



(51) International Patent Classification:

B62D 55/104 (2006.01) B62D 55/10 (2006.01)

(21) International Application Number:

PCT/CA2019/050721

(22) International Filing Date:

28 May 2019 (28.05.2019)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/677,099 28 May 2018 (28.05.2018) US

(71) Applicant: UTV INTERNATIONAL INC. [CA/CA];

8650 Darnley Road, Montreal, Québec H4T 1M4 (CA).

(72) Inventor: SZTORC, Andrzej; 61 Elgin, Pointe-Claire,

Québec H9R 2J9 (CA).

(74) Agent: EQUINOX IP INC.; 2300 Boul Alfred-Nobel,

Saint-Laurent, Québec H4S 2A4 (CA).

(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, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,

HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, 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.

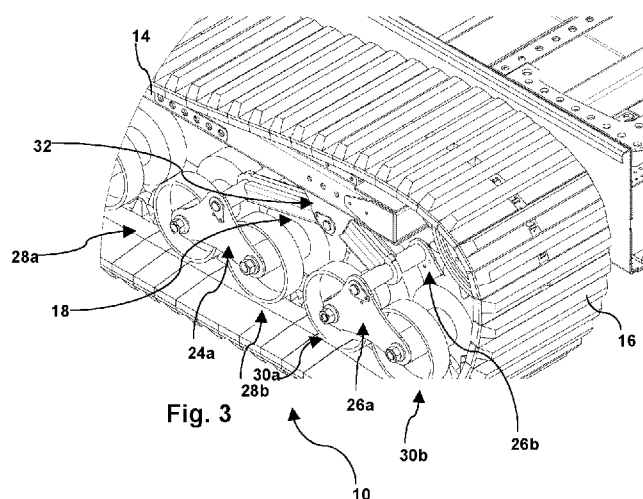
(84) Designated States (unless otherwise indicated, for every

kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, 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, KM, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE

(54) Title: TANDEM WALKING BEAM SUSPENSION SYSTEM FOR A TRACK-MOUNTED VEHICLE



(57) Abstract: The present disclosure relates to a tandem walking beam suspension system which comprises a main walking beam pivotably mounted to the vehicle sub-frame, a first pair of spaced apart and parallel secondary walking beams pivotably mounted about the main walking beam first end, a second pair of spaced apart and parallel secondary walking beams pivotably mounted about the main walking beam second end, a first pair of rollers rotatably mounted in-between and to the first pair of secondary walking beams, and a second pair of rollers rotatably mounted in-between and to the second pair of secondary walking beams, the first and second pairs of rollers being configured to roll along the track when the track-mounted vehicle is in displacement. The system may further comprise a compression device connecting the sub-frame and the main walking beam such as to provide vertical displacement of the main walking beam relatively to the sub-frame.



TANDEM WALKING BEAM SUSPENSION SYSTEM FOR A TRACK-MOUNTED VEHICLE

CROSS-REFERENCE TO RELATED APPLICATIONS

[001] This application claims priority from U.S. Provisional Patent Application no. 62/677,099 filed on May 28, 2018.

TECHNICAL FIELD

[002] The present disclosure relates to suspension systems adapted for track-mounted vehicles. More particularly, the present disclosure relates to an improved walking beam suspension system for track-mounted vehicles and to methods of using the same.

BACKGROUND

[003] Known track-mounted vehicles usually integrate walking beam suspension systems, connecting the rubber tracks and the track-mounted vehicle frame, to allow better maneuverability of the vehicle in harsh terrains. Appropriately designed track-mounted vehicles, such as military vehicles, excavators, bulldozers, off-road industrial vehicles, and the like, can have advantages in cases where good traction, good flotation and/or low ground pressure are required. In a typical walking beam suspension system, an endless loop of track passes around a pair of idlers. Bogie wheels or rollers pivotably mounted on a main walking beam, bear against the track between the idlers to transfer weight of the vehicle to the ground.

[004] However, walking beam suspension systems adapted for track-mounted vehicles currently available on the market suffer from numerous shortcomings.

[005] As track-mounted vehicles are operated in extreme road conditions (slopes, side slopes, rocks, uneven ground contour, bumps, etc.), there exists variations in the pressure applied by the rollers to the rubber track, providing the track itself to quickly wear out. Furthermore, typical walking beam suspension systems designed for track-mounted vehicles do not offer a sufficient number of degrees of freedom to maneuver over a variety of harsh terrain features such as bumps, side slopes, and trenches. Such lack in the available degrees of freedom limits the ability of such vehicles to negotiate turn without unevenly loading different parts of the track.

[006] There is therefore a need for an improved walking beam suspension system adapted for a track-mounted vehicle, being provided with the freedom of motion

required to properly distribute pressure along the track while navigating through rough and/or irregular terrain, including side slopes. There is also a need for an improved walking beam suspension system adapted for a track-mounted vehicle that would reduce vibrations, the likelihood of de-tracking or track overload, and the wear on the track.

SUMMARY

[007] It is an object of the present disclosure to provide a tandem walking beam suspension system for track-mounted vehicles that overcomes or mitigates one or more disadvantages of known walking beam suspension systems or at least provides a useful alternative.

[008] According to an embodiment, there is provided a tandem walking beam suspension system for a track-mounted vehicle defining a sub-frame and a track, the system comprising: a main walking beam pivotably mounted to the sub-frame of the track-mounted vehicle, the main walking beam defining a main walking beam first end and a main walking beam second end opposite the main walking beam first end; a first pair of parallel and spaced apart secondary walking beams pivotably mounted about the main walking beam first end; a second pair of parallel and spaced apart secondary walking beams pivotably mounted about the main walking beam second end; a first pair of rollers rotatably mounted in-between and to the first pair of parallel and spaced apart secondary walking beams; and a second pair of rollers rotatably mounted in-between and to the second pair of parallel and spaced apart secondary walking beams, the first and second pairs of rollers being configured to roll along the track when the track-mounted vehicle is in displacement.

[009] According to another embodiment, there is provided the tandem walking beam suspension system as defined above, further comprising a compression device connecting the sub-frame and the main walking beam for providing vertical displacement of the main walking beam relatively to the sub-frame.

[0010] According to a further embodiment, there is provided the tandem walking beam suspension system as defined above, wherein the compression device comprises: a main casing fixedly mounted on the sub-frame, the main casing defining a main casing lower end, the main walking beam being pivotably mounted at the main casing lower end; and a spring-loaded mechanism slidably mounted within the main casing and adapted to displace between a fully released position and a fully compressed position.

[0011] According to yet another embodiment, there is provided the tandem walking beam suspension system as defined above, wherein the main walking beam comprises a main walking beam first opening at the main walking beam first end, a main walking beam second opening at the main walking beam second end, and a main walking beam third opening between the main walking beam first and second ends, the system further comprising: a main shaft fixedly mounted on the main casing at the main casing lower end, the main walking beam being pivotably mounted via the main walking beam third opening on the main shaft.

[0012] According to another embodiment, there is provided the tandem walking beam suspension system as defined above, further comprising a first secondary shaft connecting together the first pair of parallel and spaced apart secondary walking beams, the first secondary shaft defining a first secondary shaft first end and a first secondary shaft second end, one of the first pair of parallel and spaced apart secondary walking beams being pivotably mounted at the first secondary shaft first end, the other one of the first pair of parallel and spaced apart secondary walking beams being pivotably mounted at the first secondary shaft second end.

[0013] According to a further embodiment, there is provided the tandem walking beam suspension system as defined above, wherein the main walking beam is being pivotably mounted via the main walking beam first opening on the first secondary shaft.

[0014] According to yet another embodiment, there is provided the tandem walking beam suspension system as defined above, further comprising a second secondary shaft connecting together the second pair of parallel and spaced apart secondary walking beams, the second secondary shaft defining a second secondary shaft first end and a second secondary shaft second end, one of the second pair of parallel and spaced apart secondary walking beams being pivotably mounted at the second secondary shaft first end, the other one of the second pair of parallel and spaced apart secondary walking beams being pivotably mounted at the second secondary shaft second end.

[0015] According to another embodiment, there is provided the tandem walking beam suspension system as defined above, wherein the main walking beam is being pivotably mounted via the main walking beam second opening on the second secondary shaft.

[0016] According to a further embodiment, there is provided the tandem walking beam suspension system as defined above, further comprising an articulating member mounted on the main walking beam and connecting the first and second secondary

shafts for allowing a tilting movement of the main walking beam relatively to the first and second pairs of parallel and spaced apart secondary walking beams.

[0017] According to yet another embodiment, there is provided the tandem walking beam suspension system as defined above, wherein the articulating member comprises an articulating member first element and an articulating member second element mounted on the main walking beam, the articulating member first element connecting the main shaft and the first secondary shaft for allowing a first independent tilting movement of the main walking beam relatively to the first pair of parallel and spaced apart secondary walking beams, the articulating member second element connecting the main shaft and the second secondary shaft for allowing a second independent tilting movement of the main walking beam relatively to the second pair of parallel and spaced apart secondary walking beams.

