(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 October 2012 (11.10.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/135890 A1

(51) International Patent Classification:
B65H 54/28 (2006.01) *B66D 1/38* (2006.01)

(21) International Application Number:
PCT/AU2011/001152

(22) International Filing Date:
7 September 2011 (07.09.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2010904012 7 September 2010 (07.09.2010) AU

(71) Applicant *(for all designated States except US)*: **SPRAY NOZZLE ENGINEERING PTY.LIMITED** [AU/AU]; PO Box 457, Cheltenham, Victoria 3192 (AU).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **MORGAN, Stuart**; PO Box 467, Cheltenham, Victoria 3192 (AU). **MORGAN, Sean**; PO Box 467, Cheltenham, Victoria 2192 (AU).

(74) Agent: **DREW, David**; PO Box 155, Carlton South, Victoria 3053 (AU).

(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, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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.

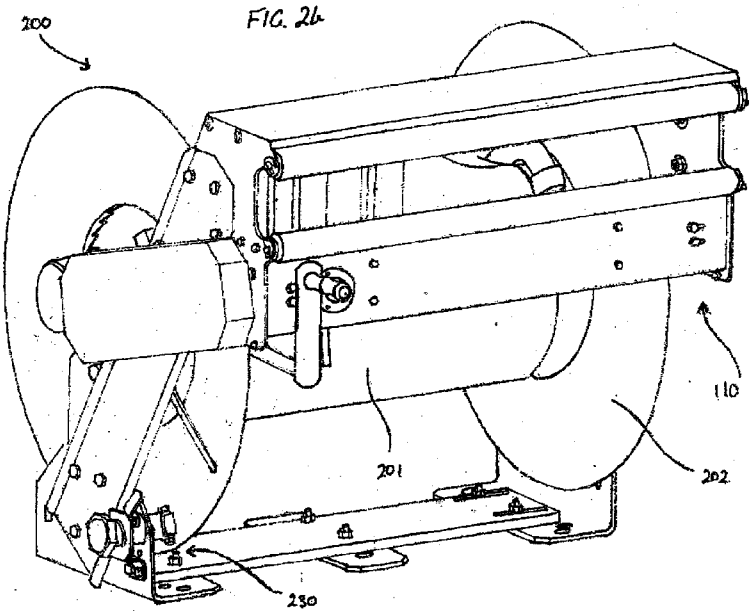
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, 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, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

WO 2012/135890 A1

(54) **Title**: STORAGE REEL CONTROL



(57) **Abstract**: The level winder device 100 includes a pair of spaced and opposed side walls 101, 102 connected by an elongate beam 103 and supported for rotation about axes parallel to the longitudinal axis of the beam 103 a pair of upper and lower elongate rollers 104, 105 to control the height at which a hose (not shown) is wound on or paid out relative to the spool 201. Mounted tor reciprocal linear travel along horizontal rails is a carriage 110 comprising a roller housing 41 and a pair of spaced short rollers mounted for rotation about a respective vertical axes. The short vertical rollers 106, 107 are adapted to control the pa> out and the winding on of the hose with regard to lateral placement on the spool 201 and are spaced sufficiently to permit the free passage of the hose defined by the gap between the vertical rollers 106, 107 and the horizontal rollers 104, 105.

STORAGE REEL CONTROL

Area of the invention

This invention relates to a reel for storing hose and cable. In particular, the invention relates to rewind spool control means.

Background to the invention

The following references to and descriptions of prior proposals or products are not intended to be, and are not to be construed as, statements or admissions of common general knowledge in the art. In particular, the following prior art discussion does not relate to what is commonly or well known by the person skilled in the art, but assists in the understanding of the inventive step of the present invention of which the identification of pertinent prior art proposals is but one part.

Typically, hose or cable is stored upon a spool mounted horizontally upon an axle hub, when not in use. It is usually wrapped upon the rotating spool by hand, thus its uniform distribution upon the spool can be difficult to control whilst the spool rotates. This is exacerbated when the operator must manually rotate the spool whilst attempting to control the wrap of the hose upon the reel.

In many instances, the efficient execution of this process may require two operators rather than one. This process leads to significant inefficiency when operators attempt uniform hose distribution upon the spool.

This inefficiency is countered via the use of a far larger spool to accommodate an inefficient wrap, which adds to the cost of the reel itself, along with stealing valuable space within the confines of a vehicle e.g. a fire truck, to which the reel is mounted.

Where increased spool size is not possible, this inefficiency will limit the hose capacity readily wrapped, or will significantly influence the amount of time required to very carefully facilitate uniform hose storage by hand.

Level winders can assist but have associated problems. An example is a level wind device which can be offered as an option on most hose storage reels today. It must be mentioned however that due to the complex mechanical nature of most commonly available level wind devices (almost exclusively utilising a double acting lead screw and carriage arrangement) they are typically a very expensive option and require a specially dedicated and more costly reel chassis, rarely specified at point of sale. But when the need becomes apparent they are extremely difficult, if not impossible, to retro-fit to a standard reel. It must be mentioned also that due to difficult and dirty operating

environments, along with excessive lateral pulling loads applied to the hose, such existing devices are not reliable in service without constant attention and maintenance

The level wind of hose or cable upon a horizontal spool is typically facilitated via a reciprocating carriage sliding from the left to right side upon a horizontal guide rail, whose length of travel is dictated by the width of the spool or the structural limits of the reel frame itself. The rail system of the level wind is typically an integral part of a special and costly reel frame structure, and is not self contained as a separable modular device. Upon this carriage is usually mounted a pair of closely located vertical and a pair of closely located horizontal rollers which surround the hose at a fixed pitch typically matched to the hose diameter.

These rollers move with the reciprocating carriage and act directly upon the hose to provide lateral directional guides of low frictional resistance towards the moving hose being wrapped or unwrapped from the spool, by means of their ability to act as rollers.

This reciprocating action is typically facilitated via a double acting lead screw mounted horizontally either above or below a fixed carriage rail, forming a parallel carriage rail pair, and driven in one direction by the motive force acting to rotate the spool either via a manual crank device, or by some motor power means.

As an alternative to the double acting screw in level wind devices, it is known in relation to load bearing cable winches, that earlier level wind devices used a chain drive to power a cable guide specifically for that application but this approach has never been utilized on storage reels.

Hose and cable storage reels however are specifically not designed to carry a load bearing cable to move objects. Specifically storage reels must allow payout without supporting a load and in most instances are required to facilitate "free" manual payout by hand without geared resistance. In addition, the hose reel need only be able to rewind the hose or cable to be stored and is not designed to apply a pull force to any other mass. A main issue with simple hose and cable storage devices is the need for free unhindered payout.

In the case of the earlier winch applications described, it would seem that the reciprocating function is entirely dependent upon the motive power of the spool, and that payout and lateral control of the cable will only occur under controlled "powered" conditions. It can therefore be seen even that even if the drive force is decoupled at the spool shaft itself, negating any spool drive gear reduction and resistance, there still remains the inherent fixed gear reduction employed by the level wind device specifically to satisfy the required reciprocating speed of the carriage to evenly lay the cable, which is significant, in that this alone, without means to decouple the level wind drive reduction, will

prevent the cable from being "freely" run off the spool by hand whilst this fixed resistance is present . It is clear that in these designs, a need to free payout the hose by hand was not a consideration, nor a need, and that the facility to do this was not inherent in these level wind Inventions themselves which employed the chain and sprocket drive to the carriage.

In fact in one application the cable carriage is fixed firmly to the chain with the chain unable to be freed from its motive drive while in another the cable carriage is actuated via a scotch yolk device firmly engaging the chain and carriage without means of freeing either from each other. These applications therefore do not have the ability to disengage the carriage from the chain drive and allow free unhindered carriage movement.

Objects

It is an object of the invention to ameliorate one or more of the disadvantages of the prior art described above or to at least provide a useful alternative thereto.

A storage reel and spool for hose and cable may be provided with a level wind device and spool rotation mode control and spool rotation control or braking.

An improved level winder device for a storage spool may be provided which ameliorates the previously described problems.

Outline of the Invention

In one aspect of the invention there is provided a hose and cable storage reel having a level winder powered from the reel drive system and including a carriage mechanism which allows the hose to be paid out through the carriage, the storage reel being provided with a chain and sprocket drive to initiate lateral movement and reciprocate the carriage upon the level winder device.

The invention also includes a brake means to control the rotation of the spool. The brake means includes at least one roller that can be variably axially offset to provide a frictional retarding force against a rotating wall and a controllable variable braking force. The roller may be alignable to the plane of the spool wall so that its rotating axis is normal to the direction of travel of the wall at the point of contact to allow the roller to be free-wheeling, thereby applying minimal friction to the spool wall. The roller may be mounted to a sprung arm. The sprung arm may be axially rotatable whereby to vary the orientation of the roller axis relative to the direction of travel of the spool wall at the point of contact.

It is preferred that the chain and sprocket drive in the storage reel be provided with at least one specially shaped elongated lobe or dog mounted upon the side of the chain and sprocket drive to initiate lateral movement and reciprocate the carriage upon the level winder device.

It is further preferred that the carriage be provided on its inner side, facing the chain and dog lobe with at least one detent that is adapted to selectively engage the dog. The detent may have an inclined surface facing the direction of an approach dog whereby to enable the dog to slide over the surface in ramped fashion. The detent may be ramped. The detent may be sprung for pivotal, eccentric or other movement such that it can move from an engaging position with the dog, to a non-engaging or slipping position relative to the dog. The detent may be movably mounted to selectively present a flat engaging or inclined slipping surface. The detent may be configured to permit relatively unimpeded travel of the chain past the dog in one direction of chain travel, and engagement of the detent with the dog when the chain travels in the other direction of chain rotation to cause movement of the carriage with the chain. The carriage may therefore be permitted to travel in a reciprocating manner back and forth along a linear path in a plane parallel to the chain. The linear path may correspond to a rail on which the carriage is mounted for reciprocal movement. The chain may be mounted as a loop for rotation about sprockets at either end of the rail.

The detent may be one of two or more detents. The detents may be identical in structure. The carriage may include two to four detents in the form of strategically placed sprung latch ramps. The ramps may diagonally appose each other in orientation, with one ramp at each of four corners of the special carriage through which the hose is paid out or wound in. It is further preferred that the dog abuts and engages the flat face of the latch-ramp in one direction to initiate lateral displacement of the carriage and move it along the rail.

In a preferred arrangement, once the carriage arrives at the end of the rail, the dog lobe rotates about one of the end sprockets, and is allowed to clear this previously engaged first latch as its direction departs from linear to circular about the sprocket. In this rotational phase it is allowed to clear and pass a second corner latch (which would facilitate engagement later in the cycle if the device drive was reversed). The dog then begins to travel linearly in the other direction until it engages the flat face of a third latch ramp that is diagonally opposed to the first latch ramp, the third latch ramp providing the resumed engagement of a dog for initial return displacement of the carriage back along the rail. As such the process is repeated as the carriage reciprocatingly travels back and forth along the rail in alternating directions.

It is further preferred that the carriage mechanism allows for a dwell period at the end of each stroke to facilitate more efficient wrap of the hose at the extremities of the spool. Other designs

dictate an immediate change of direction at the end of each stroke. Therefore, at the end of travel in each direction, there may be a controlled pause of movement or dwell time of the carriage whilst one of the ramps disengages one dog and the same or a different ramp engages another dog for return travel. This pause may facilitate orderly winding of the hose at the extreme edges of the spool.

