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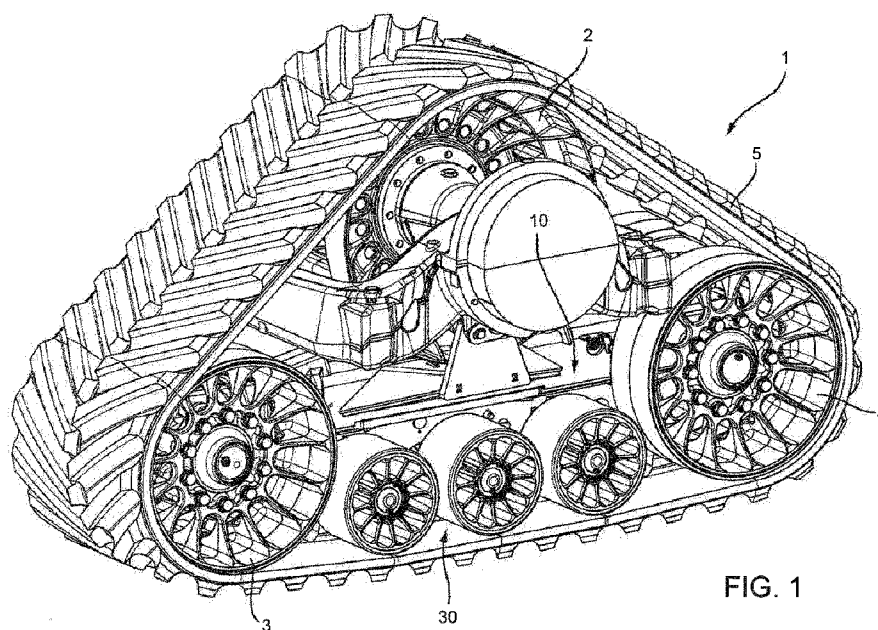


FIG. 1

(57) Abstract: Suspension system (30) for a track band transmission (1) of a vehicle, comprising at least a front wheel (3) and a rear wheel (4) around which a track band (5) is wound and being configured to transmit the motion to the front and rear wheels (3, 4), and an undercarriage (10) coupled pivotally to the vehicle and carrying the front and rear wheels (3, 4), the suspension system (30) comprises a first and a second rocker arms (33, 34), each being coupled pivotally to the undercarriage (10) in a position between their extremities (33a, 34a, 33b, 34b), a first extremity (33a, 34a) of the first and second rocker arms (33, 34) being pivotally coupled respectively to first and second roller groups (31, 32) and a second extremity (33b, 34b) of the first and second rocker arms (33, 34) being pivotally coupled each other by a third rocker arm (35).



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"SUSPENSION SYSTEM FOR A TRACK BAND TRANSMISSION"TECHNICAL FIELD

The present invention relates to a suspension system, in particular to a suspension system for a track band transmission for agricultural vehicles, such as a tractor.

BACKGROUND OF THE INVENTION

Agricultural vehicles, for sake of example tractors, may use track band transmissions instead of ordinary wheels for the motion of the vehicle on the ground.

A typical track band transmission for agricultural vehicles comprises a drive wheel configured to supply a torque to a track band, which is wrapped around a boogie assembly typically coupled to the vehicle itself; such boogie assembly comprises an undercarriage essentially provided with two or more idler wheels and a suspension system.

The suspension system is necessary to maintain the track band in contact with the ground and to dampen the vibration transmitted to the vehicle.

Many typologies of suspension systems for such agricultural track band vehicles are known.

"Quadtrac" or "Rowrtrac" system, by CNH Industrial, comprises a suspension system comprising three rollers arranged between two idler wheels, which are all connected together by a rod; such rod is suspended with respect to an

undercarriage fixed to the vehicle and to which the idler wheels are singularly hinged.

Such systems, although being simple and composed only by mechanical parts, do not guarantee an equal pressure applied by the ground on the rollers, during the vehicle motion.

Other known suspension systems use hydraulic elements, such as active cylinders, to regulate the position of the rollers. These system, although they guarantee an almost equal pressure applied on the rollers, are really complex and expensive, due to the presence of the hydraulic system. Moreover, the maintenance and cleaning of this latter is difficult and time-consuming.

Another known suspension system, by Zuidberg, comprises an undercarriage pivotally connected in the rotation center of the driving wheel and comprising one single suspension element for each roller coupled to the undercarriage.

Such solution, although guaranteeing a good roller compliance, has an elevated pivot position of the undercarriage and therefore presents an high risk of stumbling.

Combine harvesters 1995 or Harain and many other systems by John Deere disclose a structure in which it is not present a classic undercarriage pivoted on the vehicle, but instead a plurality of rods and boogie elements pivoted with respect to one another is present.

Such systems are complex and normally require the presence of an active hydraulic suspension and, therefore, a related hydraulic supply system, with the associated problems already described above.

Versatile Delta Track or John Deere HSD systems disclose suspension systems comprising a boogey journaled to the undercarriage with the journal point coplanar with the pivot axis of the undercarriage. The system further comprises two rollers hinged to the boogey.

Such systems have an high ground pressure and an uneven load distribution on the rollers. Moreover, the suspension is not configured to support vertical loads and therefore such vertical loads are transferred directly to the vehicle.

GB396888 discloses an elastic suspension system for the rollers of endless track band vehicles.

In particular, this configuration discloses a suspension system comprising first and second rocking arms pivotally coupled to an undercarriage and linked with one another by a leaf spring. The first rocking arm have a substantially triangular shape having three distinct end portions, pivotally coupled respectively with one roller, the undercarriage and one first end of the leaf spring.

The second rocking arm presents, in turn, three distinct end portions, two of which are pivotally coupled respectively to the undercarriage and to a boogie assembly, which

pivotally carries two rollers. The other end portion is rigidly coupled to a second end of the leaf spring.

Such system is capable of reducing the torsional stress to which the rollers are subjected, especially during steering operations. Furthermore, the weight of the vehicle is distributed uniformly over the rollers, in normal conditions.

However, although being a simple completely mechanical system, this system does not provide for a uniform distribution of the load over the rollers, when the same is subjected to unusual conditions, for example when an obstacle on the ground path produces a sudden rebound of the suspension system.

Moreover the presence of the leaf spring, which works in flexion solicitation, does not allow to bear high forces and therefore has a lower useful life.

In view of the preceding, the need is felt to improve existing suspension systems for track band vehicles in order to decrease their cost and complexity and to increase their performances.

An aim of the present invention is to satisfy at least one of the above mentioned needs.

SUMMARY OF THE INVENTION

The aforementioned aim is reached by a suspension system as claimed in the appended set of claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, a preferred embodiment is described in the following, by way of a non-limiting example, with reference to the attached drawings wherein:

- Figure 1 is a perspective view of a track band transmission comprising a suspension system according to the present invention;
- Figure 2 is a partial sectioned view of the track band transmission of figure 1;
- Figure 3 is a perspective view of the suspension system according to the present invention;
- Figure 4 is a schematic representation of the suspension system of figure 3;
- Figure 5 is a partial sectioned view of a track band transmission comprising a first alternative embodiment of the suspension system of the present invention;
- Figure 6 is a perspective view of the suspension system of the track band transmission of figure 5;
- Figure 7 is a partial sectioned view of a track band transmission comprising a second alternative embodiment of the suspension system of the present invention;
- Figure 8 is a perspective view of the suspension system of the track band transmission of figure 7;

- Figure 9 is a schematic representation of the suspension system of figure 8;
- Figure 10 is a partial sectioned view of a track band transmission comprising a third alternative embodiment of the suspension system of the present invention;
- Figure 11 is a perspective view of the suspension system of the track band transmission of figure 10; and
- Figure 12 is a partial sectioned view of an alternative embodiment of the track band transmission comprising a suspension system according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

In the following description the same reference numbers apply to the same elements in the different embodiments of the present invention.

In figures 1 to 3 it is disclosed a track band transmission 1 for an agricultural vehicle (not shown), such as a tractor, according to a preferred embodiment of the present invention.

Track band transmission 1 essentially comprises a driving wheel 2 and two couples of wheels 3,4, more specifically a couple of front idler wheel 3 and a couple rear idler wheel 4 and an endless track band 5 which is wrapped around the driving wheel 2 and the front and rear idler wheels 3,4.

The track band transmission 1 further comprises an undercarriage 10 coupled to the agricultural vehicle and comprising a main portion 11 having substantially a rectangular shape and a secondary portion 12, defining substantially a vertical abutment extending from the middle of the main portion 11 towards driving wheel 2.

The secondary portion 12 comprises an hinge 13 by which the undercarriage 10 is coupled pivotally, around an axis A of rotation, to the agricultural vehicle. The main portion 11 comprises instead respective front and rear extremities 11a, 11b to which the couple of idler wheels 3, 4 are hinged in a common way

The track band transmission 1 may further comprise preloading means 16 coupled to undercarriage 10 and configured to ensure a predetermined level of tension of endless track band 5 around wheels 2, 3 and 4.

