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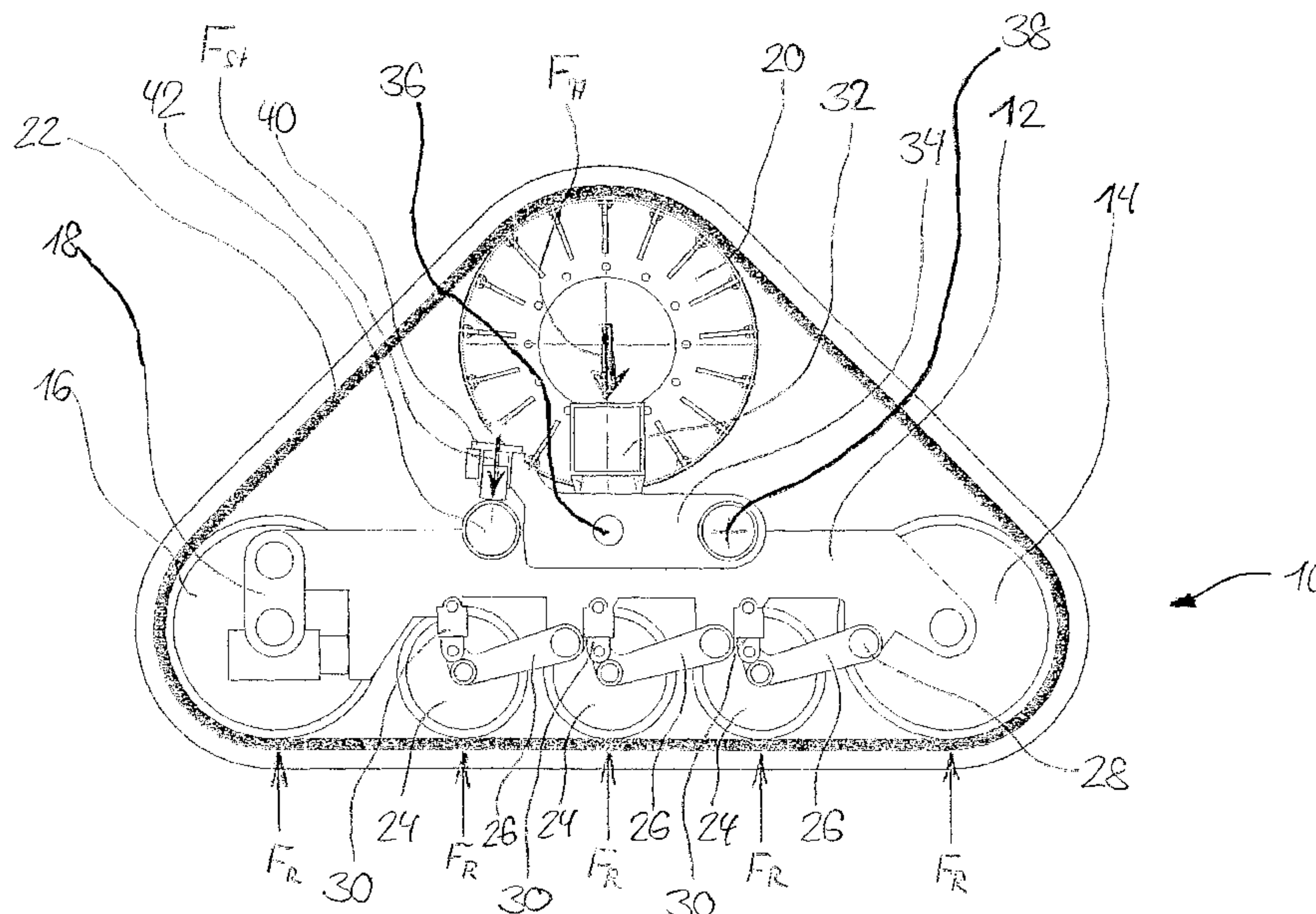
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(54) Titre : MECANISME DE DEPLACEMENT POUR MACHINES AGRICOLES ET VEHICULES TOUT-TERRAINS A MECANISME DE ROULEMENT A COURROIE CONTINUE, ET MECANISME DE ROULEMENT A COURROIE CONTINUE CORRESPONDANT

(54) Title: TRAVELLING MECHANISM FOR AGRICULTURAL MACHINES AND OFF-ROAD VEHICLES HAVING AN ENDLESS BELT-BAND TRAVELLING GEAR AND A CORRESPONDING BELT-BAND TRAVELLING GEAR



(57) **Abrégé/Abstract:**

The invention relates to a spring-suspended, bearing force-optimized belt-band travelling gear (10) for ground vehicles, particularly for self-propelled agricultural machines and other off-road vehicles, comprising at least two outer deflection rollers (14, 15, 16, 17) over whose periphery an endless belt-band (22) rolls off, and at least one supporting roller (24) for supporting the belt-band section, which is in contact with the ground, between both deflection rollers (14, 15, 16, 17). A bogie truck (12, 13), in which the at least two deflection rollers (14, 15, 16, 17) are mounted in a manner that enables them to rotate, is supported against a body frame of the vehicle by means of a first fluidic suspension unit and/or damping unit. The at least one supporting roller (24) is supported on the bogie truck (12, 13) by means of a second fluidic suspension unit and/or damping unit. A fluidic coupling of the suspension units and/or damping units of the bogie truck (12, 13) is provided against the vehicle frame and the at least one supporting roller (24) mounted on the bogie truck (12, 13).

ABSTRACT

The invention relates to a spring-suspended, bearing force-optimized belt-band traveling gear (10) for ground vehicles, particularly for self-propelled agricultural machines and other off-road vehicles, comprising at least two outer deflection rollers (14, 15, 16, 17) over whose periphery an endless belt-band (22) rolls off, and at least one supporting roller (24) for supporting the belt-band section, which is in contact with the ground, between both deflection rollers (14, 15, 16, 17). A bogie truck (12, 13), in which the at least two deflection rollers (14, 15, 16, 17) are mounted in a manner that enables them to rotate, is supported against a body frame of the vehicle by means of a first fluidic suspension unit and/or damping unit. The at least one supporting roller (24) is supported on the bogie truck (12, 13) by means of a second fluidic suspension unit and/or damping unit. A fluidic coupling of the suspension units and/or damping units of the bogie truck (12, 13) is provided against the vehicle frame and the at least one supporting roller (24) mounted on the bogie truck (12, 13).

TRAVELLING MECHANISM FOR AGRICULTURAL MACHINES AND OFF-ROAD VEHICLES HAVING AN ENDLESS BELT-BAND TRAVELLING GEAR AND A CORRESPONDING BELT-BAND TRAVELLING GEAR

DESCRIPTION

[0001] The present invention relates to a traveling mechanism for agricultural machines and off-road vehicles having an endless belt-band traveling gear. The invention further relates to a belt-band traveling gear, particularly a spring-mounted, belt-band traveling gear with optimum bearing strength specifications, said belt-band traveling gear being suitable *inter alia* for self-propelled agricultural machines and other off-road vehicles. Furthermore, the invention relates to a ground vehicle having a spring-mounted belt-band traveling gear with optimum bearing strength specifications.

STATE OF THE ART

[0002] Ground vehicles used in agriculture usually comprise pneumatic tires, which create the interface to the ground. The tires have to support the weight of the vehicle on the one hand while providing the required traction on the other. In very heavy vehicles, for example, in self-propelled harvesters, relatively high surface pressures result below the contact surfaces in spite of very broad tires with six or more individual wheels. These high surface pressures can lead to an impermissibly high soil compaction especially in wet farmlands. Even a reduced internal pressure of tires cannot change much about this problem since in the case of a clearly reduced tire pressure as would be desirable per se for traveling on soft or wet farmlands, the load on the tires is reduced as a result of which the weight of the vehicle can no longer be supported. This relates particularly to vehicles having a greatly fluctuating weight such as e.g. root crop harvesters or the like.

[0003] Chain traveling gears or belt-band traveling gears represent a possible alternative for wheeled traveling mechanisms since the effective contact surface can be increased distinctly using a traveling gear of this type, thus enabling an improved transmission of the traction force on soft and wet farmlands to be realized in most cases. Due to the increasing requirement of protecting the ground and particularly the farmlands used for agriculture from excessively high weight loads resulting from machines and vehicles, those vehicles are being used increasingly which comprise suitable belt-band traveling gears instead of drive wheels and support wheels

having pneumatic tires. This is because the former offer a larger contact surface as compared to the tread contacts of rubber wheels and additionally promise an improved traction force on the soft ground. In practice, those traveling gears are used exclusively, in which either all the carrier rollers and deflection rollers are mounted rigidly on a bogie or at most individual small carrier rollers are linked using spring mounting. The reason for this is that the belt-band traveling gears known from prior art require very high pretensioning forces of the belts in order to absorb sufficiently large loads between the carrier rollers. Therefore the hitherto known belt-band traveling gears comprise deflection rollers that are mostly rigidly mounted.