It is also preferred that the carriage mechanism allows the hose to be payed out through the carriage at an axis both parallel (0 degrees) and at 90 degrees to the axis of rotation of the drive sprockets on the reciprocator chain. Preferably, the orientation of the sprockets is vertical thereby providing for a more horizontally compact design of significantly reduced depth when the parallel option (0 degree) is chosen. That is the footprint occupied by the hose reel mechanism is smaller. This has advantages for applications where compact design is important, for example, for vehicle-mounted hose reels.

It is further preferred that the carriage mechanism allows for reversing direction in driven mode to prevent the device jamming if the drive is reversed (this would be due to the strategic nature of the location of the latch ramps). The latch that would otherwise hinder the movement is provided with a ramp as mentioned which allows the lobe dog to travel over the ramped side by means of the ramp allowing the latch to be displaced away from the lobe dog within a guide mechanism which is sprung, allowing the latch to resume its operating position once the lobe dog has passed it in a reversed direction.

It is preferred that the carriage be a disengaging reciprocating carriage device that can be "delatched" from the chain drive by an operator either mechanically or via a solenoid for free unhindered travel of the hose off the spool. This make reduce the load and force required to be applied by the operator during payout of the hose. It is further preferred that the carriage automatically engages on rewind for uniform rewind of the hose onto the spool once the winder is energized. This function may be enabled by utilising the anti jamming displacement ability of the latch-ramps collectively. This may be achieved by means of a central cam device actuated via a lever and/or a lever & solenoid device. This will be easily actuated by an operator either remotely or locally. As mentioned earlier, specifically, storage reels generally must allow payout without imposing a drive and/or gearing load. In most instances , this involves the facilitation of "free" manual payout by hand without geared resistance. . The nature of this requirement is typically dictated by growing Occupational, Health and Safety (OH&S) requirements in respect of injuries, primarily to an operator's back, caused by the payout resistance of hose reels used by personnel in

the work place. In addition, the hose reel need only be able to rewind the hose or cable to be stored and is not designed to apply a pull force to any other mass.

It is further preferred that the carriage mechanism allows for variation in roller position to properly accommodate a large range of typical hose sizes encountered.

It is further preferred that the level wind device allows a simple modification of 3 channel beam components, and two rollers, and chain length, a significant variation in length depending on the hose reel to be fitted to accommodate fitment on to any number of typical hose storage reels. This may involve stand end components interposed with variable length beams. The chain length can be adjusted according standard methods by inserting or removing links, noting that it is preferable to space the multiple dogs along its length equally.

It is also preferred that the level wind device of the invention be a self contained level wind device independent of the reel frame structure. This would contain all the operable features of the level wind, and can be simply bolted to basic channel support arms retrofitted to any reel type. It would then only require simple chain sprocket engagement to an existing drive sprocket shaft on any reel to provide the rewind drive.

It may also be preferred that rewinding be facilitated by the provision of a spring forced roller mounted on arms connectible to the storage reel which is directed onto the winding hose.

It is further preferred that a spool mode control be provided comprising a manual lever or solenoid actuated "Mode" selector incorporating three special positions obtained via a rotational slide selector with a gate. It is preferred that an emergency crank rewind that decouples a potentially seized drive motor be provided. Preferably a solenoid is provided which can be actuated to achieve the three optional positions, including engaged, disengaged and crank rewind.

The invention also provides for free unhindered spool rotation and payout. It is further preferred that the selector allows the slide shaft to attain this all important free full neutral position where the bevel gears are fully disengaged and the reel spool is completely free running to allow easy pay-out of the hose without the resistance of the motor and reduction gearing. Once the level wind is also disengaged to be in neutral, there is nothing at all to hinder the free lateral movement of the hose moving off the spool during payout.

It is also preferred that an integrated PTO (power take off) be provided to operate the level winder.

It is further preferred that an integrated optional emergency bevel gear crank rewind with adjustable crank angle be provided.

It is further preferred that a side mount chain sprocket cartridge unit that allows for quick ratio changes of predetermined sprocket sets to set correct level wind speeds of varying hose sizes be provided.

It is further preferred that an overload safety function be provided.

It is also preferred that the mode selector device be designed as a mirrored unit in that the selector mechanism can be reversed as a mirror to allow the matching gears to be normally engaged with each other or normally disengaged, depending upon the arrangement of the slide components which are uniquely designed to be reversible to facilitate such modes.

It is further preferred in the invention that a resistance wheel brake acting on a spool disc be provided. The wheel brake may be a simple rolling rubber wheel. The roller wheel may be mounted to a screw adjustable axial spring preload arm that applies varying resistance pressure to the periphery of the spool disc as it rolls around. The resistance may be increased by tightening the screw. More importantly, the rubber wheel can also be swung around to provide rolling resistance via a lever actuator. This resistance continues to increase as the roller is swung through a full 90 degrees, at which it discontinues to roll and locks up. This may be when it has no forward vector urging rolling motion in the direction of the spool disc at the point of engagement. This provides maximum resistance to rotation and full braking of the spool to prevent rotation, for example, during vehicle motion or hose storage.etc.

Brief Description of an Embodiment of the Invention

The invention may provide a level winder device for use in association with a hose and cable storage reel which permits a range of controls of the winding process on the spool.

With the previously mentioned pitfalls of such a device, a more cost effective reliable, reliable reciprocating mechanism was required, one which was readily adaptable to varying reel spool widths in production, along with the ability to retrofit to varying other reel types, including those of other manufacturers. In order to achieve this it is preferred that it be a self contained, separable and modular in design although this is not restrictive in the invention.

To resolve these issues of cost, reliability, ability to retrofit, and separability as a self contained unit, the new level wind invention is described as follows.

To utilize proven, low cost and robust means to facilitate movement of the hose carriage guide. This would need to typically employ the most common power and motion transmission components used in general storage reel manufacture. As such. our invention utilizes a chain and sprocket drive with a specially shaped elongated lobe or dog mounted upon the side of this chain and sprocket

drive. It conforms to the profile of one chain link, thus utilising two link pins in the chain for increased load bearing capability. Our invention can also call upon heavier chain for greater lateral stiffness in supporting the carriage load, as well as accommodating larger heavier reel hose applications.

Upon the inner side of the carriage facing this chain and dog lobe are contained four strategically placed sprung latch-ramps that diagonally appose each other in orientation, at each corner of a special carriage. The dog abuts and actuates against the flat face of a latch-ramp in one direction to initiate lateral displacement and move the carriage along the rail. Once the carriage arrives at the end of the rail, the dog lobe rotates about the end sprocket, and is allowed to clear this previously engaged latch-ramp as its direction departs from linear to circular about the sprocket. In this rotational phase it is allowed to clear and pass the second corner latch-ramp (which would facilitate engagement later in the cycle if the device drive was reversed) then it begins to travel lineally in the other direction until it engages the flat face of the latch-ramp that diagonally opposed the latch-ramp providing the initial engagement for initial displacement. As such the process is then repeated in the alternative direction.

Another unique feature of this carriage mechanism is that it allows the hose to be payed out through the carriage at an axis both parallel (0 degrees) and at 90 degrees to the axis of rotation of the drive sprockets on the reciprocator chain. In the versions previously discussed the hose can only pay out through a carriage at 90 degrees to the axis of rotation of the drive sprockets and reciprocator chain. This provides for a more horizontally compact design of significantly reduced depth when the parallel option (0 degree) is chosen.

It is also a feature of the invention to prevent the device jamming if the drive is reversed (this would be due to the strategic nature of the location of the latch-ramps), the latch-ramp that would hinder the movement is facilitated with a ramp as mentioned which allows the lobe dog to travel over the ramped side by means of the ramp allowing the latch to be displaced directly away from the lobe dog within a guide mechanism which is sprung, allowing the latch to resume its operating position once the lobe dog has passed it in a reversed direction.

Another significant feature of the unique carriage mechanism is that it allows for a dwell period at the end of each stroke to facilitate more efficient wrap of the hose at the extremities of the spool. Other designs dictate an immediate change of direction at the end of each stroke, preventing efficient hose wrap at the extremity of travel of the level winder carriage.

Another critical feature of the new carriage is a unique "disengaging" reciprocating carriage device that can be "delatched" from the chain drive by an operator either mechanically or via a solenoid for

free unhindered travel of the hose, off the spool, It will automatically engage on rewind to for uniform rewind of the hose onto the spool once the winder is energized.

This function is enabled by utilising the anti-jamming displacement ability of the latch-ramps collectively by means of a central cam device actuated via a lever and or a lever and solenoid device. This will be easily actuated by an operator either remotely or locally. As mentioned earlier storage Reels must allow payout without supporting a load and in most instances are required to facilitate "free" manual payout by hand without geared resistance. The nature of this requirement is typically dictated by growing OH&S requirements in respect to back injuries caused by the payout resistance of hose reels used by personnel in the work place. In addition, the hose reel need only be able to rewind the hose or cable to be stored and is not designed to apply a pull force to any other mass.

The carriage also contains a special mechanism that allows for the variation in roller position by means of adjusting location holes to properly accommodate a large range of typical hose sizes encountered.

The level wind device itself allows simple modification of 3 only channel beam components, and two only rollers, along with a simple shortened chain length, to provide significant reduction in device width from maximum available to accommodate fitment on to any number of typical hose storage reels of varying widths.

An important strength of the design is the complete self contained nature of the level wind device independent of the reel frame structure. This would contain all the operable features of the level wind, and can be simply bolted to basic channel support arms retrofitted to any reel type. It would then only require simple chain sprocket engagement to an existing drive sprocket shaft on any reel.

A further feature of the invention is a spool mode control comprising a manual lever or solenoid actuated "Mode" selector incorporating three special positions:

Position 1. Full powered drive

Position 2. Emergency Crank rewind that "uniquely" decouples a potentially seized drive motor.

Position 3. Free (unhindered) spool rotation and payout. The selector also allows the slide shaft to attain this all important free (unhindered) full neutral position were the bevel gears are fully disengaged and the reel spool is completely free running to allow easy pay-out of the hose without the resistance of the motor and reduction gearing. Once the level wind is also disengaged to be in neutral there is nothing at all to hinder the free lateral movement of the hose moving off the spool during payout.

The spool mode control comprises a primary sliding output shaft providing sliding interconnectivity to the static integrated PTO (Power take off to operate the level winder) along with the integrated optional emergency bevel gear crank rewind with adjustable angle crank combined secondary output shaft which in turn drives the chain sprocket reduction drive cartridge(a side mount chain sprocket cartridge unit that allows for quick ratio changes of predetermined sprocket sets to set correct level wind speeds of varying hose sizes) and finally the level winder itself.

The sliding functionality is provided via a simple fork and pin sliding joint arrangement. The primary sliding output shaft in the device comprises two spur gears of varying sizes, with unique side bevel cut teeth upon the outboard side, cut in a way that allows for the axial meshing of both gears into two corresponding gears set upon a parallel shafts, one for each gear, one being a power input shaft connected to a motor drive, the other being a shaft providing the final direct drive input into the spool. The continued meshing of these gears facilitates both the drive function of the spool, along with the engagement of the level wind device. In this case the crank drive would also be live however in this instance the crank handle will be removed. This meshing of gears is maintained by an axial thrust force being applied to the slide gear and slide shaft say via a light actuation spring, a powered solenoid, or by this shaft being locked into place via a special selector gate mechanism that rotates about the device housing.