Preloading means 16 may be housed inside an inner volume 17 of the undercarriage 10 and essentially comprise an hydraulic cylinder 20 whose housing is fixed to the rear extremity 11b of the main portion 11 of the undercarriage 10, dampening means 22 fixed to the coupling of front wheel 3 to the undercarriage 10 and a movable sleeve 21 fixed to its rear extremity to a rod of the hydraulic cylinder 20 and to its front extremity to the dampening means 22. Dampening means 22 may comprise a spring 22a and a damper

22b coaxial to spring 22a itself.

The hydraulic cylinder 20, modifying the length of its rod allows front wheel 3 to get closer or farther with respect to rear wheel 4 thereby increasing or lowering the tension, i.e. the preload, of track band 5. Dampening means 22 allow preset fluctuations of the tension of the track band 5 during its use.

The track band transmission 1 further comprises a suspension system 30 coupled to the undercarriage 10 in a lower central part of the main portion 11 and configured to cooperate with track band 5 as below described.

Advantageously, the suspension system 30 essentially comprises first and second roller groups 31, 32 each hinged to the undercarriage 10 through respective first and second rocker arms 33, 34 which are further coupled together through a third rocker arm 35.

In greater detail, the first and second rocker arms 33, 34 are hinged to the undercarriage 10 thanks to respective hinges 42, 43 positioned between the extremities of the first and second rocker arms 33, 34 themselves.

Preferably hinges 42, 43 each are positioned substantially in the middle with respect to the length of the respective first and second rocker arms 33, 34. lower extremities 33a, 34a of first and second rocker arms 33, 34 are further hinged to first and second roller groups 31, 32

via hinges 44, 45 and upper extremities 33b, 34b of first and second rocker arms 33, 34 are hinged to the third rocker arm 35 via hinges 46, 47.

The first roller group 31 may comprise two couples of rollers 31a, 31b connected together thanks to a boogie 37 and configured to cooperate with the track band 5. In particular, each roller 31a, 31b may be hinged to the boogie 37 thanks respective hinges 48a, 48b and the boogie 37 is hinged the rocker arm 33 via hinge 44. Preferably the couple of rollers 31a, 31b are hinged to boogie 37 symmetrically with respect to hinge 44.

The second roller group 32 may comprise a single couple of rollers 32a connected to the rocker arm 34 via hinge 45 and configured to cooperate with the track band 5..

The rocker arm 35 allows that the movement of the rocker arm 34 is transmitted to the rocker arm 33, i.e. the movement of roller group 31 will cause a movement on roller group 32. Preferably the third rocker arm 35 may be realized as a rigid element so that the movement of the roller group 31 directly cause a movement on the roller group 32 without any substantial damping.

The rocker arm 35, being coupled pivotally via hinges 46 and 47 respectively to rocker arms 33 and 34 works mainly in a compression/traction state, therefore it can bear very high loads.

Making reference to figure 4 the suspension system 30 of the aforementioned embodiment may be schematized as follows. For sake of clarity, all the distances are referred to the hinge 13 which defines the pivot around axis A of the undercarriage 10.

The hinges 46 and 47 of the third rocker arm 35 define two axis B, C of rotation for respectively the first and second rocker arms 33, 34 with respect to the third rocker arm 35. The hinges 42, 43 of the first and second rocker arms 33, 34 on the undercarriage 10 define two further axis of rotation D, E of these latter with respect to the undercarriage 10. The hinge 44 of first rocker arm 33 with the boogie 37 defines a further axis F of rotation of the boogie 37 around the rocker arm 33. The hinges 48a, 48b define axis I, II of rotation of the rollers 31a, 31b with boogie 37 and finally hinge 45 defines axis III of rotation of roller 32 with the extremity of the rocker arm 34. All the aforementioned axis are parallel to each other.

In the described configuration axis A is collinear with axis II. The horizontal distance between axis A and D is X_1 while the horizontal distance between axis A and axis E is two times X_1 . The horizontal distance between axis F axis A is equal to X_2 while the distance between axis III and axis A is equal to two times X_2 . Moreover, the axis I, II, III are collinear to each other and similarly axis F and E are

collinear between them. Finally the axis B and D are respectively positioned vertically closer to axis A with respect to axis C and E.

The operation of the above described preferred embodiment is the following.

If a force, e.g. $3F$, acts on hinge 13, thanks to the above described geometrical configuration, it can be split in equal parts, i.e. on three forces equal to F , on each of the pairs of rollers 31a, 31b and 32a.

If one of the roller groups 31 or 32 is moved from its position by ground irregularities, e.g. a stone on the ground which give an impulse to roller group 31, thanks to the third rocker arm 35 the impulse given to the roller group 31 is transmitted to roller group 32 and therefore, thanks to the aforementioned described configuration, equally divided between the pairs of rollers 31a, 31b and 32a.

It may be noted that the undercarriage 10 and the suspension system 30 are internally balanced. The undercarriage 10 rotates about pivot A independently from the dynamic of the elements of the suspension system 30. In this way, the movement of suspension system 30 is not transmitted to the vehicle as well as the vibrations due to ground contour.

In a first alternative embodiment, disclosed in figures 5 and 6, the upper extremities of the rocker arms 33 and 34

are connected thanks to dampening means 60.

Dampening means 60 may comprise a spring 61 and/or a damper 62. The spring 61 may be realized as a coil spring and the damper 62 may be realized as an hydraulic cylinder. In the described alternative embodiment, the spring 61 and the damper 62 are positioned coaxially in parallel between hinges 46 and 47.

The operation of the above described first alternative embodiment is substantially the same of the preferred embodiment of the invention, however between axis B and C there is not a direct pivotally coupling because of the delay introduced by the dampening of dampening means 60. Such delay will help the suspension system 30 to dampen excessive loads acting on roller groups 31, 32.

Moreover, the presence of the dampening means 60 allows to vary the position of roller groups 31 and 32 with respect to the ground by increasing or decreasing the length of the damping means 60 themselves. This allows to achieve a sort of "levelling function" which improve the capability of the rollers to follow the ground contour.

In a second alternative embodiment, disclosed in figures 7 and 8, the suspension system 30 comprises two roller groups 31, 32, each comprising two rollers 31a, 31b; 32a, 32b connected together by respective boogies 37; in particular, each roller 31a, 31b; 32a, 32b may be hinged to

the boogies 37 through respective hinges 48a, 48b; 49a, 49b. The boogies 37 are hinged the respective rocker arms 33 via hinges 44, 45.

Making reference to fig 9, the suspension system 30 of the aforementioned embodiment may be schematized as follows. For sake of clarity, all the distances are referred to the hinge 13 which defines the pivot around axis A of the undercarriage 10.

The hinges 46 and 47 of the third rocker arm 35 define two axis B, C of rotation for respectively the first and second rocker arms 33, 34 with respect to the third rocker arm 35. The hinges 42, 43 of the first and second rocker arms 33, 34 on the undercarriage 10 define two further axis of rotation D, E of these latter with respect to the undercarriage 10. The hinges 44, 45 of first and second rocker arm 33, 34 with boogies 37 define further axis F, G of rotation of the boogies 37 around the respective arms. The hinges 48a, 48b; 49a, 49b of the two couples of rollers 31a, 31b; 32a, 32b define axis I, II, III and IV of rotation of the two couple of rollers 31a, 31b; 32a, 32b themselves with respective boogies 37.

In the described configuration axis A is positioned in the middle of the horizontal distance between axis II and III. The horizontal distance between axis A and axis D and E is the same, as well as the horizontal distance between

axis A and axis F and G. Moreover, axis I, II, III and IV are collinear to each other, similarly axis F and G, axis D and E and axis B and C are respectively collinear to each other.

The operation of the above described second alternative embodiment is the following.

If a force, e.g. $4F$, acts on hinge 13, thanks to the above described geometrical configuration, it can be split in equal parts, i.e. on four forces equal to F , on each of the two pairs of rollers 31a, 31b; 32a, 32b.

If one of the roller groups 31 or 32 is moved from its position by ground irregularities, e.g. a stone on the ground which gives an impulse to roller group 31, thanks to the third rocker arm 35 the impulse given to the roller group 31 is transmitted to roller group 32 and therefore, thanks to the aforementioned described configuration, divided between the two pairs of rollers 31a, 31b; 32a, 32b.

In a third alternative embodiment disclosed in figures 10 and 11 the hinges 48a, 48b of the first roller group 31 and the hinge 45 of the second roller group 32 may allow a rotation of rollers 31a, 31b and 32 around an axis Y perpendicular to their axis of rotation I, II and III.

First and second roller groups 31, 32 further comprise stop means 70 configured to limit the amplitude of rotation of the pair of rollers 31a, 31b and 32 around axis Y.

In particular stop means 70 may comprise a couple of stops 71 fixed respectively to the boogie 37 and to the rocker arm 34 and configured to cooperate with a respective couple of projections 72 fixed respectively to the hinges 48a, 48b of the first roller group 31 and the hinge 45 of the second roller group 32.