[0004] The typical disadvantage of these rigidly mounted deflection rollers is a very limited driving and rolling comfort as compared to a wheeled traveling mechanism, particularly during on-road operation. An additional serious disadvantage of the traveling gears known from prior art is that the resulting contact loads cannot be distributed uniformly on all the carrier and deflection rollers. There exists a uniform load distribution only in the ideal case of absolutely even ground conditions. However, if one carrier roller runs on a bump, the carrier roller is overloaded and the load on the other carrier rollers is relieved resulting in turn in high loads on the grounds.

[0005] A traveling mechanism for agricultural machines having resilient belts is known from US 54 09 075 A, in which the track rollers supported on the ground each have a pneumatic suspension system. The pneumatic suspension elements are coupled to one another on the pressure side in order to enable the most uniform possible pressure distribution of the contact surface of the track rollers and the belt in the case of varying ground conditions and ground unevenness.

[0006] Another traveling mechanism for agricultural machines having resilient belts is disclosed in DE 196 20 759 A1. The track rollers of the traveling mechanism are each suspended on rocker arms, which are supported against the frame by means of hydraulic control elements. The hydraulic control elements are coupled to one another in an action-oriented manner in order to achieve a spring effect and to be able to ensure constant ground pressures of the track rollers with varying ground factors and ground unevenness.

[0007] Finally, DE 601 00 536 T2 describes a belt-band traveling gear for an agricultural tractor, which belt-band traveling gear is supposed to enable an adjustment to varying ground

conditions and ground unevenness by means of a spring suspension of the track rollers and the track roller frames. The suspension system comprises several air spring systems by means of which each of the front and rear crawler frames or the individual track rollers are supported.

[0008] The known spring systems for belt-band traveling gears or chain traveling gears enable an improved pressure distribution of the effective traveling mechanism contact surfaces between the outer deflection rollers in the case of an uneven ground surface by means of the resiliently suspended track rollers. However, they do not enable any uniform pressure distribution over the entire length of the traveling gear, as a result of which very high pressure peaks are transmitted partially in the farmlands even in the case of traveling mechanisms known from prior art.

OBJECT OF THE INVENTION

[0009] A priority objective of the present invention is to avoid the afore-mentioned disadvantages and to provide a belt-band traveling gear, which enables a more uniform ground loading and additionally offers increased driving and rolling comfort.

[0010] A spring-mounted belt-band traveling gear with optimum bearing load specifications for ground vehicles, said belt-band traveling gear having the characteristics of the independent clause 1, comprises at least two outer deflection rollers, over whose periphery an endless belt rolls off and also at least one support wheel or a supporting roller for supporting the belt section which is in contact with the ground, between both the deflection rollers. Both the deflection rollers are mounted in a bogie in a manner that enables them to rotate, which bogie is supported against a body frame of the vehicle by means of a first fluidic suspension and/or damping unit. The at least one supporting roller is supported on the bogie by means of a second fluidic suspension unit and/or damping unit.

[0011] The belt-band traveling gear according to the present invention comprises a fluidic coupling of the first fluidic suspension and/or damping unit, by means of which the bogie is supported against the chassis frame, with the second suspension and/or damping unit, by means of which the at least one supporting roller is mounted on the bogie.

[0012] Although the term “endless belt-band” has been mostly used in the present invention to mean a belt-band, it can also be meant to connote e.g. a resilient belt of suitable material – especially an elastomer material with or without reinforcing fabric inserts or wire inserts.

However, a crawler or the like which can optionally be provided with damping supports can also be used as a belt within the scope of the present invention.

[0013] The fluidic suspension and/or damping units within the meaning of the present invention can be, e.g. lever units, which are supported by means of suitable fluid cylinders with a springy or damping effect. A pure suspension system can be implemented e.g. by means of a gas filling as the circumflowing fluid. In this case, additional damping units, e.g. hydraulic dampers or mechanical (friction) dampers or the like could be provided, if necessary. The fluidic suspension and/or damping units could also be a part of a hydropneumatic suspension and/or damping system, in which the relatively slow circumflow times of a hydraulic fluid are used for vibration damping and in which the rapid response behavior and the compressibility of a suitable pressure gas are used for implementing a desired springing effect.

[0014] The belt-band traveling gear according to the present invention having the characteristics of the independent claim comprises at least two carrier or deflection rollers of the traveling gear which are mounted by means of rockers or another suitable bearing on the bogie in a manner that enables them to rotate. Naturally more than two deflection rollers can also be provided if this is expedient and if the corresponding installation space is available. The corresponding portion of load is applied on the individual carrier rollers preferably by means of suitable supporting elements, e.g. the fluidic units mentioned above or suitable supporting cylinders. The carrier and deflection rollers, over which the endless belt-band is tensioned, are preferably connected rigidly to the bogie or have a belt tension device integrated therein.

[0015] The belt-band traveling gear can be e.g. a triangular traction unit comprising a central or laterally offset, overhead drive wheel. Such a triangular traction unit is particularly suitable for being adapted to already existing wheel suspensions in order to make a partly or completely crawler-mounted vehicle from a wheeled vehicle.

[0016] In one design form of the present invention, the belt-band traveling gear comprises two or more supporting rollers of the same or varying size, which are each arranged between both the deflection rollers for supporting the belt section, which is in contact with the ground. Depending on the required length of the load-bearing section of the belt, almost any number of supporting rollers can be arranged between both the outer carrier or deflection rollers which are

supported preferably individually or also in pairs or groups against the bogie by means of second fluid elements.

[0017] Furthermore, in a preferred variant of the present invention, the supporting rollers are each suspended or mounted so as to enable a definite twist of the preferably resilient belt. This can be possible by means of a suitable swivelability of the rotation axes of the supporting rollers about a real or virtual swivel axis oriented approximately parallel to the longitudinal direction of the vehicle. In a sufficiently resilient belt, it is possible in this manner to prevent the belt from digging into the ground with only one load-bearing edge in the case of a greatly uneven ground. The pivoting angle of the supporting rollers can be limited, if necessary, in order to reliably prevent the belt from wearing.

[0018] Optionally, it is also possible to actively influence this swivelability of the individual supporting rollers by which an improved traction can be achieved in certain driving situations. Thus it can be expedient to press the edges of the belt lightly into the slope e.g. during a drive along a slope, in order to create a certain cant of the belt with the ground and in order to thus prevent the vehicle from slipping or drifting off. This cant of the belt can be supported firstly by the above-mentioned horizontal deviation of individual or all the carrier rollers, by their intensified pressurization (see explanation below) or also by a combination of both the control interventions.

[0019] In addition, it can also be expedient for the bogie or the two, three, four or more bogies themselves to be gimbal-mounted or suspended in any another way in order to enable a slope compensation for the vehicle body. This slope compensation can be effected optionally by means of inclination sensors and associated settling circuits or manually by the driver.

[0020] In order to implement a largely uniform load distribution on all the carrier and deflection rollers, the vehicle axle load to be supported is initially transmitted in a suspension arranged on the bogie, e.g. a rocker connected to the bogie in a manner that enables said rocker to rotate. This rocker is then in turn supported against the bogie by means of one supporting cylinder or an appropriately constructive design of several supporting cylinders to prevent said rocker from twisting. Corresponding to the applied axle load, a system pressure dependent thereon is built up in the supporting cylinder/s, which usually are hydraulic or pneumatic cylinders.

[0021] In one design form according to the present invention, this system pressure is now used for being applied to the supporting cylinders of the carrier rollers and to apply the same portion of axle load to every carrier roller taking into consideration all the lever and cylinder surface area ratios. This means that e.g. in a bogie with a total of five carrier and deflection rollers, altogether three carrier rollers are mounted on the bogie by means of one rocker each so as to enable them to rotate and are supported by means of supporting cylinders. The active surfaces of the supporting cylinders for the rocker for absorbing the axle load and the active surfaces of the three supporting cylinders for the rotatably mounted carrier rollers must then be adjusted to the rockers taking the lever ratios into account so as to be able to support $1/5$ of the applied axle load on each carrier roller in the case of the same system pressure in all the cylinders. The advantage of a uniform ground loading over the entire contact surface of a belt-band traveling gear is thus ensured.

[0022] In another design form according to the present invention, an accumulator – usually a hydropneumatic reservoir – can be connected to the mutually supporting cylinder system. Thus, a springy effect is also achieved advantageously and a corresponding belt-band traveling gear is decoupled from the associated vehicle frame, so that the highest driving and rolling comfort is possible.

[0023] According to the present invention, and for absorbing all the occurring forces on a belt-band traveling gear, the rocker designed for absorbing and transmitting said forces in the bogie must have a defined width and lever lengths that are intended for taking up distances to be specified. Thus, the given space conditions within a traveling gear are then exceeded under certain circumstances. In a design form according to the present invention, the rocker is then attached so as to be offset laterally by a required measure, preferably towards the center of the vehicle. The operating mode of the overall system is however not affected thereby.