The invention also includes a unique overload safety function which includes another special side cut bevel gear axially fixed with a limited sliding action upon the parallel power shaft within the device driven by an electric motor or other power source which has fixed directly to it a typically smaller drive gear with a mating axial bevel cut. This small drive gear is normally held engaging this special shaft gear of limited sliding action. The large side cut gear with limited sliding action is forced against the motor drive side cut gear continually via a preloaded heavy spring acting upon it about the shaft, and is able to apply an adequate force to ensure the duty of the reel is fulfilled, but if the reel is compelled to stall due to a jam or excessive load, the side cut bevel gears being forced together by the spring will push apart due to a load in excess of the springs pressure.

The spring pressure can also be adjusted via a pretension bolt or similar. The special side cut of the meshing bevel gears allows for adequate power transmission whilst the gears are held in mesh by the spring, however when a load exceeds the springs compressive load the gears are allowed to move axially out of mesh by the superior pull load of the hose being rewound against the lesser spring load, to allow slippage. Therefor they act as a safety clutch device. This spring load may be adjusted by means of a screw applying for compressive load to the spring, therefore adjusting the slip rate of the reel.

The mode selector device is designed as a mirrored unit in that the selector mechanism sleeve can be reversed as a mirror to allow the matching gears to be normally engaged with each other or normally disengaged, depending upon the arrangement of the slide components which are uniquely designed to be reversible to facilitate such modes. Two locating rings attached via grub screws contain the selector sleeves and provide for the setting of the selector positions and act as fixed limits.

The invention also features a unique resistance wheel brake acting on spool disc. A simple rolling rubber wheel with a screw adjustable axial spring preload applies varying resistance-pressure to the periphery of the spool disc as it rolls around, the resistance is increased by tightening the screw. More importantly, the rubber wheel can also be swung around to provide rolling resistance via a lever actuator.

This resistance continues until the rubber roller is swung a full 90 degrees, at which in discontinues to roll and locks up, providing maximum resistance to rotation and fully braking the spool preventing rotation during vehicle motion and providing positive hose storage.

In a further embodiment of the invention a spring pressured roller is provided on arms attachable to the storage reel to provide pressure on the winding hose loops thereby facilitating their orderly distribution.

The invention provides in a hose and cable storage reel a means for distributing the hose upon the reel in an improved manner provided by a variety of unique means. In particular the invention is able to be applied to a wide variety of spool widths without the need for a specific level winder to be provided for any given reel dimension.

Brief Description of the Drawings

Possible and preferred features of the present features of the present invention will now be described with particular reference to the accompanying drawings. However, it is to be understood that the features illustrated in and described with reference to the drawings are not to be construed as limiting on the scope of the invention. In the drawings:

Figure 1a is an exploded perspective view of a drive mechanism according to one aspect of the invention;

Figure 1b is a perspective view of a level winding assembly according to a preferred embodiment;

Figure 2a is a perspective view, and end and side elevations, of a level winding mechanism according to the embodiment shown in Fig. 9b;

Figure 2b is a perspective view of a hose reel with attached level winding mechanism according to a preferred embodiment;

Figure 3a is an exploded perspective and partly magnified view of a winding guide head assembly according to the embodiment shown in Fig. 9b;

Figure 3b is another exploded perspective view of the winding guide head assembly shown in Fig. 3a;

Figure 4 is side elevation view of a level winder assembly according to the embodiment shown in Fig. 9b;

Figure 5 is a carriage assembly according to the embodiment shown in Fig. 9b;

Figure 6 shows front and side elevations of a part of a level winder and carriage assembly according to the embodiment shown in Fig. 9b;

Figure 7 is non-continuous front elevation of a carriage drive assembly according to the embodiment shown in Fig. 9b;

Figure 8 is a perspective view of a brake assembly according to another aspect of the invention;

Figure 8b is a perspective view of a brake assembly according to another aspect of the invention;

Figure 9a shows front, and left and right hand side, elevations of a carriage and rail assembly according to the embodiment shown in Fig. 1;

Figure 9b is an exploded perspective view of a carriage and rail assembly, together with a magnified view of the carriage assembly according to a preferred embodiment of the invention;

Figure 10 is a schematic drawing of a constant pressure roller frame according to another aspect of the invention; and

Figure 11 is a schematic drawing of a manual mode selector.

Detailed Description of the Drawings

Referring to the drawings, there is shown a level winder device 100 for use in association with a hose and cable storage reel 200 which permits a range of controls of the winding process on a spool 201.

Figure 1a shows a drive mechanism 130 that is coupled to the level wind controller 100 shown in Fig. 2a. The drive mechanism comprises reducing gears including sprockets 7,27 that are easily interchangeable, unlike the prior art, due to the mounting mechanism designed by the applicants in which a connector hub 8 for the transitioning sprocket 7 allows easy disassembly and replacement

of one sprocket 7,27 for another, so that the gear ratios of the device 100 can be modified to suit different applications, such as different sized (length) level winder assemblies made according to the invention, different sized hoses, and desired reel winding speeds.

In Fig. 1b there is shown a preferred form of the level winder assembly 300 which demonstrates the capacity of the device to be easily adjusted in length to suit a variety of hose reel size requirements and applications. Instead of providing a beam 103 in one piece, the linear guide 303 is made up of pair of identical end sections 305,306 that provide guides or supports for the chain 30. The beam 303 is generally channel shaped and its top and bottom walls are adapted to trap the carriage wear plates 9 (see Fig. 3b) therein. In Fig. 3b, the beam 303 is more clearly seen. Extending from the internal vertical wall of the beam 303 are a pair of ribs 308,309 extending the length of the beam to support the chain 30. There are a pair of wear plates 9 above and below the carriage housing 5. The wear plates are made of PTFE (Teflon®) to ensure friction is kept to a minimum as the carriage 110 travels up and down the beam 303.

With reference to Fig. 3a, the carriage housing is able to be shifted towards or away from the beam 303 to move the latches 112 into and out of the plane of engagement of the chain dogs 32 by means of a telescopic cam tube 37. The cam tube 37 is rotatable about and telescopically mounted on a stub 37b extending normally from the outer wall plate 119a. A pin 38a is press fitted into the stub through radially opposed apertures to present a pair of radial knobs protruding from the surface of the stub 37b. The cam tube has a corresponding S-shaped slot 37c to receive the pin knob 38a which combination controls the rotation of the cam tube 37 about the stub 37b. The arrangement is such that the compression springs 118b, held in compressed stated by the axial compressive combinations of a plurality of bolts 25 extending through a lift plate 47 and tube guides 61 (4 in this case corresponding to the number of deflector latches 112) to receive the spring 118b as a sleeve and the latch 112 as a nut (the latch 112 being also pivotally engaged by a short bolt 16 extending through the upper and lower plates 119). The cam tube 37 is axially connected to handle lever 140,35 that can be used to rotate the cam tube 37, bearing against the plate 47 to move the carriage housing 5 and latches 112 into and out of the engagement plane of the chain dogs 32.

The level winder device 100 includes a pair of spaced and opposed side walls 101, 102 connected by an elongate beam 103 and supported for rotation about axes parallel to the longitudinal axis of the beam 103 a pair of upper and lower elongate rollers 104, 105 to control the height at which a hose (not shown) is wound on or paid out relative to the spool 201. Mounted for reciprocal linear travel along horizontal rails 103 is a carriage 110 comprising a roller housing 41 and a pair of spaced short rollers mounted for rotation about a respective vertical axes. The short vertical rollers

106, 107 are adapted to control the pay out and the winding on of the hose with regard to lateral placement on the spool 201 and are spaced sufficiently to permit the free passage of the hose defined by the gap between the vertical rollers 106, 107 and the horizontal rollers 104, 105. The hose reel 200 includes the spool 201 and reel disc 202.

The exploded view of the level winding assembly 100 is shown in Figure 9b and reference is made to the reference tables in Figures 1, 2, 9a and 9b in this connection, which tables are incorporated herein by reference.

Figure 2 shows the carriage assembly 110 mounted on the level winding assembly 100 for linear reciprocal motion along a rail 103 extending between the ends of the carriage assembly 100. The level winding assembly 100 includes a drive means 120 including a drive shaft 231 operably engaged to the variable level wind speed gear or reduction mechanism 130 as show in Figure 11. The level winder drive mechanism 120 includes bevelled gears 121 adapted to engage with vertically aligned and spaced sprockets 125, 126 that lie in the same plane and are adapted to drive a tensioned chain 30 comprising a loop that travels in a vertical plane corresponding to the plane of the spaced sprockets 29, 125, 126. The chain 30 preferably includes multiple, equispaced dogs 32, for example at 100mm or greater intervals. The closeness of the dogs 32 with respect to adjacent dogs is determined by the application, noting that even a chain 30 with a single dog 32 would still be largely operable, although corrective winding might be required in particular cases where the winding has got in ineffective, irregular or inefficient.

The carriage 110 is adapted to reciprocate along a linear pathway by engagement with beam 103 support and guides for chains and tie in the beam 103 end pieces 127, 128 extending a substantial proportion of the length of the horizontal rollers 104, 105 and defining the lateral limits of travel of the carriage assembly 110. The carriage assembly includes a cam mechanism and lever assembly 140 adapted to shift the carriage 110 out of engagement with the chain 30 as described herein. The chain 30 comprises regularly spaced dogs or lobes adapted to engage a plurality of deflectable latch ramps housed in the lower section 111 of the carriage 110, the deflectable latch ramps 112 numbering 4 and located in apposed pairs 113, 114. The carriage comprises an upper section 115.

As show in Figure 3, the carriage may comprise more than a pair of spaced vertical rollers 106, 107, but may comprise a set of four or more vertical rollers to control the lateral positioning of the hose during payout and winding in of the hose.

In Figure 6, there is shown two variants of the deflectable latch ramp 112a, 112b. The deflectable latch ramps comprise a flat face 116 adapted to engage a dog 32 mounted on the chain 30 and a ramped surface 117 adapted to permit the dog 32 to ride over the ramp 117 when the chain is

travelling in a reverse direction. Various mechanisms can be provided to permit deflection of the latch ramp 112. the preferred arrangement being shown in Figures 6 and 6b, where the latch ramp 112 is pivotally mounted and sprung against deflection towards the wall 119a.

The opposed pairs of latch ramps 113, 114 lie in different vertical planes, as shown in Figure 5. This permits the latch ramps to variously engage with the chain dogs 32 selectively, depending on the direction of travel of the chain 30.

As shown in Figure 5b, the latch ramps 112 are pivotally mounted to horizontal and spaced walls 119 joined by a vertical plate 119a.

The crank 140 provides a cam mechanism whereby to vertically shift the carriage 110 away from the chain 30 and out of engagement and out of the plane of travel of the dogs 32, so that the carriage is free to stop. This may be achieved by an automated mechanism utilising a solenoid or mechanical device 145.

The offset alignment of the latch ramps 112, by their pairings 113, 114 allows the carriage device to slip passed the chain dogs 32 on payout when the hose is hauled by an operator, and to engage the chain dogs 32 during winding on of the hose. As the skilled person will appreciate, it is only important during rewind to control the winding of the hose onto the spool 201, but not in the payout mode of the hose reel 200. Complete delatchment of the carriage 110 from the chain dogs is achieved by shifting the carriage 110 by the manual cam lever 140 or solenoid 145 to shift the latch ramps 112 out of the plane of the chain dogs 32. Furthermore, the gear box generally shown in Figure 1 with reference to reference numeral 130 and shown in greater detail in the sketch of Figure 11, the gear box 130 may be disengaged for totally free payout of the hose reel 200.