The rotation of rollers 31a, 31b and 32 around axis Y is limited in function of the relative angular position of stops 71 with respect to projections 72 thereby defining an angular clearance.

The operation of the above described third alternative embodiment is substantially the same of the preferred embodiment of the invention. The presence of revolution joints which allow also a rotation of rollers 31a, 31b and 32 around an axis Y perpendicular to their axis of rotation guarantees a better compliance with the ground contour. Stop means are necessary to avoid excessive rotation around axis Y which could lead to stumbling between the components of the suspension system 30 and to an unequal distribution of loads on the rollers 31a, 31b and 32.

Figure 12 discloses an alternative embodiment for track band transmission 1 comprising a suspension system 30 as previously described.

In such alternative embodiment the main portion 11 of the undercarriage 10 comprises two portions, an upper portion

90 and a lower portion 91. The upper portion 90 defines the inner volume 17 into which the preloading means 16 are housed, the lower portion 91 instead defines the support for hinges 42 and 43 of the suspension system 30.

The lower portion 91 is coupled to upper portion 90 by a couple of lateral hinges 93 defined in the extremities 11a, 11b of the main portion 11. Lateral hinges 93 may be realized as elastic joints defining a damping between the lower portion 91 and the upper portion 90.

Between the lower portion 91 and the upper portion 90 the undercarriage 10 may further comprise stop means 94 comprising bumpers 95 carried, e.g., to the upper portion 90 and configured to limit excessive vertical movements of the lower portion 91 with respect to the upper portion 90 by cooperating with correspondent stops 96 carried by the lower portion 91.

The operation of the above described fourth alternative embodiment is substantially the same of the preferred embodiment of the invention. The presence of the two additional hinges 93 adds further degrees of freedom to the track band transmission 1 and therefore improve its dynamic behavior.

Moreover, thanks to the fact that the lower portion 91 may be uncoupled from the upper portion 90, it may be possible to couple and uncouple different typologies of lower

portion 91 to the same upper portion.

In view of the foregoing, the advantages of a suspension system 30 according to the invention are apparent.

The suspension system 30 guarantees an equal repartition of the loads acting on each roller 31a, 31b, 32 even in case of impulse forces acting on one of them.

The dynamic independency of the undercarriage 10 and the suspension system 30 allows a substantial reduction of the vibration transmitted from the ground to the vehicle.

The suspension system 30 is made only of mechanical elements and therefore is simply to manufacture and cheap. Moreover the maintenance of such mechanical elements is simpler and there is no need of hydraulic circuits or complex electronic controls.

Since the force acting on rollers 31a, 31b, 32 is equalized there is less probability to compact and to damage the soil compressed by the track band 5.

Further, the useful life of the track band 5 is improved since the load of the rollers 31a, 31b, 32 is equal even if the ground contour is irregular. In fact, as said, force impulses are equally divided between rollers 31a, 31b, 32 and there are not overloads on the track band 5.

The fact that each roller 31a, 31b, 32 is substantially free of moving in vertical and horizontal direction, obviously dynamically coupled to the other rollers 31a, 31b,

32 themselves, allows a better capacity of the rollers 31a, 31b, 32 to follow the ground contour and therefore enhance the capability of the system to cross obstacles.

The free movement of the rollers 31a, 31b, 32 moreover decreases their resistance and therefore the fuel consumption of the vehicle and the wear of the machine.

The optional presence of dampening means 60 increase the capability of the suspension system 30 to dampen the vibrations; further it increases the possibility of rollers 31a, 31b, 32 to follow ground contours.

The possibility to use four rollers 31a, 31b; 32a, 32b allows the use of the suspension system 30 also in vehicle which have heavy loads acting on track band 5.

The additional revolute joints 48a, 48b; 49a, 49b in longitudinal direction improve the lateral compliance of the rollers 31a, 31b, 32 on the ground.

The fact that the main portion 11 of the undercarriage 11 comprise a lower portion 91 which may be uncoupled from an upper portion 90 and substituted by a different one, increase the flexibility of the track band transmission 1. In addition, its manufacture may be simplified since all the upper parts will be equal for different typologies of lower parts of the undercarriage 10, thereby reducing again costs.

It is clear that modifications can be made to the described suspension system 30 which do not extend beyond

the scope of protection defined by the claims.

First, all the above described alternative embodiments may be combined each other, e.g. it may be possible to have a suspension system 30 having dampening means 60 and four rollers or a suspension system 30 having roll compliance around axis Y and an undercarriage divided into lower and upper portions 90, 91.

Moreover, the shape of rocker arms 33, 34, 35 or of other elements of suspension system 30 may be varied if the relative distances between the hinges are maintained.

CLAIMS

1. Suspension system (30) for a track band transmission (1) of a vehicle, said track band transmission (1) comprising at least a front wheel (3) and at least a rear wheel (4) around which a track band (5) is wound and being configured to transmit a motion to said front and rear wheels (3, 4), said track band transmission (1) comprising an undercarriage (10) coupled pivotally to said vehicle and carrying said front and rear wheels (3, 4), said suspension system (30) being coupled to said undercarriage (10) and being configured to cooperate with said track band (5), said suspension system (30) being characterized by comprising a first and a second rocker arms (33, 34), each being coupled pivotally to said undercarriage (10) in a position between their extremities (33a, 34a, 33b, 34b), a first extremity (33a, 34a) of said first and second rocker arms (33, 34) being pivotally coupled respectively to first and second roller groups (31, 32) and a second extremity (33b, 34b) of said first and second rocker arms (33, 34) being pivotally coupled each other by a third rocker arm (35).

2.- Suspension system according to claim 1, characterized in that said first roller group (32) comprises one roller (32a) pivotally coupled to said first extremity (33a, 34a) of one of said rocker arms (33, 34) and in that said second roller group (31) comprises two rollers (31a,

31b) pivotally coupled to a boogie (37) which is pivotally coupled to said first extremity (33a, 34a) of the other of said rocker arms (33, 34).

3.- Suspension system according to claim 2, characterized in that the horizontal distance of the pivot coupling between said first roller group (32) and said first extremity (33a, 34a) of one of said rocker arms (33, 34) is the double of the horizontal distance of the pivot coupling between said second roller group (31) and said first extremity (33a, 34a) of the other of said rocker arms (33, 34).

4.- Suspension system according to claim 1 or 2, characterized in that the horizontal distance of the pivot coupling between said one of said rocker arms (33, 34) and the undercarriage (10) is the double of the horizontal distance of the pivot coupling between said other of said rocker arms (33, 34) and said undercarriage (10).

5.- Suspension system according to claim 1, characterized in that said each of said first and second roller groups (31, 32) comprise two rollers (31a, 31b; 32a, 32b) pivotally coupled to a respective boogie (37) which is pivotally coupled to said second extremities (33b, 34b) of said rocker arms (33, 34).

6.- Suspension system according to claim 5, characterized in that the horizontal distance of the pivot

coupling between said first roller group (32) and said first extremity (33a, 34a) of one of said rocker arms (33, 34) is the same with respect the horizontal distance of the pivot coupling between said second roller group (31) and said first extremity (33a, 34a) of the other of said rocker arms (33, 34).

7.- Suspension system according to claim 5 or 6, characterized in that the horizontal distance of the pivot coupling between said one of said rocker arms (33, 34) and the undercarriage (10) is the same of the horizontal distance of the pivot coupling between said other of said rocker arms (33, 34) and said undercarriage (10).

8.- Suspension system according to any of claims 2 to 7, characterized in that the pivot coupling between said second extremity (33b, 34b) of one of said rocker arms (33, 34) is vertically closer to the pivot coupling of the undercarriage (10) to the vehicle with respect to the pivot coupling between said second extremity (33b, 34b) of the other of said rocker arms (33, 34).

9.- Suspension system according to any of the preceding claims, characterized in that said third rocker arm (35) is a rigid element working in a compression/traction state.

10.- Suspension system according to any of claims 1 to 8, characterized in that said third rocker arm (35) comprises dampening means (60) working in a compression/traction

state.

11. Suspension system according to any of the claims 2 to 10, characterized in that said first and second roller groups (31, 32) comprises revolute joints (48a, 48b, 45) allowing a rotation of said couples of said couples of rollers (31a, 31b, 32a) around an axis (Y) perpendicular to the axis of rotations (I, II, III) of said couples of rollers.

12. Track band transmission (1) of a vehicle, said track band transmission (1) comprising at least a front wheel (3) and a rear wheel (4) around which a track band (5) is wound and being configured to transmit the motion to said front and rear wheels (3, 4), said track band transmission (1) comprising an undercarriage (10) coupled pivotally to said vehicle and carrying said front and rear wheels (3, 4) said track band transmission (1) being characterized by comprising a suspension system (30) as claimed in any of the preceding claims.