[0024] Varying operating conditions can be realized for a belt-band traveling gear by means of another design form of the pressure system – usually a hydraulic system according to the present invention. Thus, during on-road operation the traveling gear is preferably operated with a spring effect, in which an accumulator is connected. Since the system pressure also increases or drops in the case of a varying axle load, it may be expedient, e.g. to detect the displacement of the rocker for absorbing the axle load and to accordingly track the fluid volume in the system by

means of a corresponding pressure source and power source. This practically corresponds to a level control system as has been realized already many times and therefore need not be described further.

[0025] A variant according to the present invention can provide an amplitude-dependent variation of the spring rate. Here, e.g. two or more accumulators can be provided, which can be connected or disconnected depending on the load condition of the vehicle. Thus e.g. an amplitude or the traveling gear rocker can be detected. The vibration amplitude normally increases in the case of a larger vehicle load and greater ground unevenness and higher travel speed. This can be counteracted by reinforcing the pressure fluid system particularly by decoupling one of several accumulators. A finer adjustment can be carried out by variably disconnecting one, two, or more accumulators from the pressure fluid system so as to achieve a variable spring rate, which can be adapted to the varying driving and operating conditions. Optionally, the variations mentioned above can also be made during travel particularly by means of a suitable settling circuit.

[0026] If a disconnection of the suspension system is desired, this is possible easily by disconnecting the accumulator or separating it from the remaining hydraulic system. This can be the case e.g. if a harvester is equipped with the automatic depth control of a header and the control mode could also be influenced negatively by a suspension. Usually there is also no requirement of tracking the system volume in this operating condition since there occur no volume changes in the case of varying system pressure in a then closed system formed between supporting cylinders of the axle rocker and supporting cylinders of the carrier rollers. The sum of the volumes remains constant.

[0027] Another advantage is achieved according to the present invention by decoupling the supporting cylinders and impinging the rotatably mounted carrier rollers by a pressure source deliberately so that these carrier rollers are loaded or relieved of load accordingly. Thus it can be advantageous, e.g. on a side slope, to shorten the contact surface of the bogie by loading the middle carrier rollers more heavily than the front and rear carrier rollers so as to largely be able to prevent a lateral slippage on the slope. This variant also can be equipped in turn with or without suspension.

[0028] The belt-band traveling gear according to the present invention is particularly suitable for self-propelling agricultural work machines, for forest machines and construction machines and also for other commercial vehicles and transport vehicles, which can be used on soft, resilient and/or uneven grounds and also on impassable terrains. The advantages of the vehicles having conventional wheeled traveling mechanisms, namely their flexibility, their relatively good maneuverability and the relatively high travel speed are predominantly influential during on-road operation or when traveling on paved dry grounds. In contrast, wheeled traveling gears reach their limits in the case of very high vehicle weights.

[0029] The disadvantages usually associated with belt-band traveling gears, namely the transmission of relatively high shearing forces during the transfer of high traction forces, relatively poor maneuverability, low travel speed, high wear of the belts and last but not least the loss of comfort and the strong tendency of the vehicle to jump and rock, can be prevented largely with the present invention as a result of which the belt-band traveling gear according to the present invention enables a versatile use of such traveling gears for the most different types of vehicles and applications. This was not the case in the hitherto known systems or was achievable only with high design-related expenditure.

[0030] In addition, the belt-band traveling gear according to the present invention enables a very easily realizable, automatically controllable or manually adjustable slope compensation since a certain inclination can be compensated during travel uphill or downhill by a corresponding pressurization of the traveling gear supporting cylinders. A camber compensation of the vehicle body can be achieved in an additional gimbal-mounted suspension or any other suitable suspension of the bogie preferably on the left and right side each independent of the other. This firstly leads to an improved driving comfort and secondly an increased tilt resistance and improved traction.

[0031] In addition, the present invention relates to a traveling mechanism, which is equipped with at least two belt-band traveling gears according to one of the previously described embodiments. A vehicle provided with such a traveling mechanism could optionally comprise two, three, four or more such belt-band traveling gears. Thus e.g. an arrangement with two rear belt-band traveling gears and one or two front, steerable, pneumatic wheels is possible. Naturally, special-purpose vehicles are also feasible which comprise only one rear preferably

centrally arranged belt-band traveling gear according to one of the previously described embodiments and two front wheels. Traveling mechanisms with four belt-band traveling gears, of which two or even all are steerable, are also possible. Numerous modifications and variations are possible depending on the desired application of the vehicle or the traveling mechanism.

DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0032] The present invention shall now be explained in detail on the basis of a preferred exemplary embodiment with reference to the attached drawings. The example serves for illustrating the invention. However, it is by no means to be construed as a restriction of the invention. Identical parts and parts performing identical functions are denoted by the same reference numerals; repeat explanations have been avoided to some extent.

Fig. 1 shows a schematic drawing of a basic structure of a variant of the belt-band traveling gear according to the present invention.

Fig. 2 shows a schematic drawing of a section of the basic structure of the belt-band traveling gear shown in fig. 1.

Fig. 3 shows a schematic sectional view of the belt-band traveling gear.

Fig. 4 shows a lateral view of another variant of the belt-band traveling gear.

Fig. 5 shows a possible structure of the piping for connecting the elements of the belt-band traveling gear based on a schematic block diagram.

Fig. 6 shows a schematic perspective view of a rigid vehicle axle equipped with two belt-band traveling gears according to the present invention.

Fig. 7 shows another variant of the embodiment of a belt-band traveling gear according to the present invention, which is equipped with a double rocker for the bearing of a symmetrically designed bogie.

[0033] Fig. 1 shows the schematic diagram of a first variant of a basic structure of the belt traveling gear **10**, said basic structure being selected in the form of an isosceles triangle here, since this is an advantageous form with regard to the installation space in an agricultural vehicle (not illustrated).

[0034] The figure shows the lateral view of the bogie **12** on which the rear carrier and deflection roller **14** and the front carrier and deflection roller **16** are fitted tightly and mounted in

a manner that allows them to rotate. In the exemplary embodiment illustrated, the front carrier and deflection roller **16** is provided with a suitable clamping device – here a suitable clamping cylinder **18**. Between both the outer rollers **14** and **16** and with its rotation axis arranged above the clamping cylinder there lies a drive wheel **20** on the bogie **12**, which drive wheel is to be designed according to the driving type selected e.g. mechanical or even hydraulic, but is not illustrated in detail here.

[0035] The wrapping of the preferably resilient belt **22** around the drive wheel **20**, carrier and deflection roller at the front **16** and carrier and deflection roller at the back **14** results in the basic shape of the belt-band traveling gear **10**. Furthermore, small supporting rollers or carrier rollers **24** are visible which are each mounted on associated rockers **26** in a manner that enables them to rotate about rotation axes **28**. The carrier rollers **24** are each then supported against the bogie **12** by means of a supporting cylinder **30** assigned to each carrier roller and by means of the rockers **26**.

[0036] Furthermore, in fig. 1 a carrying axle **32** of any vehicle can be seen which transmits the axle load F_A into the rocker **34** of the traveling gear by means of a rotary bearing **36** using which the traveling gear rocker **34** is supported against the traveling mechanism carrying axle **32**. It can also be seen that the bogie **12** of the belt-band traveling gear **10** is mounted on the rocker **34** of the traveling gear in a manner that enables said bogie to rotate about the rotation axis **38**. It is further apparent that the traveling gear rocker **34** is supported by means of the traveling gear supporting cylinder/s **40** on a supporting axle **42**, thus preventing said traveling gear rocker from twisting due to the transmitted axle load F_A . Depending on the design, the rotation axis **38** of the traveling gear rocker and the supporting axle **42** are either a component of the bogie **12** or fixedly connected thereto. Thus according to the invention the transmitted axle load F_A can be transmitted in the bogie **12** by the supporting force F_{ST} applied by the traveling gear supporting cylinder **40** and the connection of the traveling gear rocker **34**.

[0037] According to the present invention, depending on the axle load F_A , the lever ratios and the selected cylinder surface, a system pressure is built up in the traveling gear supporting cylinder **40** for achieving the supporting force F_{ST} on the traveling gear, which system pressure then in turn for impinging the supporting cylinders **30** for the carrier rollers **24** by means of a

piping and hose line system (not illustrated in detail here) as is shown schematically in fig. 5 by way of example.

[0038] If all the lever and active surface ratios are configured appropriately in this system, the transmitted axle load F_A is distributed uniformly on all the carrier rollers **24** and also the front carrier and deflection roller **16** and the rear carrier and deflection roller **14** from which there results a uniform contact load F_R of the carrier and deflection rollers **14**, **16** and **24**.

[0039] Fig. 2 schematically shows a section of the basic structure of a belt-band traveling gear **10** shown in fig. 1. On the basis of the drawing it can be seen how the axle load F_A is transmitted in the traveling gear rocker **34** according to the invention by means of the rotary bearing **36** of the carrying axle. Furthermore, the rotation axis **38** of the traveling gear rocker **34** is mounted rotatably on the bogie **12**. The supporting cylinder **30** connected to the traveling gear rocker **34** is supported against the supporting axle **42** of the bogie **12** and thus prevents the traveling gear rocker **34** from twisting.