Referring to Figure 7, the drive mechanism 30 for the level winding assembly is shown in greater detail. As can be seen, the drive shaft 31 is operably connected to vertically oriented sprockets 29 which carry a tensioned chain 30. The chain 30 carries multiple dogs 32 that engage latch ramps 112 by abutting their broad face 116 whereby to move the carriage assembly 110 along the rails 103. The dog 32 is generally block shaped and dimensioned to match the general dimensions of the link to which it is attached on the drive chain 30. The dog 32 is about the same length, height and depth of a link, with a similar radius 138 at each of its respective ends 133. The radiused ends 138 facilitate smooth transfer over the ramped surfaces 117 of the latches 112, whilst presenting a solid engagement surface when abutting the flat faces 116 of the latches 112.

Preferably, as shown in Figure 5b, the latch ramps 112b are four in number, with a latch ramp 112 located in each corner of the lower section of the carriage assembly 110 to reduce lag times and

facilitate clean and responsive engagement of the carriage assembly 110 with the drive assembly 30.

In relation to Figure 8 there is shown a breaking device 230 comprising a main bracket 231adapted to be mounted to a hose reel 200 and a brake in the form of a rubber roller 235 adapted to engage a reel disc 202 (see Fig. 2b). The roller 235 is rotatably mounted to a U-shaped axle support 236 which, in turn, is axially mounted to a shaft 237 journalled in the bracket 231and braced between bushes 238 and a brake bracket 239. The brake bracket 239 is spaced from the main bracket 231 whereby the roller 235 is mounted to apply axial force through the shaft 237 to the reel disc 202, whereby the roller 235 is adapted to permanently engage and abut the reel disc 202. The axial tension of the roller (an axial force applied to the reel disc 202 surface) is applied through the shaft 237 to the reel disc 202 and is controlled by rotation of the shaft 237, threadably engaged to the main plate 231.

The tension imposed by the roller 235 is adjustable by axially displacing the threaded shaft 237. In this regard, the shaft 247 is rotatable by a handle 243 whereby to vary the length of shaft 237 extending beyond the main plate 231 towards the disc reel 202 and the consequent force applied thereto, the force being regulated by the compression spring 240 interposed between he brackets 231,239.

The orientation of the roller 235 axis 246 is controlled by the attachment of the axle bracket 236 to a tube shaft 238 that is integrally formed with its slotted extension sleeve 242 on the opposite side of the main bracket 231. The slotted sleeve surrounds the shaft 237 and spring 240 an the slotted sleeve extends integrally into a brake lever 244. The brake lever 244 may assume any one of a number of radial positions about the brake bracket 239, being sprung to bear on the outer edge of the brake bracket 239. The lever 244 is flat faced and cooperates with one of a number of positions around the brake bracket 239 to vary the roller axis orientation in one of a number of fixed axial alignments. The alignment of the roller axis 246 may be varied by moving the sprung lever 244 whereby to either allow the roller to freely rotate relative to the reel disc 202 or be rotated diagonally to apply considerable friction to the reel disc 202 through to the point of engagement with the roller 235, such that the roller 235 may be oriented so as to cease rolling and provide a locking brake to the reel disc 202.

In an alternative arrangement shown in Fig. 8, the lever 244 is replaced with a rod 244a having a round cross-section and the brake bracket 239 is replaced with a scalloped or sprocket like bracket 239a having a large number of radial positions into which the sprung lever 29a nests. The range of angles of the roller axis 246 relative to the direction of travel of the reel disc 202 at the point of

engagement is consequently much greater in this arrangement. Accordingly, the payout or winding procedures may be regulated by the brake means 230.

Definitions and Explanations

Throughout the specification and claims the word "comprise" and its derivatives are intended to have an inclusive rather than exclusive meaning unless the contrary is expressly stated or the context requires otherwise. That is, the word "comprise" and its derivatives will be taken to indicate the inclusion of not only the listed components, steps or features that it directly references, but also other components, steps or features not specifically listed, unless the contrary is expressly stated or the context requires otherwise.

Whilst the invention is generally be described with reference to storage spools or reels for both hose and cable for the sake of convenience, the word "hose" is used herein to mean both "hose" and "cable".

Orientational terms used in the specification and claims such as vertical, horizontal, top, bottom, upper and lower are to be interpreted as relational and are based on the premise that the component, item, article, apparatus, device or instrument will usually be considered in a particular orientation, typically with the [name item] uppermost.

Therefore while we have described herein one particular embodiment of the invention it is to be understood that variations and modifications in the materials used and the features described can still lie within the scope of the invention.

The claims:

1. A level winding control device for use on a hose reel, the control device including:

a moving carriage which is adapted to control winding of a hose onto the hose reel and to allow the hose to be paid out through the carriage;

a carriage drive mechanism including at least one chain dog adapted to engage the carriage to move the carriage reciprocally along a track;

at least one deflectable latch mounted to the carriage and adapted to selectively engage the chain dog in a first direction of travel of the chain and to deflect or avoid engagement of the chain dog in a second direction.

2. A level winding control device according to claim 1, wherein the deflectable latch has an inclined surface facing the chain dog travelling in the second direction.

3. A level winding control device according to claim 1, wherein the deflectable latch has an abrupt or flat face facing the chain dog travelling in the first direction.

4. A level winding control device according to claim 1, wherein the deflectable latch is springably mounted to deflect as the chain dog passes travelling in the second direction.

5. A level winding control device according to claim 1, wherein the deflectable latch is a first deflectable latch and the carriage includes a second deflectable latch oriented in the opposite direction whereby to selectively engage the chain dog in the second direction of travel of the chain and to deflect or avoid engagement of the chain dog in the first direction.

6. A level winding control device according to claim 5, wherein the first deflectable latch is one of a matching pair of apposed deflectable latches mounted to the carriage, lying in a first plane and oriented in the same direction to each other and relative to the chain dog, and the second deflectable latch lies in a second plane spaced from the first plane.

7. A level winding control device according to claim 5 or 6, wherein the second deflectable latch is one of a matching pair of apposed deflectable latches mounted to the carriage, lying in a second plane and oriented in the same direction to each other and relative to the chain dog.

8. A level winding control device according to claim 1, wherein the carriage drive mechanism is oriented vertically such that the drive sprockets and the drive chain lie in a vertical plane whereby the footprint of the control device is smaller than if the drive mechanism is oriented horizontally.

9. A level winding control device according to claim 1, wherein the chain dog is one of a plurality of chain dogs spaced along the length of the chain loop.

10. A level winding control device according to claim 1, wherein the hose reel comprises a variable brake having a roller sprung to apply a tensioned force to a disc of the hose reel.

11. A level winding control device according to claim 10, wherein the variable brake includes a shaft axially threaded to a brake mounting bracket to vary the compression of an axial spring applying the tensioned force.

12. A level winding control device according to claim 10, wherein the roller may be rotated so that its rotating axis is angled relative to the direction of travel of the reel disc at the point of engagement with the roller to apply a braking force.

13. A level winding control device according to claim 10, wherein the roller may be rotated so that its rotating axis is normal relative to the direction of travel of the reel disc at the point of engagement with the roller to apply a stopping force.

14. A level winding control device according to claim 1, wherein the chain dog is a specially shaped elongated lobe or dog mounted upon the side of the chain to initiate lateral movement and reciprocate the carriage upon the level winder device.

15. A level winding control device according to claim 1, wherein the carriage can be "delatched" from the chain drive by an operator either mechanically or via a solenoid for free unhindered travel of the hose off the spool.

16. A level winding control device according to claim 1, wherein the location and frequency of the chain dogs permits the carriage to rest for a dwell time at the end of each travel along a rail to effect a better wrap of the hose at the extreme ends of the spool.

17. A level winding control device according to claim 1, wherein the control device comprises a rail and support frame comprising spaced end brackets and a beam extending therebetween that is length adjustable by substituting the variable length beam for one of different length.

18. A level winding control device according to claim 1, wherein the carriage is driven by a PTO (power take off) to operate the level winder that is integrated with the hose reel drive mechanism.

19. A level winding control device according to claim 1, wherein an inner side of the carriage facing the chain dog are mounted four strategically placed sprung latch-ramps that diagonally appose each other in orientation, at each corner of a special carriage.

20. A level winding control device according to claim 19, wherein the dog abuts and actuates against the flat face of a latch-ramp in one direction to initiate lateral displacement and move the carriage along the rail.