[0018] According to another embodiment, there is provided the tandem walking beam suspension system as defined above, wherein each secondary walking beam from the first and second pairs of parallel and spaced apart secondary walking beams comprises: an upper section; a lower section opposite the upper section; a pivot opening found within the upper section for receiving one of the first secondary shaft and the second secondary shaft; a first rotation opening found within the lower section for rotatably receiving one of the first or second pair of rollers; and a second rotation opening found within the lower section at a distance from the first rotation opening for rotatably receiving the other one of the first or second pair of rollers.

[0019] According to a further embodiment, there is provided the tandem walking beam suspension system as defined above, wherein the first pair of rollers comprises: a first roller shaft in a rotatable engagement with the first rotation openings of the first pair of parallel and spaced apart secondary walking beams; a second roller shaft in a rotatable engagement with the second rotation openings of the first pair of parallel and spaced apart secondary walking beams; a first roller member outwardly and peripherally extending from the first roller shaft for rolling along the track; and a second roller member outwardly and peripherally extending from the second roller shaft for rolling along the track.

[0020] According to yet another embodiment, there is provided the tandem walking beam suspension system as defined above, wherein the first roller member comprises a plurality of wheels outwardly and peripherally extending from the first roller shaft and the second roller member comprises a plurality of wheels outwardly and peripherally

extending from the first roller shaft for rolling along the track.

[0021] According to another embodiment, there is provided the tandem walking beam suspension system as defined above, wherein the second pair of rollers comprises: a first roller shaft in a rotatable engagement with the first rotation openings of the second pair of parallel and spaced apart secondary walking beams; a second roller shaft in a rotatable engagement with the second rotation openings of the second pair of parallel and spaced apart secondary walking beams; a first roller member outwardly and peripherally extending from the first roller shaft for rolling along the track; and a second roller member outwardly and peripherally extending from the second roller shaft for rolling along the track.

[0022] According to a further embodiment, there is provided the tandem walking beam suspension system as defined above, wherein the first roller member comprises a plurality of wheels outwardly and peripherally extending from the first roller shaft and the second roller member comprises a plurality of wheels outwardly and peripherally extending from the first roller shaft for rolling along the track.

[0023] According to yet another embodiment, there is provided the tandem walking beam suspension system as defined above, wherein the main walking beam comprises a main walking beam first member pivotably mounted to the sub-frame of the track-mounted vehicle and a main walking beam second member pivotably mounted to the sub-frame of the track-mounted vehicle, each one of the main walking beam first and second members defining a main walking beam first end and a main walking beam second end opposite the main walking beam first end.

[0024] According to another embodiment, there is provided the tandem walking beam suspension system as defined above, wherein each one of the main walking beam first and second members comprises a main walking beam first opening at the main walking beam first end, and a main walking beam second opening at the main walking beam second end, the system further comprising: a main shaft fixedly mounted on the main casing at the main casing lower end, the main walking beam first and second members being pivotably mounted via the main walking beam second openings on the main shaft.

[0025] According to a further embodiment, there is provided the tandem walking beam suspension system as defined above, further comprising a track tensioning idler wheel system connected to the sub-frame to tension the track.

[0026] According to yet another embodiment, there is provided the tandem walking beam suspension system as defined above, further comprising at least one additional

shock absorber connecting the sub-frame and the main walking beam.

[0027] According to another embodiment, there is provided the tandem walking beam suspension system as defined above, wherein the articulating member is made of a resilient material.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] Further features and advantages of the present disclosure will become apparent from the following detailed description, taken in combination with the appended drawings, in which:

[0029] Figure 1 is a first side elevation view of a track of a track-mounted vehicle which is provided with two independent tandem walking beam suspension systems in accordance with an embodiment;

[0030] Figure 2 is a second side elevation view of the track of Figure 1 which is provided with two independent tandem walking beam suspension systems;

[0031] Figure 3 is a top perspective view of one of the two independent tandem walking beam suspension systems shown in Figures 1 and 2, where the compression device is shown in its released position;

[0032] Figure 4 is a top perspective view of the tandem walking beam suspension system of Figure 3, where the compression device is shown in its compressed position;

[0033] Figure 5 is a side elevation view of the tandem walking beam suspension system of Figure 3, where the compression device is shown in its fully released position;

[0034] Figure 6 is a side elevation view of the tandem walking beam suspension system of Figure 3, where the compression device is shown in its fully compressed position;

[0035] Figure 7 is a top perspective cross-sectional view of the tandem walking beam suspension system of Figure 3, where the compression device is shown in its fully released position;

[0036] Figure 8 is a top perspective cross-sectional view of the tandem walking beam suspension system of Figure 3, where the compression device is shown in its fully compressed position;

[0037] Figure 9 is a side elevation view of the tandem walking beam suspension system of Figure 3, where the compression device is shown in its fully released position;

[0038] Figure 10 is a side elevation view of the tandem walking beam suspension system of Figure 3, where the compression device is shown in its fully compressed position;

[0039] Figure 11 is a top perspective view of part of the tandem walking beam

suspension system shown in Figure 3, illustrating the first and second secondary shafts, the main beam pivotably mounted thereon, and the compression device;

[0040] Figure 12 is a side elevation view of the parts shown in Figure 11;

[0041] Figure 13 is a top perspective view of part of the tandem walking beam suspension system shown in Figure 3, illustrating first and second secondary shafts, first and second pairs of parallel and spaced apart secondary walking beams pivotably mounted thereon as well as first and second pairs of rollers rotatably mounted thereon;

[0042] Figure 14 is a side elevation view of the parts shown in Figure 13;

[0043] Figure 15 is a top perspective view showing the tandem walking beam suspension system shown in Figure 3 in operation when the track-mounted vehicle travels on harsh terrains;

[0044] Figure 16 is a side elevation view of the tandem walking beam suspension system shown in Figure 15;

[0045] Figure 17 is another top perspective view showing the tandem walking beam suspension system shown in Figure 3 in operation when the track-mounted vehicle travels on harsh terrains;

[0046] Figure 18 is a side elevation view of the tandem walking beam suspension system shown in Figure 17; and

[0047] Figure 19 is a front elevation view of a tandem walking beam suspension system mounted in a track-mounted vehicle, and further, where the track-mounted vehicle is travelling on an inclined contour or slope.

DETAILED DESCRIPTION

[0048] Referring now to the drawings, and more particularly to Figures 1-14, there is shown tandem walking beam suspension systems **10**, or systems **10**, which are adapted for a track-mounted vehicle **12**.

[0049] As well illustrated in Figures 1 and 2, track-mounted vehicle **12** defines a sub-frame **14** and tracks **16** (only one track **16** illustrated). It is to be noted that even though track-mounted vehicle **12** of Figures 1 and 2 includes a total of four tandem walking beam suspension systems **10** (two systems **10** for each track **16**), more or less systems **10** may be provided.

[0050] Still referring to Figures 1-14, there is shown that system **10** comprises a main walking beam **18**, which is pivotably mounted to sub-frame **14** of track-mounted vehicle **12**. Main walking beam **18** defines a main walking beam first end **20** and a main walking beam second end **22**, found opposite main walking beam first end **20**. System **10** further

comprises a first pair of parallel and spaced apart secondary walking beams **24a**, **24b**, where each secondary walking beam **24a**, **24b** is pivotably mounted about main walking beam first end **20** such that it can pivot about a pivot axis. System **10** also comprises a second pair of parallel and spaced apart secondary walking beams **26a**, **26b**, where each secondary walking beam **26a**, **26b** is pivotably mounted about main walking beam second end **22** such that it can pivot about a pivot axis.

[0051] Still referring to Figures 1-14, there is shown that system **10** further comprises a first pair of rollers **28a**, **28b**, where each roller **28a**, **28b** is rotatably mounted in-between and to both secondary walking beams **24a**, **24b** such that it can rotate about a rotation axis. System **10** further comprises a second pair of rollers **30a**, **30b**, where each roller **30a**, **30b** is rotatably mounted in-between and to both secondary walking beams **26a**, **26b** such that it can rotate about a rotation axis. According to the configuration of system **10**, each roller **28a**, **28b**, **30a**, **30b** is being configured to roll along/against track **16** when track-mounted vehicle **12** is in displacement. Rollers **28a**, **28b**, **30a**, **30b** therefore roll along track **16**, distributing pressure along the track while track-mounted vehicle **12** navigates through varying terrains. Rollers will thus bear against a lower portion of the track, which includes a guide which engages with the rollers **28a**, **28b**, **30a**, **30b**.

[0052] Still referring to Figures 1-14, there is shown that system **10** further comprises a compression device **32** which connects sub-frame **14** and main walking beam **18** such as to provide vertical displacement of main walking beam **18** relatively to sub-frame **14**. Compression device **32** comprises a main casing **34** which is fixedly mounted on sub-frame **14**. Main casing **34** defines a main casing lower end **36**. As shown, main walking beam **18** is pivotably mounted at main casing lower end **36**. Compression device **32** further comprises a spring-loaded mechanism **38** which is slidably mounted within main casing **34** and adapted to displace between a fully released position (Figures 5 and 7) and a fully compressed position (Figures 6 and 8).

[0053] Still referring to Figures 1-14, there is shown that main walking beam **18** further includes a main walking beam first opening **40** at main walking beam first end **20**, a main walking beam second opening **42** at main walking beam second end **22**, and a main walking beam third opening **44** between main walking beam first and second ends **20**, **22**. System **10** further comprises a main shaft **46** which is fixedly mounted on main

casing **34** at main casing lower end **36**. Main walking beam **18** is therefore pivotably mounted via main walking beam third opening **44** on main shaft **46**.

[0054] Still referring to Figures 1-14, there is shown that system **10** further comprises a first secondary shaft **48** which connects secondary walking beams **24a**, **24b** together. First secondary shaft **48** defines a first secondary shaft first end **50** and a first secondary shaft second end **52**. As illustrated, secondary walking beam **24a** is pivotably mounted at first secondary shaft first end **50**, while secondary walking beam **24b** is pivotably mounted at first secondary shaft second end **52**. Main walking beam **18** is therefore pivotably mounted via main walking beam first opening **40** on first secondary shaft **48**.

[0055] Still referring to Figures 1-14, there is shown that system **10** further comprises a second secondary shaft **54** which connects secondary walking beams **26a**, **26b** together. Second secondary shaft **54** defines a second secondary shaft first end **56** and a second secondary shaft second end **58**. Secondary walking beam **26a** is pivotably mounted at second secondary shaft first end **56**, while secondary walking beam **26b** is pivotably mounted at second secondary shaft second end **58**. As illustrated, main walking beam **18** is being pivotably mounted via main walking beam second opening **42** on second secondary shaft **54**.

[0056] Now referring to Figures 11 and 12, there is shown that tandem walking beam suspension system **10** further comprises an articulating member **60** which is mounted on main walking beam **18** which connects first and second secondary shafts **48**, **54** for allowing a tilting movement of main walking beam **18** relatively to walking beams **24a**, **24b**, **26a**, **26b**. Articulating member may be made of a resilient material, such as of a rubber material, an elastomeric material, a polyurethane material, and the like.

[0057] Still referring to Figures 11 and 12, and further to Figure 19 there is shown that articulating member **60** comprises an articulating member first element **62** and an articulating member second element **64**, both being mounted on main walking beam **18**. Articulating member first element **62** connects main shaft **46** and first secondary shaft **48** for allowing a first independent tilting movement of main walking beam **18** relatively to secondary walking beams **24a**, **24b**, while articulating member second element **64** connects main shaft **46** and second secondary shaft **54** for allowing a second independent tilting movement of main walking beam **18** relatively to secondary walking beams **26a**, **26b**. Therefore, if track-mounted vehicle **12** travels in harsh terrain

provided with an uneven ground contour (i.e., on an inclined slope), each system **10** will independently operate such as to allow secondary walking beams **24a**, **24b**, **26a**, **26b** to tilt relatively to main walking beam **18** as needed, based on the ground contour provided underneath tracks **16**, so that each pair of secondary walking beams **24a**, **24b** and **26a**, **26b** is oriented substantially perpendicularly to the ground contour found underneath tracks **16** (Figure 19). It is to be noted that secondary walking beams **24a**, **24b** will tilt the same way (secondary walking beams **24a**, **24b** will remain spaced apart and parallel during such operation), while secondary walking beams **26a**, **26b** will tilt the same way (secondary walking beams **26a**, **26b** will remain spaced apart and parallel during such operation). Articulating member first and second elements **62**, **64**, such as articulated flexible bushings **62**, **64**, offer a suspension movement across two degrees of freedom, allowing track-mounted vehicle **12** to articulate or to tilt in response to variations in pitch and roll, but by limiting the yaws as much as possible as this may damage tracks **16**. As such, pressure is distributed evenly along tracks **16**, regardless of the type of terrain encountered.

[0058] Referring now to Figure 19, according to the configuration of system **10**, despite the angle of an inclined slope for example, rollers **28a**, **28b**, **30a**, **30b** will remain in full contact with tracks **16** due to the articulation provided by articulating member **60** or articulating member first and second elements **62**, **64**. This ensures an even pressure distribution along the tracks **16** which promotes a longer lifespan of tracks **16**. In addition, traction is therefore increased, vehicle vibrations are reduced and steering is improved. Providing two articulating members (first and second elements **62**, **64**), increases torsional stiffness of system **10**.

[0059] Now referring more particularly to Figures 13 and 14, there is shown that each secondary walking beam **24a**, **24b**, **26a**, **26b** (four secondary walking beams for one system **10**) comprises an upper section **66**, a lower section **68**, found opposite upper section **66**, a pivot opening **70**, found within upper section **66** which is adapted to receive first secondary shaft **48** (first or second ends **50**, **52**) or second secondary shaft **54** (first or second ends **56**, **58**). Each secondary walking beam **24a**, **24b**, **26a**, **26b** further comprises a first rotation opening **72**, which is found within lower section **68** for rotatably receiving rollers **28a** or **30a**, and a second rotation opening **74**, which is found within lower section **68** at a distance from first rotation opening **72**, for rotatably receiving rollers **28b**, **30b**.

[0060] Still referring to Figures 13 and 14, there is shown that first pair of rollers **28a**, **28b** comprises a first roller shaft **76**, defining a first roller shaft first end **77a** and a first roller shaft second end **77b** in a rotatable engagement with first rotation openings **72** of parallel and spaced apart secondary walking beams **24a**, **24b**, and a second roller shaft **78**, defining a second roller shaft first end **79a** and a second roller shaft second end **79b** found opposite second roller shaft first end **79a**, in a rotatable engagement with second rotation openings **74** of parallel and spaced apart secondary walking beams **24a**, **24b**. First pair of rollers **28a**, **28b** further comprises a first roller member **80** which outwardly and peripherally extends from first roller shaft **76** and adapted to roll/travel along track **16**, and a second roller member **82** which outwardly and peripherally extends from second roller shaft **78** and also adapted to roll/travel along track **16**.

[0061] Still referring to Figures 13 and 14, there is shown that first roller member **80** comprises two spaced apart wheels or bogue wheels **81a**, **81b** which outwardly and peripherally extends from first roller shaft **76** and further, second roller member **82** comprises two spaced apart wheels or bogue wheels **83a**, **83b** which outwardly and peripherally extends from second roller shaft **78** to roll/travel along track **16**. It is to be noted that a person skilled in the art to which system **10** pertains would understand that the configuration of rollers **28a**, **28b** (shown as two wheels **81a**, **81b** and two wheels **83a**, **83b**) may vary, as long as it allows system **10** to displace relatively to tracks **16** and according to the uneven contour found underneath tracks **16**.

[0062] Still referring to Figures 13 and 14, there is shown that second pair of rollers **30a**, **30b** comprises a first roller shaft **84**, defining a first roller shaft first end **85a** and a first roller shaft second end **85b** in a rotatable engagement with first rotation openings **72** of parallel and spaced apart secondary walking beams **26a**, **26b**, and a second roller shaft **86**, defining a second roller shaft first end **87a** and a second roller shaft second end **87b** found opposite second roller shaft first end **87a**, in a rotatable engagement with second rotation openings **74** of parallel and spaced apart secondary walking beams **26a**, **26b**. Second pair of rollers **30a**, **30b** further comprises a first roller member **88** which outwardly and peripherally extends from first roller shaft **84** and adapted to roll/travel along track **16**, and a second roller member **90** which outwardly and peripherally extends from second roller shaft **86** and also adapted to roll/travel along track **16**.

[0063] Still referring to Figures 13 and 14, there is shown that first roller member **88** comprises two spaced apart wheels **89a**, **89b** which outwardly and peripherally extend from first roller shaft **84** and further, second roller member **90** comprises two spaced apart wheels **91a**, **91b** which outwardly and peripherally extend from second roller shaft **86** to roll/travel along track **16**. It is to be noted that a person skilled in the art to which system **10** pertains would understand that the configuration of rollers **30a**, **30b** (shown as two wheels **89a**, **89b** and two wheels **91a**, **91b**) may vary, as long as it allows system **10** to displace relatively to tracks **16** and according to the uneven contour found underneath tracks **16**.

[0064] It is also to be noted that a person skilled in the art to which tandem walking beam suspension system **10** pertains would understand that main walking beam **18** may include a main walking beam first member (not shown) which is pivotably mounted to sub-frame **14** of track-mounted vehicle **12** and a main walking beam second member (not shown) which is also pivotably mounted to sub-frame **14** of track-mounted vehicle **12**. According to such a scenario, each one of the main walking beam first and second members would define a main walking beam first end and a main walking beam second end opposite the main walking beam first end. Each one of the main walking beam first and second members would further comprises a main walking beam first opening at the main walking beam first end, and a main walking beam second opening at the main walking beam second end. In this case, main shaft **46** would be similarly and fixedly mounted on main casing **34** at main casing lower end **36**. The main walking beam first and second members would be pivotably mounted via main walking beam second openings on the main shaft. Such configuration may provide an independent articulation of the main walking beam first and second members which may offer a more precise on rough or irregular terrain.

[0065] A person skilled in the art to which system **10** pertains would further understand that main walking beam **18** may take any shape, size and configuration, as long as it allows a pivot connection at a pivot point with sub-frame **14** and further, as long as it allows a first pivot connection at main walking beam first end **20** with first pair of parallel and spaced apart secondary walking beams **24a**, **24b** and a second pivot connection at main walking beam second end **22** with second pair of parallel and spaced apart secondary walking beams **26a**, **26b** (See Figure 11).

[0066] It is to be noted that tandem walking beam suspension system **10** may further comprise a track tensioning idler wheel system **100** (Figures 1 and 2) connected to sub-frame **14** to help in tensioning the track. Hydraulically actuated, the idler wheel is pushed in the direction of arrow **102** such as to add tension to the track.

[0067] It is also to be noted that a person skilled in the art to which system **10** pertains would understand that tandem walking beam suspension system **10** may further comprise at least one additional shock absorber (not shown) connecting sub-frame **14** and main walking beam **18**. Such shock absorber may help in controlling vertical movement of system **10** and may apply additional and distributed pressure against rollers **28a**, **28b**, **30a**, **30c**.

[0068] Alternatively, it is to be noted that compression device **10** connecting sub-frame **14** and main walking beam **18** may take any shape, size and configuration, as long as it allows vertical displacement of main walking beam **18** relatively to sub-frame **14**, providing comfort to occupants of track-mounted vehicle **12**.

[0069] Integration of tandem walking beam suspension systems **10** described above within a track-mounted vehicle **12** therefore provides freedom of motion required to properly distribute pressure along tracks **16** while navigating through rough, uneven and/or irregular terrain (ground contour/surface). Tandem walking beam suspension systems **10** further reduce vibrations, the likelihood of de-tracking or track overload, and the wear on tracks **16**.

[0070] Tandem walking beam suspension system **10** also improves traction to yield higher efficiency by improving the conformity of tracks **16** to the ground. Track-mounted vehicles, such as vehicles **12**, which are equipped with tandem walking beam suspension systems **10** as described above, can also maneuver over larger obstacles than currently available track-mounted vehicles (that are not provided with systems **10**), while keeping an interesting level of comfort for its occupants (even when the vehicle is travelling over side slopes, thanks to the articulating member that allows the main walking beam to tilt relatively to the two pairs of spaced apart secondary walking beams). Indeed, tandem walking beam suspension system **10** as described above improves steering and offers a smoother ride for the operator of the track-mounted vehicle **12** when compared to what offers currently available track-mounted vehicles.

[0071] Although the present invention has been described hereinabove by way of specific embodiments thereof, it can be modified, without departing from the spirit and nature of the subject invention defined in the appended claims.

CLAIMS

1. A tandem walking beam suspension system for a track-mounted vehicle defining a sub-frame and a track, the system comprising:
 - a main walking beam pivotably mounted to the sub-frame of the track-mounted vehicle, the main walking beam defining a main walking beam first end and a main walking beam second end opposite the main walking beam first end;
 - a first pair of parallel and spaced apart secondary walking beams pivotably mounted about the main walking beam first end;
 - a second pair of parallel and spaced apart secondary walking beams pivotably mounted about the main walking beam second end;
 - a first pair of rollers rotatably mounted in-between and to the first pair of parallel and spaced apart secondary walking beams; and
 - a second pair of rollers rotatably mounted in-between and to the second pair of parallel and spaced apart secondary walking beams, the first and second pairs of rollers being configured to roll along the track when the track-mounted vehicle is in displacement.
2. The tandem walking beam suspension system of claim 1, further comprising a compression device connecting the sub-frame and the main walking beam for providing vertical displacement of the main walking beam relatively to the sub-frame.
3. The tandem walking beam suspension system of claim 2, wherein the compression device comprises:
 - a main casing fixedly mounted on the sub-frame, the main casing defining a main casing lower end, the main walking beam being pivotably mounted at the main casing lower end; and
 - a spring-loaded mechanism slidably mounted within the main casing and adapted to displace between a fully released position and a fully compressed position.
4. The tandem walking beam suspension system of claim 3, wherein the main walking beam comprises a main walking beam first opening at the main walking beam first end, a main walking beam second opening at the main walking beam second end, and a main walking beam third opening between the main walking beam first and second ends, the system further comprising:

- a main shaft fixedly mounted on the main casing at the main casing lower end, the main walking beam being pivotably mounted via the main walking beam third opening on the main shaft.

5. The tandem walking beam suspension system of claim 4, further comprising a first secondary shaft connecting together the first pair of parallel and spaced apart secondary walking beams, the first secondary shaft defining a first secondary shaft first end and a first secondary shaft second end, one of the first pair of parallel and spaced apart secondary walking beams being pivotably mounted at the first secondary shaft first end, the other one of the first pair of parallel and spaced apart secondary walking beams being pivotably mounted at the first secondary shaft second end.

6. The tandem walking beam suspension system of claim 5, wherein the main walking beam is being pivotably mounted via the main walking beam first opening on the first secondary shaft.

7. The tandem walking beam suspension system of claim 5, further comprising a second secondary shaft connecting together the second pair of parallel and spaced apart secondary walking beams, the second secondary shaft defining a second secondary shaft first end and a second secondary shaft second end, one of the second pair of parallel and spaced apart secondary walking beams being pivotably mounted at the second secondary shaft first end, the other one of the second pair of parallel and spaced apart secondary walking beams being pivotably mounted at the second secondary shaft second end.

8. The tandem walking beam suspension system of claim 7, wherein the main walking beam is being pivotably mounted via the main walking beam second opening on the second secondary shaft.

9. The tandem walking beam suspension system of claim 7, further comprising an articulating member mounted on the main walking beam and connecting the first and second secondary shafts for allowing a tilting movement of the main walking beam relatively to the first and second pairs of parallel and spaced apart secondary walking beams.

10. The tandem walking beam suspension system of claim 9, wherein the articulating member comprises an articulating member first element and an articulating member second element mounted on the main walking beam, the articulating member first element connecting the main shaft and the first secondary shaft for allowing a first independent tilting movement of the main walking beam relatively to the first pair of parallel and spaced apart secondary walking beams, the articulating member second element connecting the main shaft and the second secondary shaft for allowing a second independent tilting movement of the main walking beam relatively to the second pair of parallel and spaced apart secondary walking beams.

11. The tandem walking beam suspension system of claim 7, wherein each secondary walking beam from the first and second pairs of parallel and spaced apart secondary walking beams comprises:

- an upper section;
- a lower section opposite the upper section;
- a pivot opening found within the upper section for receiving one of the first secondary shaft and the second secondary shaft;
- a first rotation opening found within the lower section for rotatably receiving one of the first or second pair of rollers; and
- a second rotation opening found within the lower section at a distance from the first rotation opening for rotatably receiving the other one of the first or second pair of rollers.

12. The tandem walking beam suspension system of claim 11, wherein the first pair of rollers comprises:

- a first roller shaft in a rotatable engagement with the first rotation openings of the first pair of parallel and spaced apart secondary walking beams;
- a second roller shaft in a rotatable engagement with the second rotation openings of the first pair of parallel and spaced apart secondary walking beams;
- a first roller member outwardly and peripherally extending from the first roller shaft for rolling along the track; and
- a second roller member outwardly and peripherally extending from the second roller shaft for rolling along the track.

13. The tandem walking beam suspension system of claim 12, wherein the first roller member comprises a plurality of wheels outwardly and peripherally extending from the first roller shaft and the second roller member comprises a plurality of wheels outwardly and peripherally extending from the first roller shaft for rolling along the track.

14. The tandem walking beam suspension system of claim 11, wherein the second pair of rollers comprises:

- a first roller shaft in a rotatable engagement with the first rotation openings of the second pair of parallel and spaced apart secondary walking beams;
- a second roller shaft in a rotatable engagement with the second rotation openings of the second pair of parallel and spaced apart secondary walking beams;
- a first roller member outwardly and peripherally extending from the first roller shaft for rolling along the track; and
- a second roller member outwardly and peripherally extending from the second roller shaft for rolling along the track.

15. The tandem walking beam suspension system of claim 14, wherein the first roller member comprises a plurality of wheels outwardly and peripherally extending from the first roller shaft and the second roller member comprises a plurality of wheels outwardly and peripherally extending from the first roller shaft for rolling along the track.

16. The tandem walking beam suspension system of claim 3, wherein the main walking beam comprises a main walking beam first member pivotably mounted to the sub-frame of the track-mounted vehicle and a main walking beam second member pivotably mounted to the sub-frame of the track-mounted vehicle, each one of the main walking beam first and second members defining a main walking beam first end and a main walking beam second end opposite the main walking beam first end.

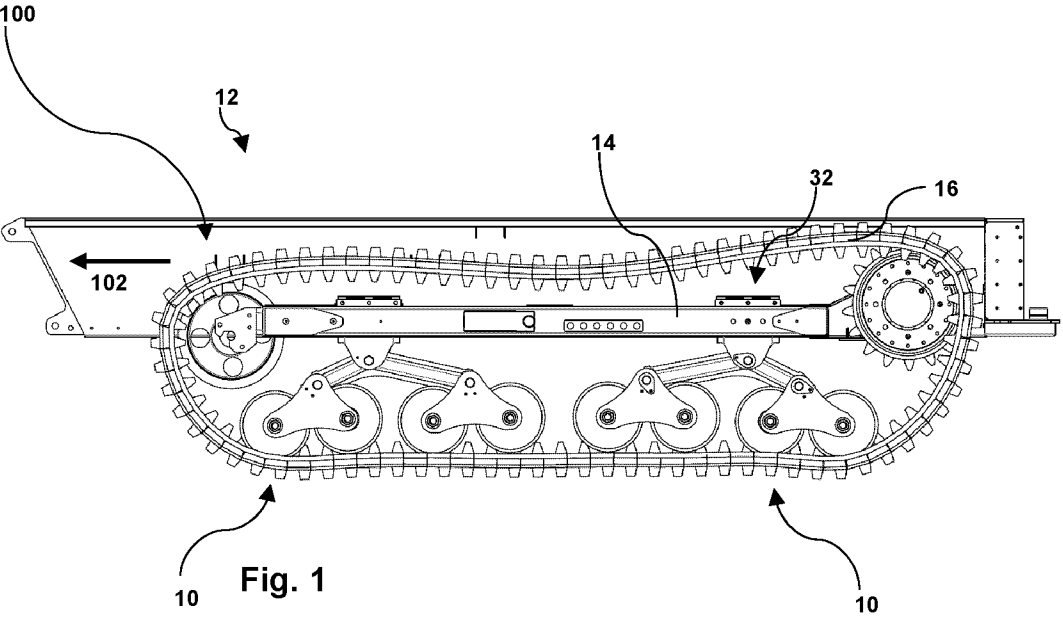
17. The tandem walking beam suspension system of claim 16, wherein each one of the main walking beam first and second members comprises a main walking beam first opening at the main walking beam first end, and a main walking beam second opening at the main walking beam second end, the system further comprising:

- a main shaft fixedly mounted on the main casing at the main casing lower end, the main walking beam first and second members being pivotably mounted via the main walking beam second openings on the main shaft.

18. The tandem walking beam suspension system of claim 1, further comprising a track tensioning idler wheel system connected to the sub-frame to tension the track.

19. The tandem walking beam suspension system of claim 1, further comprising at least one additional shock absorber connecting the sub-frame and the main walking beam.

20. The tandem walking beam suspension system of claim 9, wherein the articulating member is made of a resilient material.



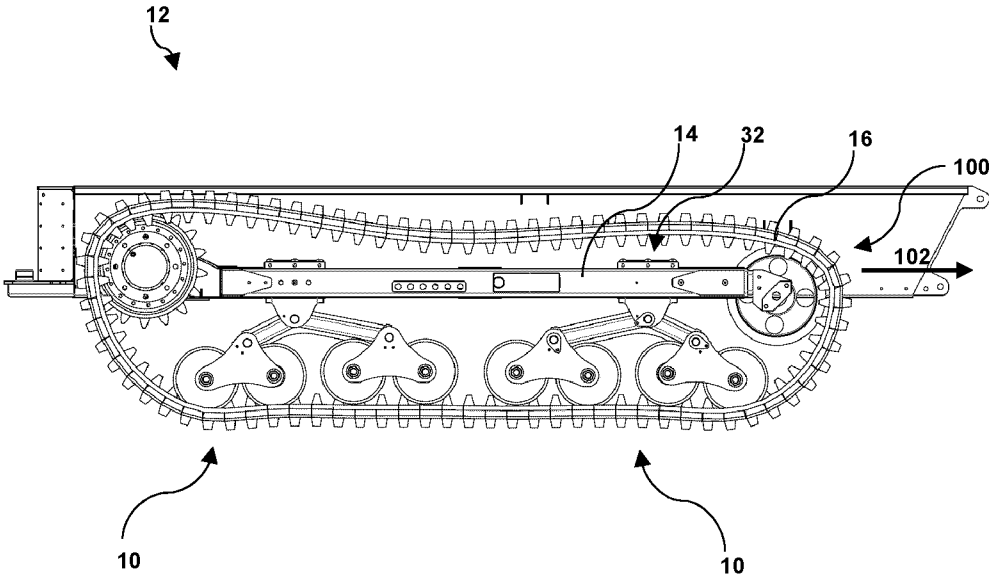
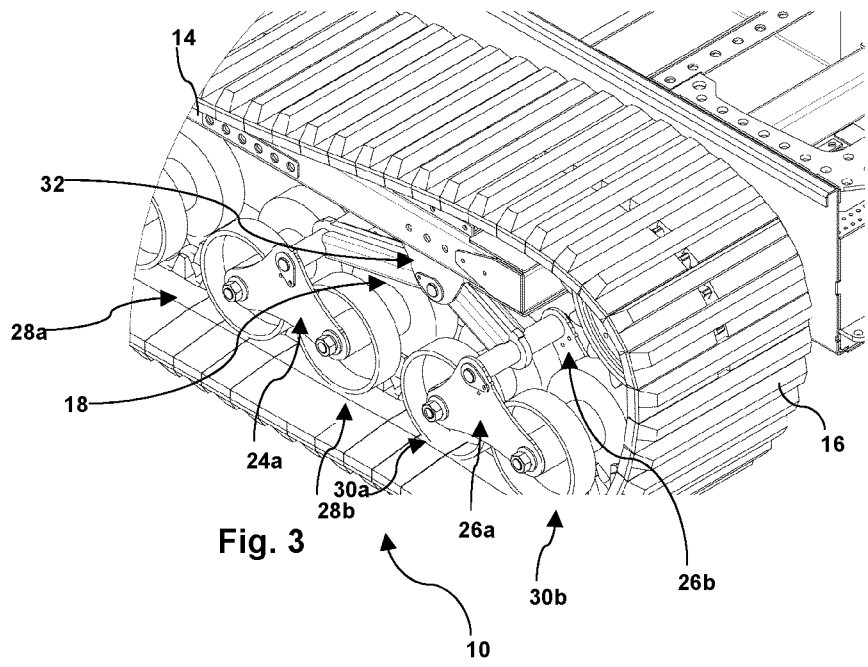
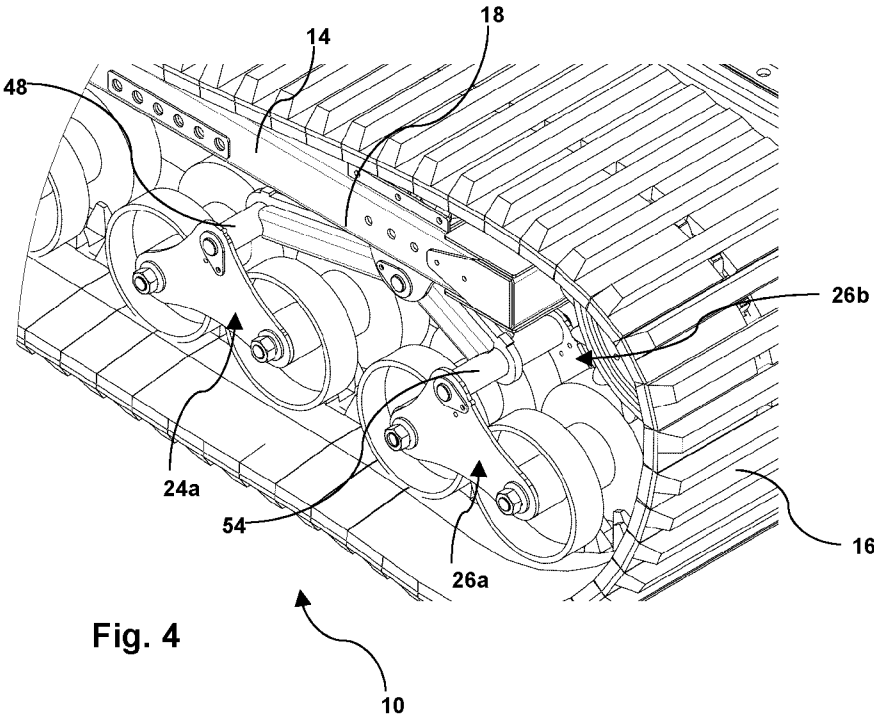
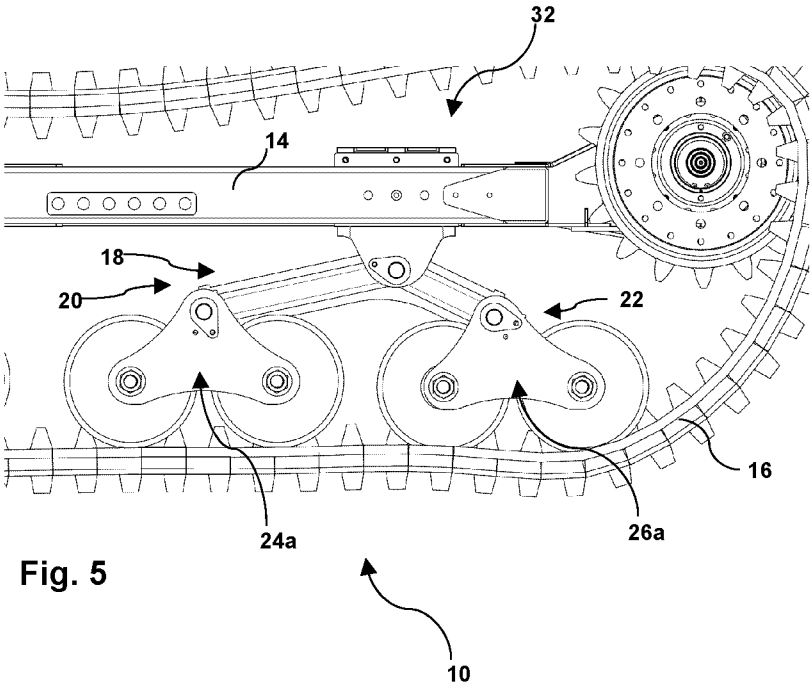
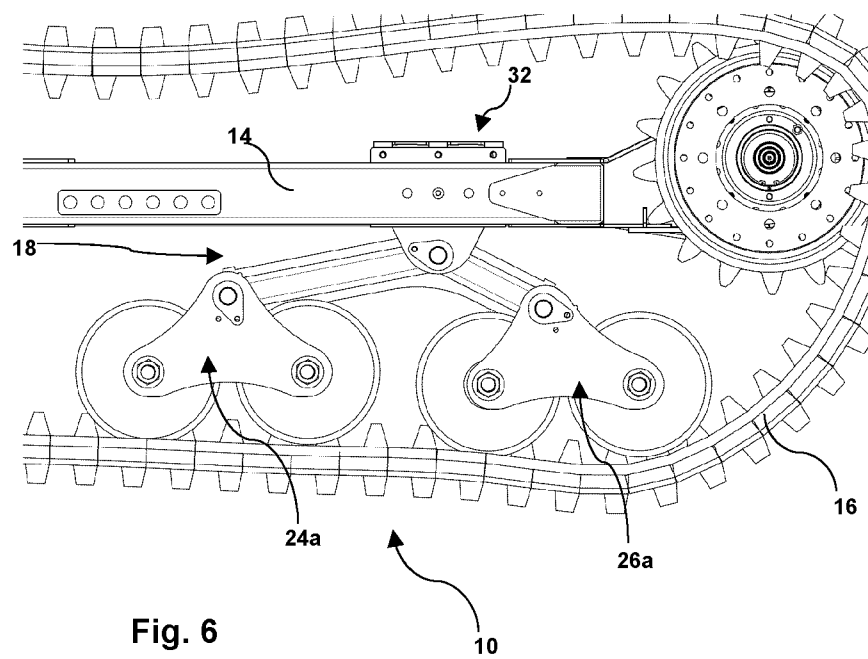


Fig. 2









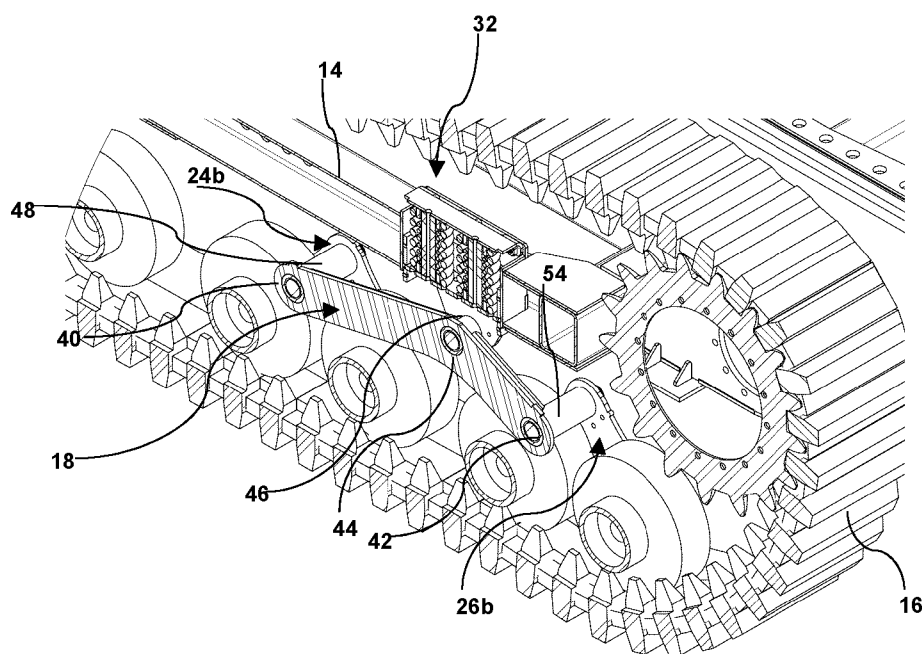


Fig. 7

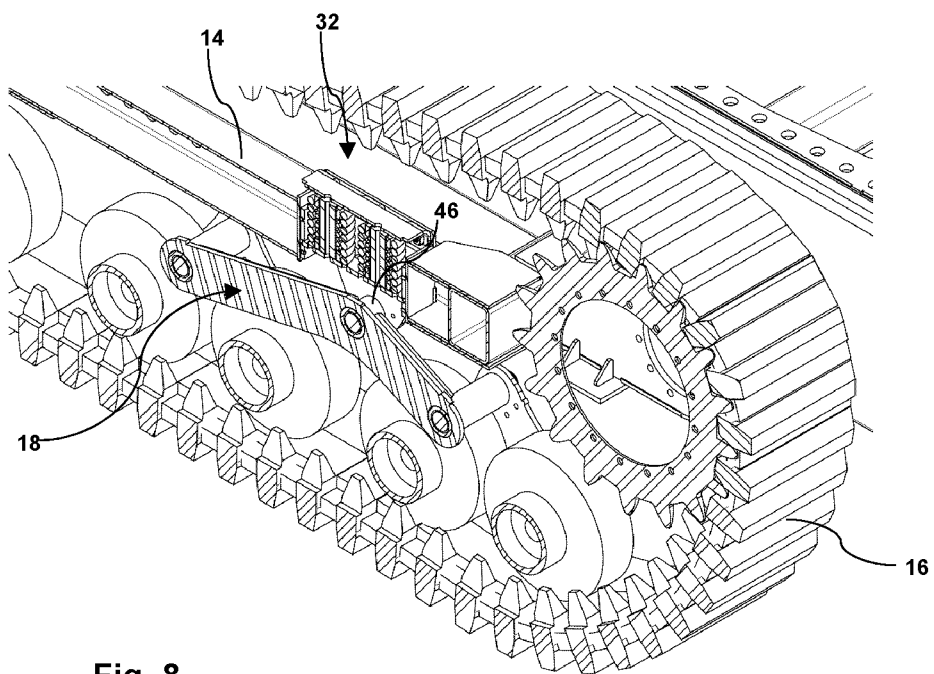


Fig. 8

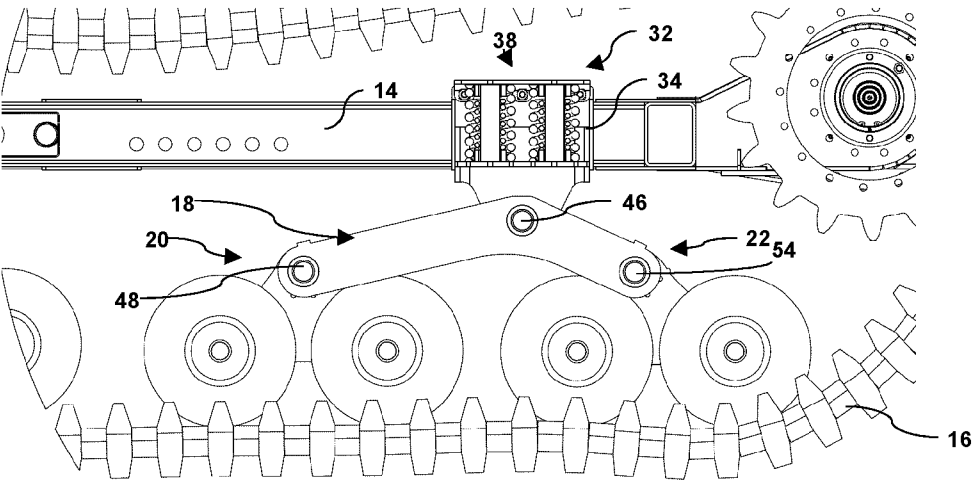


Fig. 9

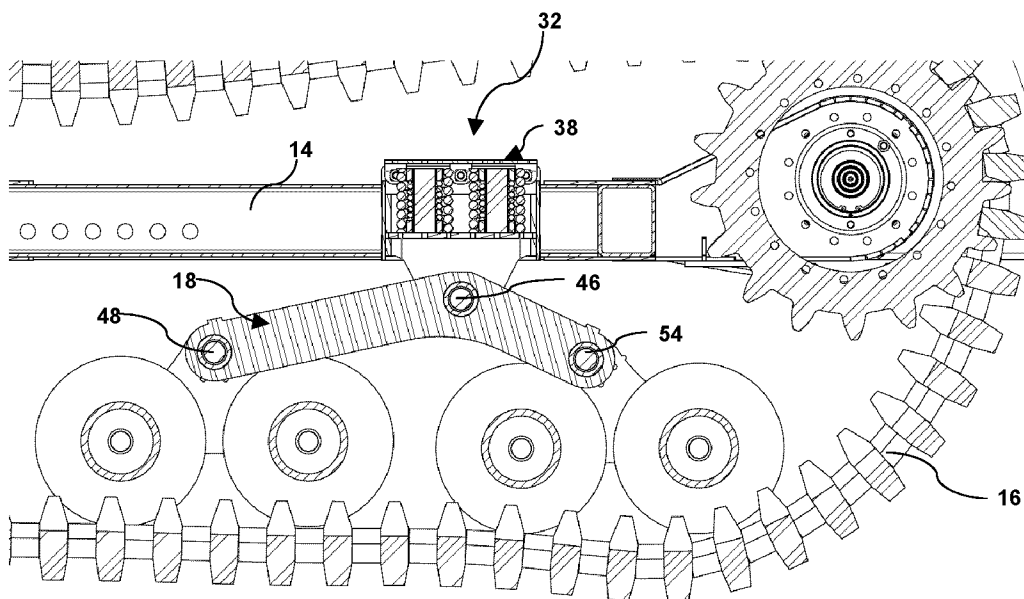


Fig. 10

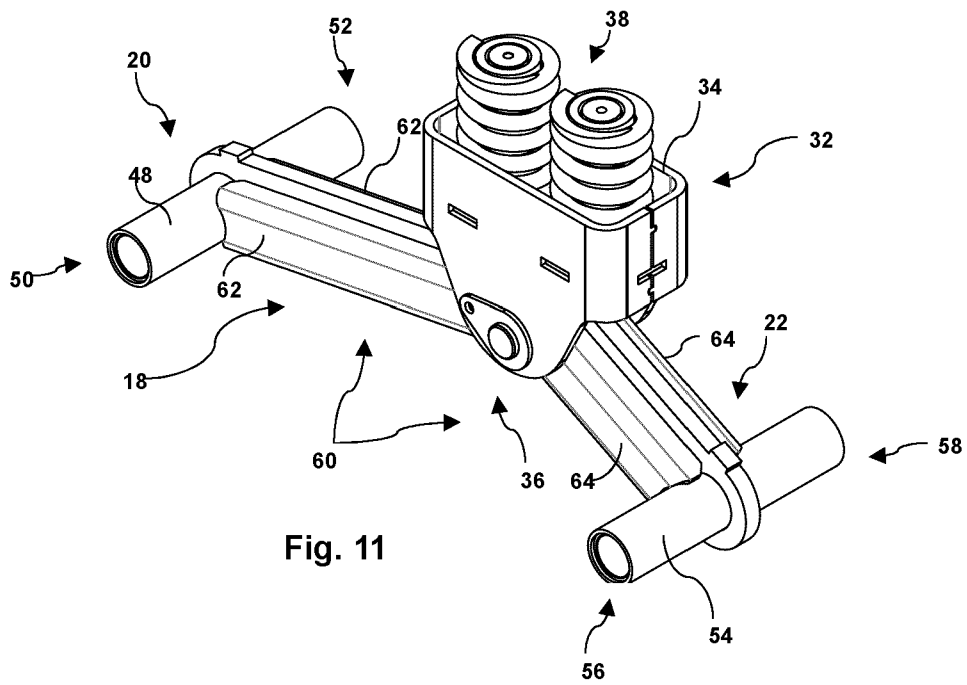


Fig. 11

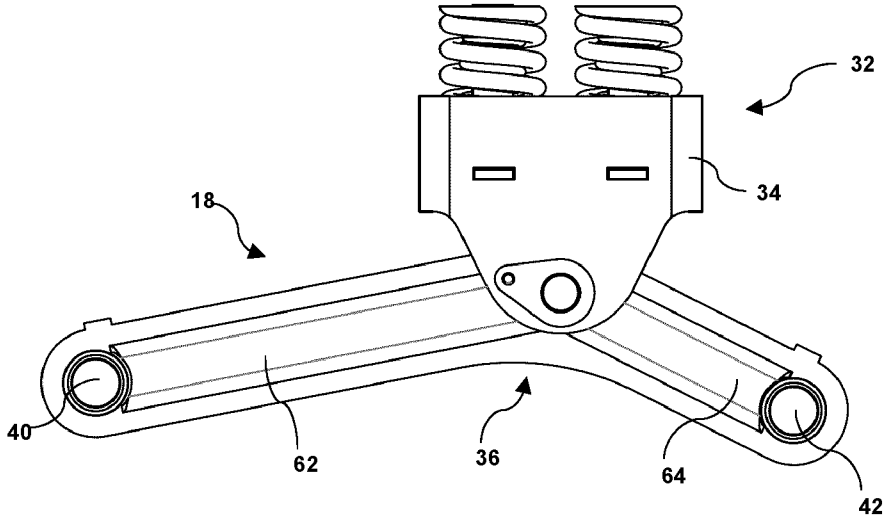
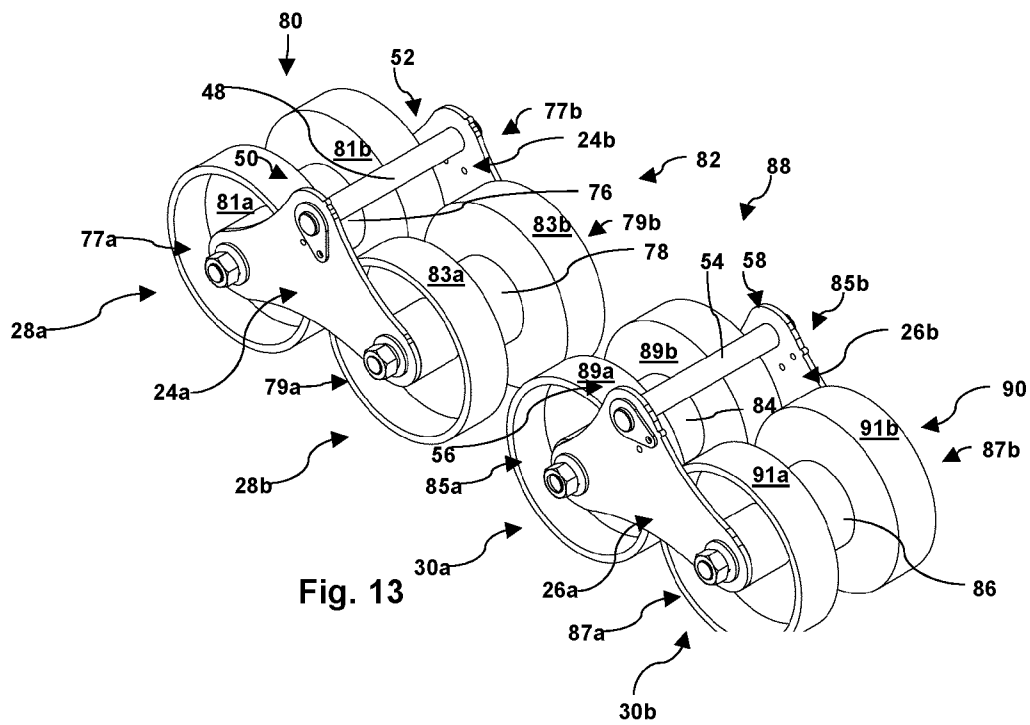
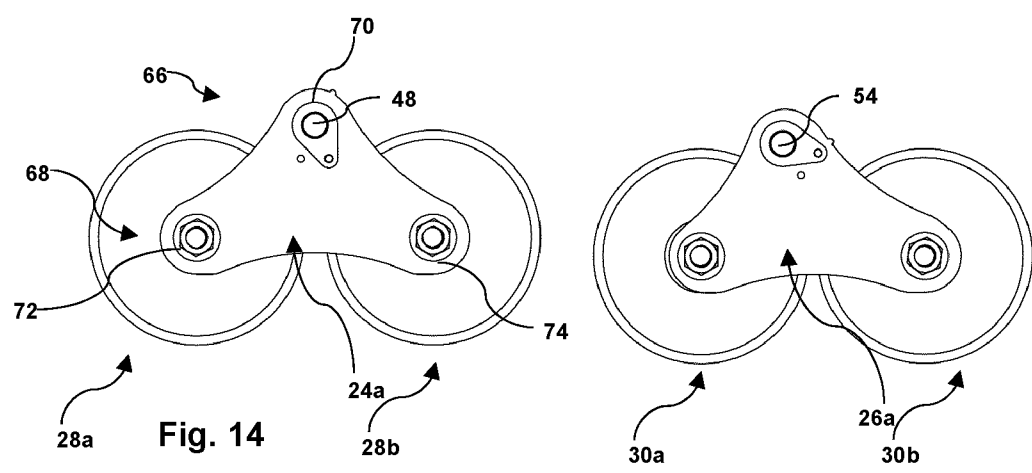
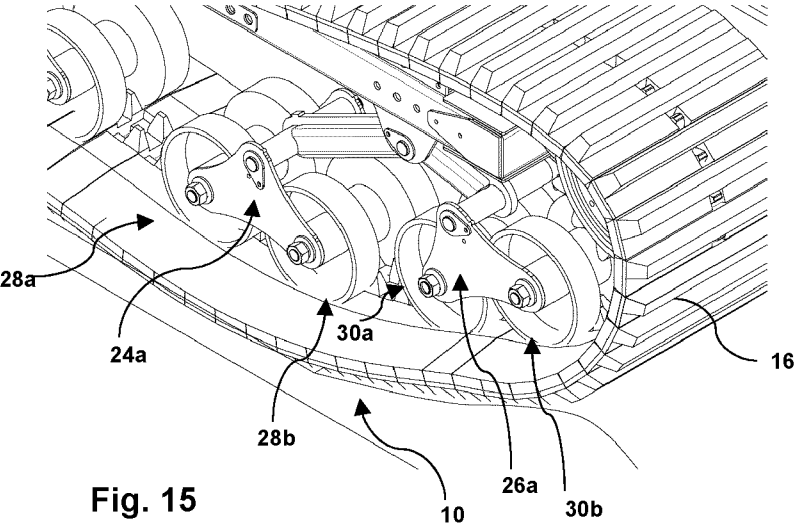


Fig. 12







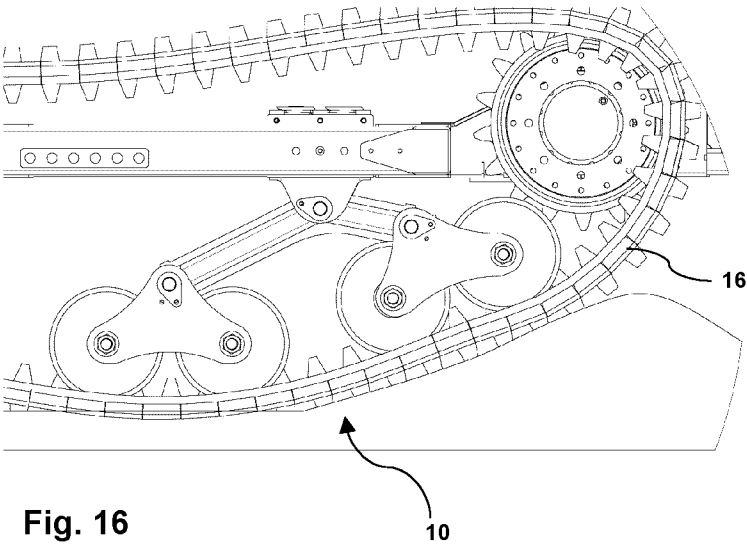
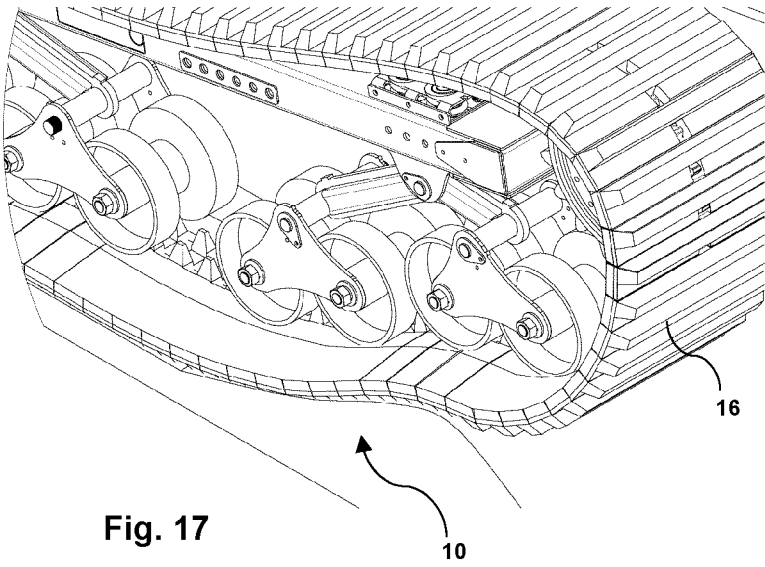


Fig. 16



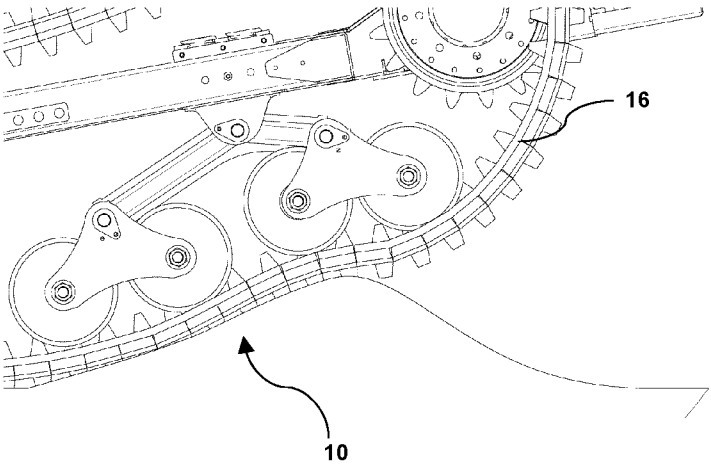


Fig. 18

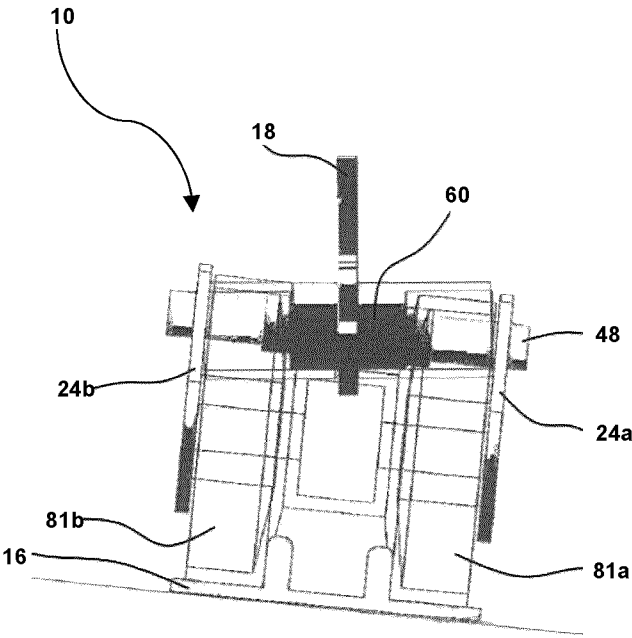


Fig. 19

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CA2019/050721

A. CLASSIFICATION OF SUBJECT MATTER
 IPC: **B62D 55/104** (2006.01), **B62D 55/10** (2006.01)

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC/CPC: B62D 55/104, B62D 55/10, B62D 55/116, B62D 55/14

USPC: 305/134

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

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

Database: Questel-Orbit

Keywords: Endless track, walking beam, roller, tandem, suspension, sliding.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	CN107244358 A (YUAN, X. et al.) 13 October 2017 (13-10-2017) *the whole document*	1, 18 2, 19
X Y	US1786430 A (KÉGRESSE, A.) 30 December 1930 (30-12-1930) *the whole document*	1, 18 2, 19
X Y	US4744431 A (STÖLLINGER, W.) 17 May 1988 (17-05-1988) *the whole document*	1, 18 2, 19
Y	US20070236085 A1 (SATZLER, R. et al.) 11 October 2007 (11-10-2007) *the whole document*	2, 19
Y	US9505454 B1 (KAUTSCH, D.) 29 November 2016 (29-11-2016) *figures 10 and 11*	2, 19

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

☒ See patent family annex.

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 "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
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Date of the actual completion of the international search
 30 July 2019 (30-07-2019)

Date of mailing of the international search report
 27 August 2019 (27-08-2019)

Name and mailing address of the ISA/CA
 Canadian Intellectual Property Office
 Place du Portage I, C114 - 1st Floor, Box PCT
 50 Victoria Street
 Gatineau, Quebec K1A 0C9
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Authorized officer

Jeremy Garnet (819) 639-7850

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CA2019/050721

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
CN107244358A	13 October 2017 (13-10-2017)	None	
US1786430A	30 December 1930 (30-12-1930)	None	
US4744431A	17 May 1988 (17-05-1988)	ATA134785A AT389092B AU5444286A AU581297B2 CN86101914A CN1003078B DE3608251A1 DE3608251C2	15 March 1989 (15-03-1989) 10 October 1989 (10-10-1989) 13 November 1986 (13-11-1986) 16 February 1989 (16-02-1989) 19 November 1986 (19-11-1986) 18 January 1989 (18-01-1989) 06 November 1986 (06-11-1986) 01 September 1988 (01-09-1988)
US2007236085A1	11 October 2007 (11-10-2007)	US7628235B2 AT452816T DE102006015153A1 DE502006005724D1 EP1840018A2 EP1840018A3 EP1840018B1	08 December 2009 (08-12-2009) 15 January 2010 (15-01-2010) 04 October 2007 (04-10-2007) 04 February 2010 (04-02-2010) 03 October 2007 (03-10-2007) 10 September 2008 (10-09-2008) 23 December 2009 (23-12-2009)
US9505454B1	29 November 2016 (29-11-2016)	US10112663B1	30 October 2018 (30-10-2018)