[0040] A supporting force F_{ST} is generated on the traveling gear, which supporting force is dependent on the lever length (axle load) L_A and the lever length (support load) L_S and also the axle load F_A transmitted by means of the traveling mechanism carrying axle **32**. The system pressure required for the supporting force F_{ST} on the traveling gear results on the basis of the selected cylinder diameter for the traveling gear supporting cylinder/s **40** and the active surface resulting therefrom.

[0041] The connection of the carrier rollers **24** to the bogie **12** by means of the carrier roller rockers **26** and the rotation axes **28** of the rockers and also the support of the carrier roller rockers **26** against the bogie **12** by means of the supporting cylinders **30** for the carrier roller **24**, said supporting cylinders **30** being mounted in the rotary axes **44** on the bogie **12** and the rotation axes **46** on the rocker **26**, are also shown according to the invention.

[0042] By means of the system pressure built up in the traveling gear supporting cylinder **40** and transmitted by means of a corresponding piping (not illustrated) to the carrier roller supporting cylinders **30**, these support cylinders **30** generate a corresponding supporting force F_Z on the respective carrier roller **24** so that taking account the lever length l_{RS} of the carrier roller rocker and the lever length l_{ST} between the rotation axis **28** and support cylinder **30**, a contact

load F_R of the carrier and deflection rollers is created that is equal for all the carrier and deflection rollers.

[0043] The schematic drawing of fig. 3 shows a sectional view of the belt-band traveling gear **10** in a plan view so that it is apparent that, e.g. in the exemplary embodiment shown in fig. 1, the traveling gear rocker **34** has a broad rocker B_S for absorbing all the acting forces. Due to the arrangement of the drive wheel **20**, it is necessary in this case to offset the traveling gear rocker **34** then by a distance A_S between the rocker and the center of the traveling gear. It makes sense to offset said traveling gear rocker **34** towards the center of the vehicle. The connection to the bogie **12** is effected by the appropriately designed rotation axis **38** of the traveling gear rocker and the supporting axle **42** of the bogie **12**. Due to the broad rocker B_S it is also possible to attach several traveling gear supporting cylinders **40** according to fig. 3, two supporting cylinders being attached in the exemplary embodiment illustrated.

[0044] The schematic drawing of fig. 4 further shows a lateral view of the spring-mounted belt-band traveling gear **10** with optimum bearing load specifications in an alternative embodiment, namely in a so-called V-formation. The figure shows that by means of a front carrier and deflection roller **17** of smaller diameter and a larger rear carrier and deflection roller **15** which can also simultaneously serve e.g. as a drive roller, a belt-band run can be drawn which permits the installation of the traveling gear rocker **34** centrally above the bogie **13** in the case of a bogie **13** that is likewise adapted to the requirements, so that there is no distance A_S between the rocker and the center of the traveling gear (c.f. fig. 3) or that this distance is equal to zero.

[0045] The remaining elements of the exemplary embodiment shown in fig. 4 correspond to the components described already based on figures 1 to 3 and shall therefore not be explained again.

[0046] On the basis of a schematic block diagram, the schematic drawing of fig. 5 shows the basic structure of a possible piping for connecting all the fluidic or hydraulic elements and thus the possible operating conditions of the belt-band traveling gear according to the present invention. It is apparent how the traveling gear supporting cylinder/s **40**, the carrier roller supporting cylinders **30**, an accumulator **48** and a pressure source P are initially interconnected according to the present invention by means of a piping and hose line system **50**. The valves **52**,

54, 56 and 58 are integrated in the piping and hose line system **50**, as is shown here schematically.

[0047] In the case of the occurring high loads of agricultural machines, this system can advantageously be a hydraulic system. However, the pressure system can comprise a gas or air as a pressure medium. The following operating conditions of the belt-band traveling gear **10** are possible according to an exemplary embodiment of the present invention. If at first only the supporting cylinders **30** and **40** and also the accumulator **48** are interconnected, i.e. valves **52** and **56** are open, valves **54** and **58** are closed, then an axle load is distributed uniformly on the carrier rollers and an active suspension of the overall system is achieved simultaneously with the help of a hydropneumatically designed accumulator **48**. In the case of a constant axle load, the pressure source **P** need not be necessarily connected since there exists an approximately constant system pressure in the closed system. However, if the axle load changes, e.g. due to an increasing loading of a harvester, the system pressure increases and the fluid volume is displaced in the case of an active suspension in the accumulator **48**. It is then expedient to track the volume by means of the pressure source **P** (valve **54** open). This can take place using control engineering by detecting the stroke of the traveling gear rocker **34**.

[0048] Detailed description of this will not be necessary since this is known from prior art and practically represents a type of level control system.

[0049] On the other hand, if an active suspension of the overall system is not desired, then the active suspension can be disconnected by disconnecting the accumulator **48** (valve **52** closed). Then only one fluid volume is exchanged between the supporting cylinders **40** and **30** according to the carrier roller movement, in the case of a system pressure determined by the axle load. The uniform distribution of the axle load is thus unaffected thereby.

[0050] If certain operating conditions or driving situations require the central carrier rollers **24** to be loaded or relieved of load, then this can take place by separating the traveling gear supporting cylinder **40** from the carrier roller supporting cylinders **30**. The valves **56** and **54** are closed in doing so and valve **58** opens. Thus the loading of the carrier rollers **24** can be controlled by means of the pressure source **P**. Thus, e.g. on a laterally slanted ground (slide slope), an increased loading of the carrier rollers located down-slope can take place so that the contact surface of the traveling gear is shortened, which can be advantageous to prevent lateral

slippage or drifting. Simultaneously, the accumulator **48** can be connected to or disconnected from the traveling gear supporting cylinder **40** by opening or closing the valve **52**, which in turn corresponds to an operating condition with or without active suspension.

[0051] The schematic perspective view of fig. 6 illustrates a rigid vehicle axle **32**, which is equipped with two belt-band traveling gears **10** according to the invention corresponding to the variant of the embodiment shown in figures 1 to 3. It is apparent that instead of conventional wheels with pneumatic tires, the drive wheels **20** of the respective left and right belt-band traveling gears **10** are now connected to the hubs of the rigid carrying axle **32** of the vehicle. The belt-band traveling gears **10** according to the present invention are thus basically suitable for the universal backfitting of existing wheeled traveling mechanisms.

[0052] Finally, fig. 7 shows another variant of the embodiment of a belt-band traveling gear **10** according to the present invention, which belt-band traveling gear is equipped with a double rocker for mounting a symmetrically designed bogie **12**. Both the similarly designed and largely symmetrically arranged traveling gear rockers **34** are coupled by means of the common bolt of the rotation axis **38**. In the exemplary embodiment illustrated, both the rockers **34** enclose a hydrostatic wheel hub motor **60**, which is coupled to a hydrostatic drive system of the vehicle (not illustrated) by means of a connection **62**. Alternatively, the drive can also be configured by means of e.g. a switchable planetary gear or any other conventional mechanical method if necessary.

[0053] In the variant shown in fig. 7, the carrier and deflection rollers **14** and **16** and also the carrier rollers **24** are each divided centrally and mounted on the centrally arranged, relatively narrowly designed bogie **12**.

[0054] The exemplary embodiment shows a spring-mounted, belt-band traveling gear **10** with optimum bearing load specifications, particularly for self-propelling agricultural machines and other off-road vehicles, in which belt-band traveling gear all the small carrier rollers **24** are connected to the bogie **12** by means of a rocker **26** in a manner that enables said carrier rollers to rotate about the carrier roller rocker rotation axes **28**. Another characteristic is that every carrier roller rocker **26** and thus the small carrier rollers **24** are supported by means of a carrier roller supporting cylinder **30** on each carrier roller rocker **26** towards the bogie **12**. The carrier roller supporting cylinders **30** are each mounted on the side of the bogie in the rotation axes **44** of the

carrier roller supporting cylinder **30** on the bogie and in the carrier roller rockers **26** in the rotation axis **46**. Another characteristic is that the first front deflection and carrier roller **16** and the last rear deflection and carrier roller **14** are each connected to the bogie **12** fixedly or by means of a clamping device with clamping cylinder **18**. The number x of the small carrier rollers **24** is to be determined corresponding to the conditions and is always $x = n - 2$ in the case of a total number n of contact rollers. Another characteristic of the traveling gear **10** is that an axle load F_A is transmitted initially in the traveling gear rocker **34** by the traveling mechanism carrying axle **32** via the rotary bearing **15** [sic: **36**] of the traveling mechanism carrying axle, said rotary bearing being necessary for ground balance. The traveling gear rocker **34** is in turn mounted rotatably on the rotation axis **38** of the traveling gear rocker and is supported on the opposing side by means of one or more traveling gear supporting cylinders **40** against the traveling gear supporting cylinder supporting axle **42**.