5

20

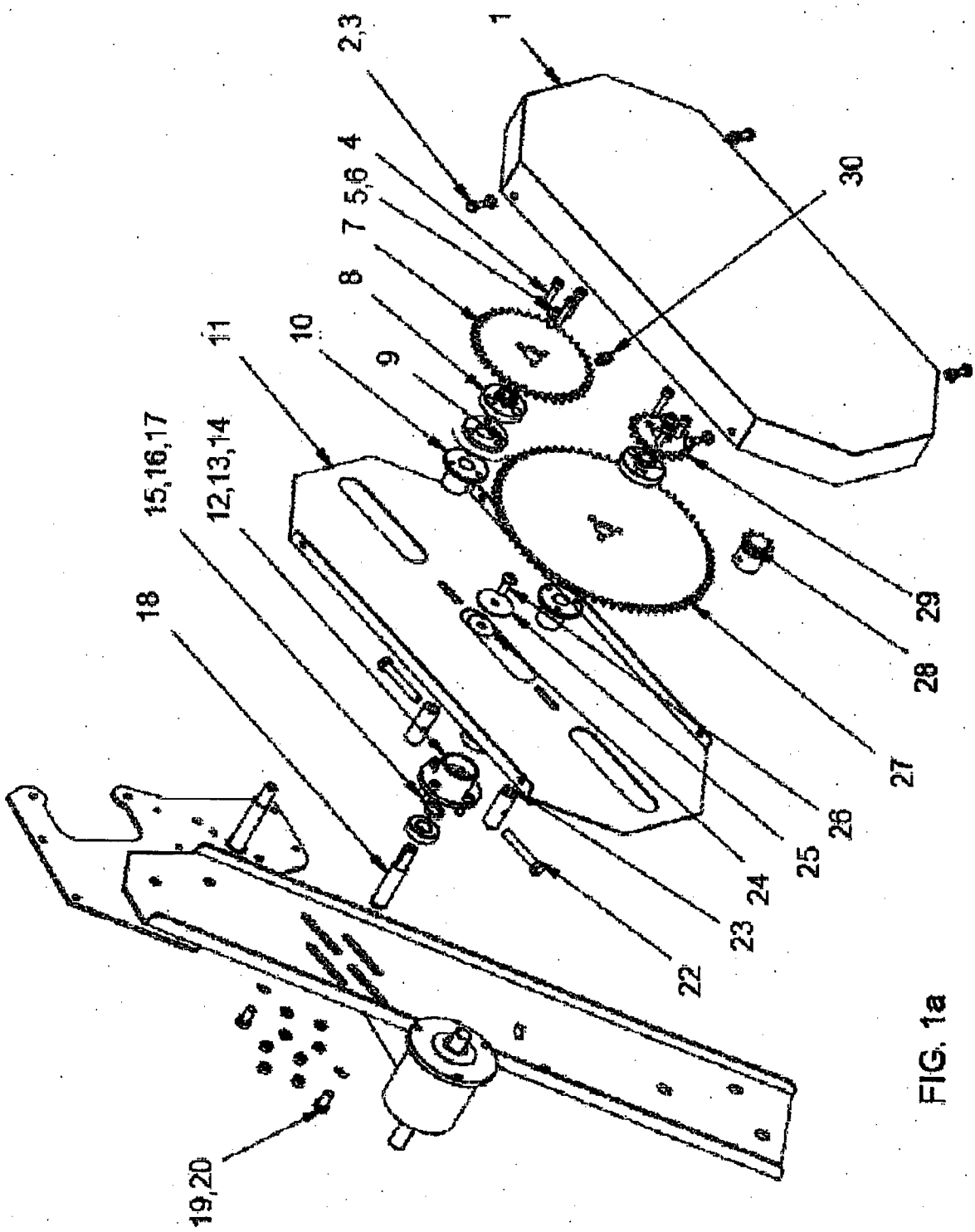


FIG. 1a

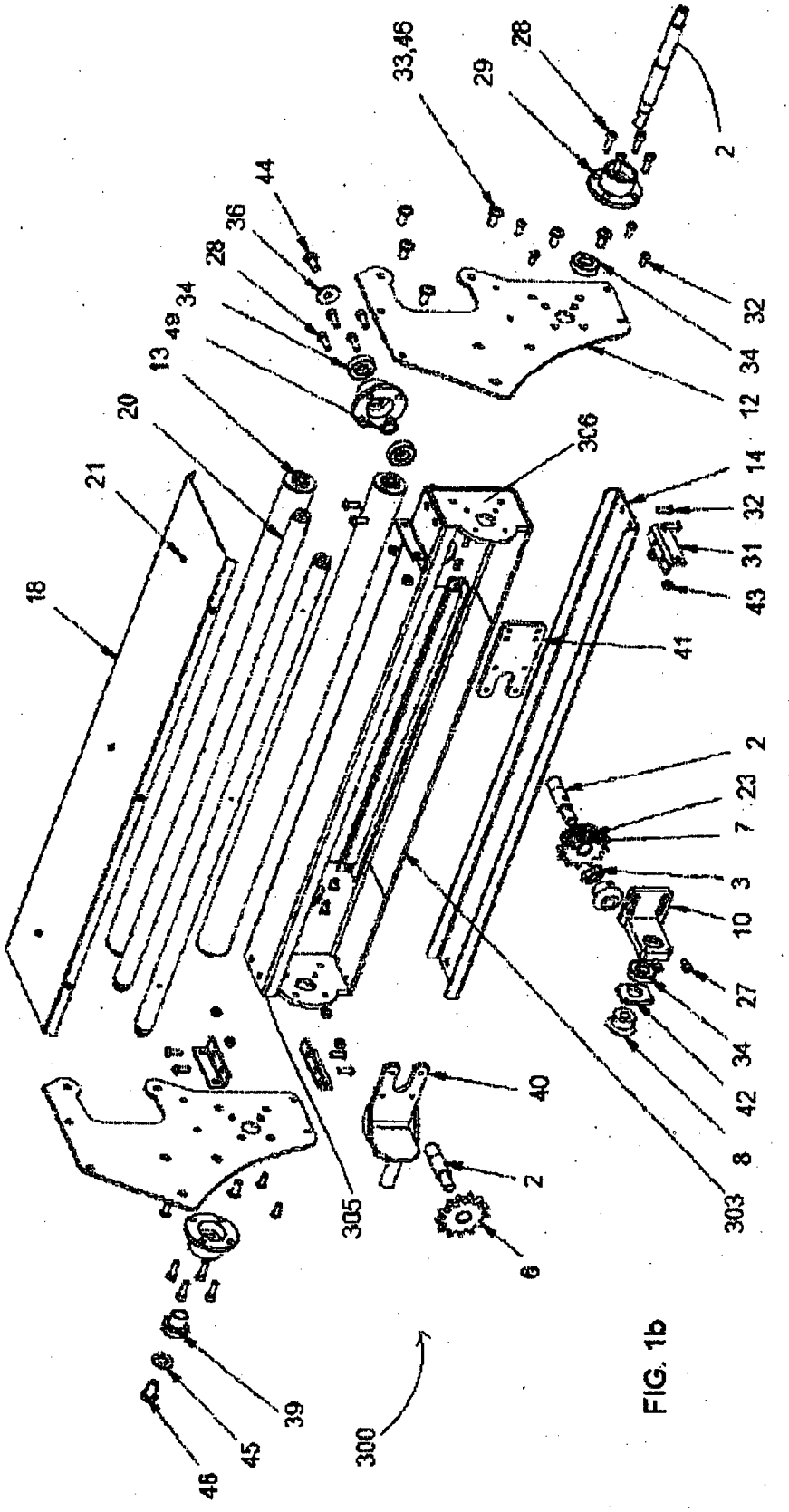

33,46
29
28
2
44
36
28
34
49
13
20
21
18
32
34
12
306
14
32
31
43
41
2
23
7
3
10
27
34
42
8
303
40
2
6
305
39
45
46
300

FIG. 1b

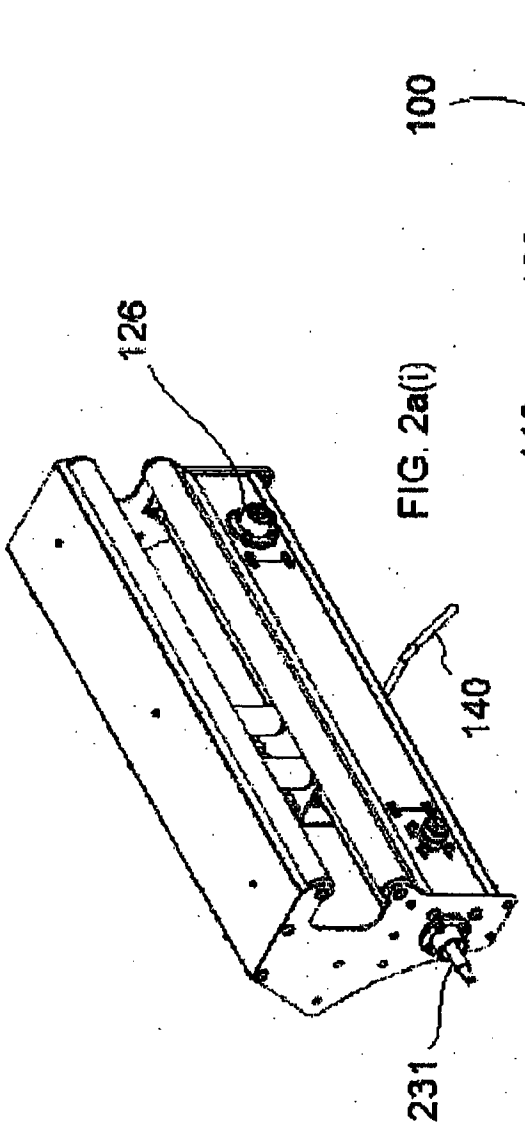


FIG. 2a(i)

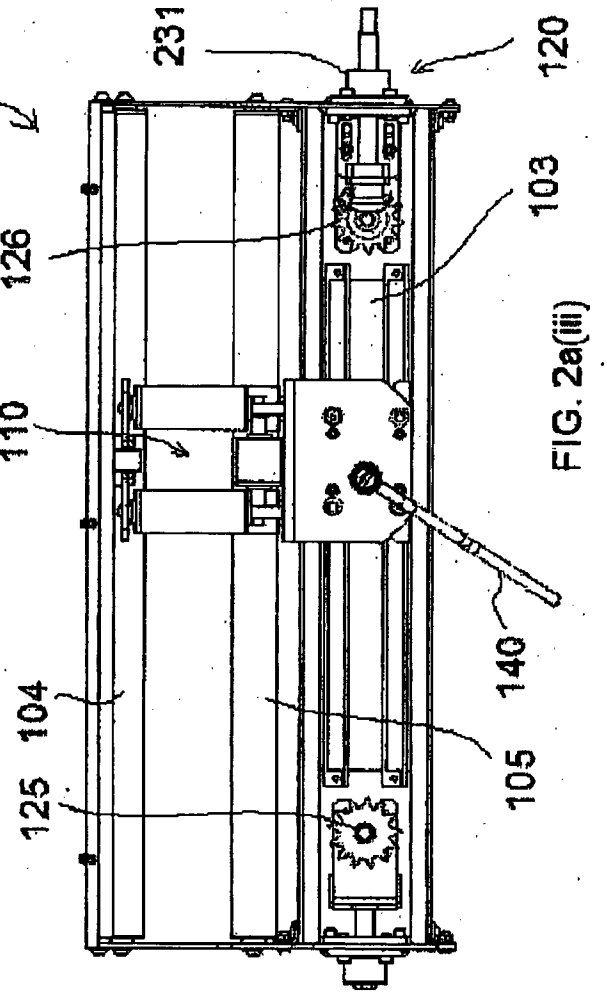


FIG. 2a(iii)

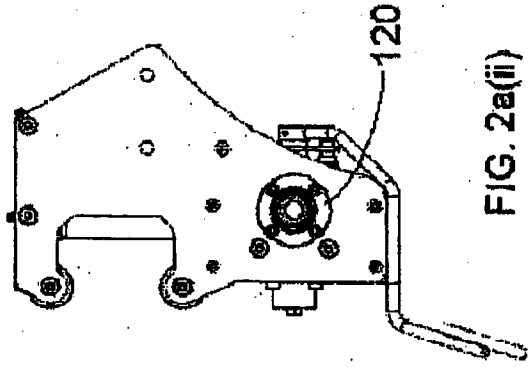


FIG. 2a(ii)

