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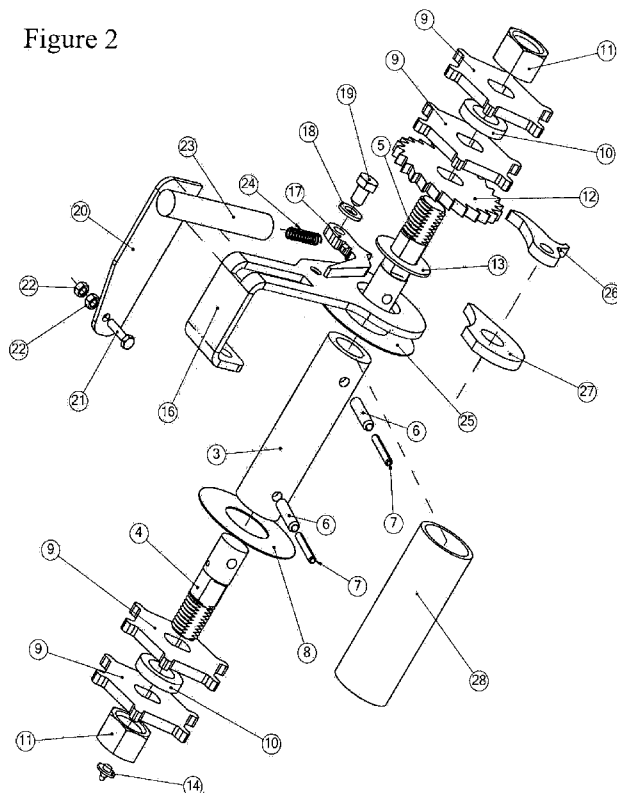
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[Continued on next page]

(54) Title: CHAIN TENSIONING DEVICE

Figure 2



(57) Abstract: The invention relates to a chain tensioning device for tensioning chain. The chain tensioning device comprises: a rotatable member adapted to be engagable with the chain so that, when engaged thereto, rotation of the member advances the chain in a direction to induce tension, wherein said rotatable member is coupled to a toothed ratchet wheel; an actuator means; a first pawl associated with the actuator means and biased into contact with said ratchet wheel such that, upon actuation, the actuator means rotates the ratchet wheel in a first direction which causes a corresponding rotation of the rotatable member and a resulting tension in the chain; and a second pawl which engages with the ratchet wheel to prevent rotation of the ratchet wheel in a second direction counter to said first direction and serves to inhibit the release of tension in the chain.

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Chain Tensioning Device

This invention relates to a chain tensioning device and in particular, but not exclusively, to a chain tensioning device for tensioning and/or tightening load anchorage chains used in securing loads to load-carrying vehicles such as trucks, trailers, railway wagons or the like.

Load anchorage chains are widely used in association with load-carrying vehicles to go over the top of a load of freight or goods and hold the load in place in the load-carrying space of such vehicles. Typically, one end of the load anchorage chain is fixed to a first side of the vehicle and the other end of the load anchorage chain is releasably fastened by a chain twitch (also known as a ratchet chain binder or load binder) on a second side of the vehicle.

Because a chain twitch is typically operated manually by a person standing in close proximity to the device, these devices need to be used carefully because of the risk of serious injury to the operator in the event that the chain is suddenly released from a high-degree of tension.

Summary of the Invention

According to a first aspect of the invention, there is provided a chain tensioning device for tensioning chain, the device comprising: a rotatable member adapted to be engagable with the chain so that, when engaged thereto, rotation of the member advances the chain in a direction to induce tension, wherein said rotatable member is coupled to a toothed ratchet wheel; an actuator means; a first pawl associated with the actuator means and biased into contact with said ratchet wheel such that, upon actuation, the actuator means rotates the ratchet wheel in a first direction which causes a corresponding rotation of the rotatable member and a resulting tension in the chain; and a second pawl which engages with the ratchet wheel to prevent rotation of the ratchet wheel in a second direction counter to said first direction and serves to inhibit the release of tension in the chain.

The chain is free at one end and fixed or locked at the other end.

The actuator means may be arranged to perform an indexing movement involving a forward stroke in which the first pawl engages the teeth of the ratchet wheel and moves the wheel forwards, and a backward stroke in which the first pawl moves in a reverse

direction without engaging the teeth of the ratchet wheel. During the backward stroke the ratchet wheel, and hence the rotatable member, are prevented from reverse movement by the second pawl.

5 The actuator means may be operated either manually and/or automatically. For manual operation, the actuator means may comprise a handle operable by an operator. Additionally or alternatively, the actuator means may comprise an air ram or other suitable mechanical actuator for automatic operation.

10 The rotatable member may comprise one or more toothed sprockets arranged to engage with the chain. The sprocket or sprockets are preferably generally polygonal in shape, for example, pentagonal or hexagonal. In one embodiment, the sprocket(s) are generally hexagonal with a tooth extending from each of the six vertices.

Detailed Description of the Invention

Various embodiments of the chain tensioning device will now be described, by way of example only, with reference to the accompanying drawings, in which:

15 Figure 1 is a see-through view of the chain tensioning device (shown in solid line) mounted in an elbow of a generally U-shaped log bolster (shown in dashed line),

Figure 2 is an exploded view of the chain tensioning device of Figure 1,

Figure 3 is a longitudinal cross-section view of the chain tensioning device of Figure 1,

Figure 4 is an exploded view of an alternative construction to Figure 1,

20 Figure 5 is an exploded view of a further alternative construction to Figure 1, and

Figure 6 is a perspective view of the chain tensioning device of Figure 5.

As shown in the drawings, the chain tensioning device, shown generally as 1, is for tensioning chain, the device comprising: a rotatable member 9 adapted to be engagable with the chain so that, when engaged thereto, rotation of the member advances the chain
25 in a direction to induce tension, wherein said rotatable member is coupled to a toothed ratchet wheel 12; an actuator means 16; a first pawl 17 associated with the actuator means and biased into contact with said ratchet wheel such that, upon actuation, the actuator means rotates the ratchet wheel in a first direction which causes a corresponding

rotation of the rotatable member and a resulting tension in the chain; and a second pawl 26 which engages with the ratchet wheel to prevent rotation of the ratchet wheel in a second direction counter to said first direction and serves to inhibit the release of tension in the chain.

- 5 The chain tensioning device 1 is designed to allow a load anchorage chain which is fixed at one end and free at the other end to be tightened around a load of freight or goods, for example, timber logs or metal pipes. In this manner, the load can be secured to a load carrying vehicle, for example a truck trailer or railway wagon, for transport.

10 As depicted in Figure 1, the chain tensioning device 1 may be mounted in an elbow of a generally U-shaped log bolster 2 for use on a trailer of a logging truck. However, it will be appreciated that the chain tensioning device is not limited to placement on a bolster and could be mounted in any suitable support surface.

With reference to the embodiment illustrated in Figures 1-3, the chain tensioning device 1 includes a longitudinally elongated, hollow, cylindrical axle 3 in which axle stubs 4 and 5 are partially inserted at either end such that a portion of each axle stub protrudes out from the axle. The axle stubs are securely fastened to the axle by means of roll pins 6 and 7 inserted through aligned apertures in the axle stub and the axle. The two axle stubs 4 and 5 are identical and each has a cylindrical portion to engage with the cylindrical hollow bore of the axle and an externally threaded portion to engage with an internally threaded locking nut 11, such as a nylock nut. A longitudinally elongated, hollow, cylindrical support tube 28 surrounds the axle and is affixed to the bolster 2 or other support surface. The support tube is sized such that the axle can rotate within the stationary support tube. The axle, axle stubs and the support tube may be made of any suitable metal or alloy, such as steel.

- 25 At one end of the axle 3, an annular wear washer 25, which may be made of nylon or any other suitable material, is mounted onto the axle stub 5 and rests on the rim shoulder of the axle. This serves as a support for other parts. A ratchet handle 16 is then mounted on the axle stub 5 so that it rests on the washer 25. The ratchet handle includes a handle portion capable of being gripped by the hand of an operator and a circular aperture sized to receive the axle stub 5. The ratchet handle is capable of being rotated either clockwise or anti-clockwise about the axle stub 5 by the operator. For greater safety, the ratchet handle is also capable of being rotated either clockwise or anti-clockwise about the axle

stub 5 by an air ram or other suitable mechanical actuator for automatic operation. A stroke adjustor plate 20 is attached to the ratchet handle to enable an air ram (not shown) to apply continuous ratchet winding tension to the device. The stroke adjustor plate includes a bolt 21 fitted with a first nut and a second locking nut, both nuts shown as 22.

5 The ratchet handle and the stroke adjustor plate are both preferably made of Domex® steel but may be made of any other suitable metal or alloy.

A cylindrical ratchet wheel 12 having asymmetric teeth is mounted on the axle stub 5 and rests on an annular shim 13. A first pawl 17 is pivotally attached to the ratchet handle 16 by a bolt 19 with a washer 18. The ratchet wheel and the pawl are both preferably made of Hardox® steel but may be made of any other suitable metal or alloy. The pawl 17 has one or more teeth corresponding to the teeth on the ratchet wheel 12. The teeth on the pawl are biased into engagement with those on the ratchet wheel by a compression spring 24 bearing against a cylindrical rod 23 which is mounted in a channel in the ratchet handle 16. The position of the cylindrical rod in the channel can be adjusted in order to ensure the compression spring provides the correct amount of bias to the pawl. The cylindrical rod may be made of steel or any other suitable metal or alloy.

The teeth on the ratchet wheel 12 and the first pawl 17 are shaped so that when the ratchet handle 16 is rotated anti-clockwise in Figure 1 the teeth on the pawl and the ratchet wheel engage firmly, whereby the ratchet handle causes corresponding rotation of the ratchet wheel and the axle 3. In contrast, clockwise rotation of the ratchet handle 16 causes the teeth on the pawl 17 to disengage and ride over the teeth on the ratchet wheel 12.

Mounted onto the axle stub 5 and resting on the ratchet wheel 12 is the first of a pair of annular toothed sprockets 9, the two sprockets being separated from each other by an annular spacer 10. The sprockets of the illustrated embodiment each have a generally hexagonal shape with a tooth extending from each of the six vertices. A generally polygonal shape, such as a pentagon or hexagon, is preferred to a circular shape because the chain can lie flat on the sprocket and, consequently, there is a decreased risk that the chain may dislodge from the sprocket, for example, during transit of the vehicle.

30 The teeth on the sprockets 9 are arranged to engage with apertures within the load anchorage chain. Thus, anti-clockwise rotation of the ratchet handle 16 causes the chain sprockets 9 to advance the engaged chain in a direction to induce tension in the chain.

The sprockets are preferably made of Domex® steel but may be made of any other suitable metal or alloy.

To inhibit the release of tension in the chain, a second pawl 26 is pivotally mounted atop a spacer 27 on the bolster 2 or other support surface. The pawl 26 has one or more teeth corresponding to the teeth on the ratchet wheel 12. The second pawl 26 is preferably made of Hardox® steel and the spacer 27 is preferably made of Domex® steel but both may be made of any other suitable metal or alloy.

At the other end of the axle 3 an annular wear washer 8, which may be made of nylon or any other suitable material, is mounted onto the axle stub 4 and rests on the rim shoulder of the axle. This is followed by a pair of annular toothed sprockets 9, the two sprockets being the same as those described above and separated from each other by an annular spacer 10. The aforesaid parts are clamped into place by an internally threaded locking nut 11, such as a nylock nut. A grease nipple 14 fits onto the end of the axle stub 4 so as to allow lubrication of the axle 3 inside the support tube 28.

When not in use, the ratchet handle 16 is prevented from rotation by the engagement of the first pawl 17 with the ratchet wheel 12. The ratchet wheel is itself prevented from rotation by the second pawl 26.

The ratchet handle 16 is arranged to perform an indexing movement involving a forward stroke in which the first pawl 17 engages the teeth of the ratchet wheel 16 and moves the wheel forwards, and a backward stroke in which the first pawl moves in a reverse direction without engaging the teeth of the ratchet wheel. During the backward stroke the ratchet wheel, and hence the toothed sprockets 9, are prevented from reverse movement by the second pawl 26. Thus, the ratchet handle may be reciprocated back and forth so as to rotate the ratchet wheel in steps, thereby causing rotation of the toothed sprockets and resulting in tension in the chain. In order to release the tension in the chain, the second pawl can simply be pivoted out of engagement with the ratchet wheel with the rate of release of tension being safely controllable by means of the ratchet handle.

In an alternative embodiment shown in Figure 4, the axle 3 only contains a single axle stub 5 at one end of the axle 3 and, apart from an annular retainer 29, does not have any further parts at the other end of the axle. In this illustrated embodiment, the chain

tensioning device 1 is mounted in a belly cylinder mount and the device includes a spring holder 30 to hold the second pawl 26 engaged with the ratchet wheel 12.

5 In a further embodiment shown in Figures 5 and 6, the ratchet handle 16 is divided into two parts 16a and 16b positioned on either side of the toothed sprocket 9. Dividing the handle into two parts improves strength and durability as it removes the twisting action associated with a one-piece handle. The two parts of the ratchet handle are held together by a pair of steel side plates, namely, a drive side plate 31 and a handle side plate 32.

10 A spacer element 33 is partially inserted through an aperture on either side of the second pawl 26 in order to prevent the second pawl from being pinched when the chain tensioning device is constructed. The second pawl is capable of pivoting on the spacer elements. The addition of a chain guide 34, bolt retainer 35, first pawl retainer 36, screw 18 and lever stop pin 38 complete the chain tensioning device shown in this embodiment.

15 While some preferred aspects of the invention have been described by way of example, it should be appreciated that modifications and/or improvements can occur without departing from the scope of the invention as set out in this specification.

The terms comprise, comprises, comprising, or comprised, if and when used herein, should be interpreted non-exclusively, that is, as conveying "consisting of or including".

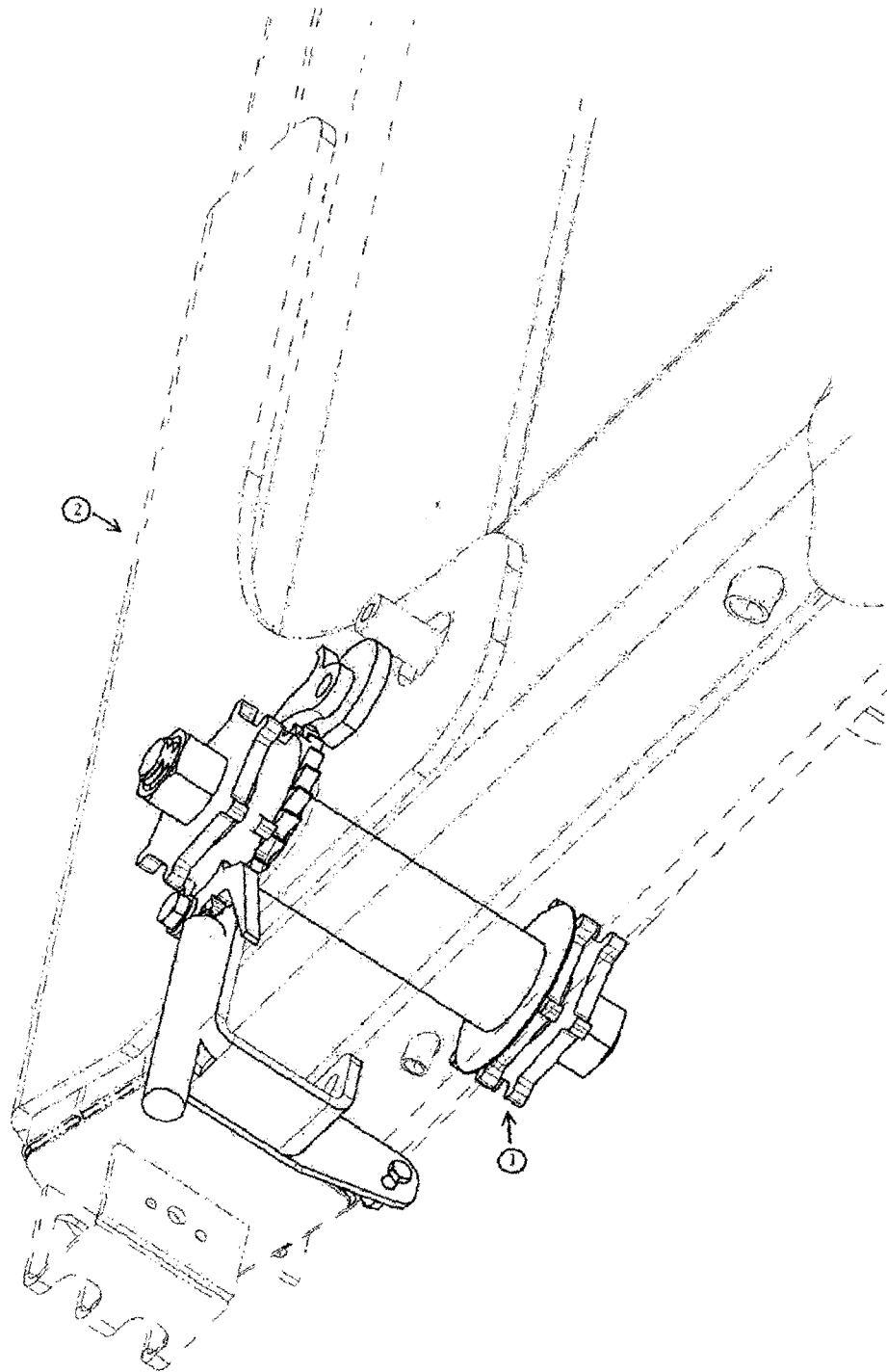
Claims

1. A chain tensioning device for tensioning chain, the device comprising: a rotatable member adapted to be engagable with the chain so that, when engaged thereto, rotation of the member advances the chain in a direction to induce tension, wherein said rotatable member is coupled to a toothed ratchet wheel; an actuator means; a first pawl associated with the actuator means and biased into contact with said ratchet wheel such that, upon actuation, the actuator means rotates the ratchet wheel in a first direction which causes a corresponding rotation of the rotatable member and a resulting tension in the chain; and a second pawl which engages with the ratchet wheel to prevent rotation of the ratchet wheel in a second direction counter to said first direction and serves to inhibit the release of tension in the chain.
2. The chain tensioning device according to claim 1, wherein the chain is free at one end and fixed or locked at the other end.
3. The chain tensioning device according to claims 1 or 2, wherein the actuator means is arranged to perform an indexing movement involving a forward stroke in which the first pawl engages the teeth of the ratchet wheel and moves the wheel forwards, and a backward stroke in which the first pawl moves in a reverse direction without engaging the teeth of the ratchet wheel.
4. The chain tensioning device according to claim 3, wherein during the backward stroke the ratchet wheel, and hence the rotatable member, are prevented from reverse movement by the second pawl.
5. The chain tensioning device according to any one of claims 1 to 4, wherein the actuator means may be operated either manually and/or automatically.
6. The chain tensioning device according to claim 5, wherein for manual operation, the actuator means may comprise a handle operable by an operator.
7. The chain tensioning device according to claims 5 or 6, wherein the actuator means comprises an air ram or other suitable mechanical actuator for automatic operation.

8. The chain tensioning device according to any one of claims 1 to 7, wherein the rotatable member comprises one or more toothed sprockets arranged to engage with the chain.

9. The chain tensioning device according to claim 8, wherein the sprocket or
5 sprockets are generally polygonal in shape.

10. The chain tensioning device according to claim 9, wherein the sprocket or sprockets are generally hexagonal with a tooth extending from each of the six vertices.



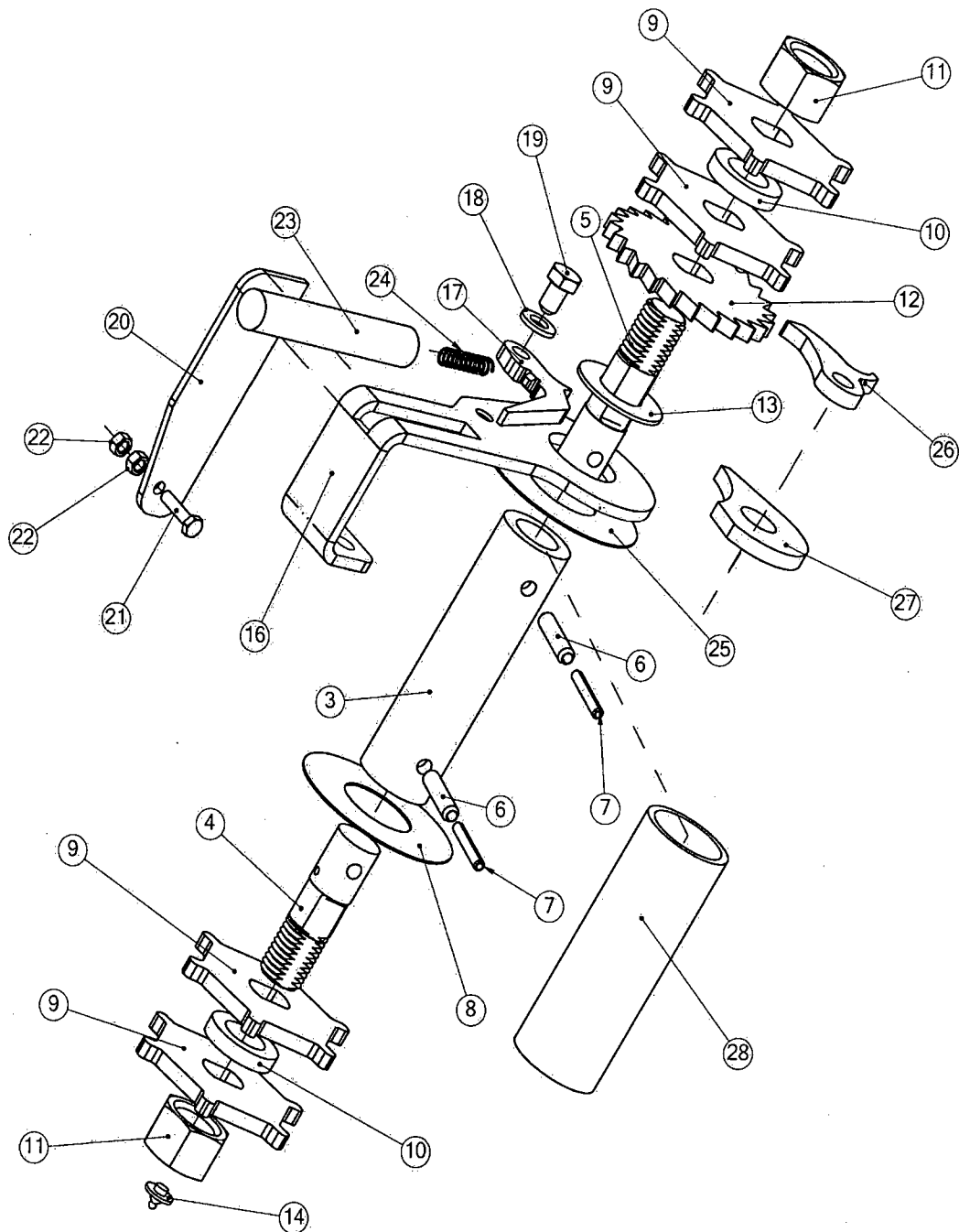


Figure 3

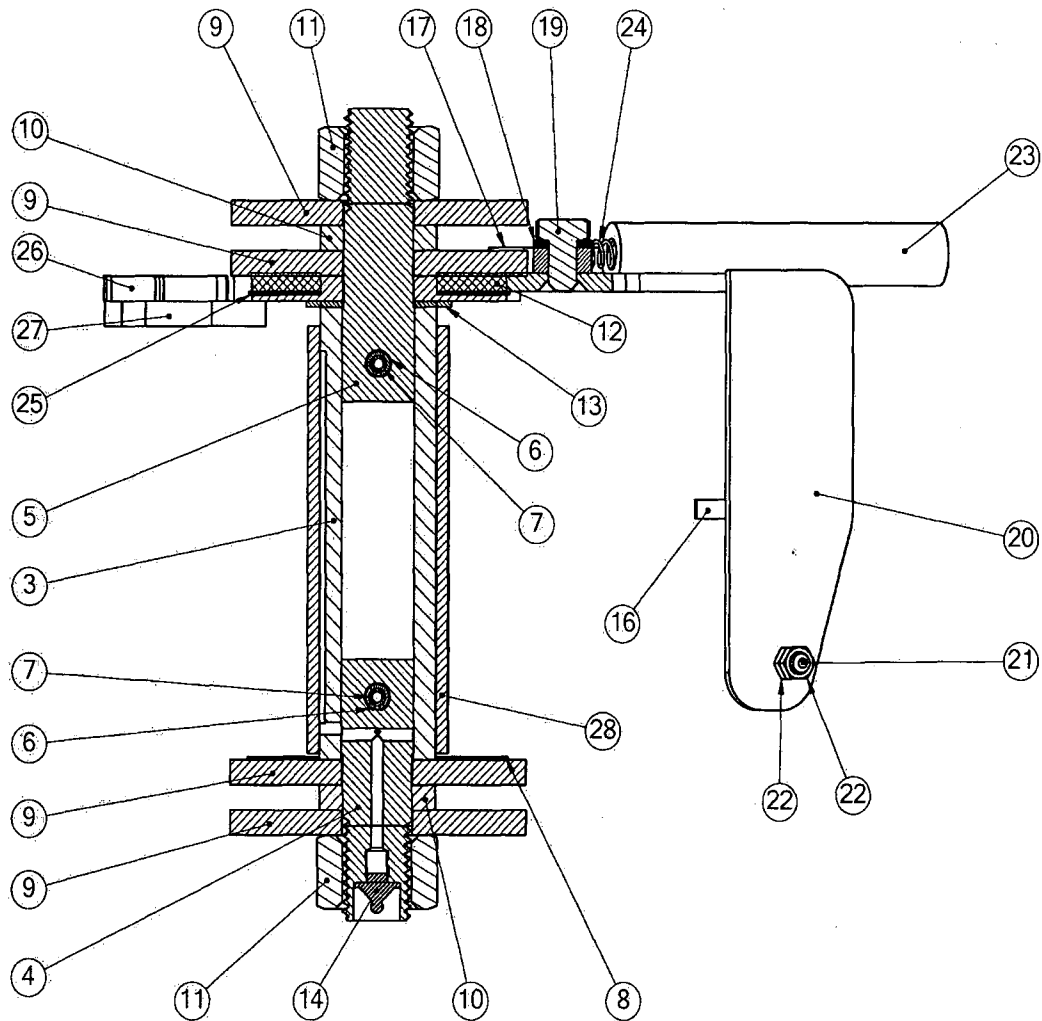


Figure 4

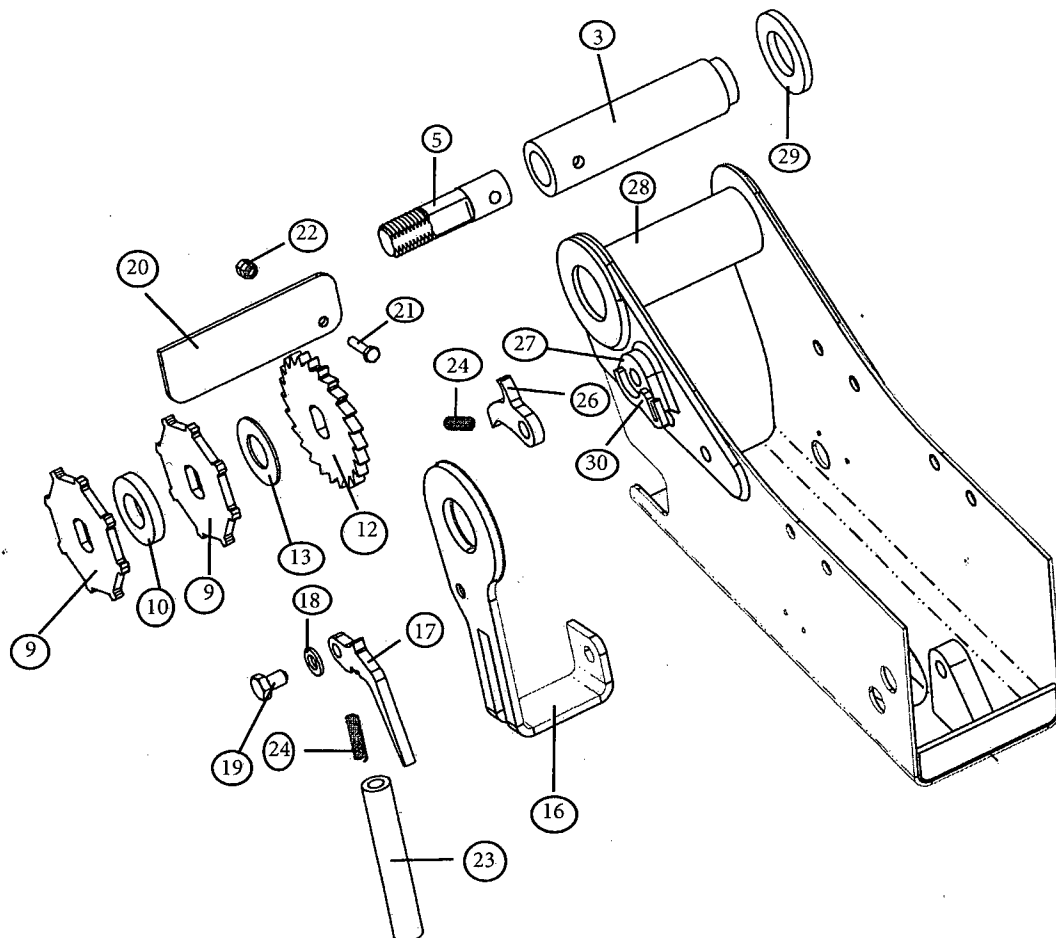
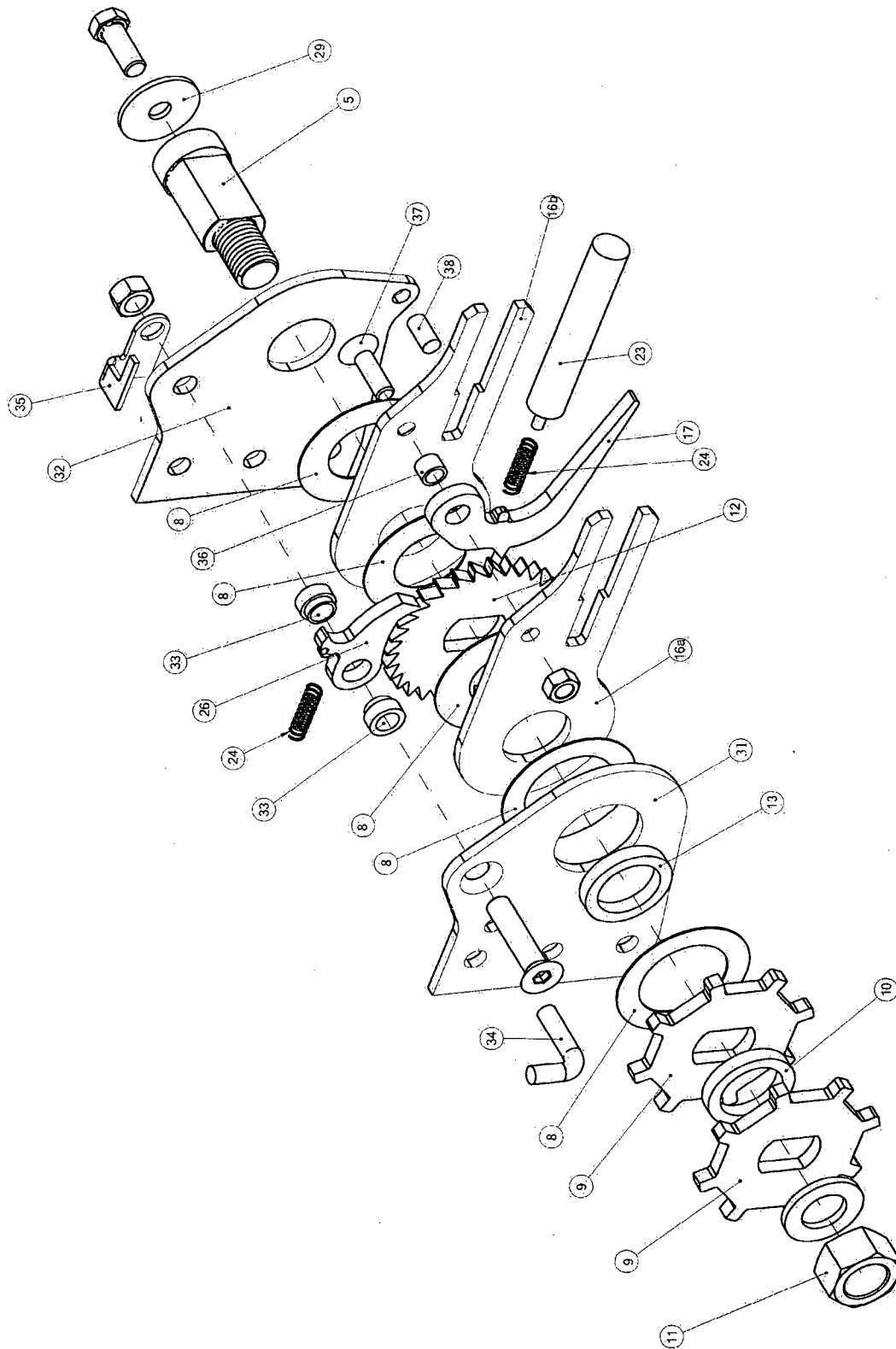
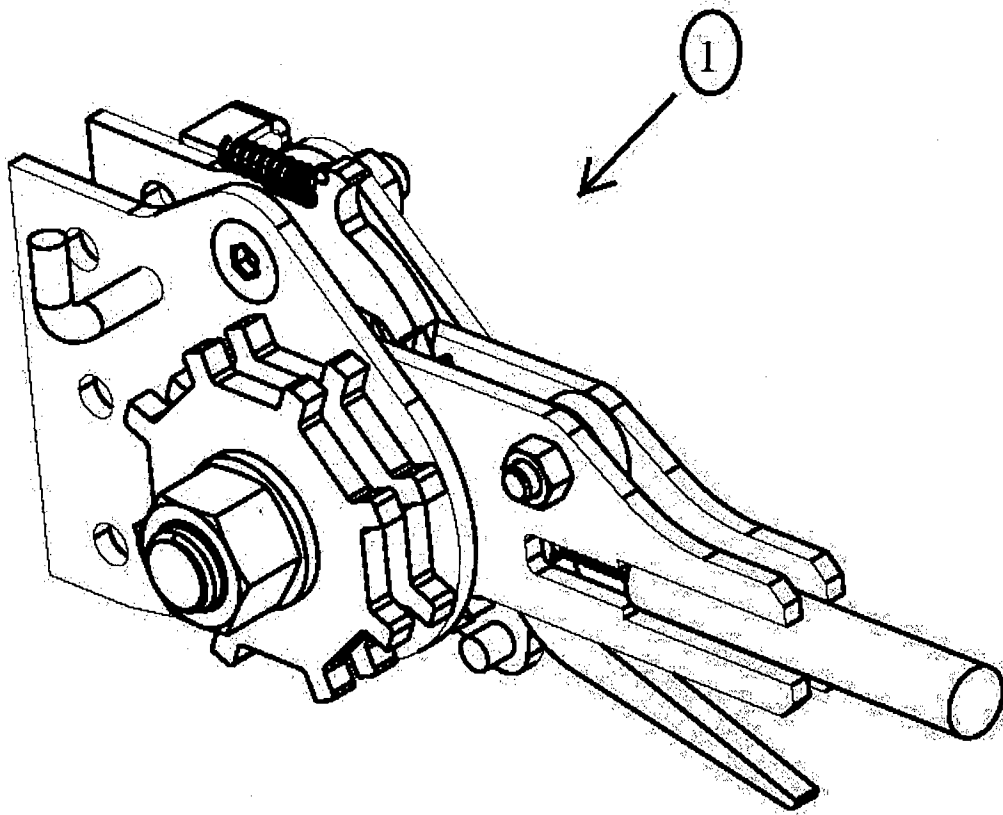


Figure 5



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Figure 6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ2013/000131

A. CLASSIFICATION OF SUBJECT MATTER B25B 25/00 (2006.01) B60P 7/08 (2006.01) B65B 13/22 (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) WPI, EPODOC: IPC, CPC, B25B, B60P7/06, B65B13 & keywords: chain, strap, belt, ratchet and like terms. WPI, EPODOC with keywords: chain, ratchet, tighten, tension, binder, spring, bias, handle, lever and like terms.		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> 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 1 November 2013		Date of mailing of the international search report 01 November 2013
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustalia.gov.au Facsimile No.: +61 2 6283 7999		Authorised officer Shuiwei Xie AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. (02) 6283 7942

INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		PCT/NZ2013/000131
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 1375558 A (BUTNER) 19 April 1921 Figures 1-3 and accompanying description	1-10
X	US 8152139 B2 (WANG) 10 April 2012 Abstract and figures 4-7	1-10
X	CN 202156546 U (ZHEJIANG TOPSUN LOGISTICS CONTROL CO LTD) 07 March 2012 English abstract and figures 1-5	1-10
A	US 2363138 A (MOORE) 21 November 1944 Figures 1-3	1

Form PCT/ISA/210 (fifth sheet) (July 2009)

INTERNATIONAL SEARCH REPORT		International application No.	
Information on patent family members		PCT/NZ2013/000131	
This Annex lists known 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/s Cited in Search Report		Patent Family Member/s	
Publication Number	Publication Date	Publication Number	Publication Date
US 1375558 A	19 Apr 1921	None	
US 8152139 B2	10 Apr 2012	AU 2006301899 B2	24 Jul 2008
		CA 2622269 A1	19 Apr 2007
		US 2010111634 A1	06 May 2010
		US 8152139 B2	10 Apr 2012
		WO 2007041752 A1	19 Apr 2007
CN 202156546 U	07 Mar 2012	None	
US 2363138 A	21 Nov 1944	None	
End of Annex			

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