13.- Track band transmission according to claim 12, characterized in that said undercarriage (10) comprises an upper portion (90) configured for carrying said front and rear wheels (3, 4) and a lower portion (91) detachably coupled to said upper portion (90), said suspension system (30) being pivotally coupled to said lower portion (91).

14.- Track band transmission according to claim 13,

characterized in that said detachably coupling between said upper and lower portions (90, 91) of said undercarriage (10) comprises a couple of hinges (93) which allow a relative movement between said upper and lower portions (90, 91).

15.- Track band transmission according to claims 13 or 14, characterized in that said undercarriage (10) comprises stop means (94) configured to limit a relative movement between said upper and lower portions (90, 91) of said undercarriage (10).

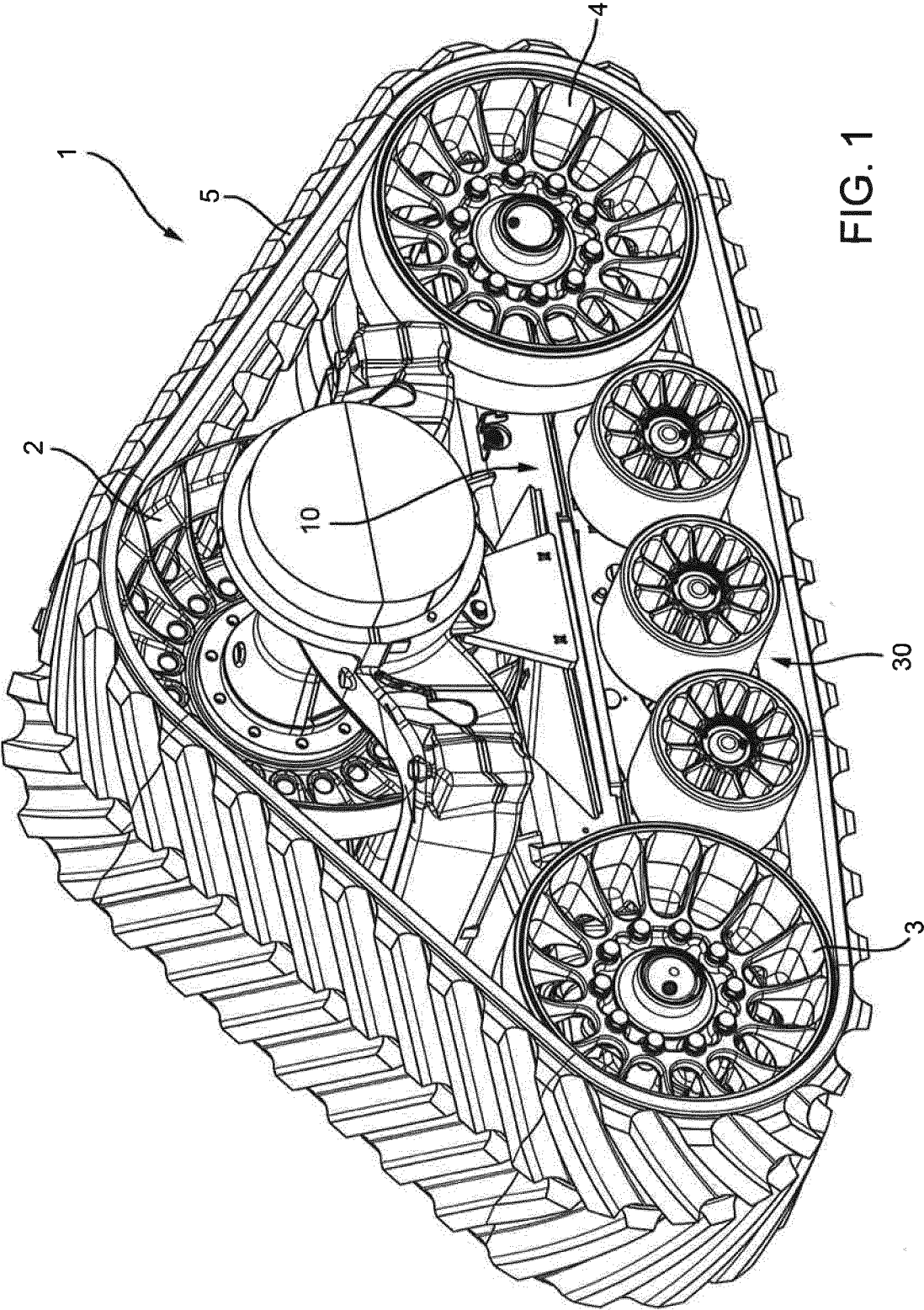
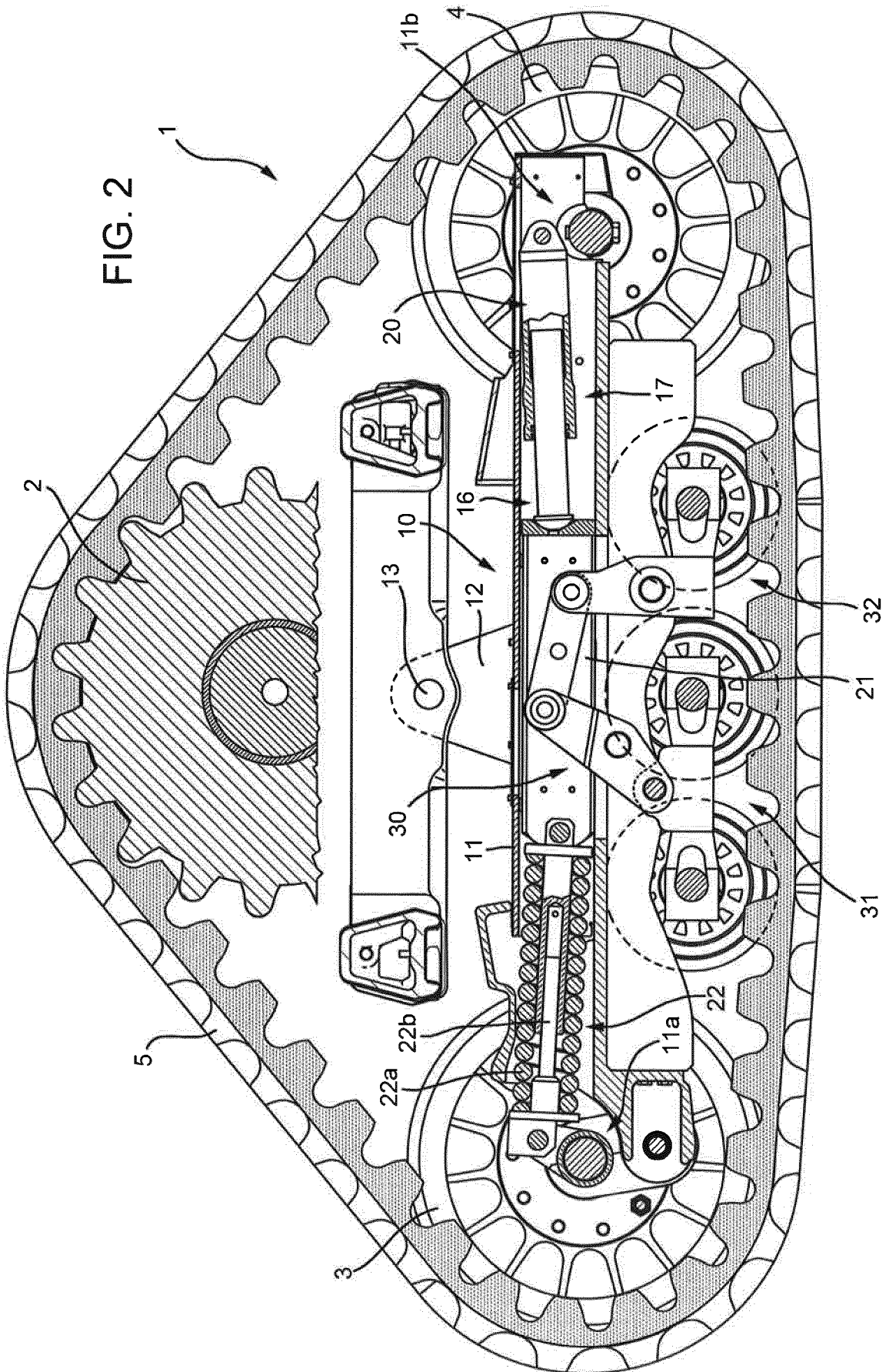
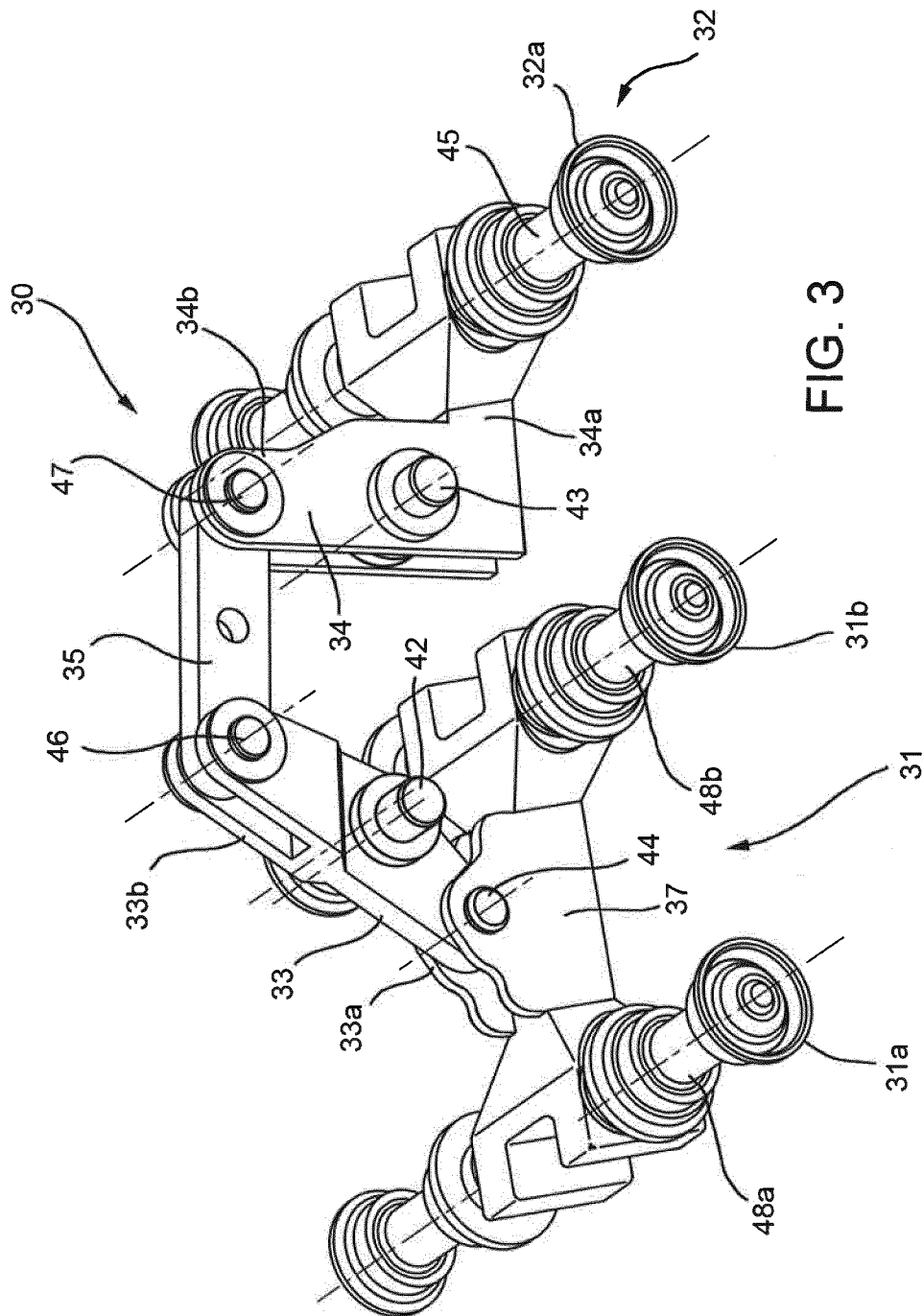
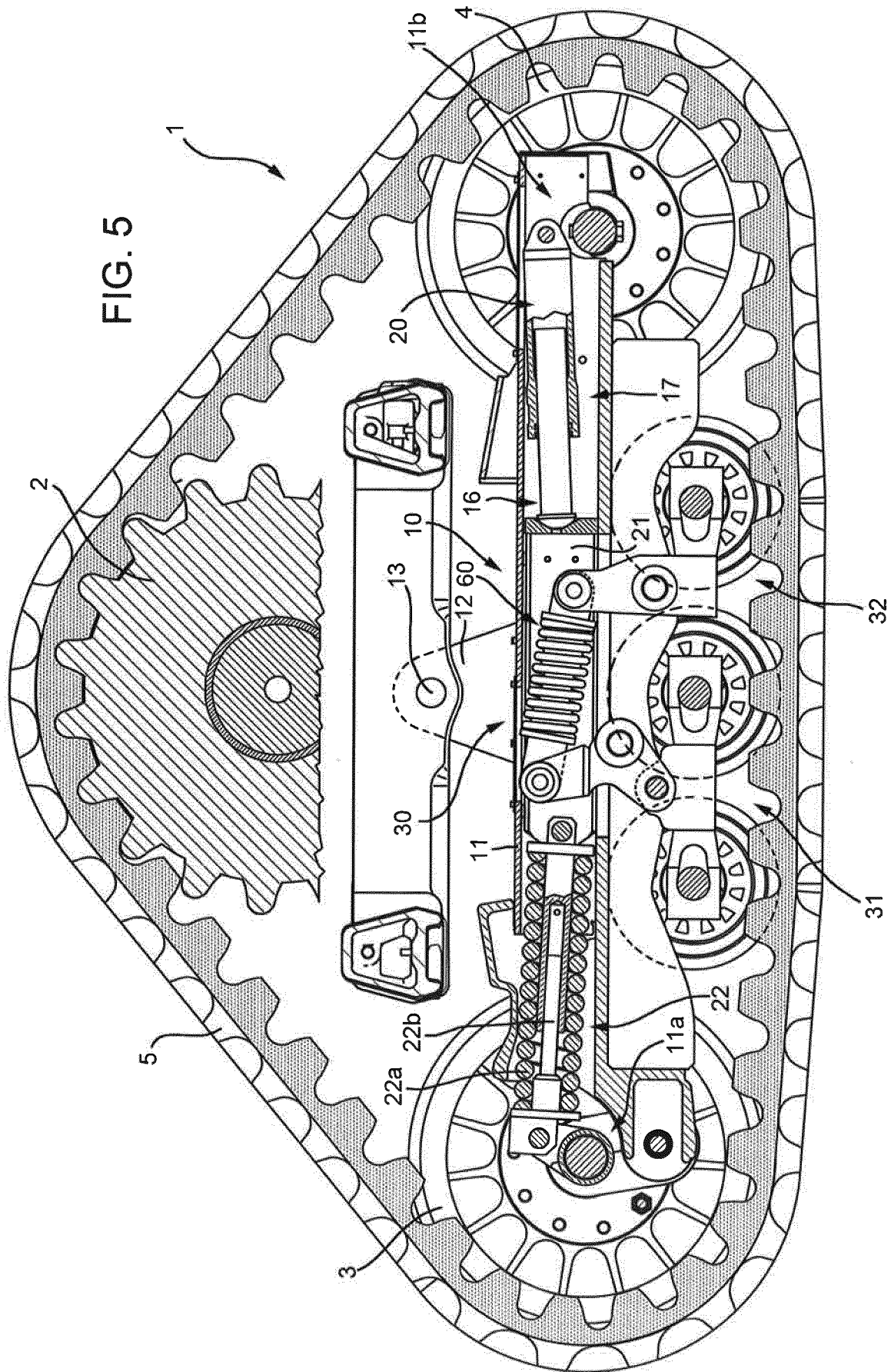


