, according to the pre-characterizing part of Claim 1.

As traction means for vehicles, the benefits of endless tracks as opposed to ground wheels provided with pneumatic tyres, are well known. These benefits include better traction in soil and less ground compaction. However, endless tracks do have several deficiencies. The endless track comprise track sections joined to one another by pivoted connections which are prone to unacceptably high rates of wear, thereby limiting the service life of the tracks. A further deficiency is that endless tracks cause damage to finished road surfaces, especially when the vehicle is turning. A still further deficiency is that endless tracks are incapable of cushioning or absorbing shocks resulting from surface irregularities and so vehicle springing is required for satisfactory ride characteristics. The endless tracks also have higher noise levels and lower maximum travel speeds than wheels equipped with pneumatic tyres.

With a view to overcoming some of the above-mentioned deficiencies, there have been various proposals to provide the endless tracks with ground contacting elements formed of elastomeric material rather than metal. One such proposal is revealed in British Patent GB-A-753,147 (Mathisen) which discloses an endless track structure comprising a plurality of traction shoes mounted on an articulated supporting structure in the form of an endless chain. The traction shoes each comprise a base structure which is connected to a link of the endless chain and a plurality of U-shaped elements made from strips of a yielding resilient material. When under load, the U-shaped elements tilt to one side to facilitate non-aggressive contact with the ground and to increase frictional engagement with the ground. While this endless track arrangement with not damage finished road surfaces, it does suffer from the disadvantage that the traction shoes are mounted on an articulated supporting structure comprising rigid links pivotally connected one to another. The pivotal connections between the rigid links are susceptible to high rates of wear which is detrimental to the service life of the endless track. Furthermore, the system of GB-A-753,147 is particularly complex and therefore costly to manufacture and service.

US Patent US-A-4,119,356 (Pohjola) (which corresponds to the preamble of claim 1) also discloses an endless track which would provide some cushioning and afford some protection to road surfaces. The endless track has a longitudinally extending central region which is non-stretchable and opposed side edge regions which are elastic and capable of stretching and contracting. The purpose of this construction is to allow the opposed side edges of the track to extend and

contract so that the track can curve as the tracked vehicle executes a turn. The track includes elongated portions which are elastic and of corrugated configuration, the effect of which would be to provide some cushioning and protection to road surfaces, but not at the centre which is the zone of greatest ground contact. The track is also unlikely to be simple and cost effective in manufacture owing to the non-stretchable nature of its central region and elastic nature of its opposed side edge regions.

It is an object of the present invention to provide a useful and novel track which is of relatively simple construction, which may travel on finished road surfaces and which can at least partly absorb shocks resulting from encountering bumps and surface irregularities.

Broadly, the invention comprises an endless track for tracked vehicles comprising an endless flexible band having an inner surface and an outer surface, and a plurality of elongated tread elements provided in spaced relationship on the outer surface of the band and extending transversely of the direction of travel of the track, characterised in that said endless flexible band is of one-piece construction and is substantially longitudinally inextensible yet flexible and further characterised in that each tread element comprises a resiliently deformable loop that engages the ground, the interior of said loop being unpressurised and open to atmosphere.

The use of the endless flexible band of one-piece construction obviates the need for rigid track sections joined to one another by pivoted connections and so provides for an endless track of relatively simple construction. Furthermore, the resilient nature of the tread elements permits the track to travel on finished road surfaces and provides at least some cushioning of shocks encountered during travel.

Preferably, the loops are open at their ends. In this way, the cavities defined within the loops open onto the exterior of the endless track.

Preferably, the loops are formed of reinforced elastomeric material.

Preferably, the endless band is formed of reinforced elastomeric material so as to be substantially longitudinally inextensible yet flexible.

Each loop may be provided with a sacrificial wear pad attached to the ground engaging portion thereof.

In one arrangement, the loops are provided by a length of resilient material arranged in a sinusoidal formation having alternating crests and troughs, the length of resilient material being anchored to the flexible band at locations corresponding to at least some of the troughs.

According to a second aspect of the invention there is provided a track assembly for a tracked vehicle, the track assembly comprising a plurality of track wheels at least one of which constitutes a drive wheel, and an endless track entrained around the track wheels, the endless track being in accordance with the first aspect of the invention as defined hereinbefore.

Although a positive drive may be provided between the or each drive wheel and the track, it is preferred that friction drive be employed. With friction drive, there is frictional engagement between the inner surface of the endless band and the outer periphery of the or each drive wheel so that the drive wheel frictionally transmits power to the endless track. To facilitate frictional engagement between the drive wheel and the endless band, the outer periphery of the drive wheel may be coated with elastomeric material.

Preferably, the track wheels are each provided with a circumferential recess which receives the endless band and serves to guide the band in its circuitous path around the track wheels.