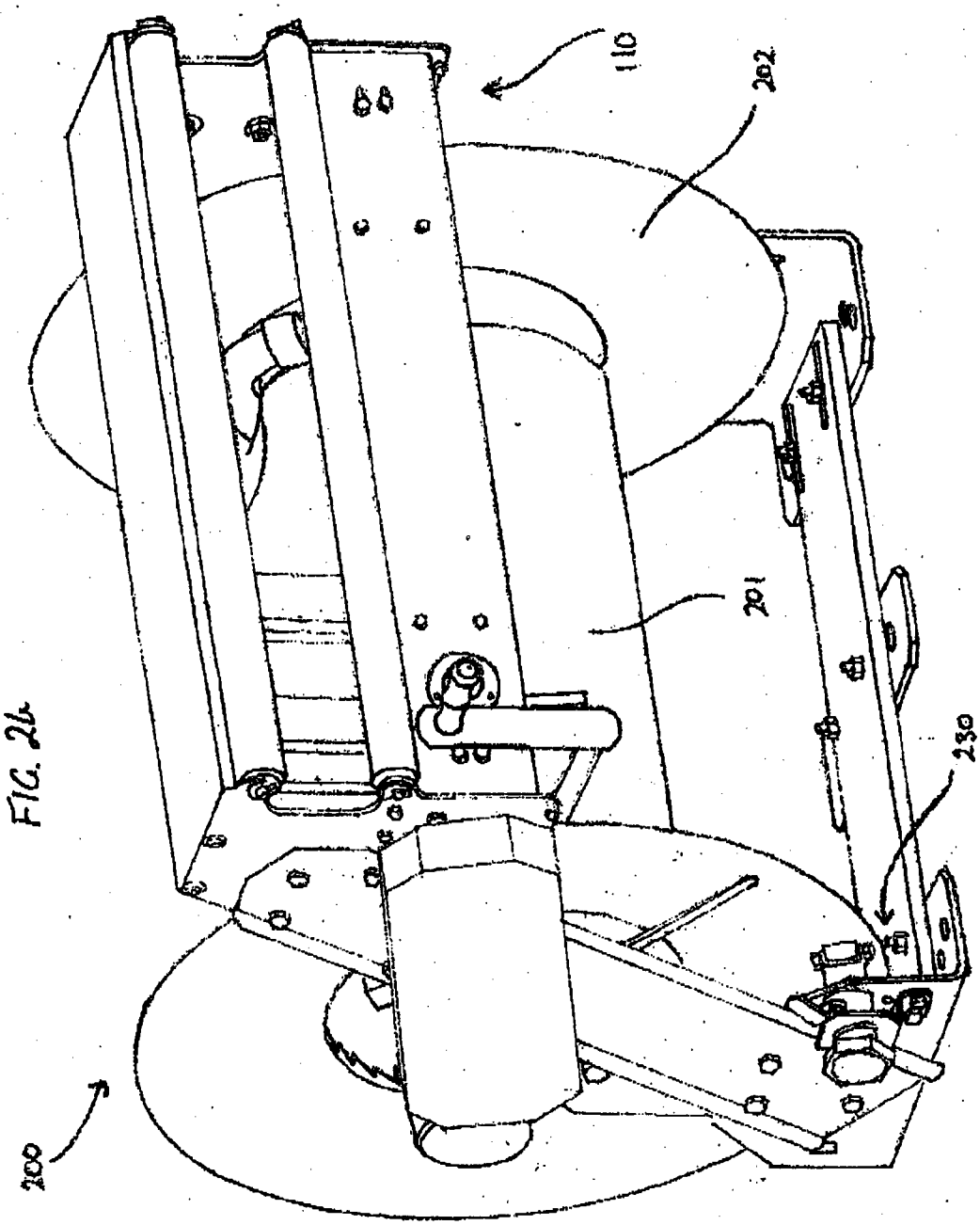


FIG. 2b

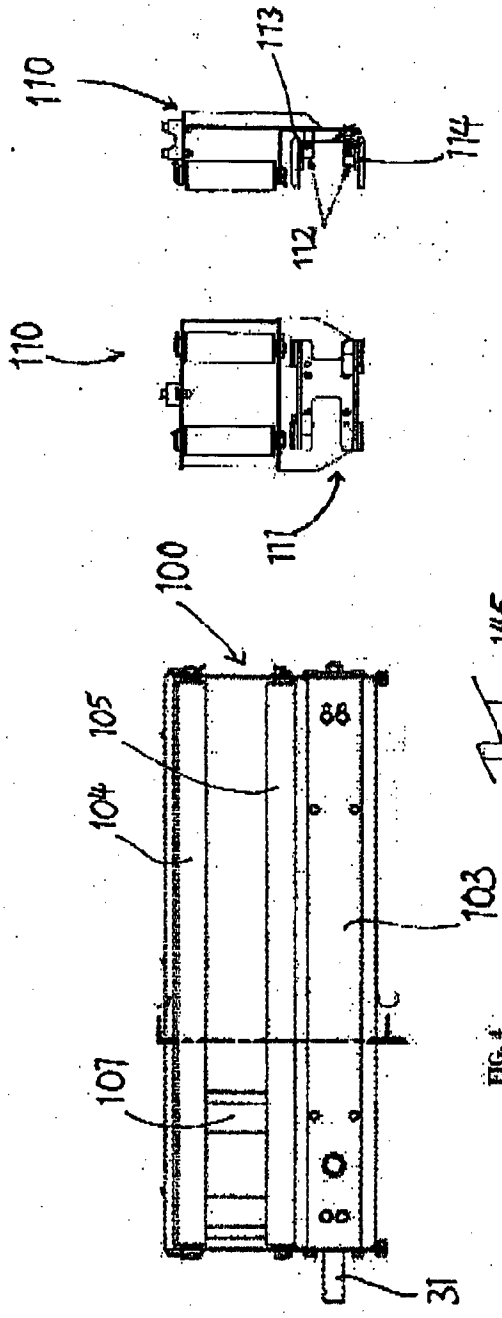


FIG. 4

FIG. 5

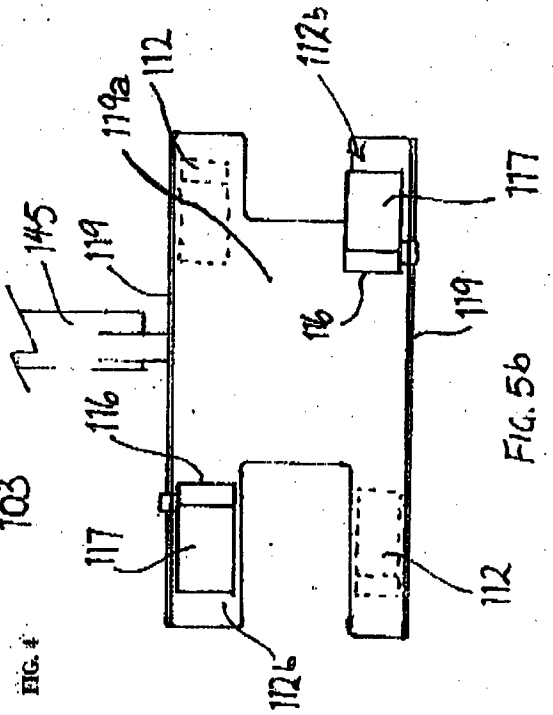


FIG. 5b

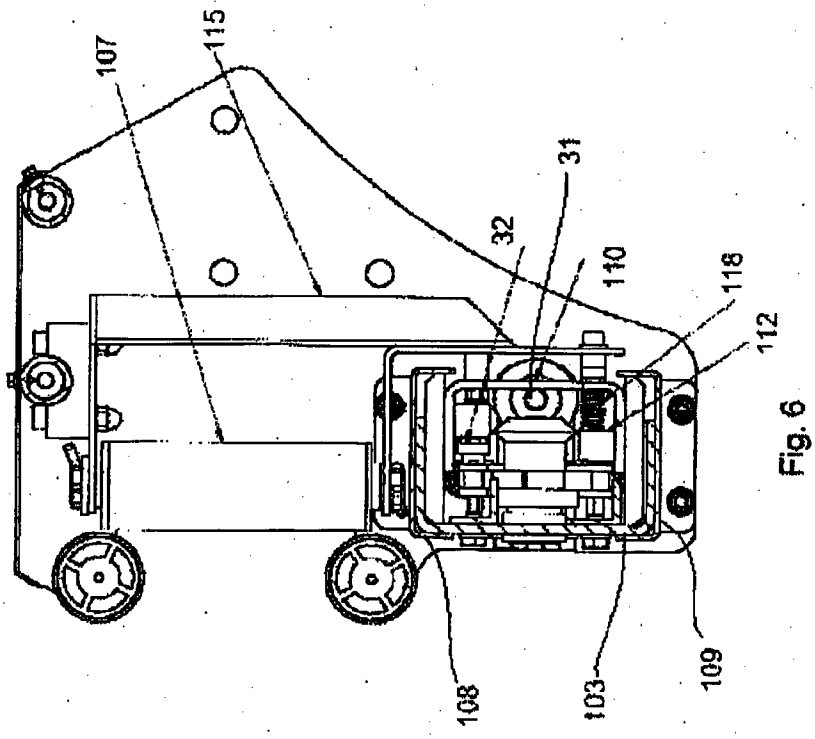


Fig. 6

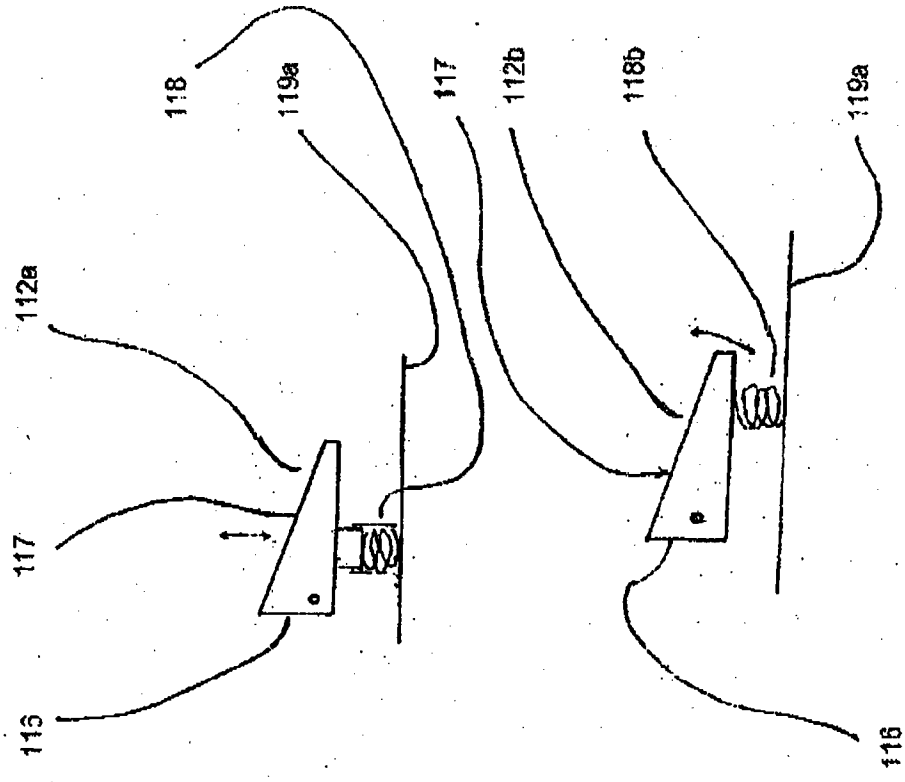


Fig. 6a

Fig. 6b

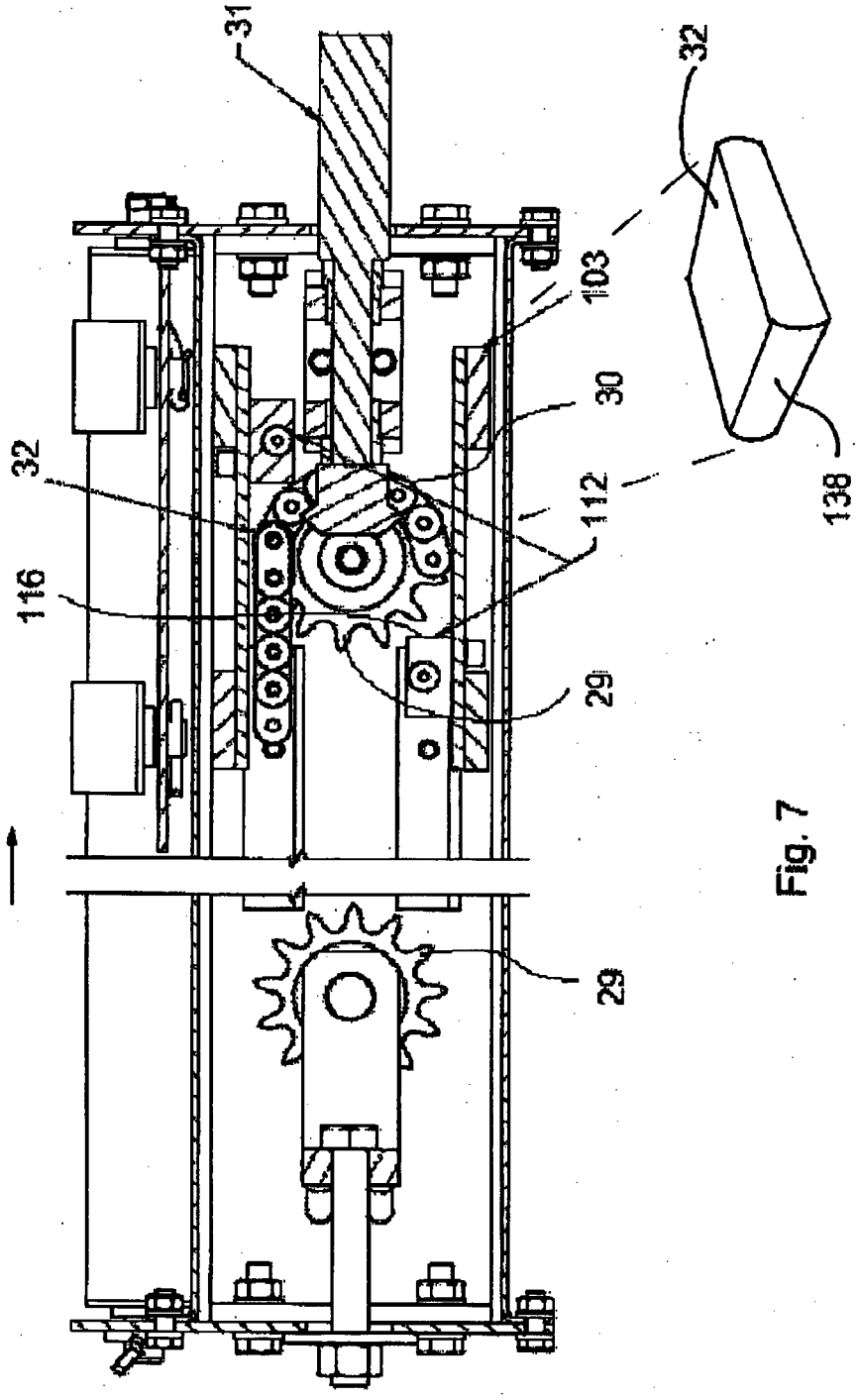