FIG. 1

FIG. 2







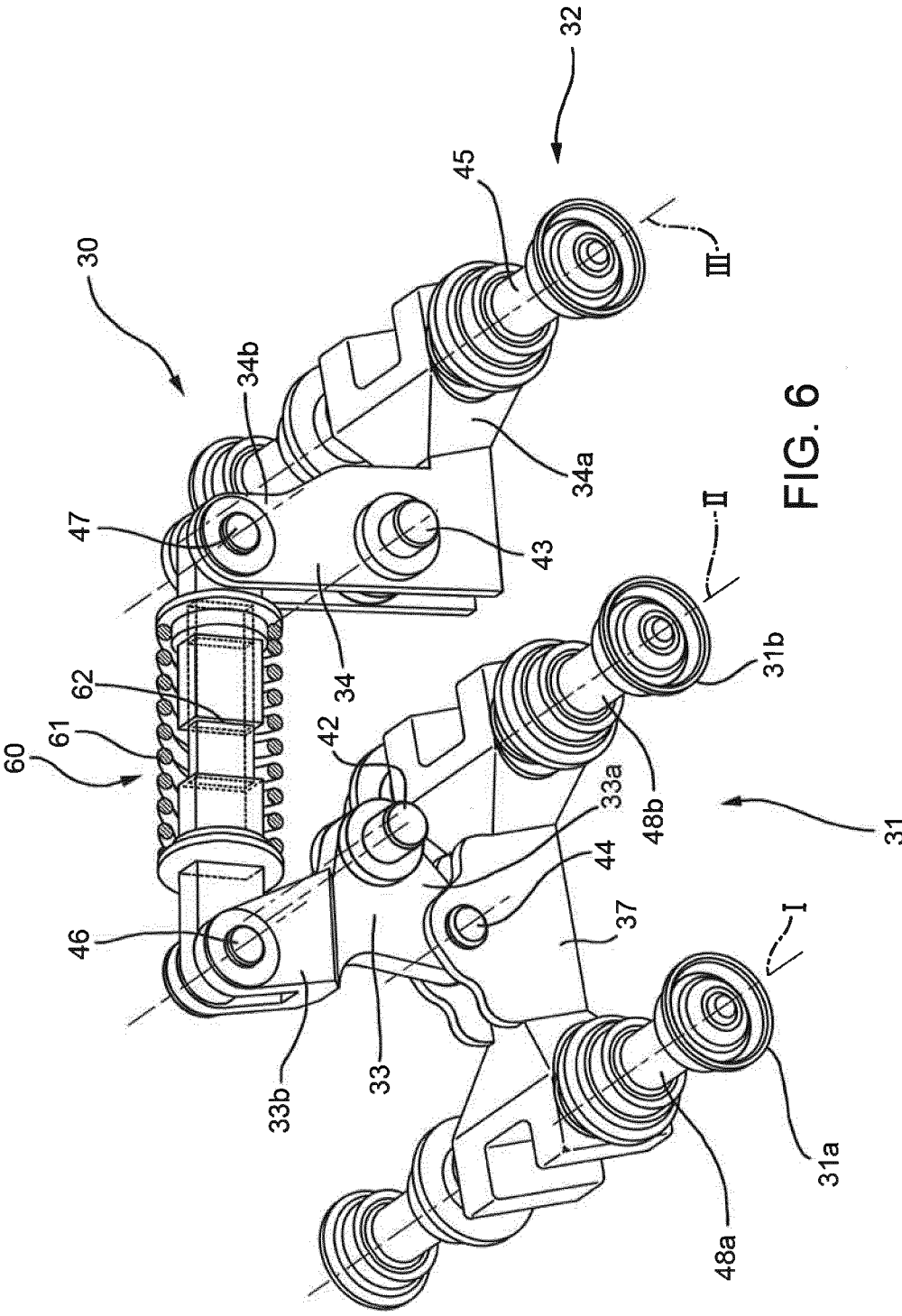
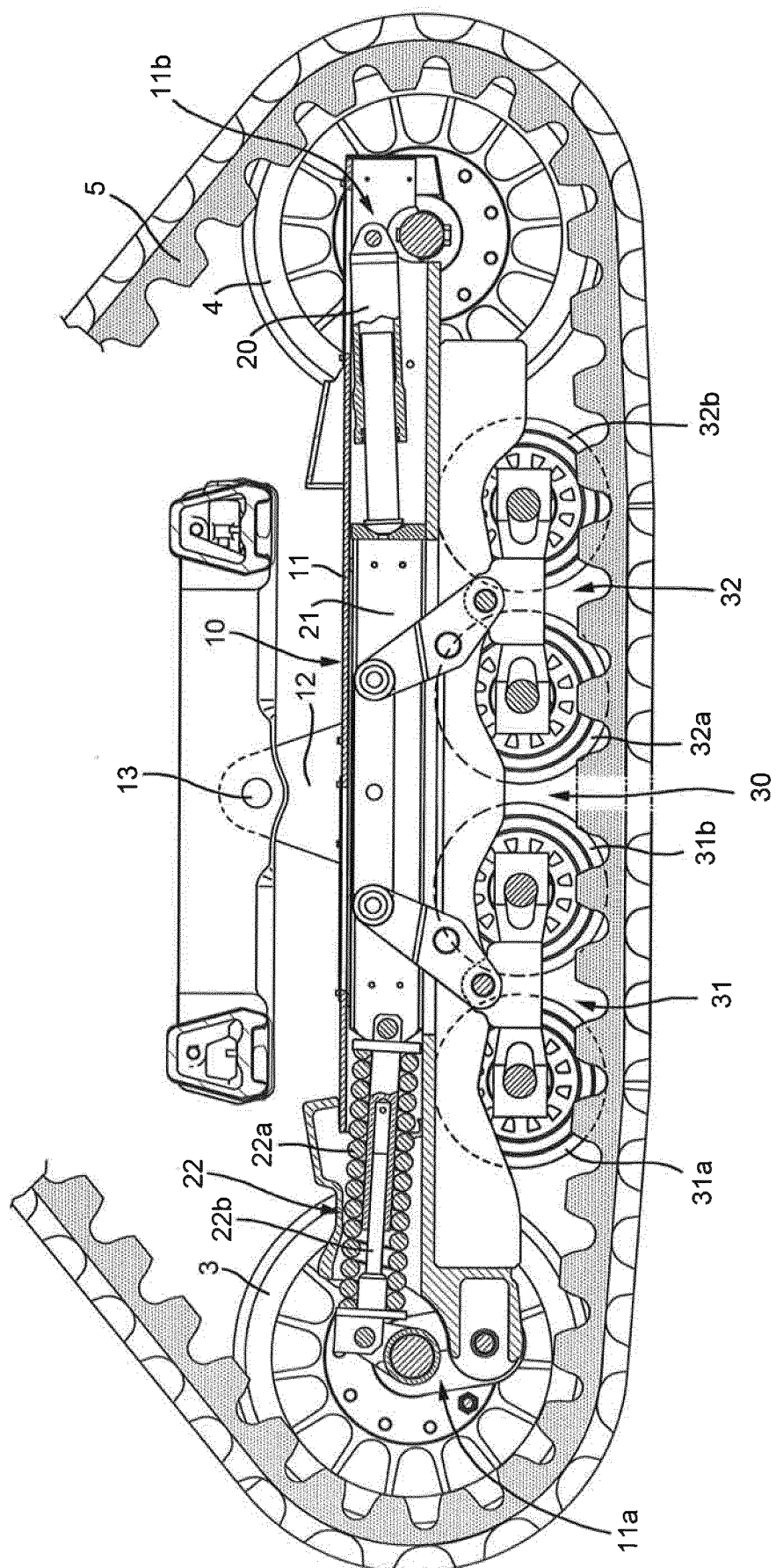