[0055] Since the rotation axis **38** of the traveling gear rocker and the supporting axle **42** of the traveling gear supporting cylinder are a component of the bogie **12** or are connected fixedly thereto depending on technical solutions, the axle load F_A transmitted into the traveling gear rocker **34** is transferred to the bogie **12**. The characterizing part is that corresponding to the lever ratios of the lever length axle load (L_A) to the lever length supporting load (L_{ST}), the traveling gear support cylinder/s **40** builds up a supporting force F_{ST} on the traveling gear depending on the axle load F_A . Here the equation $F_{ST} = F_A \times L_A / L_{ST}$ holds true.

[0056] Another characteristic is that for achieving an equalization of the contact force F_R of the carrier and deflection rollers, the traveling gear supporting cylinder/s **40** are then interconnected with all the carrier roller supporting cylinders **30** by means of a piping and hose line system **50**. Since the contact force F_R of the carrier and deflection rollers is ideally the n^{th} part of the axle load F_A in the case of a number of n carrier rollers, the active surfaces of the traveling gear supporting cylinders **40** must be adjusted to those of the carrier roller supporting cylinders **30** in such a way that at a system pressure P and taking into account the lever lengths l_{RS} of the carrier roller rocker and the lever length l_{ST} of the carrier roller supporting cylinders, a supporting force F_Z results on the carrier rollers which results in a corresponding contact load F_R of the carrier and deflection rollers at $F_R = F_A / n$.

[0057] Another characteristic is that due to the involvement of the preferably hydropneumatic accumulator **48**, a spring effect of the overall system of the belt-band traveling gear is achieved in that the traveling gear rocker **34** and the traveling gear supporting cylinder/s **40** absorb corresponding vibrations.

[0058] An additional part of the exemplary embodiment is a spring-mounted, belt-band traveling gear with optimum bearing load specifications which belt-band traveling gear is designed as a triangular traction unit with a, centrally, overhead drive wheel **20**, wherein the traveling gear rocker **34** having a rocker width B_S is mounted for installation reasons, i.e. lack of space such that it is offset by a center distance A_S of the rocker from the center of the belt **22**. Though the traveling gear rocker **34** then absorbs the corresponding torsion, the interaction of the above-mentioned components is not affected thereby.

[0059] In belt-band traveling gears having corresponding installation space due to larger deflection rollers **17** at the front and at the back **15** (cf. fig. 4), the center distance A_S to the rocker is expediently selected to be smaller, if necessary even equal to zero.

[0060] Another part of the exemplary embodiment is a spring-loaded, belt-band traveling gear with optimum bearing load specifications in which belt-band traveling gear, the carrier roller supporting cylinders **30**, the traveling gear supporting cylinder/s **40** and the accumulator **48** are interconnected by means of the piping and hose line system **50** and the valves **52**, **54**, **56** and **58** in a manner so as to enable the following operating conditions.

[0061] A characteristic of an operating condition with active suspension is that all the elements, i.e. the carrier roller supporting cylinders **30**, the traveling gear supporting cylinders **40** and the accumulator **48** are connected to one another; the system pressure P is then adjusted accordingly depending on the axle load F_A in the case of a filled system. In the case of varying axle loads F_A , a position detection system is expediently integrated in the traveling gear supporting cylinder **40** or assigned thereto so that the system pressure P and thus the stroke can be tracked accordingly. Since these systems are already known from the prior art, these will not be explained in detail.

[0062] A characteristic of an operating condition with deactivated suspension is that only the traveling gear supporting cylinder/s **40** are connected to the carrier roller supporting cylinders **30** wherein the valves **52**, **54** and **58** are closed. In the system formed between the traveling gear

supporting cylinder **40** and the carrier roller supporting cylinders **30**, a system pressure P is built up depending on the axle load F_A .

[0063] There exists another characterizing operating condition when the valves **54** and **56** are closed. Here, the carrier roller supporting cylinders **30** alone are connected to the pressure source and the system pressure P . Thus there no longer exists a dependence of the rocker displacement on the axle load F_A . However, it is possible to load the carrier rollers **24** or relieve them of loads in a targeted manner, which could be expedient in certain driving situations. Simultaneously, the accumulator **48** can be connected by means of the valve **52** to the traveling gear supporting cylinder **40** or it can be separated from the latter so that it is possible to drive selectively with or without the suspension.

[0064] Naturally, for certain special applications, control systems can also be developed, in which the previously mentioned different operating conditions (switch states of the valves etc.) for every individual traveling gear **10** or for every individual cylinder can be controlled individually.

[0065] The characteristics of the invention disclosed in the present description, drawings and claims can be of importance both individually and also in any combinations for implementing the invention in its different design forms. The invention is not restricted to the exemplary embodiments described above. Rather a number of variants and modifications are feasible which utilize the principle according to the invention and are therefore also included within the scope of protection.

LIST OF REFERENCE NUMERALS

- 10** Belt-band traveling gear
- 12** Bogie
- 13** Bogie (V-formation)
- 14** Rear carrier and deflection roller
- 15** Rear carrier and deflection roller (V-formation)
- 16** Front carrier and deflection roller
- 17** Front carrier and deflection roller (V-formation)
- 18** Clamping cylinder

20	Drive wheel
22	Belt-band
24	Carrier roller
26	Rocker
28	Rotation axis
30	Supporting cylinder
32	Traveling mechanism carrying axle
34	Traveling gear rocker
36	Rotary bearing
38	Rotation axis
40	Traveling gear supporting cylinder
42	Supporting axle
44	Rotation axis
46	Rotation axis
48	Accumulator
50	Piping/hose line system
52	Valve
54	Valve
56	Valve
58	Valve
60	Wheel hub motor

CLAIMS

1. Spring-mounted belt-band traveling gear (10) with optimum bearing load specifications for land vehicles, particularly for self-propelled agricultural machines and other off-road vehicles, said belt-band traveling gear comprising at least two outer deflection rollers (14, 15, 16, 17), over whose periphery an endless belt-band (22) rolls off, and at least one supporting roller (24) for supporting the belt-band section, which is contact with the ground, between both the deflection rollers (14, 15, 16, 17), wherein a bogie (12, 13), in which the at least two deflection rollers (14, 15, 16, 17) are mounted in a manner that enables them to rotate, is supported against a body frame of the vehicle by means of a first fluidic suspension and/or damping unit, and wherein the at least one supporting roller (24) is supported on the bogie (12, 13) by means of a second fluidic suspension and/or damping unit, said belt-band traveling gear being characterized in that a fluidic coupling of the suspension and/or damping units of the bogie (12, 13) is provided against the vehicle frame and the at least one supporting roller (24) mounted on the bogie (12, 13).
2. Belt-band traveling gear according to claim 1, comprising two or more supporting rollers (24) of the same or different sizes, each of said supporting rollers being arranged for supporting the belt-band section, which is in contact with the ground, between both the deflection rollers (14, 15, 16, 17).
3. Belt-band traveling gear according to claim 1 or 2, in which the fluidic suspension and/or damping units comprise at least one hydraulic linear unit each, which are coupled to one another fluidically on the pressure side.
4. Belt-band traveling gear according to one of the preceding claims, in which the supporting rollers (24) have a rocker bearing each.
5. Belt-band traveling gear according to one of the preceding claims, in which the bogie (12, 13) is supported against the body frame of the vehicle by means of a rocker bearing.

6. Belt-band traveling gear according to one of the preceding claims in which an amplitude-dependent variation of the spring rate is provided.
7. Belt-band traveling gear according to one of the preceding claims, in which the pressure fluid system of the suspension and/or damping units comprises a pneumatic, a hydraulic and/or a hydropneumatic pressure reservoir (48).
8. Belt-band traveling gear according to one of the preceding claims, in which the traveling gear (10) is designed as a triangular traction unit.
9. Belt-band traveling gear according to claim 8, in which the triangular traction unit comprises a central overhead drive wheel (20).
10. Belt-band traveling gear according to one of the claims 1 to 7, in which the traveling gear (10) is designed as a wedge-shaped traveling gear.
11. Belt-band traveling gear according to one of the preceding claims, in which the traveling gear rocker (34) is arranged in a laterally offset manner in relation to the belt-band (22).
12. Belt-band traveling gear according to one of the preceding claims, in which the suspension and/or damping units are coupled to one another by means of a piping (50) and valves (52, 54, 56, 58) so as to be able to achieve an active spring effect.
13. Belt-band traveling gear according to one of the preceding claims in which the system pressure is adjustable.
14. Belt-band traveling gear according to one of the preceding claims in which a level control is possible by means of a path sensor at least on the rocker (38) of the bogie (12, 13) and a correspondingly adjustable system pressure.

15. Belt-band traveling gear according to one of the preceding claims in which the accumulator (48) can be decoupled optionally from the fluid system.
16. Traveling mechanism for a ground vehicle, particularly for a self-propelled agricultural machine, agricultural work machine, off-road vehicle or the like, said traveling mechanism comprising at least two belt-band traveling gears (10) according to at least one of the claims 1 to 15, said belt-band traveling gears being arranged on opposing longitudinal sides of the vehicle.
17. Ground vehicle, self-propelled agricultural work machine or the like, having a traveling mechanism according to claim 16, which comprises at least two belt-band traveling gears (10) according to at least one of the claims 1 to 15, which are arranged on opposing longitudinal sides of the vehicle.

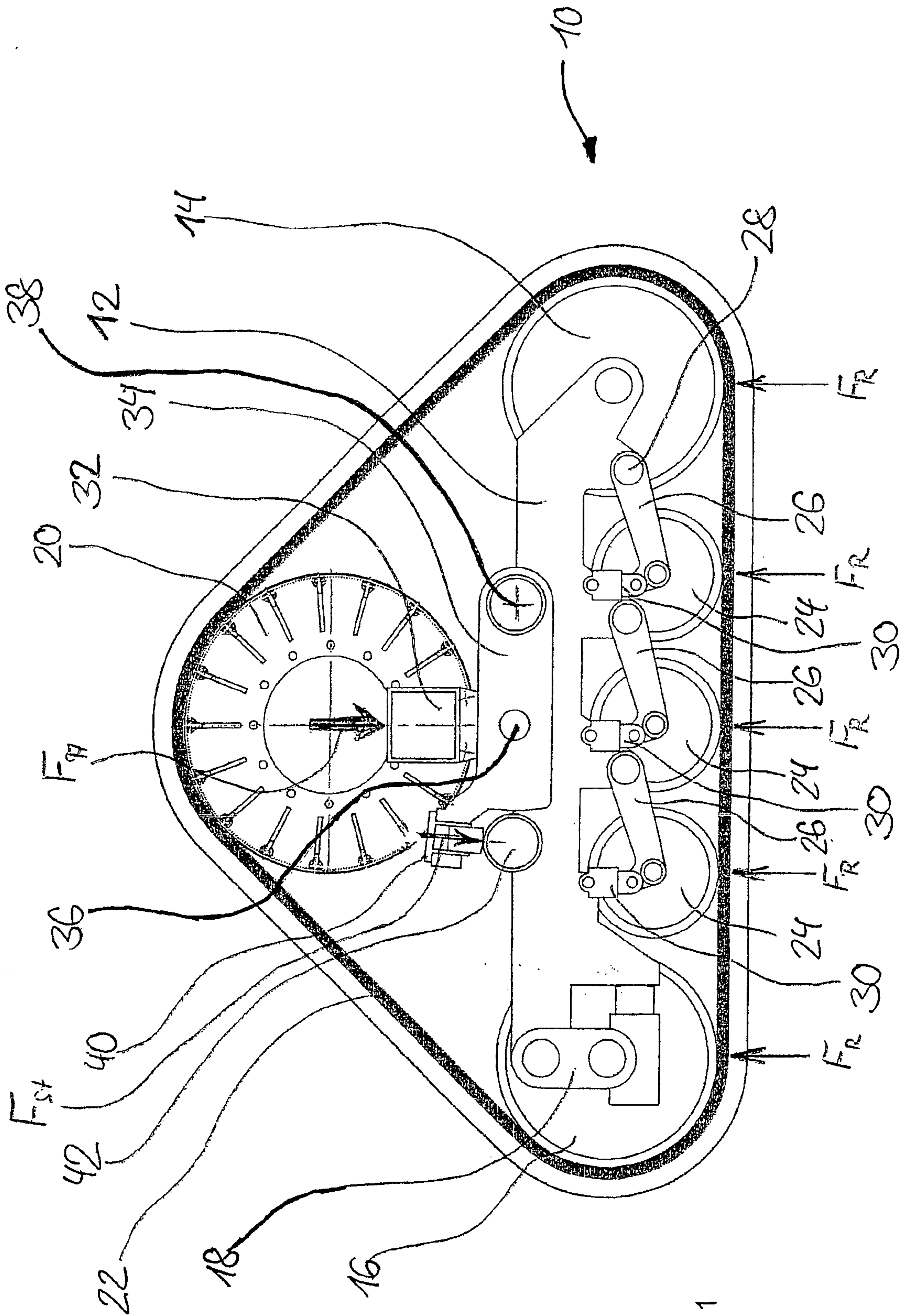


Fig. 1

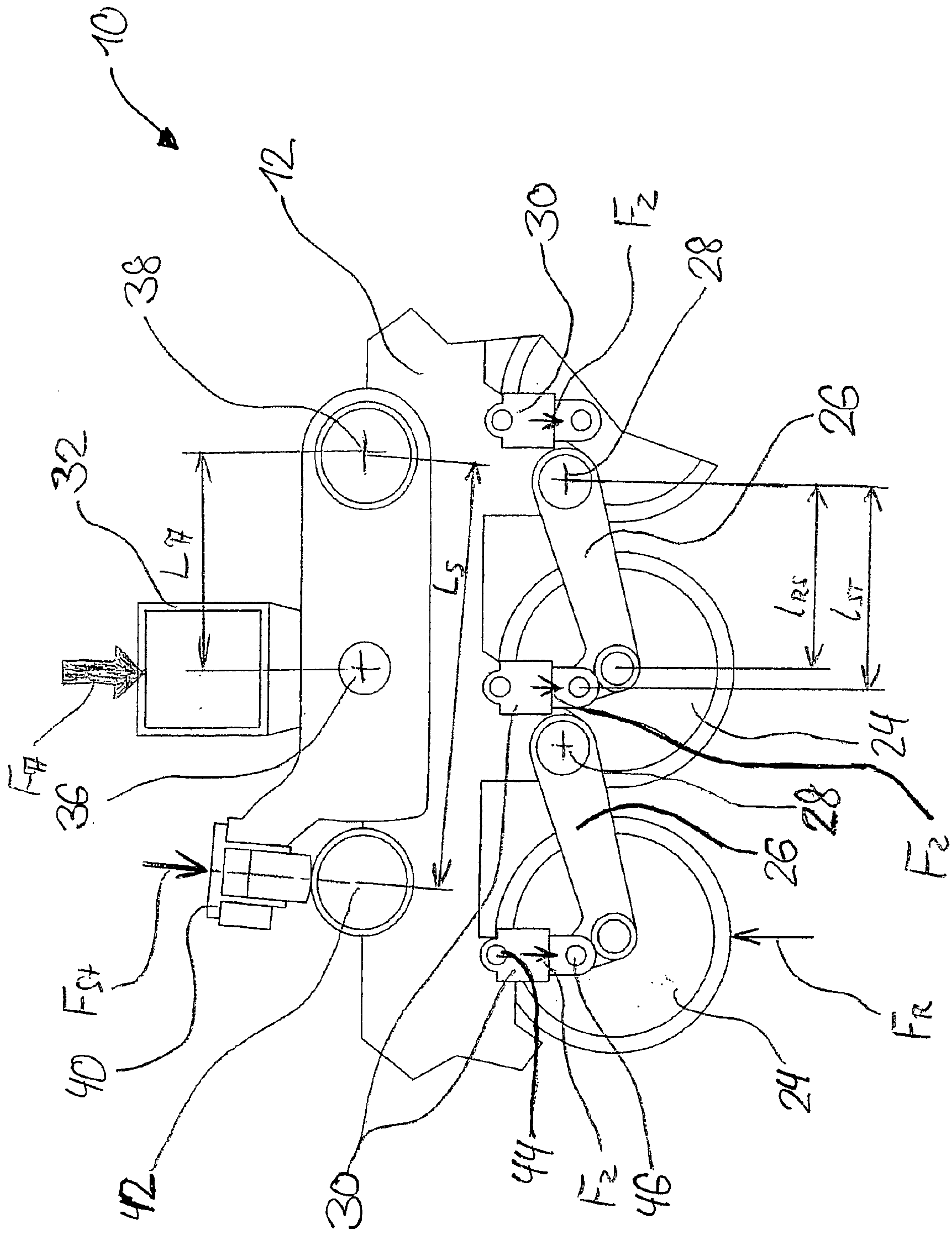


Fig. 2

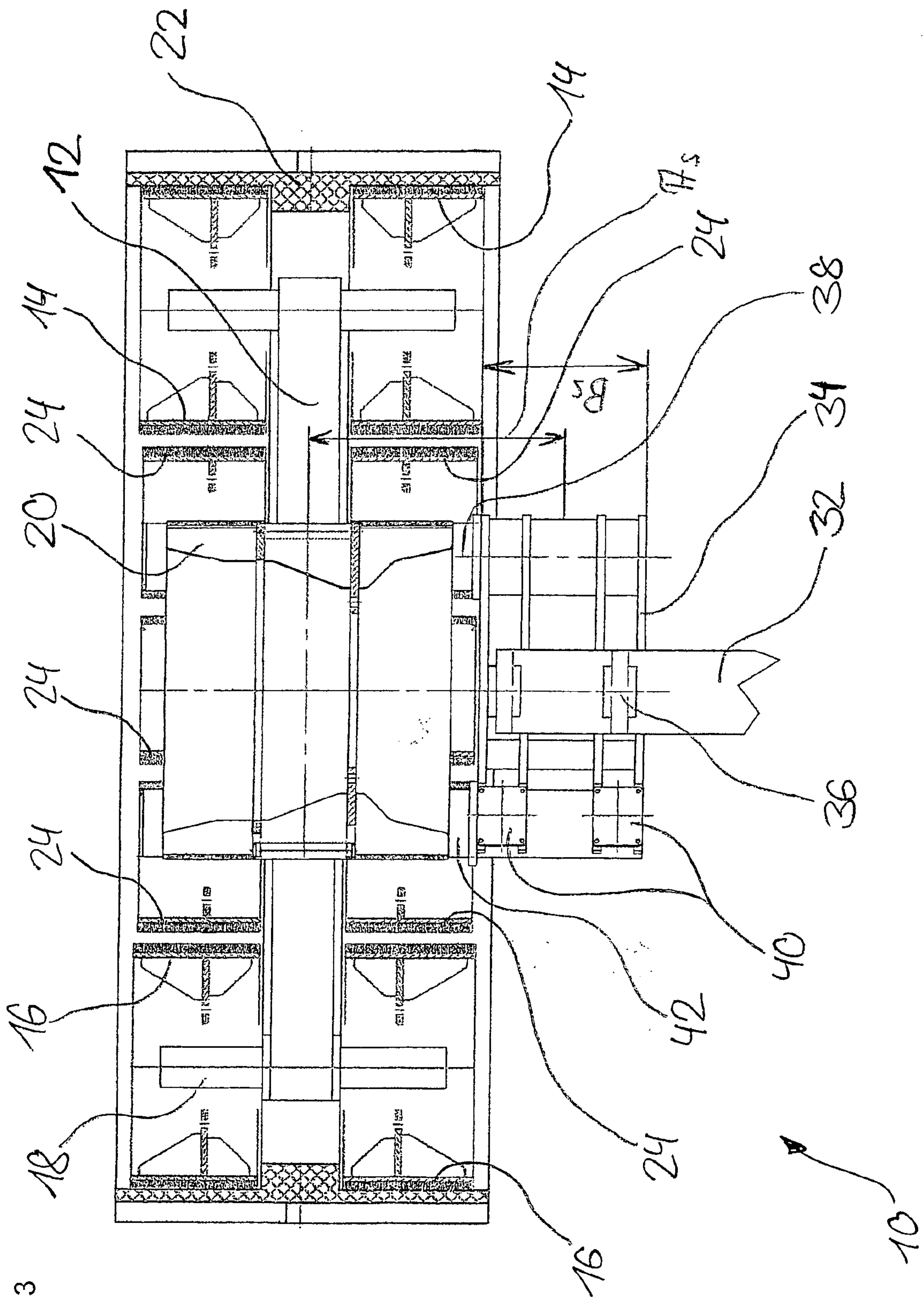


Fig. 3

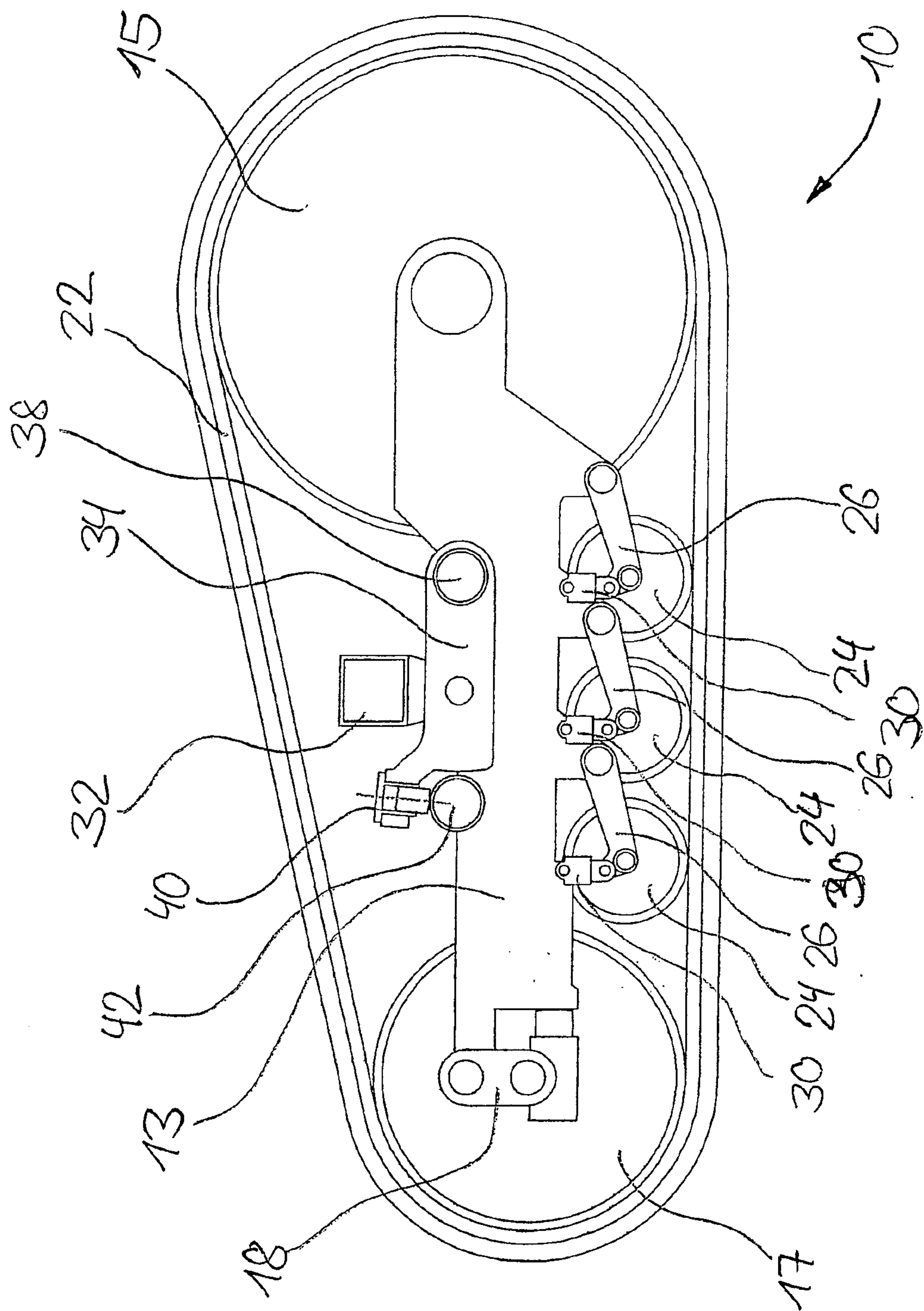


Fig. 4

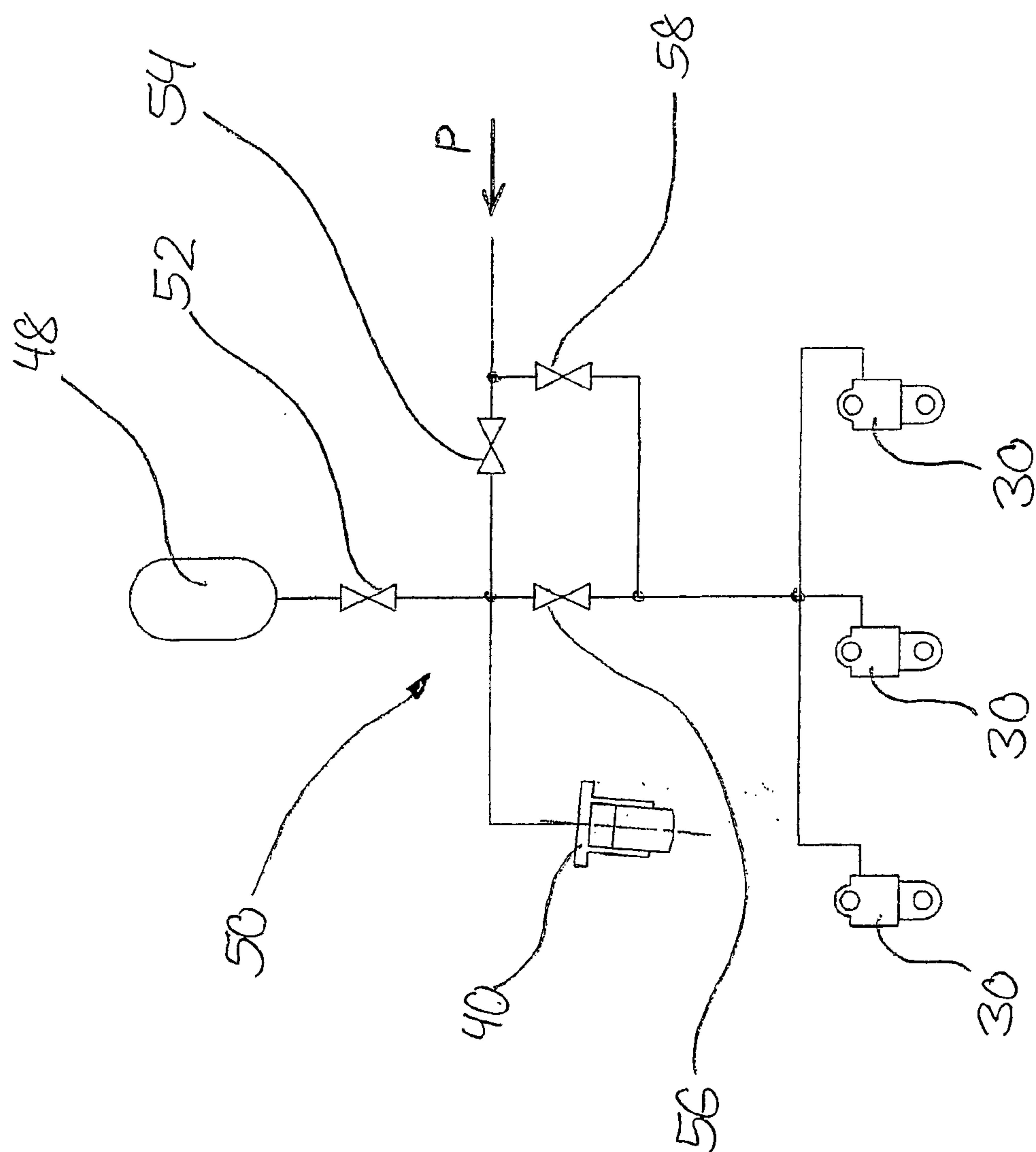


Fig. 5

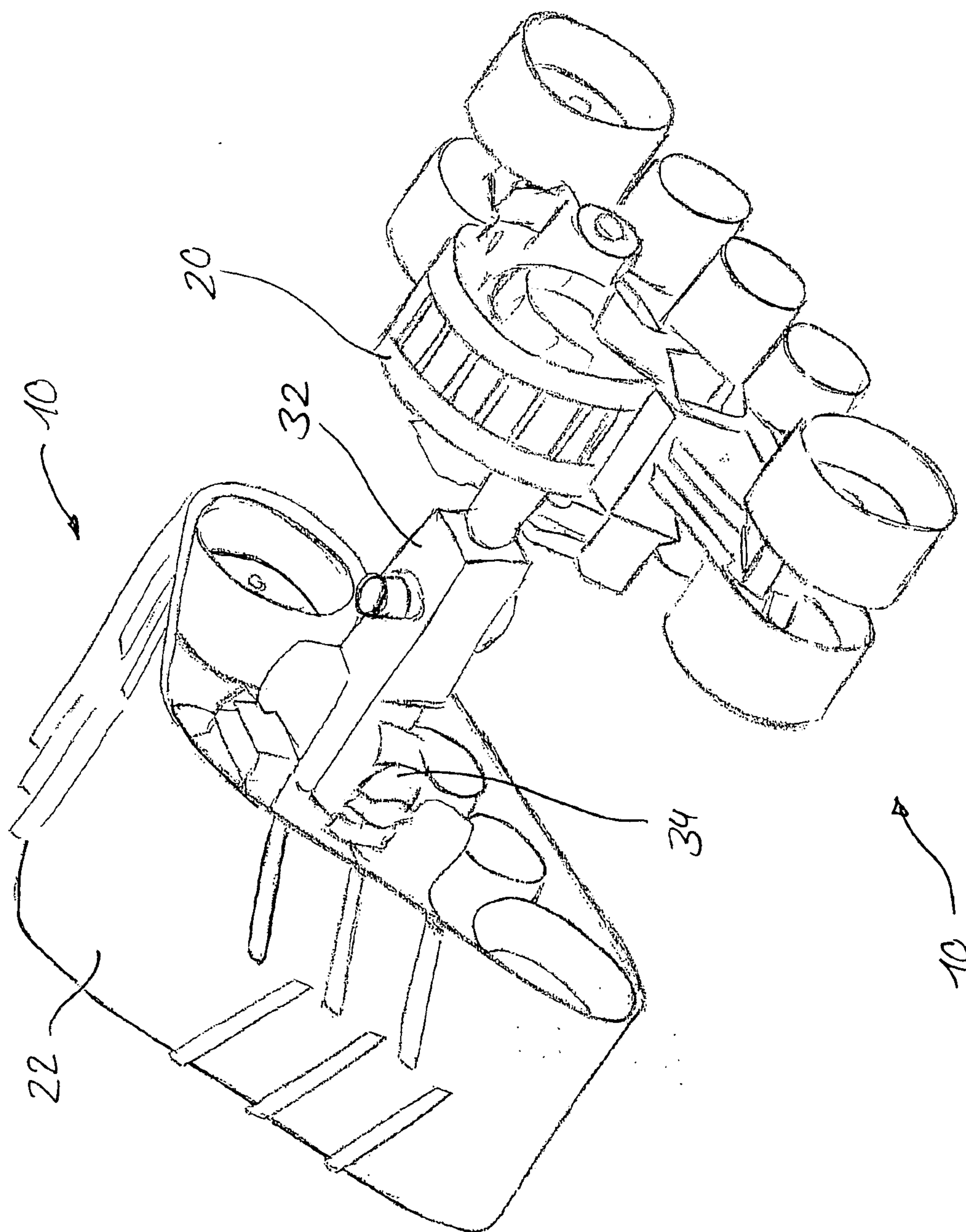


Fig. 6

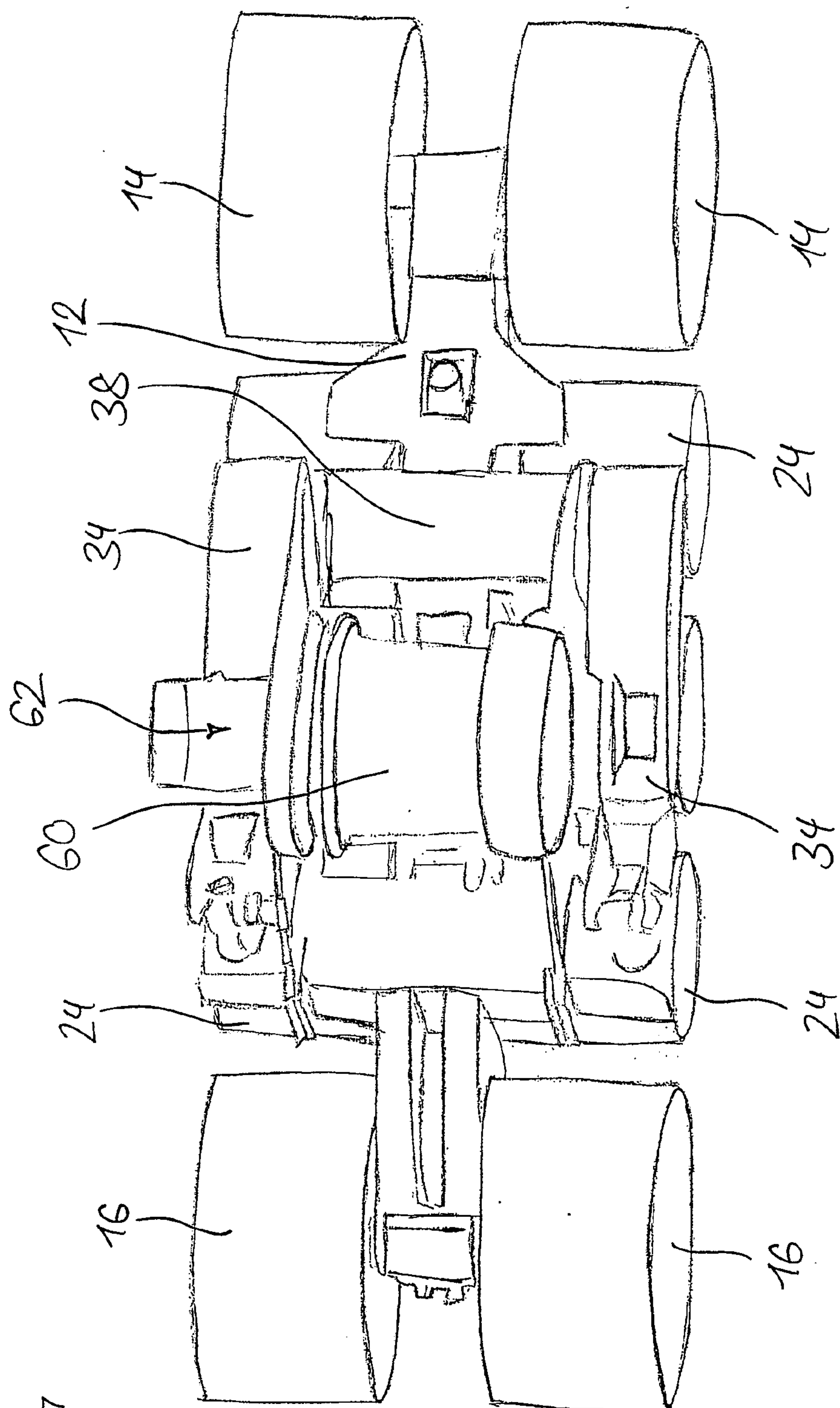


Fig. 7