Fig. 7

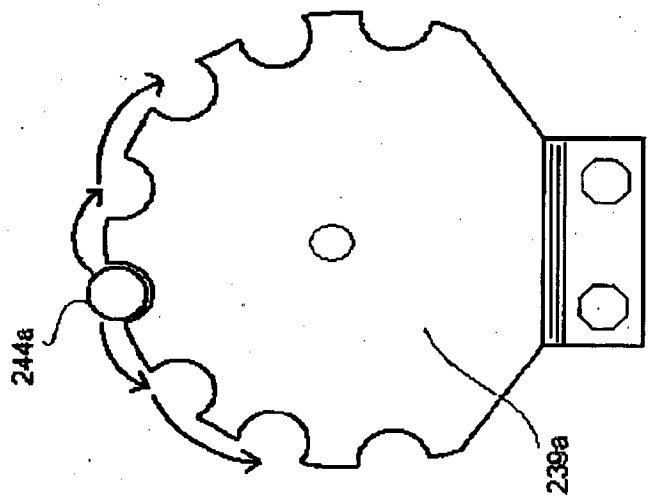


Fig. 8b

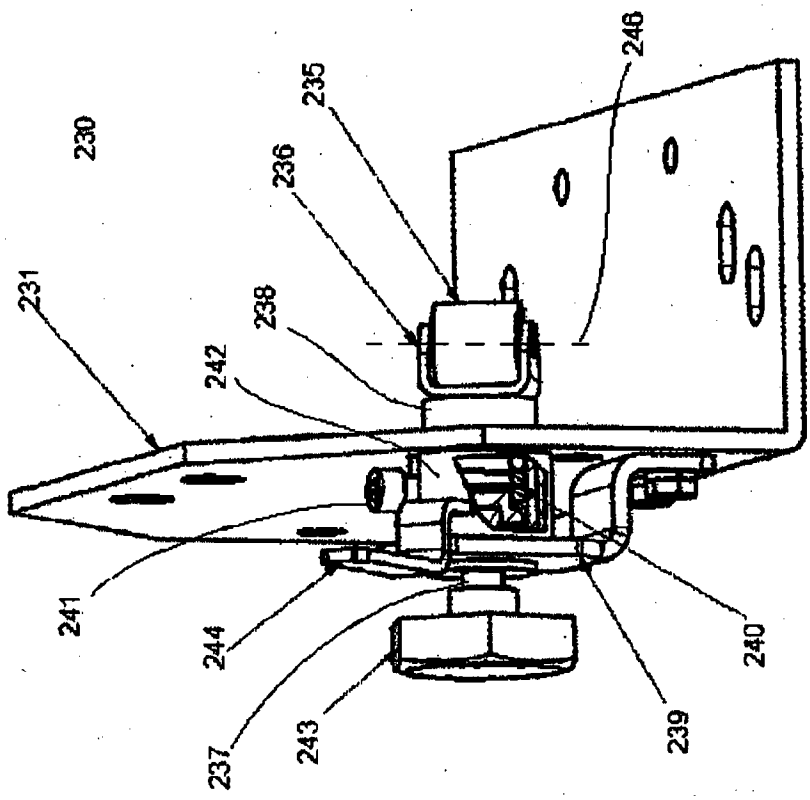


Fig. 8a

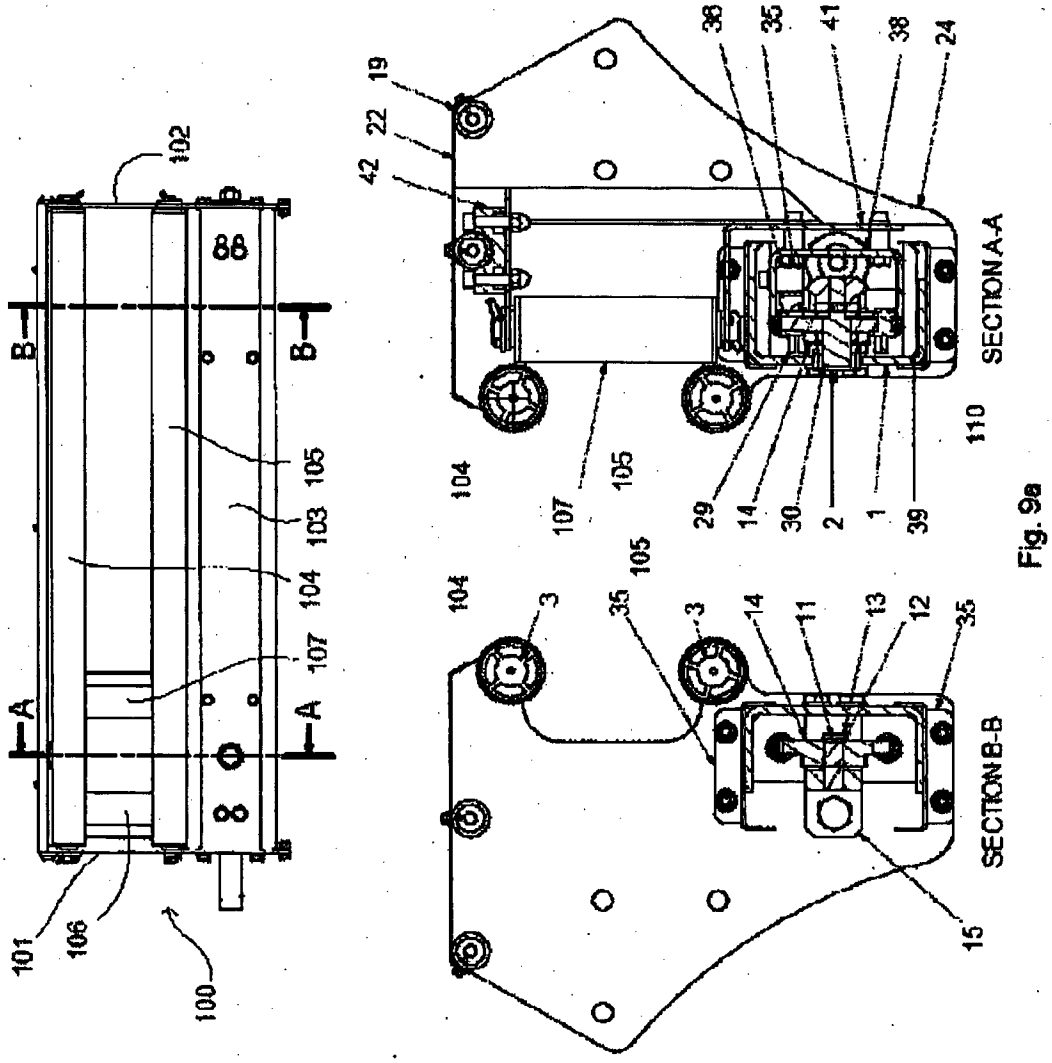

102
88
B
B
105
103
104
107
A
A
101
106
100
19
22
42
36
35
41
38
24
SECTION A-A
104
107
105
29
14
30
2
1
39
110
104
105
3
35
3
14
11
13
12
35
SECTION B-B
15