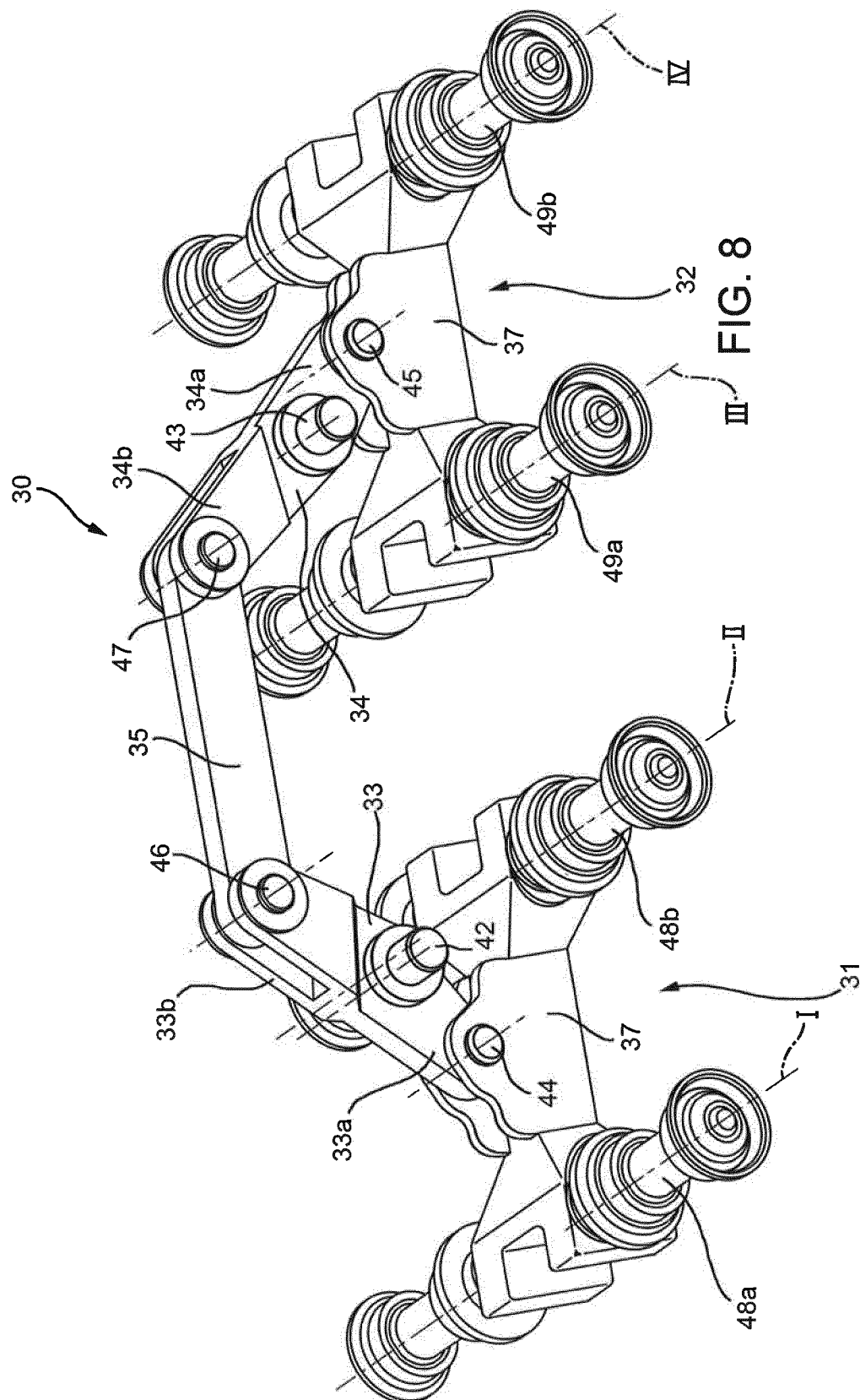
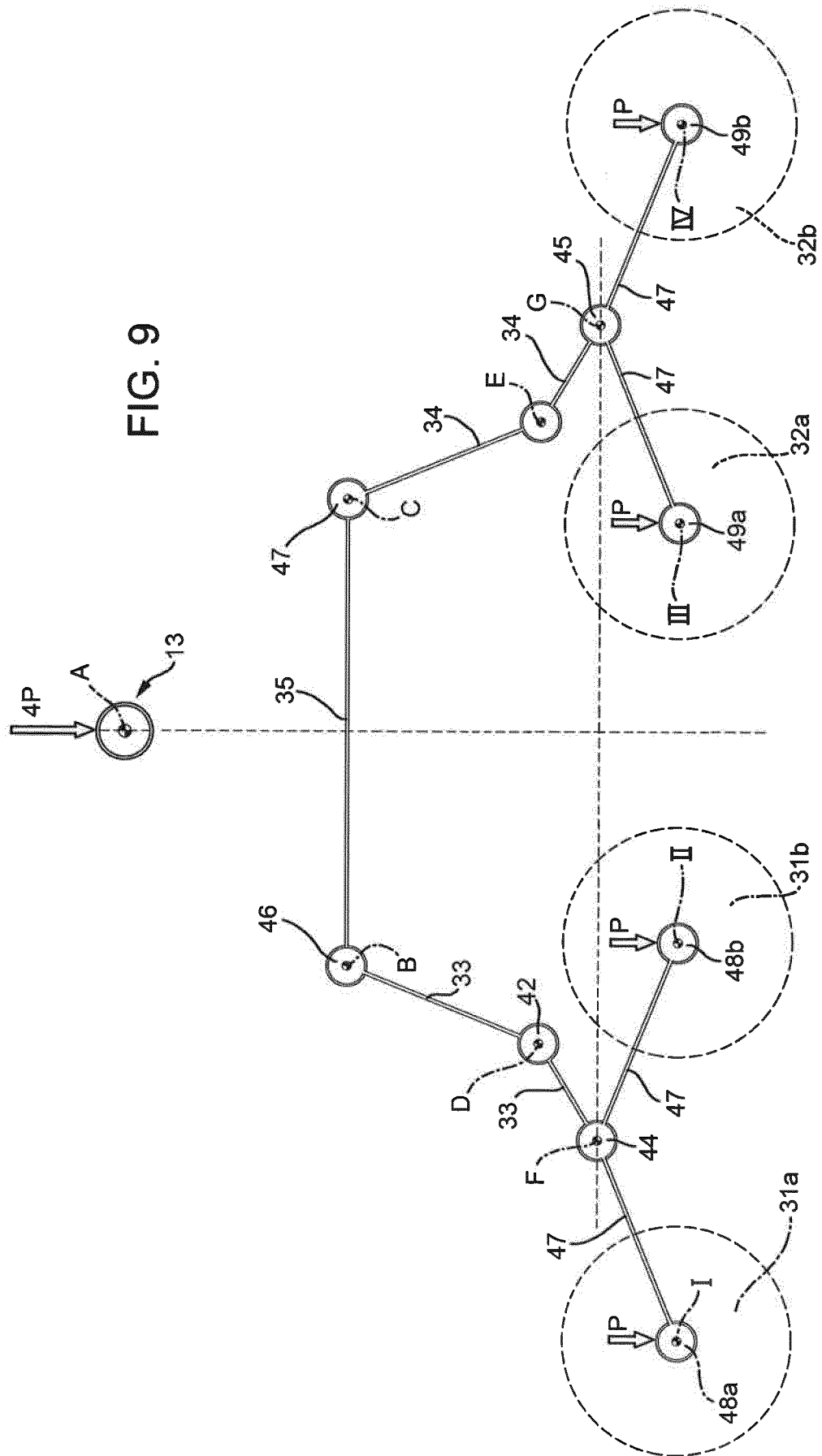


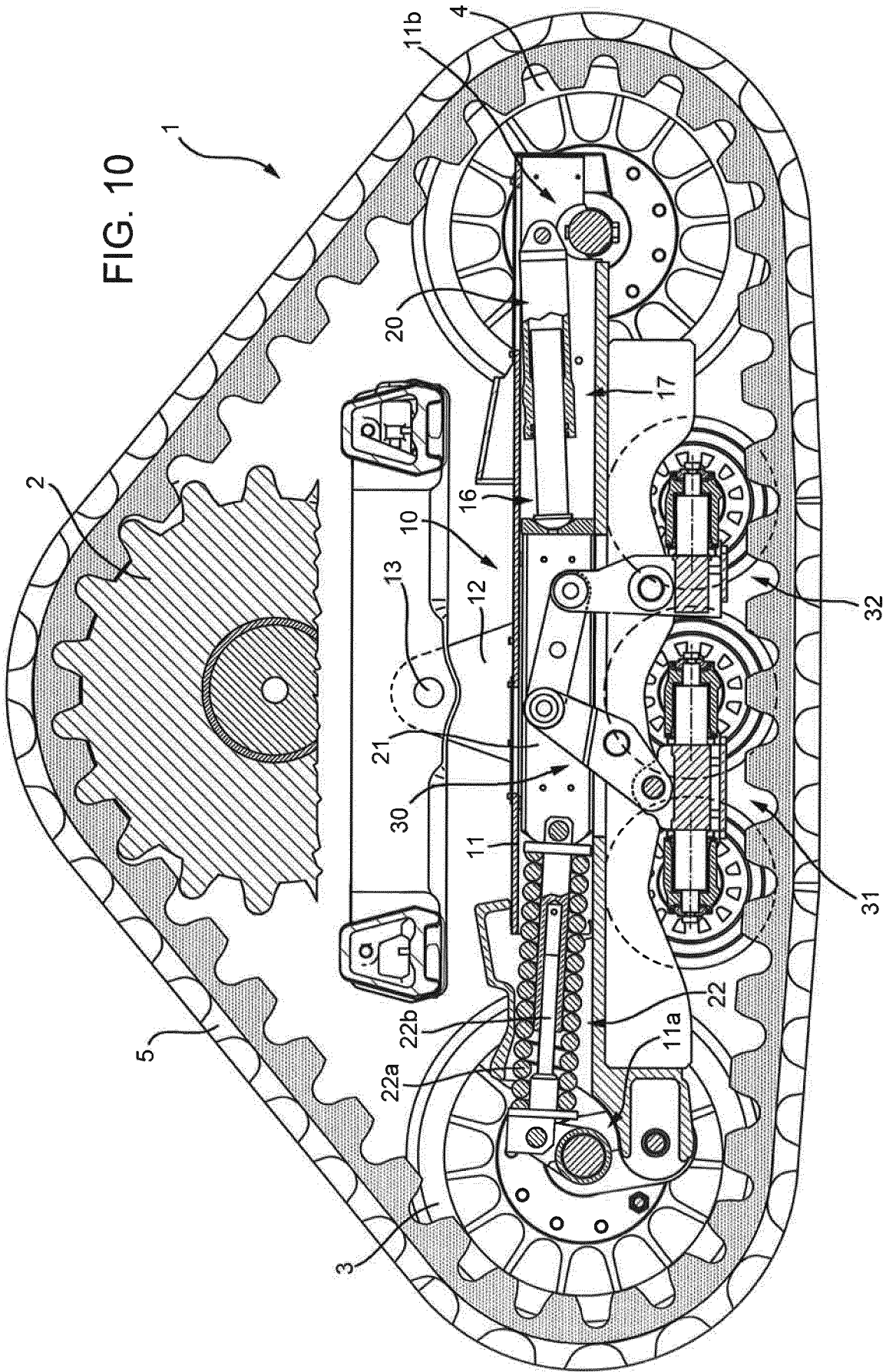
FIG. 7

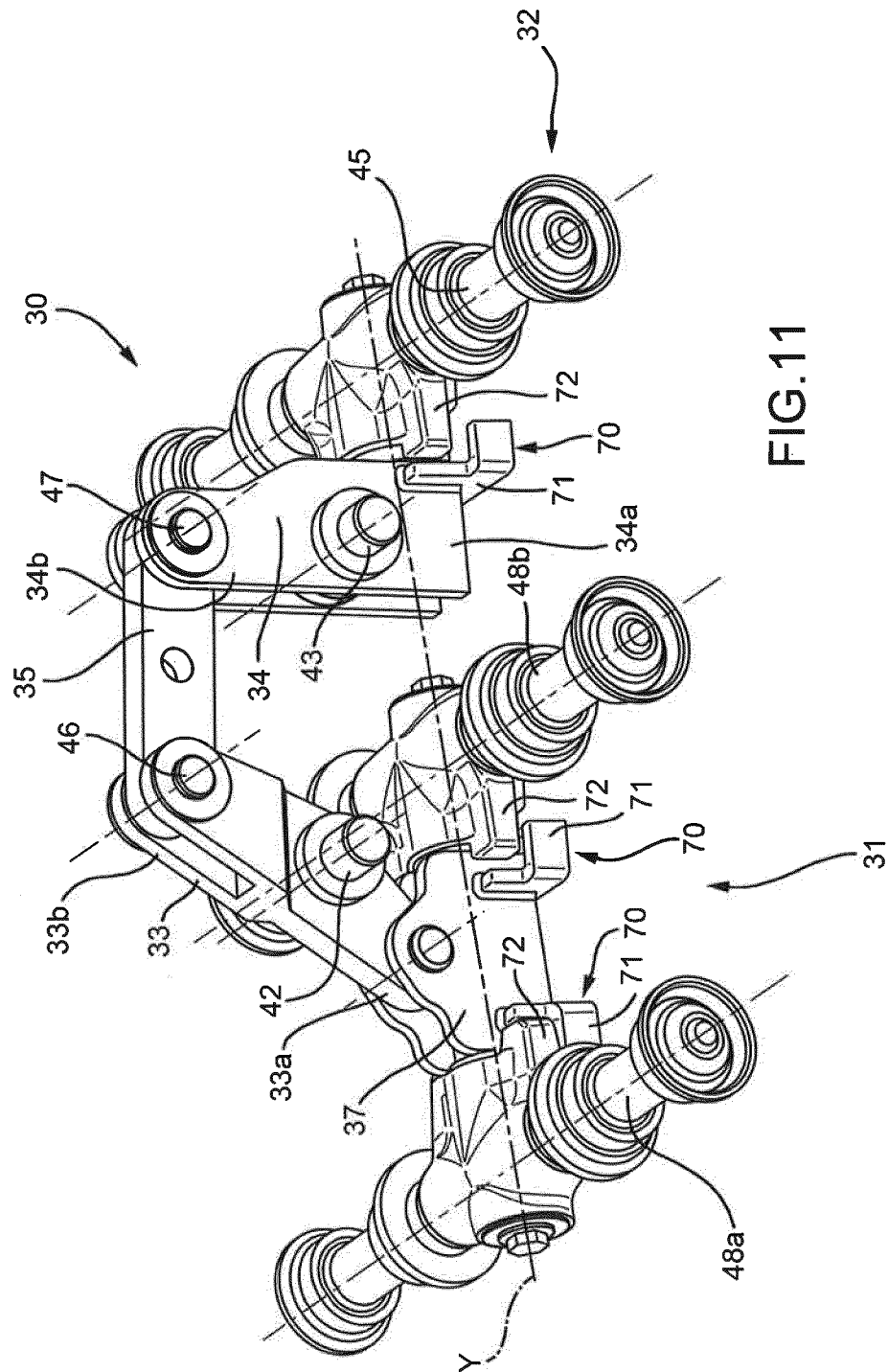


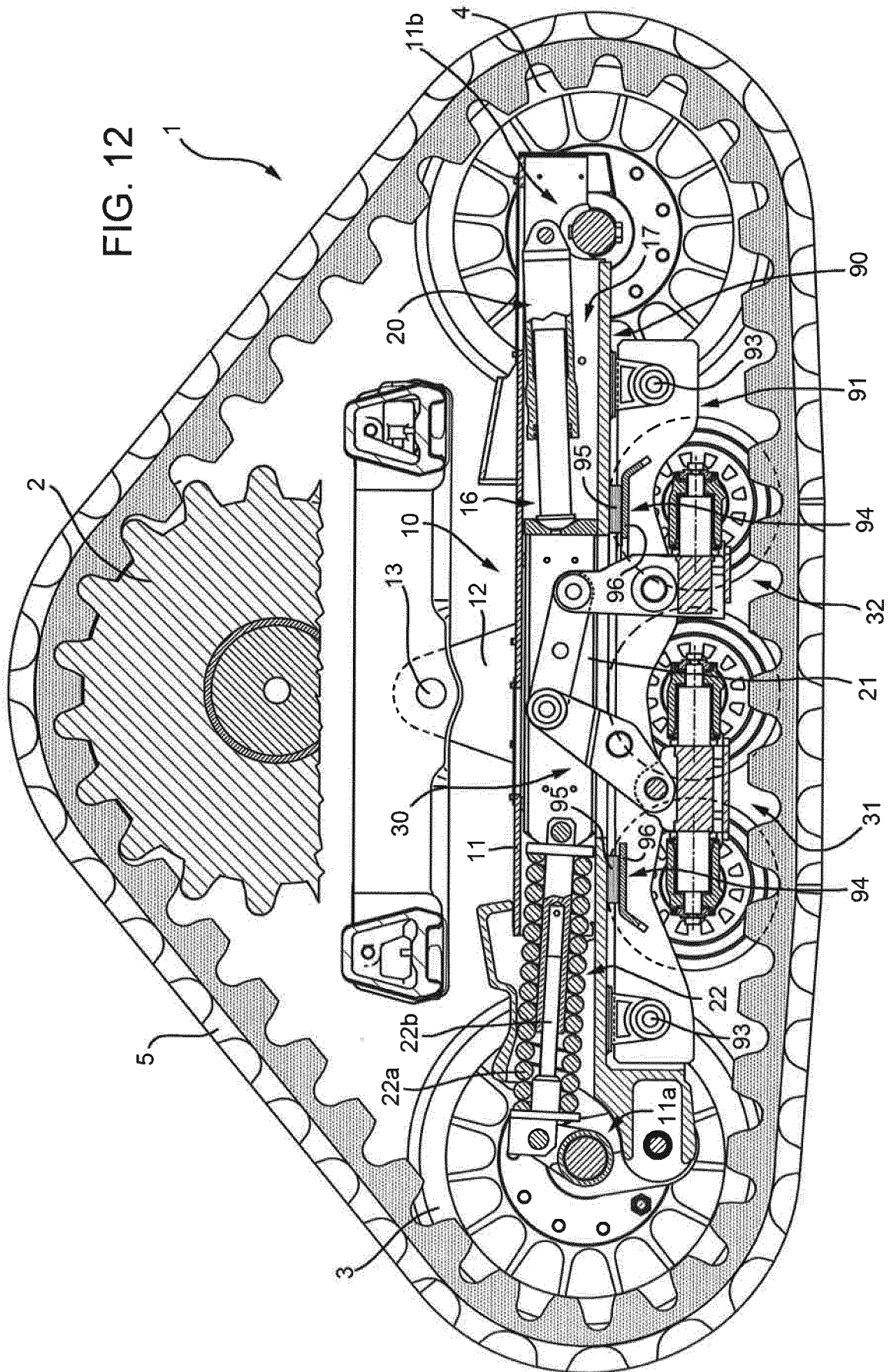


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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/054038

A. CLASSIFICATION OF SUBJECT MATTER INV. B60G5/01 B60G5/04 B62D55/108 B62D55/104 B62D55/14 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) B60G B62D		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2018/024766 A2 (CNH IND ITALIA SPA [IT]; CNH IND AMERICA LLC [US]; CNH CHINA MAN CO LT) 8 February 2018 (2018-02-08)	1,2,5-7, 9,11,12
Y	figures 3,4 the whole document	3,4,8

X	WO 2018/024762 A2 (CNH IND ITALIA SPA [IT]; CNH IND AMERICA LLC [US]; CNH CHINA MAN CO LT) 8 February 2018 (2018-02-08)	1,2,5-7, 10-12
Y	figures 4,5 the whole document	3,4,8

X	US 1 386 926 A (GEORG HAGELLOCH) 9 August 1921 (1921-08-09)	1,10, 12-15
A	figures 1,2 the whole document	2,5-7

-/-		
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 28 February 2019	Date of mailing of the international search report 08/03/2019	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Sluimer, Paul	

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/054038

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	figure 1 -----	2,5-8
Y	GB 396 888 A (ANSALDO SOCIETA ANONIMA) 17 August 1933 (1933-08-17) cited in the application figure 7 the whole document -----	3,4,8
A	DE 10 2014 115112 A1 (TITAN INTERTRACTOR GMBH [DE]) 21 April 2016 (2016-04-21) paragraph [0035]; figures 3,4 the whole document -----	13-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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WO 2018024766	A2	08-02-2018	NONE
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