Preferably, a tensioning means is provided for tensioning the endless band about the track wheels. The tensioning means may comprise means for urging one of the endmost track wheels in a direction away from the other endmost track wheel.

The invention will be better understood by reference to the following description of one specific embodiment thereof as shown in the accompanying drawings in which:

Figure 1 is a perspective view of a work vehicle provided with traction means incorporating an endless track assembly according to the embodiment;

Figure 2 is a schematic side view of the work vehicle of Figure 1 with the lower run of the endless track assembly shown in the condition it assumes under driving load;

Figure 3 is a view of the track assembly in part section;

Figure 4 is a detail view of part of the upper run of an endless track of the track assembly; and

Figure 5 is a detail view of part of the lower run of the endless track, deformed under driving load.

Referring to Figure 1 of the drawings, there is shown an amphibious work vehicle 11 having a traction means which includes a pair of track assemblies 13 according to the embodiment arranged on opposite sides of the vehicle. The vehicle is provided with a frame structure 15 and a body 17 which is carried on the frame structure and which provides an operator's cab 19, an engine compartment 21, and a load carrying compartment 23.

Each track assembly 13 comprises a plurality of track wheels 25 and an endless track 27 fitted onto the track wheels. The track wheels 25 are supported on axles which are directly connected to the frame structure of the vehicle; that is, there is no spring system between the frame structure and the axles.

One of the endmost track wheels constitutes a drive wheel to which power is selectively transmitted from an engine mounted in the engine compartment.

A tensioning means (not shown) is provided for tensioning the endless belt about the track wheels. The tensioning means is the form of a means supporting the particular endmost track wheel which is not the drive wheel on the frame structure

for movement along the fore-and-aft direction of the vehicle, and a power device (such as a hydraulic ram) for controlling such movement. With this arrangement, the movable endmost wheel can be moved in the direction away from the drive wheel thereby to tension the endless track, as will become more apparent later.

The track wheels 25 (including the drive wheel) are each provided with a circumferential recess 29 to guidingly receive the endless track for retaining the track in alignment with the track wheels. The recesses 29 are formed by circumferential flanges 31 provided on the ends of the track wheels, as best seen in Figure 3 of the drawings.

The endless track 27 comprises an endless flexible band 33 having an outer face 35, an inner face 37 and two longitudinal edges.

The endless band 33 is received in the circumferential recesses 29 of the track wheels 25 with the longitudinal edges of the band closely adjacent the circumferential flanges 31 of the track wheels.

While being flexible, the endless band 33 is also longitudinally inextensible in character so as to resist undue stretching. To this end, the endless band may be in the form of an elastomeric material reinforced with steel cables or other reinforcing elements.

The endless track 27 further comprises a plurality of spaced, elongated tread elements 41 provided on the outer face of the endless band. The tread elements 41 are formed of resilient material and extend transversely of the direction of travel of the vehicle. Each tread element 41 is in the form of a loop having a ground contacting portion 43 and a pair of side wall portions 45 which are load supporting when the tread element is in contact with the ground.

While the tread elements 41 may be formed integrally with the endless band 33, in this embodiment the tread elements are formed separately of and secured to the band. More particularly, the tread elements are provided by a length 47 of resilient material which is arranged in a sinuous formation having alternate crests and troughs. Fastening means 49 secure the length of material 47 to the endless band 33 at locations corresponding to each of the troughs. The resilient material is required to have sufficient compressive strength to support the loads imposed on it when the loops are under load and to this end may be in the form of reinforced elastomeric material.

The outer periphery of the drive wheel is provided with a friction surface for frictional engagement with the inner surface of the endless band. In this way, the drive wheel frictionally transmits power to the endless band. Tension in the endless band is regulated by the tensioning means so as to maintain the frictional driving relationship between the endless band and the drive wheel.

A scraper (not shown) or other means may be provided to displace sand and other debris gathering between the inner surface of the endless band and the outer peripheries of the track wheels.

The ground contacting portion of each loop may be provided with a sacrificial wear pad (not shown)

if desired so as to extend the service life of the endless track.

In operation, the tread elements deform under load and assume a configuration illustrated in Figure 5 when the vehicle is undergoing straight line motion. When the vehicle is turning on finished road surfaces, the tread elements twist and drag over the surface without inflicting damage thereto.

The ability of the tread elements to deform under load provides the vehicle with a degree of springing which at least partially absorbs shock forces resulting from bumps and other surface irregularities encountered in the path of the vehicle.

The traction means also provides a propulsion system for the vehicle when operating in water. In such situations, the lower run of the endless track is submerged and the upper run is above the water line. In this way, the tread elements act as paddles as the endless track follows its circuitous path.

From the foregoing, it is evident that the present invention provides both an endless track assembly and an endless track, each of which is of relatively simple construction and which can be operated on finished road surfaces without inflicting damage to such surfaces.

Although the invention has been described as applied to an amphibious work vehicle, it will be recognised that it may be applied to any suitable tracked vehicle including earth-moving machines, agricultural machines and snowmobiles.

Claims

1. An endless track for tracked vehicles comprising an endless flexible band (33) having an inner surface (37) and an outer surface (35), and a plurality of elongated tread elements (41) provided in spaced relationship on the outer surface (35) of the band (33) and extending transversely of the direction of travel of the track, characterised in that said endless flexible band (33) is of one-piece construction and is substantially longitudinally inextensible yet flexible and further characterised in that each tread element (41) comprises a resiliently deformable loop (41) that engages the ground, the interior of said loop (41) being unpressurised and open to atmosphere.

2. An endless track according to claim 1, wherein the endless band (33) is formed of reinforced elastomeric material.

3. An endless track according to claim 1 or 2 wherein the loops (41) have ends which are open.

4. An endless track according to any one of the preceding claims wherein the loops (41) are formed of reinforced elastomeric material.

5. An endless track according to any one of the preceding claims wherein the tread elements (41) are formed separately of and secured to the endless band (33).

6. An endless track according to claim 5 wherein the loops (41) are provided by a length of resilient material (47) arranged in a sinuous

formation of alternating crests and troughs around the endless flexible band, said troughs contacting the outer surface of the endless flexible band, the length of resilient material (47) being anchored to the flexible band at locations corresponding to at least some of the troughs.

7. A track assembly (13) for a tracked vehicle, the track assembly comprising a plurality of track wheels (25) at least one of which constitutes a drive wheel, and an endless track (27) according to any one of the preceding claims around said drive wheels.

8. A track assembly according to claim 7 wherein a friction drive is provided between the or each drive wheel and the endless band.

9. A track assembly according to claim 7 or 8 wherein the track wheels (25) are each provided with a circumferential recess (29) which receives the endless band (33) and serves to guide the band in its circuitous path around the track wheels.

10. A tracked vehicle (11) having an endless track (27) according to any one of claims 1 to 6.

11. A tracked vehicle (11) having a track assembly (13) according to claim 7, 8 or 9.

Patentansprüche

1. Endlosraupe für Raupenfahrzeuge, mit einem flexiblen Endlosband (33), das eine Innenfläche (37) und eine Außenfläche (35) hat, und mit einer Vielzahl von länglichen Profilelementen (41), die zueinander beabstandet an der Außenfläche (35) des Bandes (33) vorgesehen sind und sich quer zu der Bewegungsrichtung der Raupe erstrecken, dadurch gekennzeichnet, daß das flexible Endlosband (33) eine einstückige Ausbildung aufweist und in Längsrichtung im wesentlichen unausdehnbar jedoch flexibel ist, und daß jedes Profilelement (41) eine elastisch verformbare Schleife (41) umfaßt, die den Grund berührt, wobei das Innere der Schleife (41) drucklos und gegen die Atmosphäre offen ist.

2. Endlosraupe nach Anspruch 1, dadurch gekennzeichnet, daß das Endlosband (33) aus einem verstärkten Elastomermaterial gebildet ist.

3. Endlosraupe nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Schleifen (41) Enden haben, die offen sind.

4. Endlosraupe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Schleifen (41) aus verstärktem Elastomermaterial gebildet sind.

5. Endlosraupe nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Profilelemente (41) getrennt ausgebildet und an dem Endlosband (33) befestigt sind.

6. Endlosraupe nach Anspruch 5, dadurch gekennzeichnet, daß die Schleifen (41) durch einen Abschnitt eines elastischen Materials (47) bereitgestellt und mit einer sinusförmigen Ausbildung von abwechselnden Erhebungen und Mulden um das Endlosband herum angeordnet sind, wobei die Mulden die Außenfläche des flexiblen Endlosbandes berühren und der Abschnitt des



if desired so as to extend the service life of the endless track.

In operation, the tread elements deform under load and assume a configuration illustrated in Figure 5 when the vehicle is undergoing straight line motion. When the vehicle is turning on finished road surfaces, the tread elements twist and drag over the surface without inflicting damage thereto.

The ability of the tread elements to deform under load provides the vehicle with a degree of springing which at least partially absorbs shock forces resulting from bumps and other surface irregularities encountered in the path of the vehicle.

The traction means also provides a propulsion system for the vehicle when operating in water. In such situations, the lower run of the endless track is submersed and the upper run is above the water line. In this way, the tread elements act as paddles as the endless track follows its circuitous path.

From the foregoing, it is evident that the present invention provides both an endless track assembly and an endless track, each of which is of relatively simple construction and which can be operated on finished road surfaces without inflicting damage to such surfaces.

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2. An endless track according to claim 1, wherein the endless band (33) is formed of reinforced elastomeric material.

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4. An endless track according to any one of the preceding claims wherein the loops (41) are formed of reinforced elastomeric material.

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formation of alternating crests and troughs around the endless flexible band, said troughs contacting the outer surface of the endless flexible band, the length of resilient material (47) being anchored to the flexible band at locations corresponding to at least some of the troughs.

7. A track assembly (13) for a tracked vehicle, the track assembly comprising a plurality of track wheels (25) at least one of which constitutes a drive wheel, and an endless track (27) according to any one of the preceding claims around said drive wheels.

8. A track assembly according to claim 7 wherein a friction drive is provided between the or each drive wheel and the endless band.

9. A track assembly according to claim 7 or 8 wherein the track wheels (25) are each provided with a circumferential recess (29) which receives the endless band (33) and serves to guide the band in its circuitous path around the track wheels.

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elastischen Materials (47) mit dem flexiblen Band an Stellen verankert ist, die mit wenigstens einigen der Mulden übereinstimmen.

7. Raupenanordnung (13) für ein Raupenfahrzeug, wobei die Raupenanordnung eine Vielzahl von Raupenrädern (25) umfaßt, von denen wenigstens eines ein Antriebsrad bildet, sowie eine Endlosraupe (27) nach einem der vorhergehenden Ansprüche, die um die Raupenräder herumgeführt ist.

8. Raupenanordnung nach Anspruch 7, dadurch gekennzeichnet, daß ein Reibungsantrieb zwischen dem oder jedem Antriebsrad und dem Endlosband vorgesehen ist.

9. Raupenanordnung nach Anspruch 7 oder 8, dadurch gekennzeichnet, daß die Raupenräder (25) jeweils mit einer Umfangsnut (29) versehen sind, welche das Endlosband (33) aufnimmt und der Führung des Bandes bei seiner Kreislaufbahn um die Raupenräder herum dient.

10. Raupenfahrzeug (11) mit einer Endlosraupe (27) nach einem der Ansprüche 1 bis 6.

11. Raupenfahrzeug (11) mit einer Raupenanordnung (13) nach Anspruch 7, 8 oder 9.

Revendications

1. Chenille pour véhicules à chenilles, comprenant une bande flexible sans fin (33) présentant une surface intérieure (37) et une surface extérieure (35), et une pluralité d'éléments allongés de contact avec le sol (41) prévus à distance les uns des autres sur la surface extérieure (35) de la bande (33) et disposés transversalement à la direction de déplacement de la chenille, caractérisée en ce que ladite bande flexible sans fin (33) est de construction unitaire et est sensiblement non extensible dans le sens longitudinal tout en étant flexible, et caractérisée en outre en ce que chaque élément de contact avec le sol (41) comprend une boucle élastiquement déformable (41) qui s'engage dans le sol, l'intérieur de ladite boucle (41) étant sans pression et ouvert à l'atmosphère.

2. Chenille suivant la revendication 1, dans

laquelle la bande sans fin (33) est en une matière élastomère renforcée.

3. Chenille suivant la revendication 1 ou 2, dans laquelle les boucles (41) ont des extrémités qui sont ouvertes.

4. Chenille suivant une quelconque des revendications précédentes, dans laquelle les boucles (41) sont en une matière élastomère renforcée.

5. Chenille suivant l'une quelconque des revendications précédentes, dans laquelle les éléments de contact avec le sol (41) sont formés séparément de la bande sans fin (33) et fixés à celle-ci.

6. Chenille suivant la revendication 5, dans laquelle les boucles (41) sont constituées par une longueur de matière élastique (47) disposée en une formation sinueuse de crêtes et de creux alternés autour de la bande flexible sans fin, lesdits creux étant en contact avec la surface extérieure de la bande flexible sans fin, la longueur de matière élastique (47) étant fixée à la bande flexible à des endroits correspondants à au moins certains des creux.

7. Ensemble à chenille (1) pour un véhicule à chenilles, l'ensemble à chenille comprenant une pluralité de roues pour chenille (25) dont l'une au moins constitue une roue motrice, et une chenille sans fin (27) suivant l'une quelconque des revendications précédentes passant autour desdites roues motrices.

8. Ensemble à chenille suivant la revendication 7, dans lequel un entraînement à friction est prévu entre la roue ou chaque roue motrice et la bande sans fin.

9. Ensemble à chenille suivant la revendication 7 ou 8, dans lequel les roues pour chenille (25) comportent chacune une gorge circonférentielle (29) qui reçoit la bande sans fin (33) et sert à guider la bande dans son parcours fermé autour des roues de chenille.

10. Véhicule à chenilles (11) comportant une chenille (27) suivant l'une quelconque des revendications 1 à 6.

11. Véhicule à chenilles (11) comportant un ensemble à chenille (13) suivant la revendication 7, 8 ou 9.