Fig. 9a

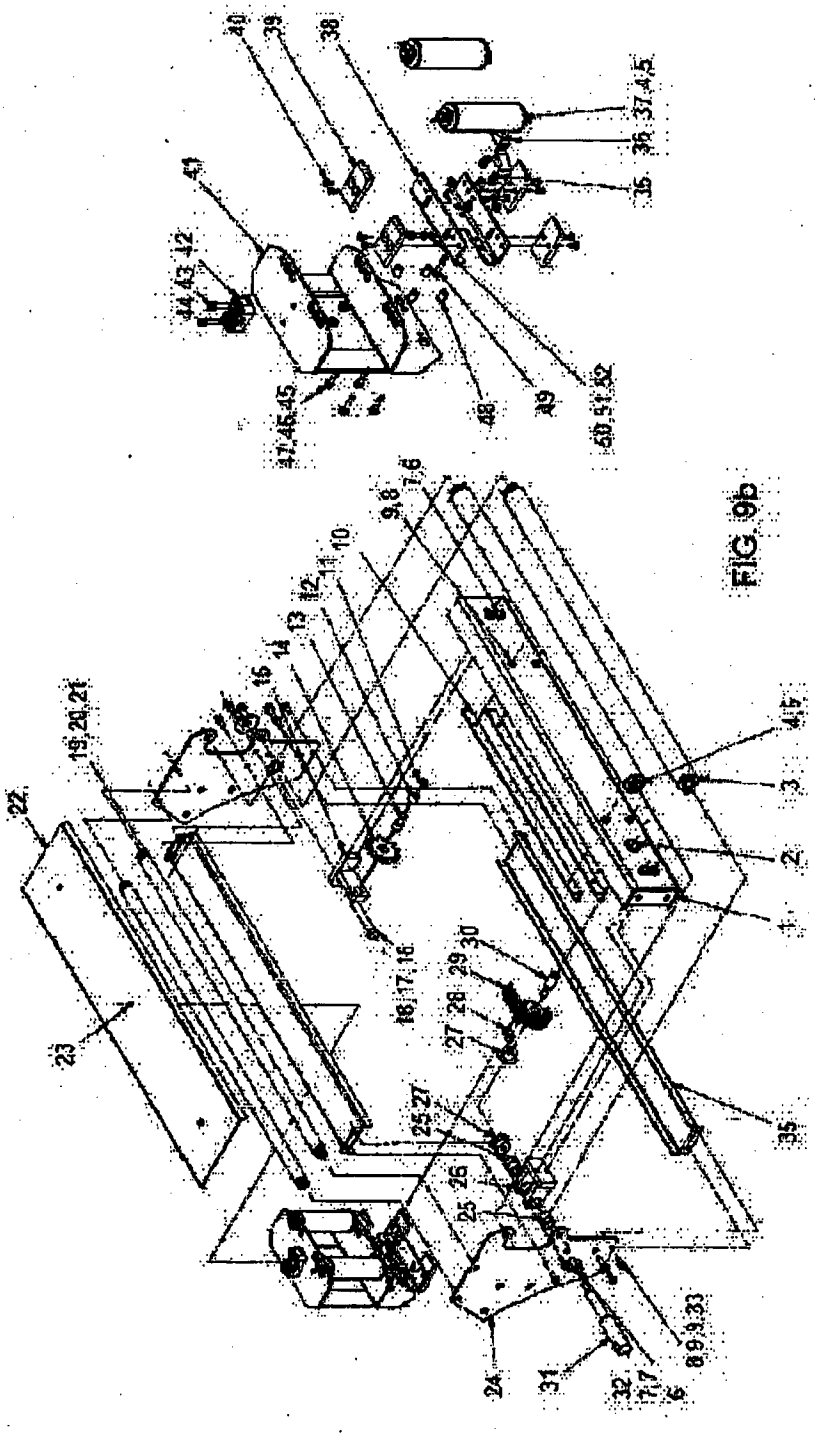

40
39
38
36 37 4,5
35
41
42
44 43
47,46,45
48
49
50,51,52
9,8
7,6
10
11
12
13
14
15
19,20,21
22
4,5
3
2
1
16,17,18
29
30
28
27
23
25,27
26
25
24
31
32
7,7
6
8,9,33
35

FIG. 9b

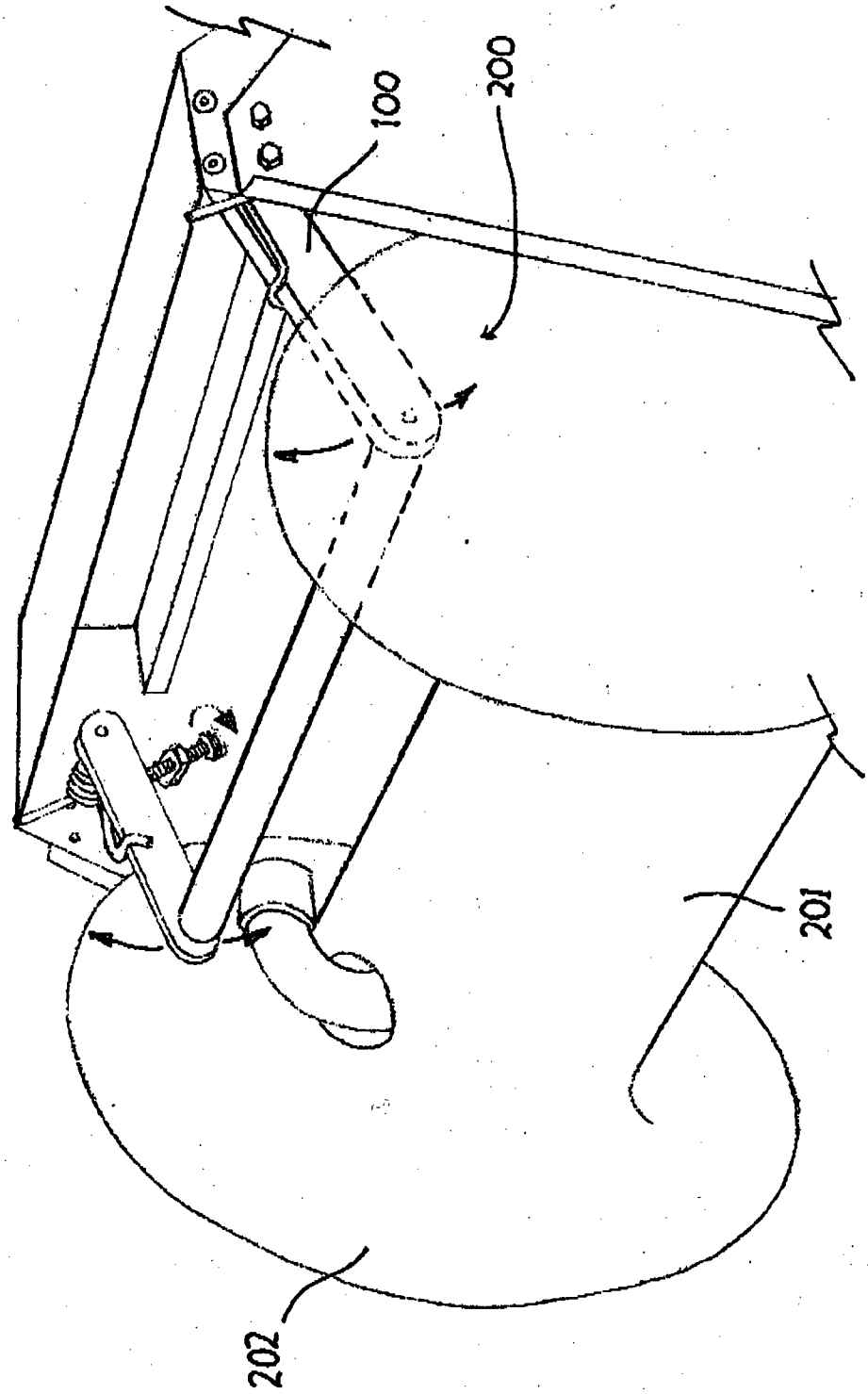


FIG. 10

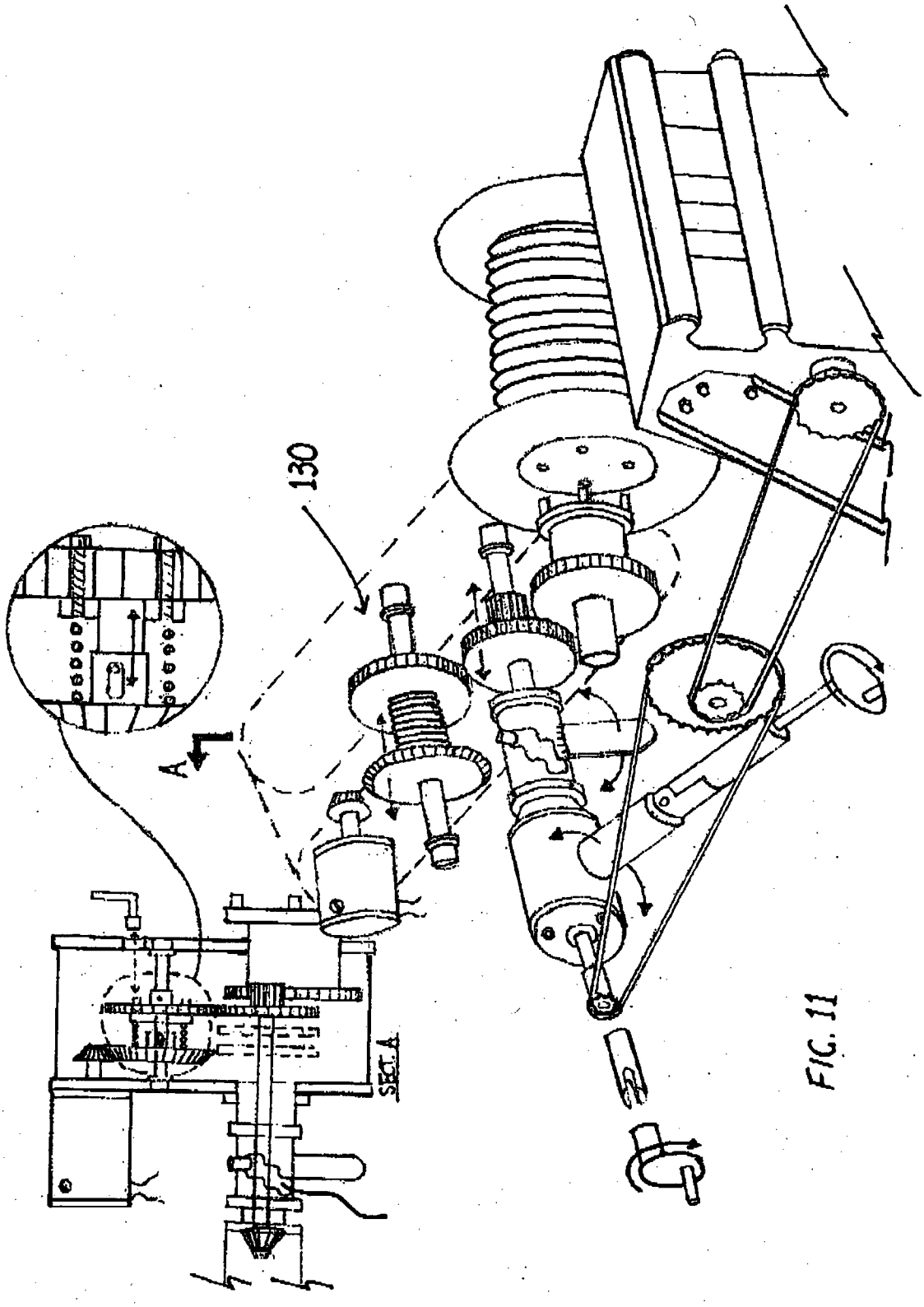


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2011/001152

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

B65H 54/28 (2006.01) ***B66D 1/38*** (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)

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)

EPODOC/WPI: B65H and keywords: reel+, spool+, cable+, hose+, wire+, tube+, rope+, level wind+, guide+, drive+, motor+, carriage+, chain+, dog+, lobe+, reciprocat+, revers+, latch+, bar+, nut+, stub+, project+, +engag+, coupl+, lock+, deflect+, slip+, avoid+, dis_engag+, de_coupl+, un_lock+, Google Patent and Espace searches: B66D plus keywords: level winding, chain, reel, carriage, guide, control.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5330122 A (WOOD) 19 July 1994 See Abstract, Figures, columns 4-5	1-20
A	US 2006/0011765 A1 (DION) 19 January 2006 See Abstract, Figures, para. [0019]-[0022], [0033]-[0034]	1-20
A	US 4251036 A (MCLAIN) 17 February 1981 See Abstract, Figures, columns 4-5	1-20
A	FR 2576886 A1 (SETIC [FR]) 08 August 1986 English Abstract retrieved from EPODOC database See whole Abstract, Figures	1-20

[X] Further documents are listed in the continuation of Box C [X] 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	Date of mailing of the international search report
16 December 2011	19/12/2011
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **HONG YU** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6283 7946

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2011/001152

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2151268 A (JOACHIM UHING) 17 July 1985 See Abstract, Figures, pages 1-2	1-20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2011/001152

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	5330122	AU	15080/92	CA	2067906		
US	2006011765	US	7210647				
US	4251036	NONE					
FR	2576886	NONE					
GB	2151268	AT	A349784	CH	665197	DE	3345420
		FR	2556703	NL	8403452		

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX