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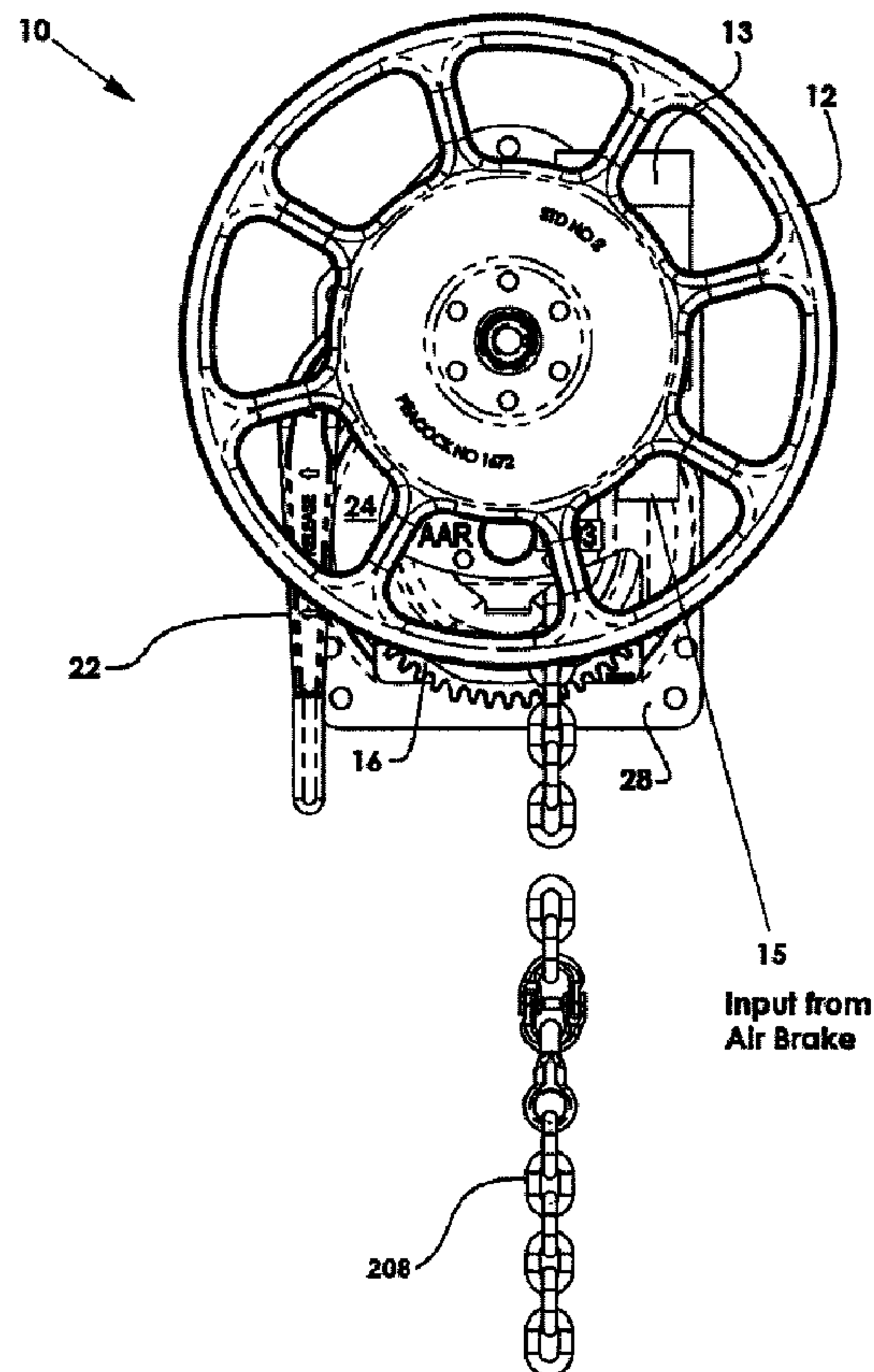
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(54) Titre : LOCALISATEUR DE CHAÎNE

(54) Title: CHAIN LOCATOR



(57) Abrégé/Abstract:

A brake mechanism having a chain locator comprises a chain coupled between a braking mechanism and a railway car brake system, a marker is releasably secured to the chain, and a sensor is coupled to the railway car proximate the chain for detecting the state of the railway car brake system. The chain is moveable between a first position in which the marker is not sensed by the sensor, and a second position in which the sensor detects the marker.



ABSTRACT

A brake mechanism having a chain locator comprises a chain coupled between a braking mechanism and a railway car brake system, a marker is releasably secured to the chain, and a sensor is coupled to the railway car proximate the chain for detecting the state of the railway car brake system. The chain is moveable between a first position in which the marker is not sensed by the sensor, and a second position in which the sensor detects the marker.

NAME OF INVENTION**CHAIN LOCATOR****FIELD OF THE INVENTION**

[001] The present invention relates generally to railcar brake systems. More particularly, the present invention relates to a chain locator for use with a railway car brake system.

BACKGROUND

[002] Wheel damage contributes a great deal to maintenance costs associated with railway freight cars. Unreleased handbrakes contribute to most damage on freight car wheels. That is, if the handbrake is left in the applied position and an engine then pulls the railway car, the wheel will not rotate thereby causing flat spots to form on the area of the wheel in contact with the rail.

[003] It is well known in the art of railroad cars to equip railcars with a manual brake system that is actuated by a manually turned wheel. The wheel is attached through gearing to an axle by a chain running down the front of the car, the other end of the chain being connected to the brake rigging. Turning of the wheel gathers the chain, putting it in tension, thereby causing the brake pads to contact the wheel. Prior art systems also use quick release handbrakes to release the brakes. However, one problem with these systems is that it is difficult to detect if the brake system is actually fully released.

[004] One way to ensure that a brake system is released is to detect when the brake is in the fully released position. Several methods have been suggested for sensing when a freight car hand brake is fully released such as those systems described in U.S. Patent Nos. 6,170,619,

6,237,722 and 6,364,069. However, these solutions present additional problems and fail to provide an automated brake release solution.

SUMMARY OF THE INVENTION

[005] The present invention recognizes and addresses disadvantages of prior art constructions and methods, and it is an object of the present invention to provide an improved braking system. This and other objects may be achieved by a brake mechanism having a chain locator comprising a chain coupled between a braking mechanism and a railway car brake system, a marker releasably secured to the chain, and a sensor coupled to the railway car proximate the chain for detecting the state of the railway car brake system. The chain is moveable between a first position in which the marker is not sensed by the sensor, and a second position in which the sensor detects the marker. In some embodiments, the sensor is a proximity sensor. In other embodiments, the sensor is a switch type sensor.

[006] In yet other embodiments, chain locator further comprises a sensor bracket. In other embodiments, the sensor bracket is in the shape of a ring and the chain passes through the bracket. In yet other embodiments, the marker is a stop block. In some embodiments, the bracket prevents the stop block from passing through the bracket. In other embodiments, when the marker is sensed, the brake mechanism is in a released state.

[007] In another preferred embodiment, a brake mechanism having a chain locator comprises a brake mechanism for applying brakes on a railway car, a connector operatively coupled between the brake mechanism and the railway car brakes, and a sensor coupled to the railway car and configured to detect a portion of the connector. When the connector portion is detected by the sensor, the brake mechanism is in one of a state of the railway car brakes being engaged and a state of the railway car brakes being disengaged.

[008] In some embodiments the sensor is a proximity sensor. In other embodiments, a sensor bracket is operatively coupled to the sensor and the connector passes through a center opening of the bracket. In yet other embodiments, a stop block is operatively coupled to the connector. The stop block being configured to prevent the connector from moving more than a predetermined distance. In some embodiments, the connector is a chain. In other embodiments, the connector is a cable.

[009] In another preferred embodiment, a method for detecting the release of a railway car brake comprises the steps of providing a connector locator operatively coupled between a brake mechanism and a railway car braking system, the connector locator comprising a connector operatively coupled intermediate the brake mechanism and the railway car braking mechanism, a marker operatively coupled to the connector and a sensor operatively coupled to the railway car and configured to detect a the connector marker. The method further comprises the step of sensing the marker when the brake mechanism is in a released state.

[0010] In some embodiment, the method further comprises the step of preventing the connector from moving more than a predetermined distance. In other embodiments, the connector is a chain. In yet other embodiments, the marker is a stop block that is operatively coupled to the connector and configured to be sensed by the sensor. In some embodiments, the method further comprises the step of releasing the brake mechanism so that the marker can be sensed by the sensor.

[0011] Various combinations and sub-combinations of the disclosed elements, as well as methods of utilizing same, which are discussed in detail below, provide other objects, features and aspects of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

- [0012] A full and enabling disclosure of the present invention, including the best mode thereof, to one of ordinary skill in the art, is set forth more particularly in the remainder of the specification, including reference to the accompanying drawings, in which:
- [0013] Figure 1 is a side elevation view of a prior art railway car having a handbrake connected to a truck brake via a chain;
- [0014] Figure 2 is a front plan view of an embodiment of a manual/automated hand brake for use in a freight car brake system;
- [0015] Figure 3 is a side view, in partial cutaway, of the hand brake of Figure 2;
- [0016] Figure 4 is an exploded perspective view of the hand brake of Figure 2;
- [0017] Figure 5 is an exploded perspective view of the hand brake gear shaft and gear mechanism of Figure 2;
- [0018] Figure 6 is a side cutaway view of the hand brake gear shaft and gear mechanism of Figure 5;
- [0019] Figs. 7A and 7B are partial cutaway views of the quick release mechanism used in the hand brake of Figure 2;
- [0020] Figs. 8A and 8B are partial perspective views of the sustained release mechanism used in the hand brake of Figure 1;
- [0021] Figure 9 is a partial perspective view of an automatic release mechanism for use with the hand brake of Figure 2;
- [0022] Figure 10 is a partial side view of the automatic release mechanism of Figure 9, shown in the released position;

- [0023] Figure 11 is a partial side view of the automatic release mechanism of Figure 9, shown in the operating position;
- [0024] Figure 12 is an exploded perspective view of an embodiment of a pulley system for use in a freight car brake system with the hand brake of Figure 2;
- [0025] Figure 13 is a perspective view of the pulley system of Figure 12 with the hand brake in the fully released position;
- [0026] Figure 14 is a perspective view of the pulley system of Figure 12 with the hand brake in the fully applied position;
- [0027] Figure 15 is an exploded view of an embodiment of a pulley system for use in a freight car brake system;
- [0028] Figure 16 is a perspective view of a drum for use in the pulley system of Figure 15;
- [0029] Figure 17 is a perspective view of the pulley system of Figure 15 with the hand brake in the fully released position;
- [0030] Figure 18 is a perspective view of the sheave of Figure 15 with the hand brake in the fully applied position;
- [0031] Figure 19 is an exploded perspective view of a chain locator for use with the hand brake of Figure 2 and/or the pulley systems of Figures 12 and 15;
- [0032] Figure 20 is a perspective view of the chain locator of Figure 19;
- [0033] Figure 21 is a perspective view of the chain locator of Figure 19;
- [0034] Figure 22 is an embodiment of a control valve for use with the hand brake of Figure 2, where the spools are in an initial position;
- [0035] Figure 23 is a plan view of the control valve of Figure 22 in a second position where the spools are in a second position that activates the hand brake; and

[0036] Figure 24 is a plan view of the control valve of Figure 22 in a third position where the spools are in a position to prevent activation of the hand brake.

[0037] Repeat use of reference characters in the present specification and drawings is intended to represent same or analogous features or elements of the invention according to the disclosure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0038] Reference will now be made in detail to presently preferred embodiments of the invention, one or more examples of which are illustrated in the accompanying drawings. Each example is provided by way of explanation, not limitation, of the invention. It is to be understood by one of ordinary skill in the art that the present discussion is a description of exemplary embodiments only, and is not intended as limiting the broader aspects of the present invention, which broader aspects are embodied in the exemplary constructions. In fact, it will be apparent to those skilled in the art that modifications and variations can be made in the present invention without departing from the scope and spirit thereof. For instance, features illustrated or described as part of one embodiment may be used on another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations as come within the scope of the appended claims and their equivalents.

[0039] Referring to Figure 1, a prior art hand brake 12 is shown mounted on a railway car 10. Railway car 10 is supported by a pair of single axle trucks "T" having respective wheels "W." Car 10 may be connected to an adjacent car (not shown) by means of a conventional coupler "C." A single axle suspension system includes a longitudinally extending side frame "S" having depending portions S1 and S2, which receive a transverse axle "A". Hand brake 12 includes a hand brake wheel 14 rotatably mounted on a vertically extending hand brake plate 16 supported by angles 17 in a conventional manner. It should be understood that any type of handbrake may

be used, and handbrake 12 is being shown for illustrative purposes. Hand brake wheel 14 coupled with a chain 18 that extends around a pulley 20 rotatably mounted on a suitable pin 22. Chain 18 is connected at one end 24 to a horizontally extending hand brake lever 26. A brake rod 31 is connected to a mid-portion 32 of lever 26. Brake rod 31, at one end 34, is connected to another horizontally extending brake lever 42.

[0040] It should be understood by those of skill in the art that the above described handbrake arrangement and railway car are presented for illustrative purposes only and do not limit the scope, breadth and use of the present invention. For example, the present invention may be used on any type of railway car in any combination of the various embodiments described herein.

[0041] Referring to Figures 2, 3 and 4, a manual/automated hand brake 10 for use in the present invention is shown having a handle 12, a geared shaft generally designated 14, a gear 16, a chain 208, which may be similar to chain 18 from Figure 1, a locking mechanism generally denoted 20, a release handle 22, an automated quick release mechanism 13 having an air input port 15 and a housing 24.

[0042] Referring particularly to Figure 4, housing 24 contains a back plate 26 and a cover plate 28. A first end of geared shaft 14 is received by back plate 26 in a bearing 30 and a second end is received by cover plate 28 by a bearing 32. Handle 12 is a round wheel that is rotationally fixed on geared shaft second end 90 and secured thereon by a washer 34 and nut 36. Gear 16 is rotationally fixed on a shaft 38 that has a first end 40 received by back plate 26 in a bearing 42 and a second end 44 received by cover plate 28 in a bearing 46. Chain 208 is secured to gear 16 by a fastener 48.

[0043] Locking mechanism 20 includes a shaft 50, a sustained release pawl 52, a locking pawl 54, a spring 56, and a bell crank 58. A first end of shaft 50 is received by back plate 26 in a

bearing 60 and a second end of the shaft is received by cover plate 28 in a bearing 62. Quick release handle 22 is rotationally fixed to the second end of shaft 50. Bell crank 58 is rotatably secured on pins 64 and 66 perpendicularly with respect to shaft 50. Referring to Figure 4 and 8A, a cam 68 formed on shaft 50 is operatively coupled to bell crank 58 so that rotation of shaft 50 causes cam 68 to engage bell crank 58, as further described herein. Sustained release pawl 52 and locking pawl 54 are rotatably received on shaft 50 and are positioned such that a portion 53 of sustained release pawl 52 extends over pawl 54. One end 56a of spring 56 is coupled to a pin 55 (Figure 4) and the other end 56b is coupled to the inside of front plate 28. The spring functions to bias both the sustained release pawl and the locking pawl about shaft 50 such that the locking pawl engages the teeth on a ratchet wheel 76.

[0044] Referring to Figure 5, geared shaft 14 includes a shaft 70, clutch plates 72 and 74, ratchet wheel 76, a driver 78, a spring 80, a coupler 82 and a pinion 84. A first end 86 of shaft 70 is generally cylindrical and is received via collar 31 in bearing 30. A pin 88 secures collar 31 to shaft first end 86. A second end 90 of shaft 70 is also generally cylindrical and includes threads 92 that receive nut 36 (Figure 3) to secure wheel 12 to shaft 70. Wheel 12 includes a polygonally shaped bore 96 (Figure 3) formed in a hub 98 that receives a polygonally shaped portion 100 of shaft 70. Intermediate polygonally shaped shaft portion 100 and shaft first end 86 is a threaded shaft portion 102. A pin 104 is received in a blind bore 106 that acts as a stop as described in greater detail herein. A radial extending flange 108 is coupled to shaft 70 intermediate polygonal portion 100 and threaded portion 102. Flange 108 can be formed apart from shaft 70 and rotationally fixed to the shaft or it may be integrally formed on the shaft.

[0045] Clutch plate 72 is rotatably received on shaft 70 intermediate flange 108 and ratchet wheel 76. Ratchet wheel 76, like clutch plate 72, is rotatably received on shaft 70. Clutch plate

74 is rotatably received on shaft 70 intermediate ratchet wheel 76 and driver 78. Driver 78 has a radially extending flange 110, a generally cylindrical splined portion 112 and a stop wall 114. An axially threaded bore 116 formed through driver 78 interengages with shaft threaded portion 102, as described in further detail below. Spring 80 is rotatably received on shaft 70 intermediate driver 78 and coupler 82. Coupler 82 is generally cylindrical in shape and includes a splined bore 115, angularly spaced openings 118 and a beveled surface 120, which formed adjacent an outer circumference 122. Coupler 82 is rotationally fixed to driver 78 through splines 112 and splined bore 115 but, it is axially moveable with respect to driver 78. Pinion 84 is rotatably received adjacent coupler 82, rotationally fixed to coupler 82 via a plurality of drive dogs 124 and coupler 82 is axially moveable with respect to pinion 84. Each drive dog 124 includes a flat top portion 126 and an angled portion 128. Pinion 84 includes a gear 130 that interengages with gear 16 (Figure 3).

[0046] Referring once again to Figure 3, one end of chain 208 is rotatably coupled to gear 16 by fastener 48 that is received in a clevis 134, which is preferably formed integral with gear 16. Fastener 48 could be any suitable fastener and in one embodiment is a bolt and nut. The distal end of chain 208 is secured to the brake rigging on a vehicle, such as a railway car, in a conventional manner so that when chain 208 is wound about gear shaft 38 the brakes of the vehicle are applied to stop or prevent movement of the vehicle.

[0047] Prior to describing the operation of the sustained brake release mechanism, a description of the general operation of the brake mechanism is presented. Beginning with the brake mechanism in the released position (Figure 8A) with quick release handle 22 positioned so that cam 68 is disengaged from bell crank 58, coupler 82 is biased toward pinion drive dogs 124 through spring 80 so that the drive dogs engage coupler openings 118. The drive dogs and

openings rotationally fix the pinion to the coupler so that they rotate in unison. Because pinion gear 130 is interengaged with gear 16, chain 208 exerts a downward force to hold gear 16 in a rotationally fixed position.

[0048] Assuming that driver 78 is positioned so that clutch plates 72 and 74 do not rotationally lock the driver to ratchet wheel 76, then movement of wheel 12 in a clockwise direction (as viewed in Figure 2) will cause shaft 70 to rotate with respect to driver 78 because of the counterforce exerted by gear 16 on coupler 82 through pinion gear 130. Thus, driver threads 116 interengage with shaft threads 102 so that the driver moves axially to the right, (with respect to Figure 3). It should be understood that as driver 78 moves axially to the right along shaft threads 102, the driver will remain rotationally locked to coupler 82 through the interaction of coupler splines 115 and driver splines 112. Thus continued clockwise rotation of wheel 12 will cause driver 78 to move further to the right until the driver pins clutch plates 72 and 74 between driver 78, ratchet wheel 76 and shaft flange 108. At this point, the ratchet wheel 76, shaft 70, driver 78, coupler 82 and pinion 84 are all rotatably fixed with respect to each other. Thus, continued application of rotational force in a clockwise direction on wheel 12 will cause gear ratchet wheel 16 to rotate so as to apply the brakes on the vehicle. Once the desired amount of force has been applied on chain 208 to properly engage the vehicle brake, pawl 54, which always remains in positive engagement with ratchet wheel 76, prevents the ratchet wheel from rotating in the opposite direction to unnecessarily release the brakes.

[0049] The brake can be released in one of three ways: by rotating wheel 12 in the counterclockwise direction, by rotating quick release handle 22 upward (with respect to Figure 2) to disengage the coupler from the pinion, or by actuating automated release mechanism 13 (Figures 9 – 11). To release the brake by the operation of wheel 12, the wheel is turned in a

counterclockwise direction (as viewed in Figure 2). Because pawl 54 prevents ratchet wheel 76 from rotating with the shaft, initially driver 78 is rotationally locked to ratchet wheel 76. Thus, the interaction of shaft threads 102 and driver threads 116 causes the driver to move axially to the left (as viewed in Figure 3) reducing the friction between driver flange 110 and clutch plate 74. Once the friction is sufficiently reduced, the force applied to driver 78 by the vehicle brake through gear 16, pinion 84 and coupler 82 causes drive member 78 to rotate in the same direction as shaft 70 relative to ratchet wheel 76.

[0050] As long as wheel 12 is rotated in the counterclockwise direction (as viewed in Figure 2), the brake will continue to be released. However, if wheel 12 is held stationary, gear 16 will continue to rotate over a short distance. That is, the rotational force exerted on gear 16 through chain 208 by the vehicle brake will cause gear 16 to continue to rotate in the clockwise direction (as viewed in Figure 2). Since shaft 70 is stationary, the counterforce on gear 16 will cause the pinion, coupler and driver to continue to rotate until the driver moves axially to the right (as viewed in Figure 2) causing the clutch plates to once again rotationally fix driver 78 and ratchet wheel 76 to shaft flange 108. Therefore, in order to release the brake, the hand wheel must be rotated several times in the counter clockwise direction before the brake is considered fully released.

[0051] In one embodiment of the invention, pin 104 extending from the shaft 70 is provided to engage with stop wall 114 on driver 78 (Figure 5) to prevent the driver from reaching the end of shaft threaded portion 102 as wheel 12 is rotate counterclockwise. Preferably, as wheel 12 is rotated counterclockwise and driver 78 moves axially to the left (with respect to Figure 3), release pin 104 will engage stop wall 114 before the driver reaches the end of the threads to prevent the driver from jamming the coupler against the pinion. After pin 104 engages stop wall

114 the driver is rotationally coupled to shaft 70, and continued counterclockwise rotation of the wheel causes rotation of driver 78, coupler 82 and pinion 84, thereby further releasing the vehicle brake.

[0052] In addition to releasing the brake by rotating wheel 12, the brake may also be released by operation of quick release lever 22 without rotating wheel 12. In particular, and referring to Figures 2 and 8A, handle 22 is rotationally fixed on shaft 50 as previously discussed above. Thus, as handle 22 (Figure 2) is lifted upward, shaft 50 (Figure 2) rotates clockwise (with respect to Figures 8A and 8B) causing cam 68 to engage bell crank 58. That is, arms 138 of bell crank 58 pivot about pins 64 and 66 (Figures. 3, 4, 7A and 7B) downward against the rear surface of coupler 82. As a result, and referring to Figures 7A and 7B, bell crank arms 138 force coupler 82 axially to the right (with respect to Figures 7A and 7B) apart from pinion drive dogs 124 into the position shown in Figure 7B. Because the pinion is rotatably mounted on shaft 70, the counterforce exerted on gear 16 by chain 208 causes pinion 84 to rotate freely in the counterclockwise direction allowing the brake on the vehicle to release. This occurs without rotation of wheel 12 since the pinion is not rotationally coupled to shaft 70 when quick release handle 22 is lifted. Opposite movement of quick release lever 22 moves bell crank arms from against coupler 82 and the force of spring 80 moves the coupler 82 axially rearward into engagement with pawl 52 so that the pawl retains the coupler in a sustained disengaged position.

[0053] Referring to Figures 9 – 11, the last method of releasing the hand brake is through actuation of quick release mechanism. The quick release mechanism consists of an air cylinder 13 mounted to brake housing 28 (Figures 2 – 4). Air cylinder 13 contains a moveable rod 71A having an exposed U-shaped first end 73. A first end 75A of a lever arm 75 is pivotally coupled to moveable rod U-shaped first end 73 by a pin 73A. An opposite second end 75B of lever arm

75 is coupled to a bracket 77 by a shoulder bolt 79. In one embodiment, bracket 77 is coupled to brake housing 28. Lever arm second end 75B is operatively in contact with bell crank 58. In operation, a control device (not shown) on the railway car sends a signal to an air solenoid control valve (not shown), which causes the valve to open and allow air to flow into air cylinder input port 15 (Figure 2). The airflow fills cylinder 13 causing moveable rod 71A to move upward (with respect to Figures 9 – 11). As rod 71A moves upward (Figure 10), lever arm 75 pivots about shoulder bolt 79 thereby causing lever arm second end 75B to move bell crank 58 downward into contact with coupler 82. Continued downward movement of bell crank 58 causes coupler 82 to move axially to the right (with respect to Figures 7A and 7B) apart from pinion drive dogs 124 into the position shown in Figure 7B. Because the pinion is rotatably mounted on shaft 70, the counterforce exerted on gear 16 by chain 208 causes pinion 84 to rotate freely in the counterclockwise direction allowing the brake on the vehicle to release. This occurs without rotation of wheel 12 since the pinion is not rotationally coupled to shaft 70. When the airflow is discontinued, rod 71A will retract back into cylinder 13 thereby causing lever arm 75 to rotate counterclockwise about shoulder bolt 79. Bell crank 58 moves out of contact from against coupler 82 and the force of spring 80 moves the coupler 82 into engagement with sustained release pawl 52 so that the coupler is maintained in a disengaged position with respect to the pinion. The brake can then be released from the sustained position as explained below.

[0054] As pointed out in the background, it is advantageous for the operator to deactivate the brake mechanism quickly, especially in a situation where many vehicle brakes must be deactivated in a relatively short time period. Thus, in order to reduce the time the operator must maintain the release handle in the released position, the present invention uses sustained release pawl 52 (Figure 8A) to maintain the coupler in the released position after quick release handle 22

or rod 71A returns downward into their normal operating state. As previously described above with reference to Figure 4, sustained release pawl 52 and pawl 54 are rotatably received on shaft 50. Sustained release pawl portion 53 extends over an end of pawl 54 so that upward movement of pawl 54 over the ratchet wheel teeth causes pawl 52 to also rotate about shaft 50 outward from its resting position. Sustained release pawl 54 generally may be located in one of two positions: the first between driver 78 and coupler 82 (Figure 8A) and the second between coupler 82 and pinion 84 (Figure 8B).

[0055] Referring to Figure 8A, sustained release pawl 52 has a first flat edge 140, a second flat edge 142 and an angled portion 144 that connects the two flat edges. Angled portion 144 is sized and shaped to correspond to the angled front surface 120 formed on coupler 82. Thus, during normal operation of brake mechanism 10, pawl 52 is positioned intermediate coupler 82 and driver 78 adjacent to the coupler. As wheel 12 is turned in the clockwise direction to activate the vehicle brake and once the clutch plates rotationally lock ratchet wheel 76 to shaft 70, ratchet wheel 76 turns in the clockwise direction in conjunction with shaft 70 causing pawl 54 to ride over the ratchet wheel teeth. This in turn also causes sustained release pawl 52 to move radially outward against the inward bias of spring 56 so that spring 56 biases pawl 54 back into operative engagement with the ratchet wheel teeth vis-a-vis sustained release pawl portion 53.

[0056] If, however, quick release handle 22 or rod 71A is lifted to release the vehicle brake, then bell crank arms rotate downward into engagement with coupler 82 thereby forcing the coupler axially to the left (with respect to Figure 8A). Consequently, as coupler 82 moves axially to the left, coupler angled surface 120 presses against angled pawl portion 144 causing the pawl to be forced radially outward so that the pawl can ride over coupler surface 120 into its second position, shown in Figure 8B. Referring to Figure 8B, sustained release pawl 52 is now

positioned intermediate coupler 82 and pinion 84 and spring 56 urges the pawl radially downward into this position. Consequently, if quick release handle 22 or rod 71A are allowed to return to their disengaged state such that cam 68 allows bell crank arms 58 to move out of engagement with coupler 82, spring 80 will once again force coupler 82 axially to the right (with respect to Figure 8B). However, coupler 82 will only move axially to the right a very short distance since sustained release pawl 52 is positioned between coupler 82 and pinion 84. Sustained release pawl 52 therefore maintains the brake mechanism in the quick released state. Furthermore, should the vehicle brake stick in the braking position due to rust that forms when the brake is engaged for a period of time, it can always break free once the vehicle is moved since the braking mechanism is maintained in the quick release position where the coupler is disengaged from the pinion.

[0057] To release the sustained release pawl to its first (Figure 8A) position so that the vehicle brake may be reengaged, the user first ensures that quick release handle 22 or rod 71A are disengaged and then begins to rotate wheel 12 clockwise (with respect to Figure 2). As wheel 12 is rotated clockwise, driver 78 moves axially to the right (with respect to Figure 3) along shaft threads 102 until clutch plates 72 and 74 rotationally fix ratchet wheel 76 to shaft 70, at which time ratchet wheel 76 rotates in conjunction with shaft 70. As the ratchet wheel rotates with the shaft, pawl 54 is forced radially outward against the radially inward bias of spring 56 through sustained release pawl portion 53 so that pawl 54 ratchets over the ratchet wheel teeth. As previously discussed, as pawl 54 ratchets over the teeth, pawl 54 also causes pawl 52 to move radially outward because of the coupling between the pawls such that sustained release pawl 52 moves out from between coupler 82 and pinion 84. Once sustained release pawl moves radially outward, spring 80 urges the coupler axially to the left (with respect to Figure 3) from the

position shown in Figure 8B into engagement with pinion 84, and pawl 52 returns to the position illustrated in Figure 8A between driver 78 and coupler 82. Once in this position, the operation of brake mechanism 10 operates similar to that described above.

[0058] Figures 22 – 24 illustrate a control valve for use with hand brake 12 in controlling the automated release of the handbrake mechanism. The control valve has a body 500, a first elongated bore 502 and a second elongated bore 508. First bore 502 has first end 504 and an opposite second end 506. Second elongated bore 508 has a first end 510 and a second end 512. A first spool 520 is slideably received in first bore 502, and a second spool 522 is slideably received in second bore 508. A first spring 524 is positioned intermediate one end of spool 520 and first bore second end 506, and a second spring 526 is positioned intermediate one end of spool 522 and second bore second end 512. First spool 520 receives a plurality of seals 528 in grooves (not numbered) formed in an outer circumferential surface of the spool. Second spool 522 receives a plurality of seals 530 in grooves (not numbered) formed in an outer circumferential surface of the spool. Seals 528 and 530 prevent air pressure from moving from one side of the seal to the other, thereby creating a plurality of air pockets along the length of first and second spools 520 and 522 in between the seals.

[0059] Body 500 defines a plurality of ports: some input, some output and some both input/output. In particular, a first input port 514 is in fluid communication with a brake pipe air supply (not shown). A first output port 516 is in fluid communication with hand brake cylinder input port 15 (Figure 2). Brake pipe air enters through first input port 514, fills the area around first spool 520 between the seals, as shown in Figure 22. Brake pipe air also fills the bottom portion of second bore 508 as it passes through opening 532. Brake pipe air enters first bore 502 via first end 504. As brake pipe pressure increases slightly, for example to 5 psi, second spool

522 moves upward against the downward bias of second spring 526 closing off port 536 (Figure 23). As brake pipe pressure increases, for example to 60 psi, first spool 520 moves slightly upward against the downward bias of first spring 524 opening first output port 516 into fluid communication with first input port 514 (Figure 23). A stop (not shown) formed in second bore 508 prevents further upward travel of second spool 522 in second bore 508.

[0060] In this position, brake pipe pressure flows from port 514 thru output port 516, which is in fluid communication with hand brake air cylinder 13 (Figure 2). As first spool 520 moves upward, any air trapped above first spool 520, proximate first bore second end 506, is exhausted via check valve 540 and dispersed through second output port 518, which is connected to the atmosphere. A third port 538 exhausts any air located above second spool 522 to atmosphere. Thus, when the input pressure is sufficient, first and second spools 520 and 522 are pushed upward so that input air on port 514 flows out of port 516 into the handbrake cylinder.

[0061] As brake pipe pressure increases, for example to 70psi, first spool 520 is pushed further upward against the downward bias of first spring 524 thereby closing off first output port 516 from first input port 514 (Figure 24). That is, the third seal from the bottom of the spool provides an airtight seal and prevents any air flowing between first bore 502 and output port 516. Instead, first output port 516 is in fluid communication with second output port 518, and air from hand brake air cylinder 13 is released to the atmosphere.

[0062] If brake pipe pressure increases above a predetermined threshold, both first spool 520 and second spool 522 are prevented from further movement upward respectively toward first bore second end 506 and second bore second end 512 due to built in stops (not shown) formed in the bores. Once the brake pipe pressure decreases, first spool 520 is locked into position because no air is allowed to migrate above the spool. Second pool 522, however, is allowed to move

downward because air can be drawn in from the atmosphere through port 538. However, second spool 522 will not move downward until the brake pipe pressure is reduced to a predetermined pressure, for example 5 psi.

[0063] At this point, movement of second spool 522 to the position shown in Figure 22 opens port 536, which places the space between first spool 520 and first bore second end 506 in fluid communication with the atmosphere through port 538 thereby allowing first spool 520 to move downward. It should be understood from the above description that second spool 522 is used to lock first spool 520 so hand brake release mechanism 13 is never charged except for when the train is initially charging the brake pipe.

[0064] Referring to Figure 12, the present invention provides an improved pulley system 200 that is positioned intermediate handbrake 12 (Figure 2) and handbrake lever 26 (Figure 1). Pulley system 200 is shown having a frame 202 and a wheel 204 having a first groove 203a and a second groove 203b. Frame 202 defines two through-holes 207 that are adapted to receive a shaft 210. Frame 202 also defines a third through hole 201 that is adapted to receive a control arm sensor 214. Wheel 204 contains a bore 209 that is adapted to fit about shaft 210. In this way, wheel 204 rotates about shaft 210 in both a first direction and an opposite second direction. Control sensor 214, at one end connects to a car control device (not shown) and at the opposite end is configured to sense the position of wheel 204. Control sensor 214 may be a proximity sensor or switch sensor that senses the position of wheel 204 to determine if the wheel is in a first released position or a second set position with respect to the brake rigging. In one embodiment, sensor 214 senses a position of a fastener 206 used to attach a first chain 208 to wheel 204. One of skill in the art should understand that sensor 214 may be configured to sense any other feature of wheel 204 to determine the position of hand brake 12.

[0065] Wheel first groove 203a receives a first end 208a of a first chain 208, which is fixed to the wheel by a fastener 206. A hand brake (not shown) is operatively coupled to an opposite second end 208b of chain 208. Wheel second groove 203b receives a first end 212a of a second chain 212, which is fixed to the wheel by a second fastener 206. Fasteners 206 may be any suitable fastener such as a threaded bolt, pin, etc. A brake rigging (not shown) is operatively coupled to an opposite second end 212b of second chain 212. A spring 216 is operatively coupled at a first end 216a to second chain second end 212b and to the frame of the railway car at a second end 216b.

[0066] Referring to Figure 13, improved pulley system 200 is shown in the first released position where hand brake chain 208 is wrapped around wheel first groove 203a (Figure 12) and only a small portion of second chain first end 212a is received in wheel second groove 203b. Spring 216 is in its rest position and provides tension on second chain 212 to keep the second chain tight. In this position, sensor 214 senses the position of wheel 204 and transmits a signal to the railway car control device that indicates the railway car brakes are in the released position. If the railway car control device does not sense that the railway car brakes are in the released position, a signal may be sent to air cylinder 13 (Figure 2) that causes the handbrake to release, as described with respect to Figures 9 – 11.

[0067] Referring to Figure 14, when the hand brake is applied, first chain 208 is pulled by handbrake 12 (Figure 2) causing wheel 204 to rotate in the counterclockwise direction with respect to frame 202. By this rotation, first chain 208 is pulled from wheel first groove 203a, and second chain 212 is caused to wrap around wheel 204 in wheel second groove 203b. As second chain 212 wraps around wheel 204, spring 216 is under tension and exerts a tension force on second chain 212 in a general direction away from wheel 204, and the railway car brakes engage

with the wheels (not shown). When the handbrake is released, the tension force exerted by spring 216 on second chain 212 will cause wheel 204 to rotated clockwise thereby wrapping first chain 208 around wheel 204 in first wheel groove 203a.

[0068] Referring to Figures 15 and 16, another embodiment of the present invention provides an improved pulley system 300 positioned intermediate handbrake 12 (Figure 2) and handbrake lever 26 (Figure 1). A pulley system 300 has a frame 302 and a wheel 304 having a first groove 303a and a second groove 303b (Figures 15 and 16). Frame 302 defines two through-holes 307 that are adapted to receive a shaft 310. Frame 302 also defines a third through hole 301 that is adapted to receive a control arm sensor 314. Wheel 304 contains a bore 309 that is adapted to fit about shaft 310. In this way, wheel 304 rotates about shaft 310 in both a first direction and an opposite second direction. Bore 309 defines a first slot 326 and a receiving chamber 324 configured to receive a torsion spring 316. One end 322 of torsion spring 316 is received in slot 326 thereby rotationally fixing one end of the spring to wheel 304. A second end 320 of spring 316 is operatively coupled to frame 302 so that wheel 304 is biased toward a released position, as further discussed below.

[0069] Control sensor 314, at one end connects to a car control device (not shown) and at the opposite end is configured to sense the position of wheel 304. Control sensor 314 may be a proximity sensor or switch sensor that senses the position of wheel 304 to determine if the wheel is in a first released position or a second set position with respect to the brake rigging. In one embodiment, sensor 314 senses a position of a fastener 306 used to attach a first chain 308 to wheel 304. One of skill in the art should understand that sensor 314 may be configured to sense any other feature of wheel 304.

[0070] Wheel first groove 303a receives a first end 308a of a first chain 308, which is fixed to the wheel by a fastener 306. A hand brake (not shown) is operatively coupled to an opposite second end 308b of first chain 308. Wheel second groove 303b receives a first end 312a of a second chain 312, which is fixed to the wheel by a second fastener 306. Fasteners 306 may be any suitable fastener such as a threaded bolt, pin, etc. A brake rigging (not shown) is operatively coupled to an opposite second end 312b of second chain 312.

[0071] Referring to Figure 17, improved pulley system 300 is shown in the first released position where hand brake chain 308 is wrapped around wheel first groove 303a (Figure 15) and only a small portion of second chain first end 312a is received in wheel second groove 303b. Spring 316 is in its rest position and provides tension on second chain 312 to keep the second chain tight. In this position, sensor 314 senses the position of wheel 304 and transmits a signal to the railway car control device that indicates the railway car brakes are in the released position. If the railway car control device does not sense that the railway car brakes are in the released position, a signal may be sent to automated release air cylinder 13 (Figure 2) that causes the handbrake to release, as described above with reference to Figures 9 – 11.

[0072] Referring to Figure 18, when the hand brake is applied, first chain 308 is pulled by handbrake 12 causing wheel 304 to rotate in the counterclockwise direction with respect to frame 302. By this rotation, first chain 308 is pulled from wheel first groove 303a, and second chain 312 is caused to wrap around wheel 304 in wheel second groove 303b. As second chain 312 wraps around wheel 304, spring ends 320 and 322 are urged toward each other placing spring 316 under compression, and the railway car brakes engage with the wheels (not shown). In this position, spring 316 biases wheel 304 in the clockwise direction. When the handbrake is

released, the spring force exerted by spring 316 causes wheel 304 to rotated clockwise thereby wrapping first chain 308 around wheel 304 in first wheel groove 303A.

[0073] Sensor 314 may operate in various configurations. For example, sensor 314 may become active only after the car control device receives an input signal indicating that the handbrake has been released. Thus, sensor 314 would provide a signal to the car control device when it detects that the brakes are in the fully released position. In the alternative, once the sensor is active, sensor 314 may only send a signal to the car control device if it detects that the brakes are more than half way to the fully applied position.

[0074] One advantage of the above described power pulley systems is that the pulley is biased in the clockwise direction to ensure that chain 212 or 312 is allowed to move to the left (with respect to Figure 1) to ensure that sufficient slack is present to allow the brake assembly to release. Moreover, the above described systems not only detect when the brake system is not fully released, but also provide a signal to the railcar control device that actuates an automated quick release mechanism to ensure that the brake released.

[0075] In some embodiments, the mechanical advantage of the improved power pulley system may be improved by varying the outside diameter of wheel 204 or 304 proximate each chain groove. For example, if wheel groove 203b has a smaller outside diameter as compared to wheel groove 203a, then a mechanical advantage is provided. In another embodiment, the outside diameter of wheel 204 or 304 could be adjusted to allow for a predetermined chain travel.

[0076] Referring to Figures 19 – 21, in some embodiments a chain locator may be used to detect the position of handbrake 12. In particular, a frame 402, defining a through hole (not numbered), a bracket flange 412 and a sensor holder (not numbered), receives a chain 404, which may

correspond to chains 208 or 308. Frame 402 may be coupled to a portion of the railway car between the handbrake and the brake assembly.

[0077] Preferably, frame 402 is positioned intermediate handbrake 12 (Figure 2) and one of pulley systems 200 or 300. A stop block 406, formed from a first half 406a and a second half 406b, is axially fixed to chain 404 by a fastener 408. Fastener 408 may be any type of suitable fastener such as a bolt, a pin, etc. Stop block 406 may be made of any suitable material, for example elastomers, polymers, ceramics, metals, etc. The key to stop block 406 is that it is formed from a suitable material that can be detected by a sensor 410 that is received in the frame sensor holder 402. Sensor 410 may be a switch type sensor, a proximity sensor or any other suitable sensor that can detect the presence of stop block 406.

[0078] Referring specifically to Figure 20, stop block 406 is seated in frame 402 when hand brake 12 is in the fully released position. That is, as chain 208 is released from hand brake 12, stop block 406 moves from the position shown in Figure 21 into the position shown in Figure 20. In this position, sensor 410 detects the presence of stop block 406 and sends a signal to the railway car control device to indicate that the handbrake is fully released.

[0079] Referring to Figure 21, when the handbrake is applied, chain 404 is moved upward thereby moving stop block 406 out of frame 402. In this position, sensor 410 will not detect the stop block. It should be understood that sensor 410 may provide a signal either if stop block 406 is in frame 402 or out of frame 402 away from sensor 410. In either case, the signal generated by sensor 410 can be used to inform the railway car control device of the position of handbrake 12. That is, the signal can be used to indicate if the brake assembly is in the released or applied position. For example, if handbrake 12 is manually released but chain 208 or 308 does not move down through frame 402 so that stop block 406 is seated in frame 402, the railway car control

device may automatically cause hand brake 12 to release, based on the signal received from sensor 410, to ensure that the brake assembly is in the released position.

[0080] While one or more preferred embodiments of the invention have been described above, it should be understood that any and all equivalent realizations of the present invention are included within the scope and spirit thereof. The embodiments depicted are presented by way of example and are not intended as limitations upon the present invention. Thus, those of ordinary skill in this art should understand that the present invention is not limited to these embodiments since modifications can be made. Therefore, it is contemplated that any and all such embodiments are included in the present invention as may fall within the scope and spirit thereof.

What we claim:

1. A brake mechanism having a chain locator comprising:
 - a. a chain coupled between a handbrake and a railway car brake system;
 - b. a marker releasably secured to said chain between said handbrake and said railway car brake;
 - c. a sensor coupled to said railway car proximate said chain for detecting the state of said railway car brake system;

wherein

said chain is moveable between a first position in which said marker is not sensed by said sensor, and

a second position in which said sensor detects said marker.
2. The brake mechanism of claim 1, wherein said sensor is a proximity sensor.
3. The brake mechanism of claim 1, wherein said sensor is a switch type sensor.
4. The brake mechanism of claim 1, wherein the sensor is coupled to said railway car by a sensor bracket.
5. The brake mechanism of claim 4, wherein said sensor bracket is in the shape of a ring and said chain passes through said bracket.
6. The brake mechanism of claim 5, wherein said marker is a stop block.
7. The brake mechanism of claim 6, wherein said bracket prevents said stop block from passing through the bracket.
8. The brake mechanism of claim 1, wherein when said marker is sensed, said railway car brake is in a released state.
9. A brake mechanism having a chain locator comprising:

- a. a handbrake for applying brakes on a railway car;
- b. a connector operatively coupled between said handbrake and said railway car brakes;
- c. a sensor coupled to the railway car and configured to detect a portion of said connector, said portion of said connector being disposed between said handbrake and said railway car brakes;

wherein when said connector portion is detected by said sensor, said brake mechanism is in one of a state of the railway car brakes being engaged and a state of the railway car brakes being disengaged.

- 10. The brake mechanism of claim 9, wherein said sensor is a proximity sensor.
- 11. The brake mechanism of claim 10, further comprising a sensor bracket operatively coupled to said sensor, wherein said connector passes through a center opening of said bracket.
- 12. The brake mechanism of claim 9, further comprising a stop block operatively coupled to said connector.
- 13. The brake mechanism of claim 12, wherein said stop block is configured to prevent said connector from moving more than a predetermined distance.
- 14. The brake mechanism of claim 1, wherein said connector is a chain.
- 15. The brake mechanism of claim 1, wherein said connector is a cable.
- 16. A method for detecting the release of a railway car brake, said method comprising the steps of:
 - a. providing a connector locator operatively coupled between a handbrake and a railway car brake, said connector locator comprising

- i. a connector operatively coupled intermediate said handbrake and said railway car brake,
 - ii. a marker operatively coupled to said connector; and
 - iii. a sensor operatively coupled to the railway car and configured to detect a said connector marker; and
 - b. sensing said marker when said railway car brake is in a released state.
17. The method for detecting the release of a railway car brake of claim 16, further comprising the step of preventing said connector from moving more than a predetermined distance.
18. The method for detecting the release of a railway car brake of claim 16, wherein said connector is a chain.
19. The method for detecting the release of a railway car brake of claim 17, wherein said marker is a stop block that is operatively coupled to said connector and configured to be sensed by said sensor.
20. The method for detecting the release of a railway car brake of claim 16, further comprising the step of releasing said handbrake so that said marker can be sensed by said sensor.

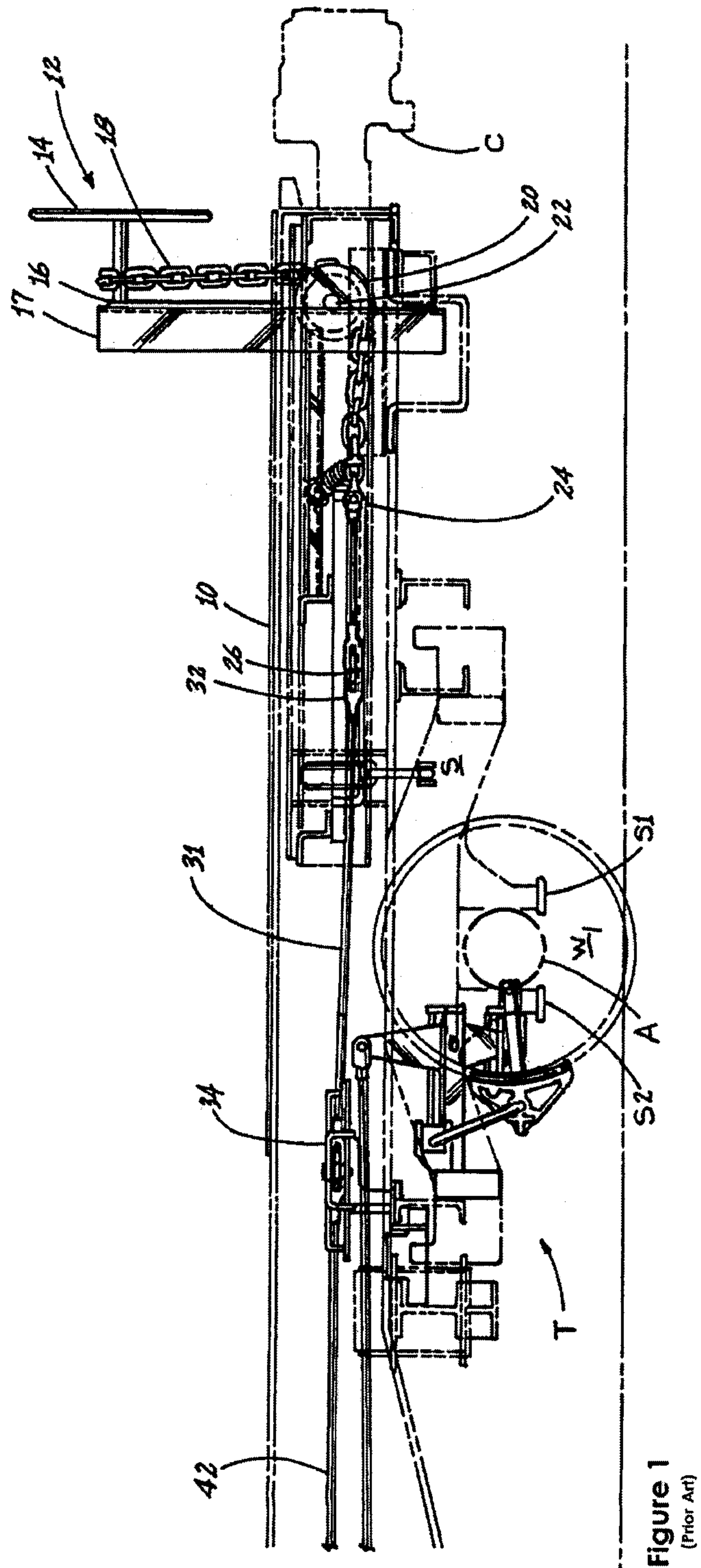
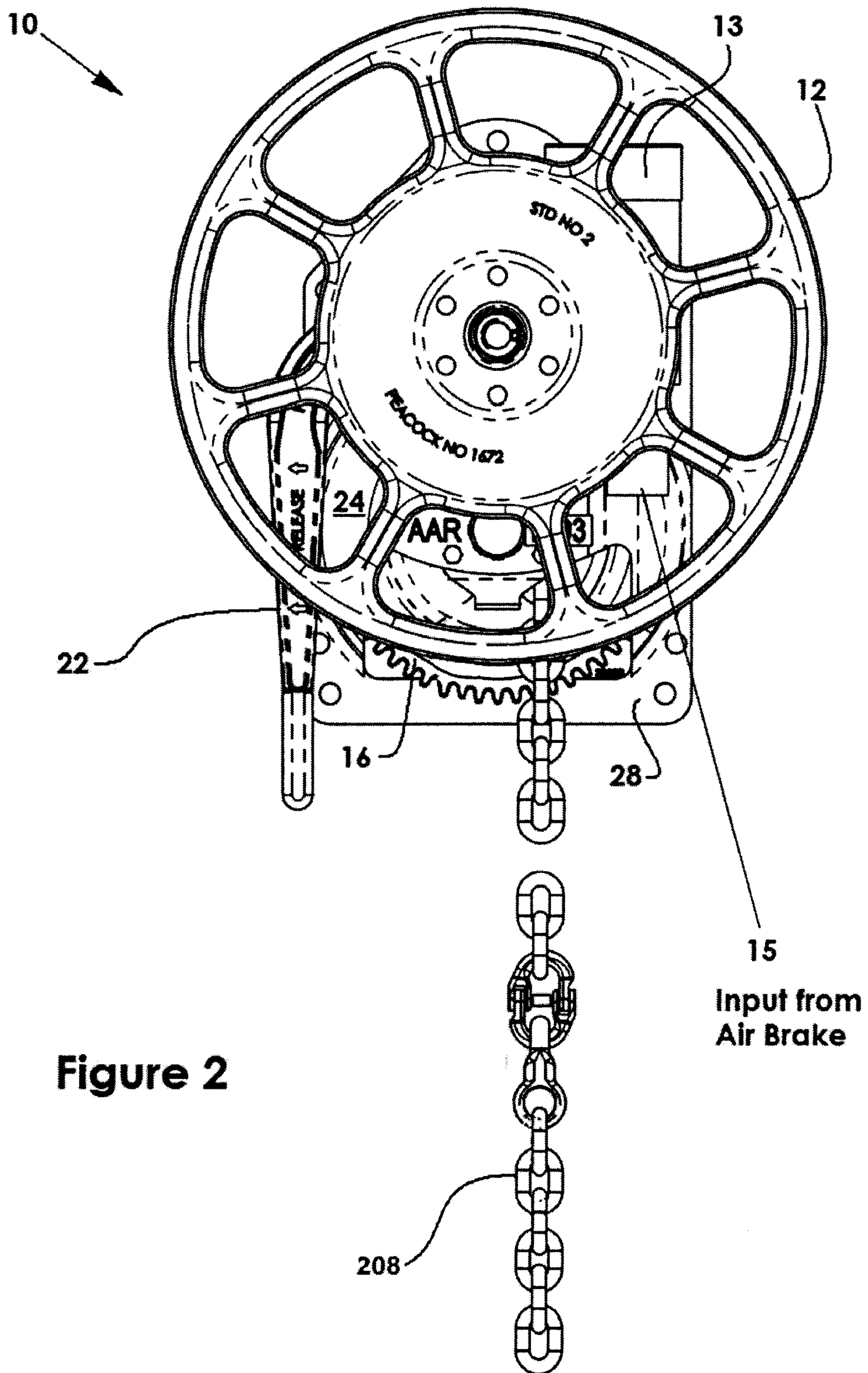
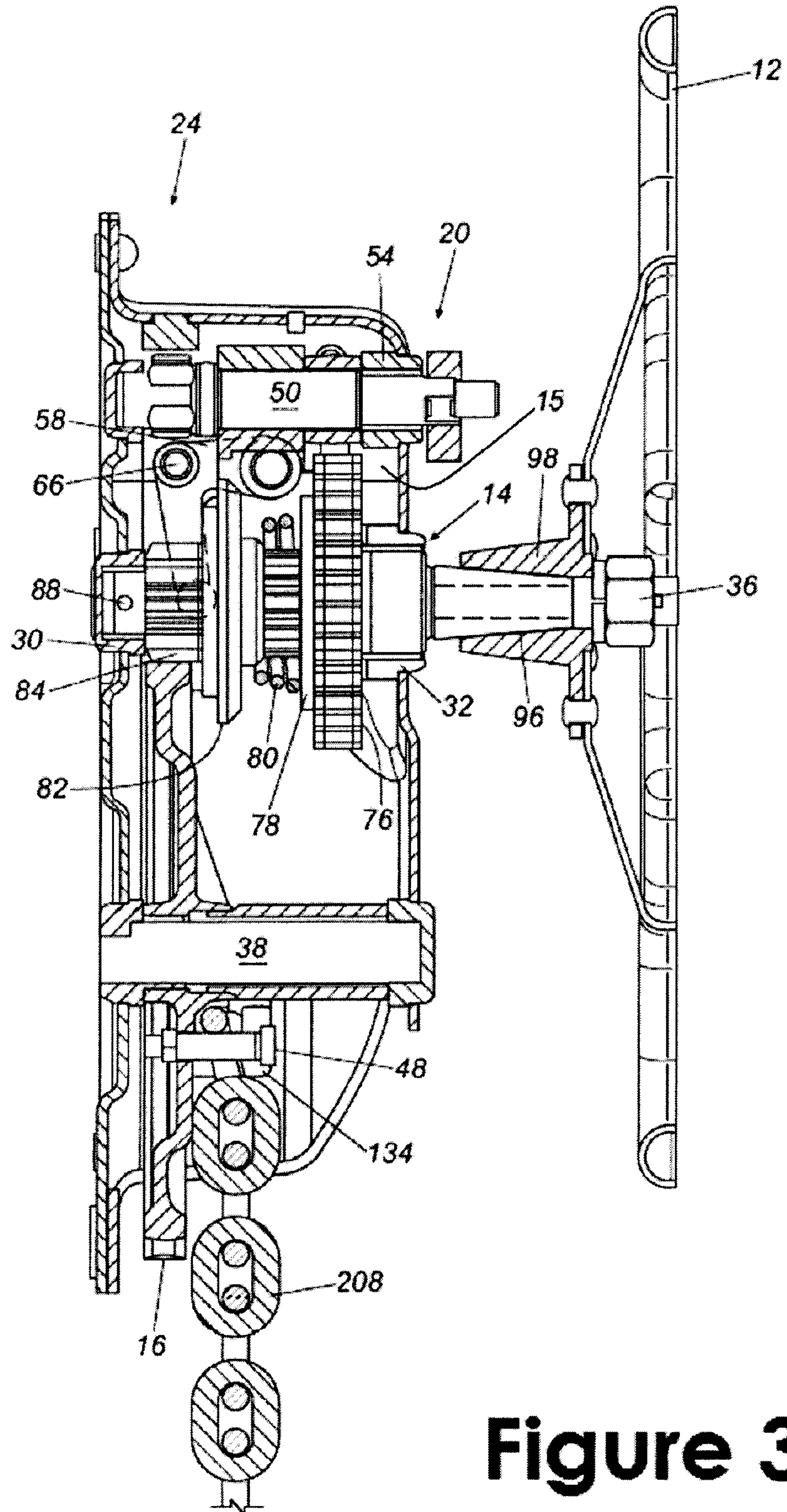


Figure 1
(Prior Art)

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**Figure 2**

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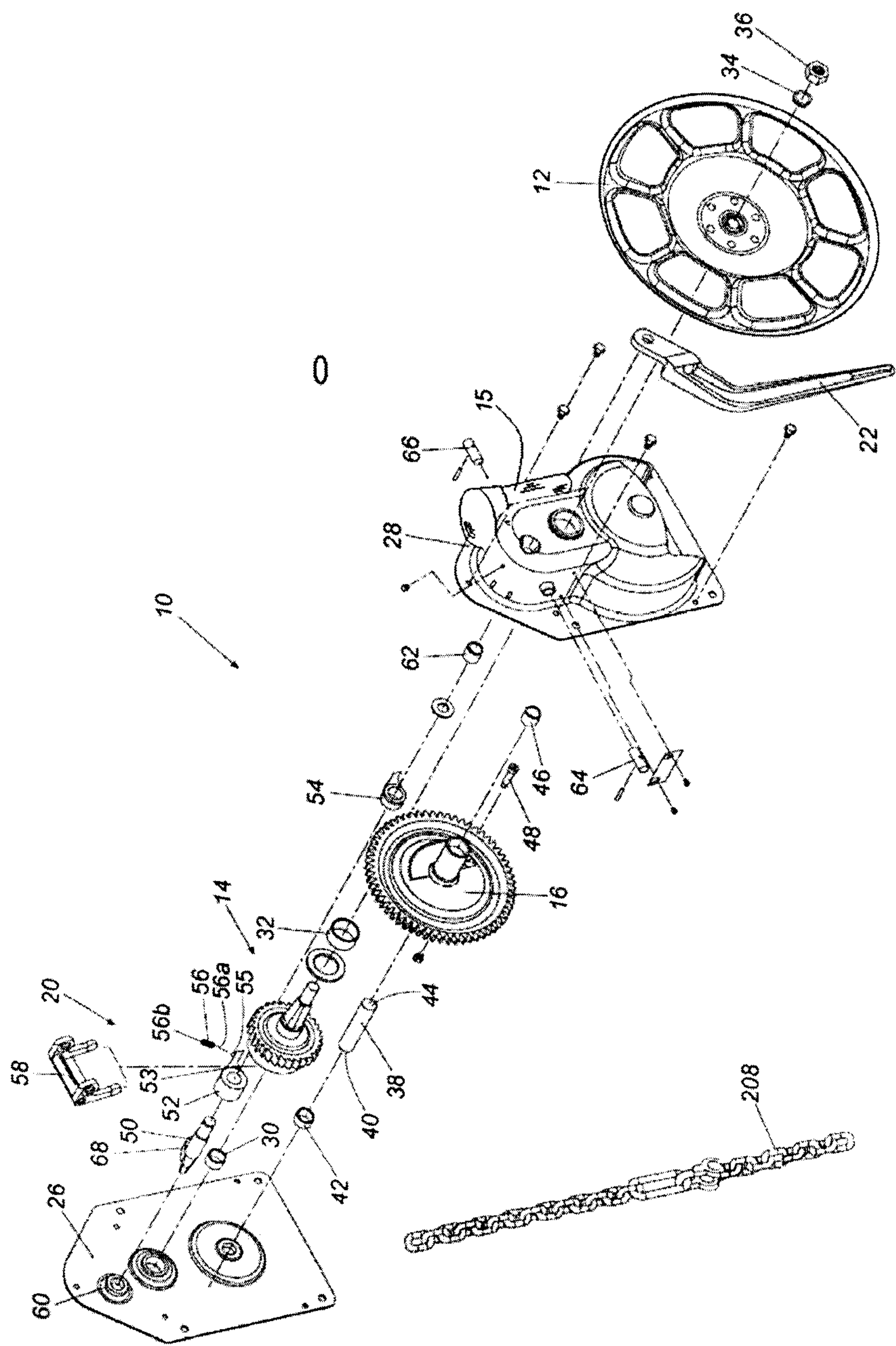


Figure 4

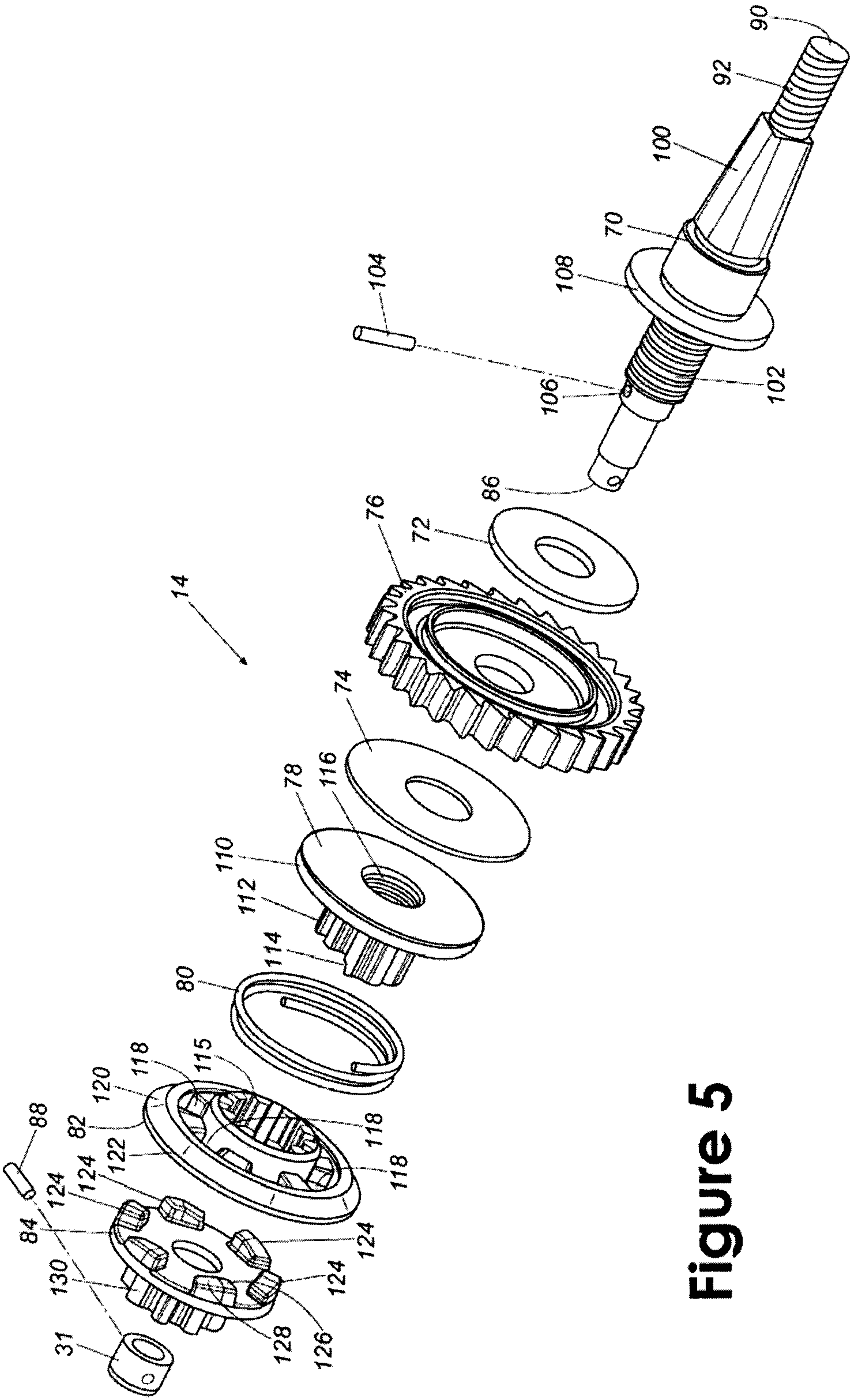


Figure 5

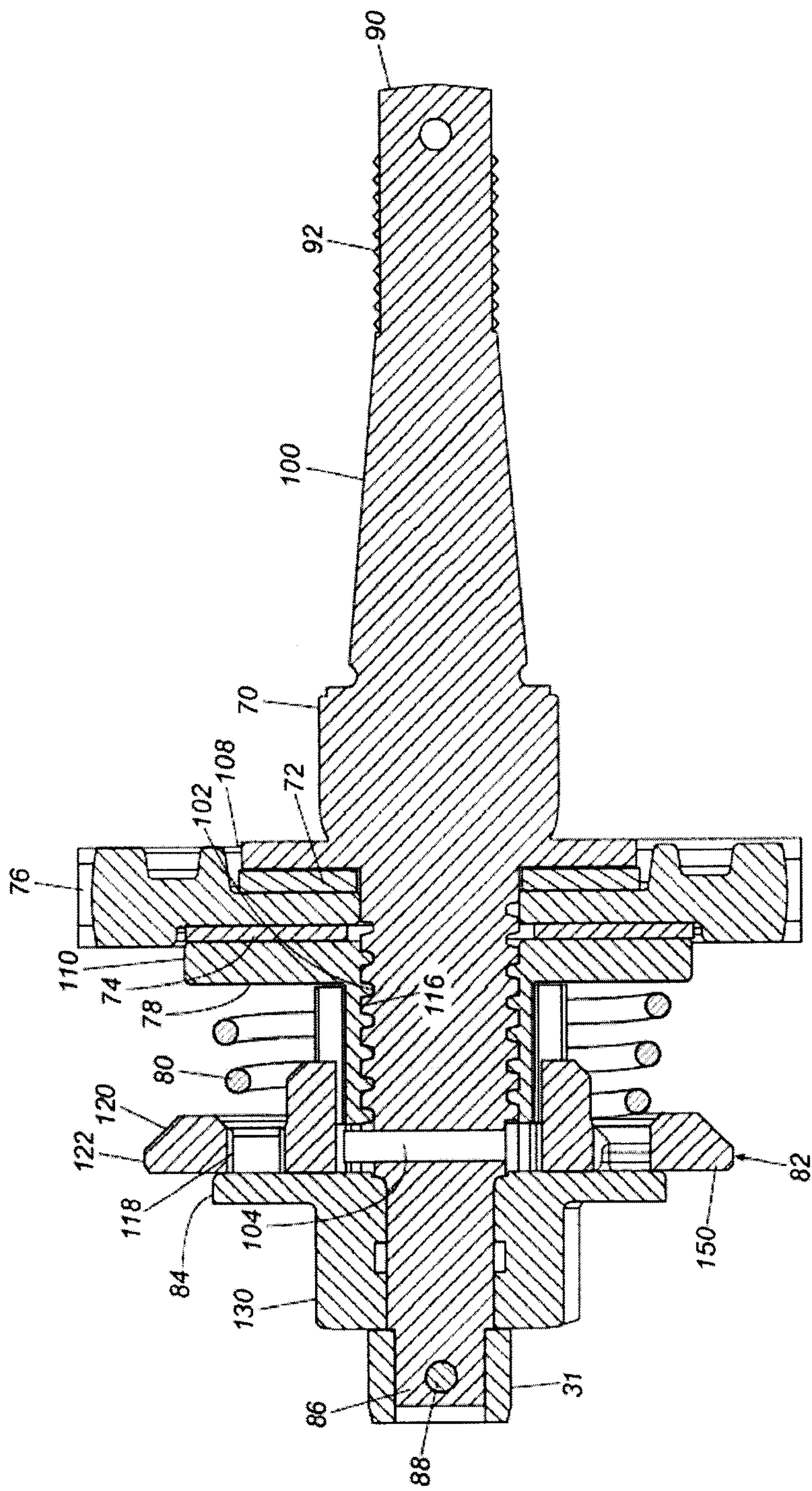


Figure 6

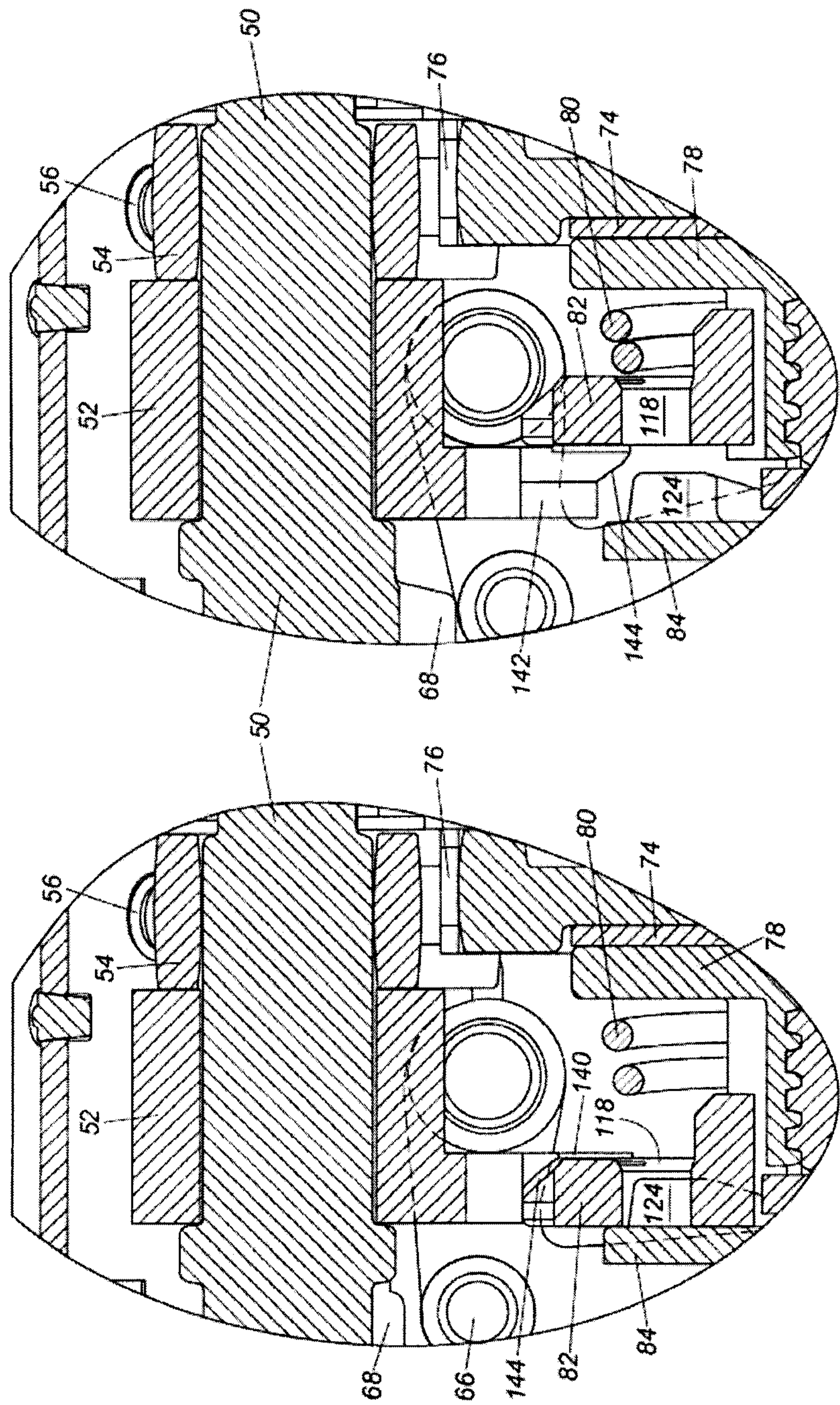


Figure 7B

Figure 7A

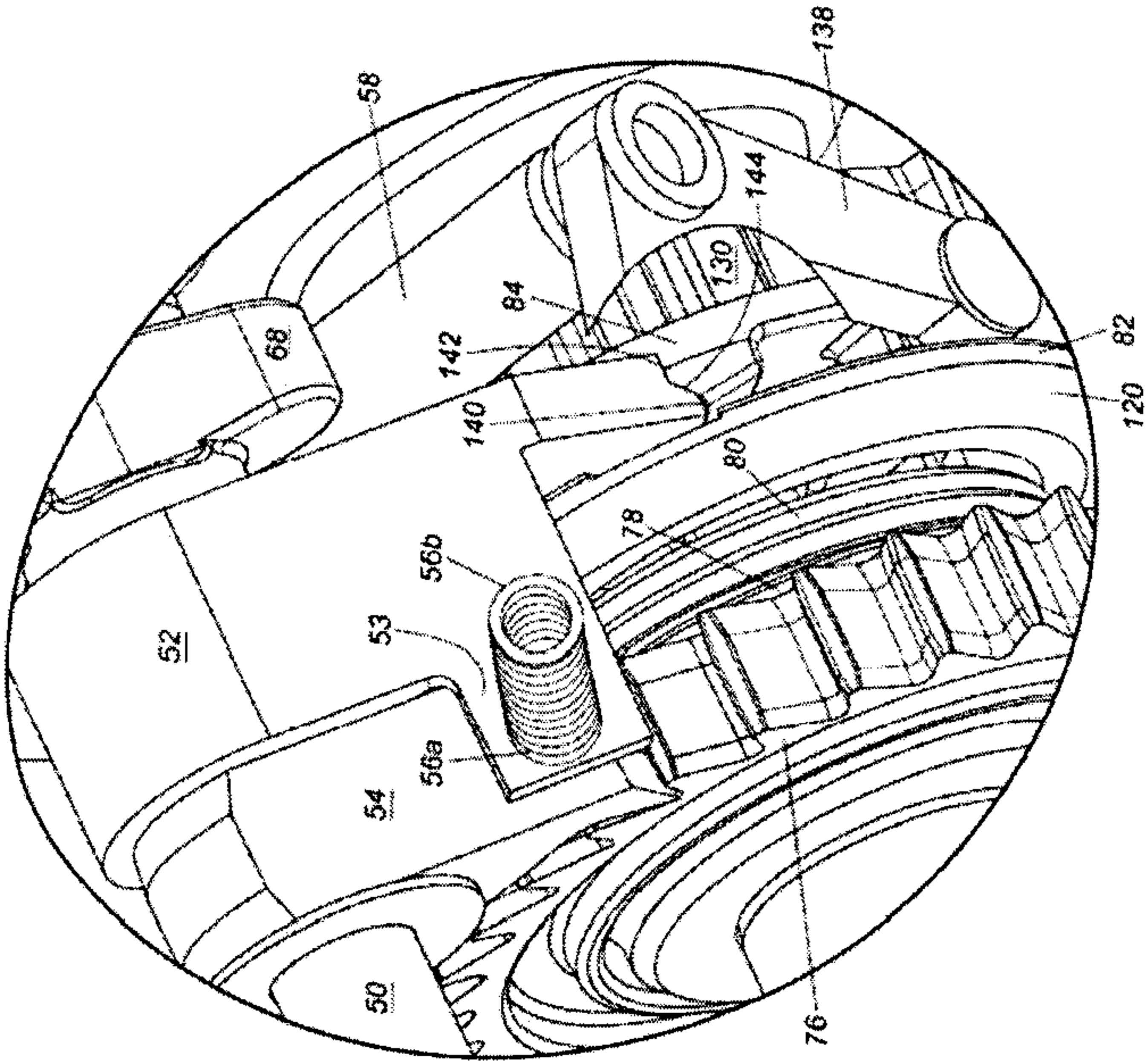


Figure 8B

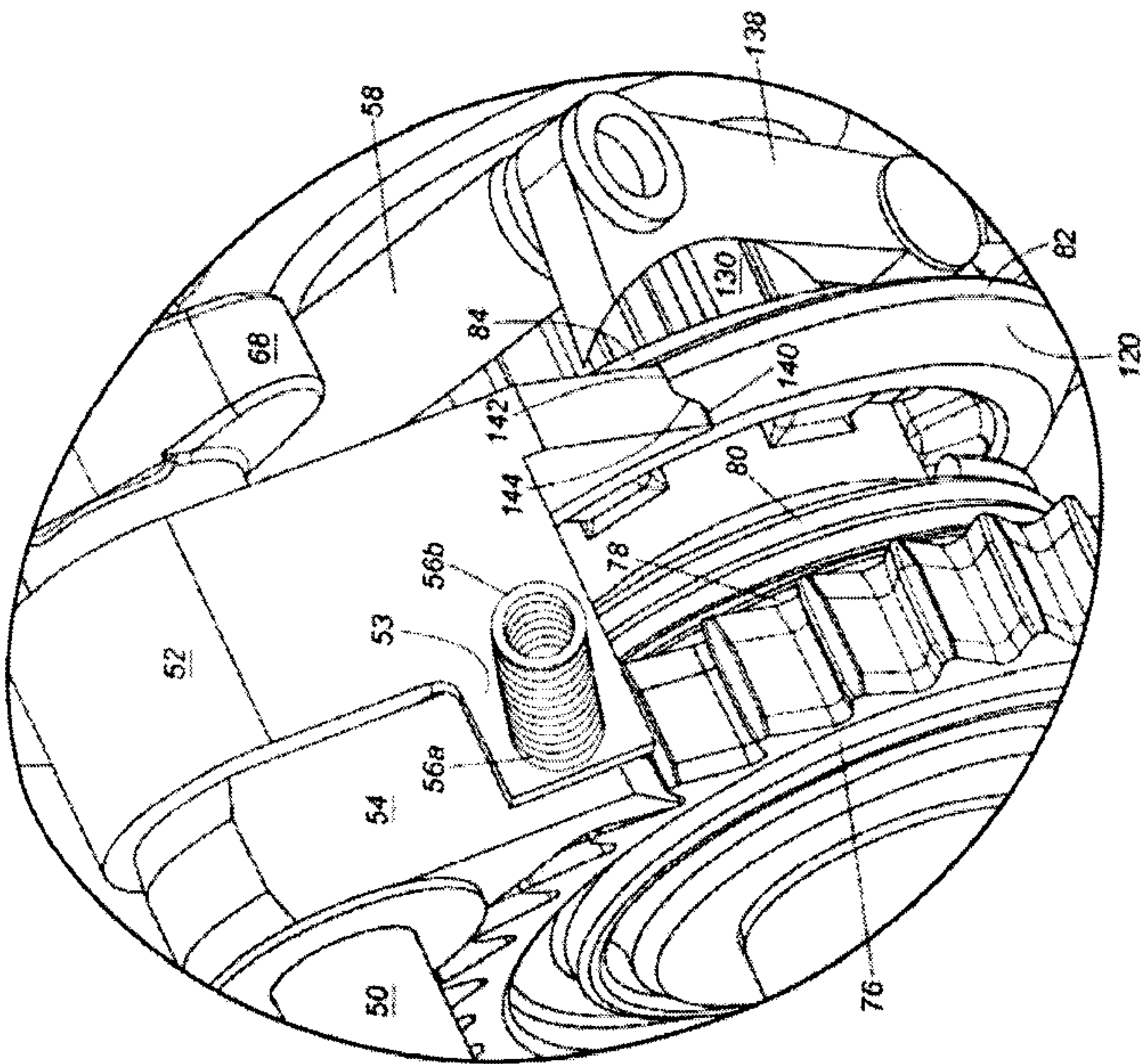


Figure 8A

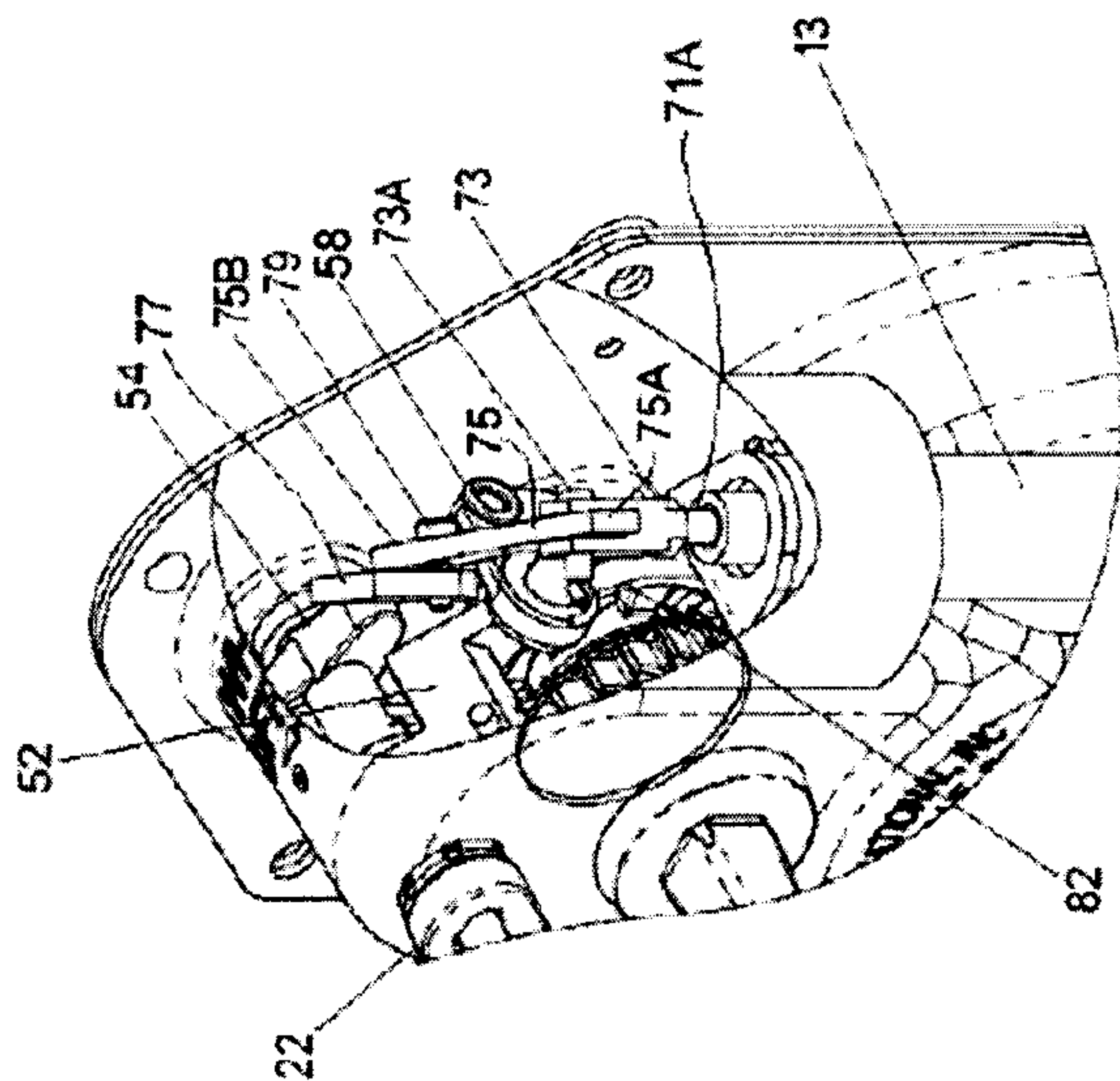


Figure 9

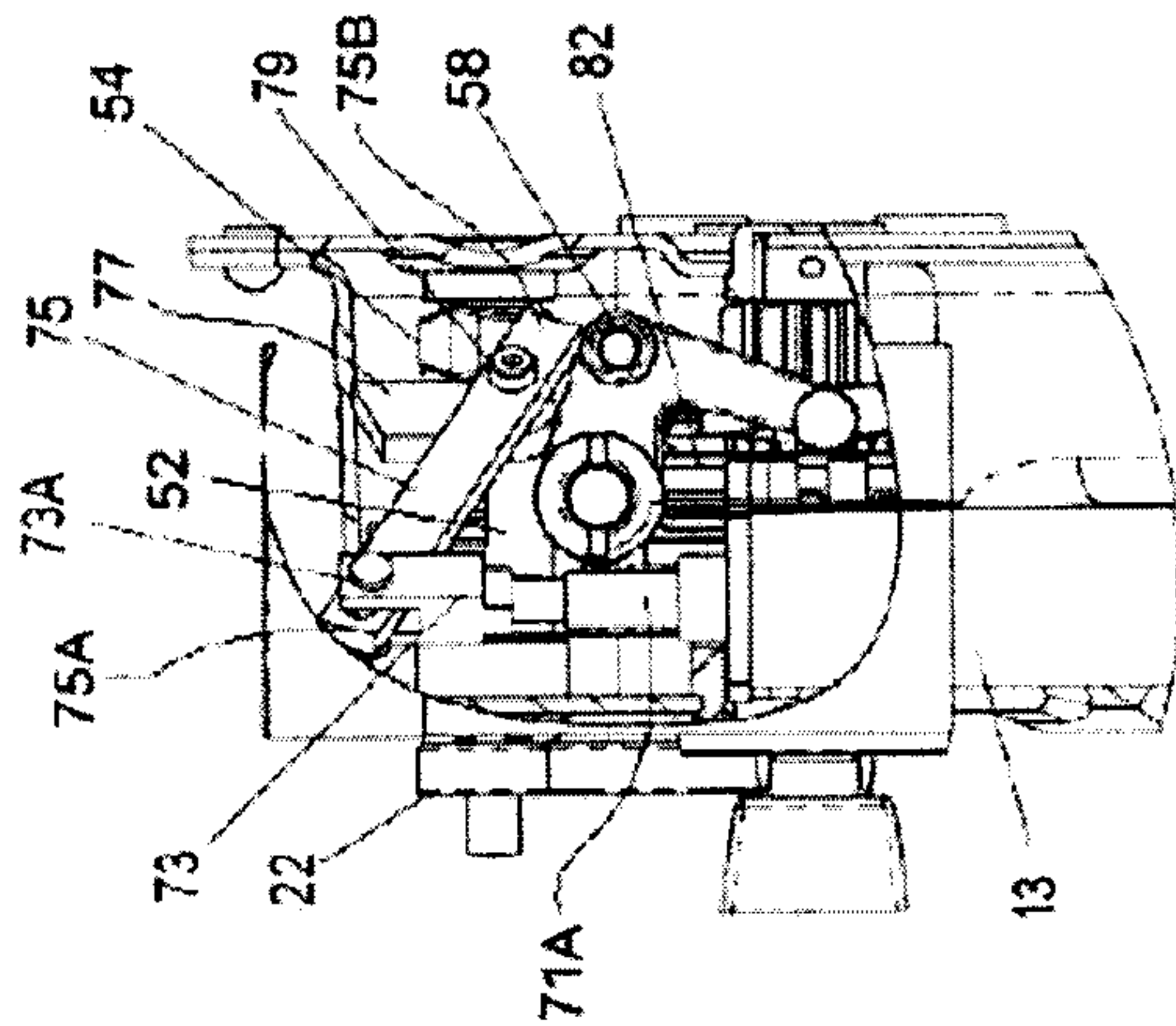


Figure 10

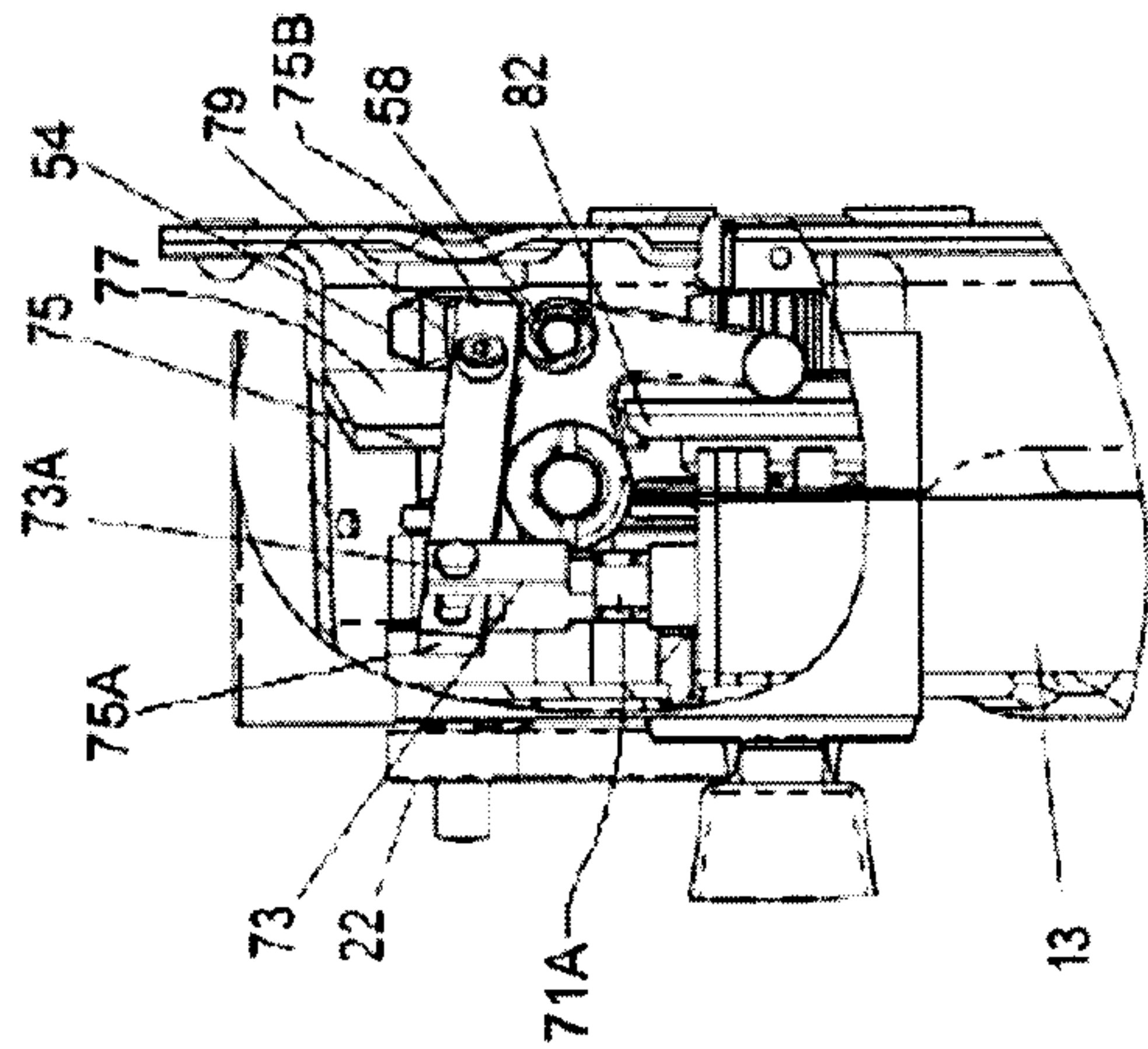
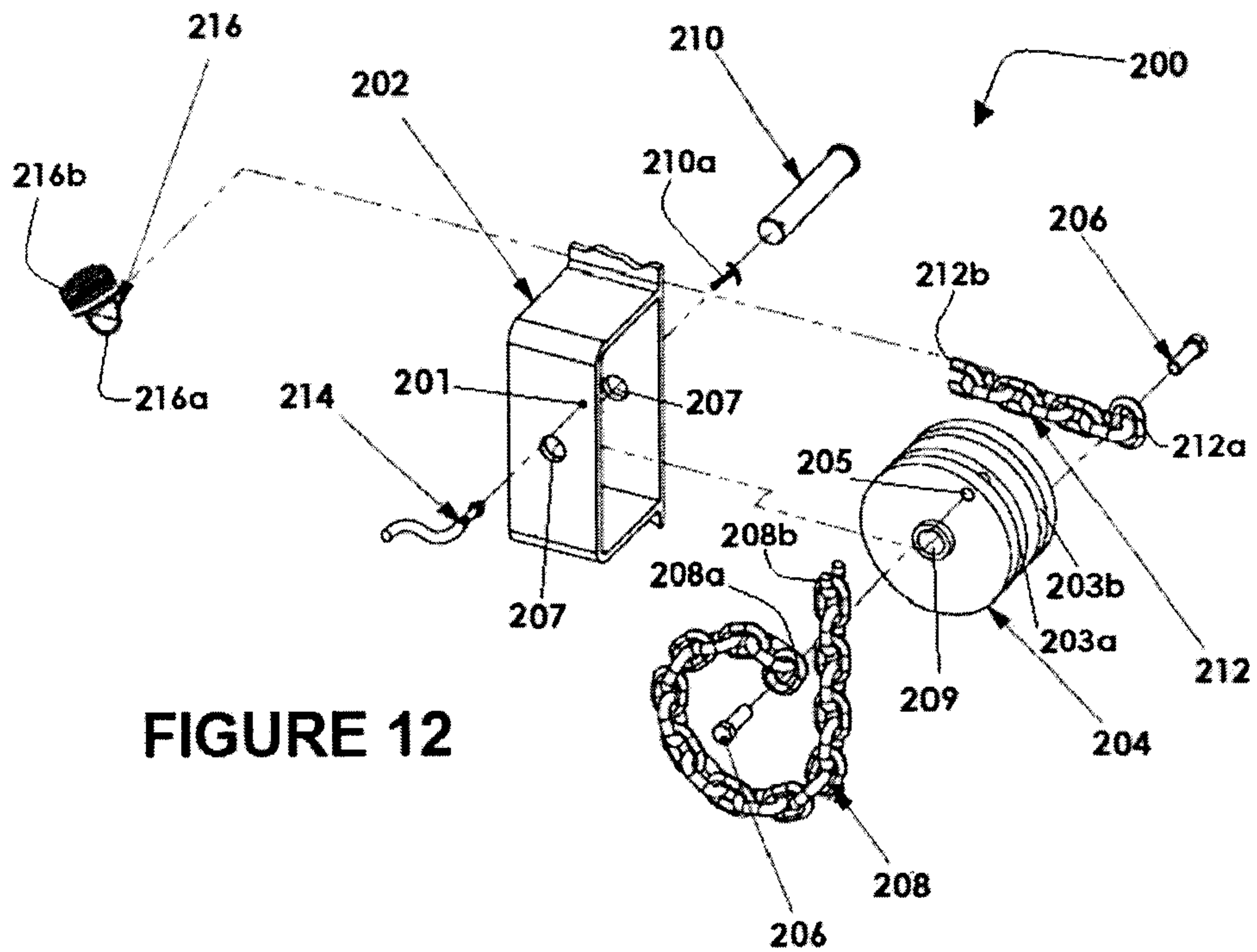
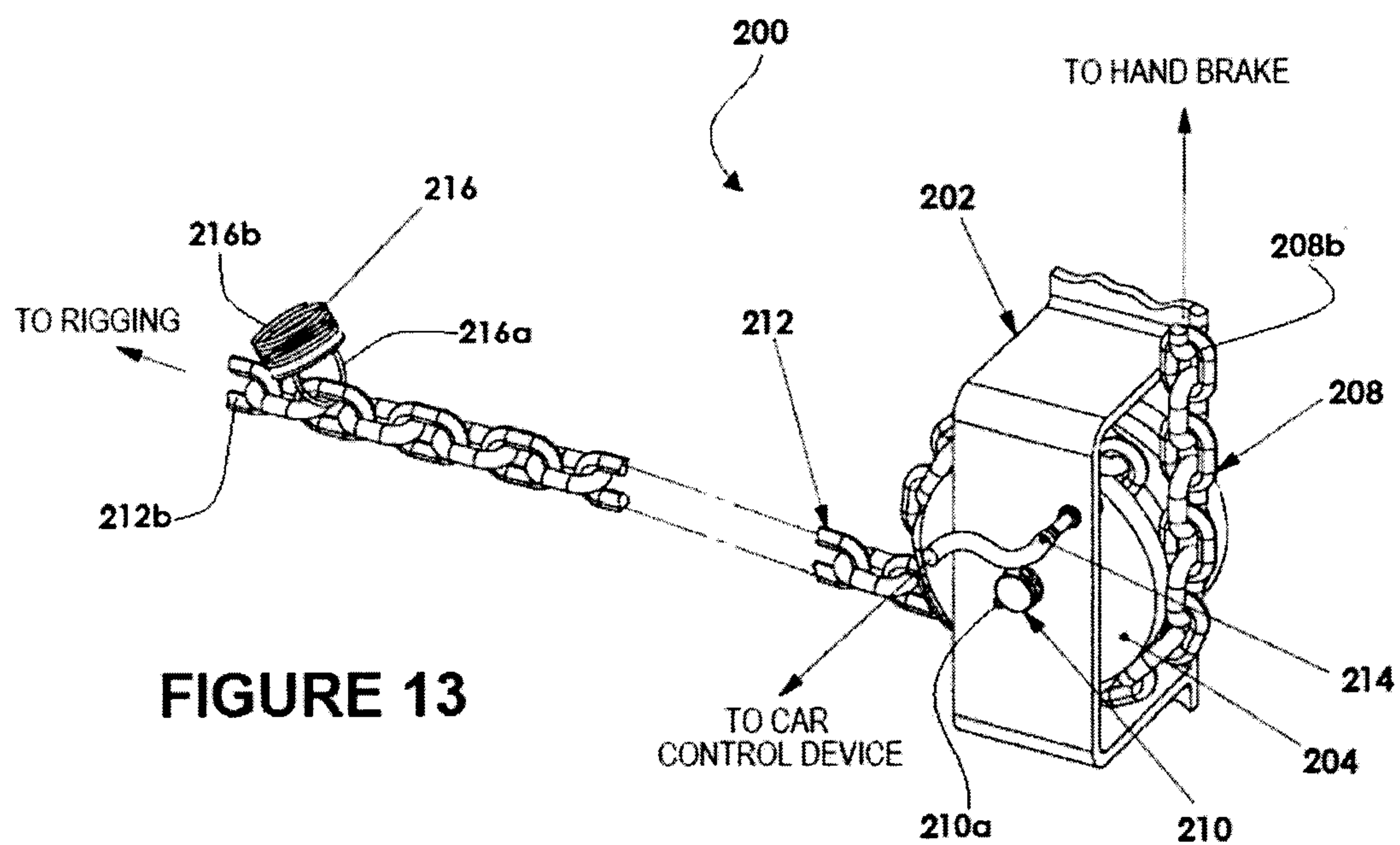


Figure 11

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**FIGURE 12****FIGURE 13**

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FIGURE 14

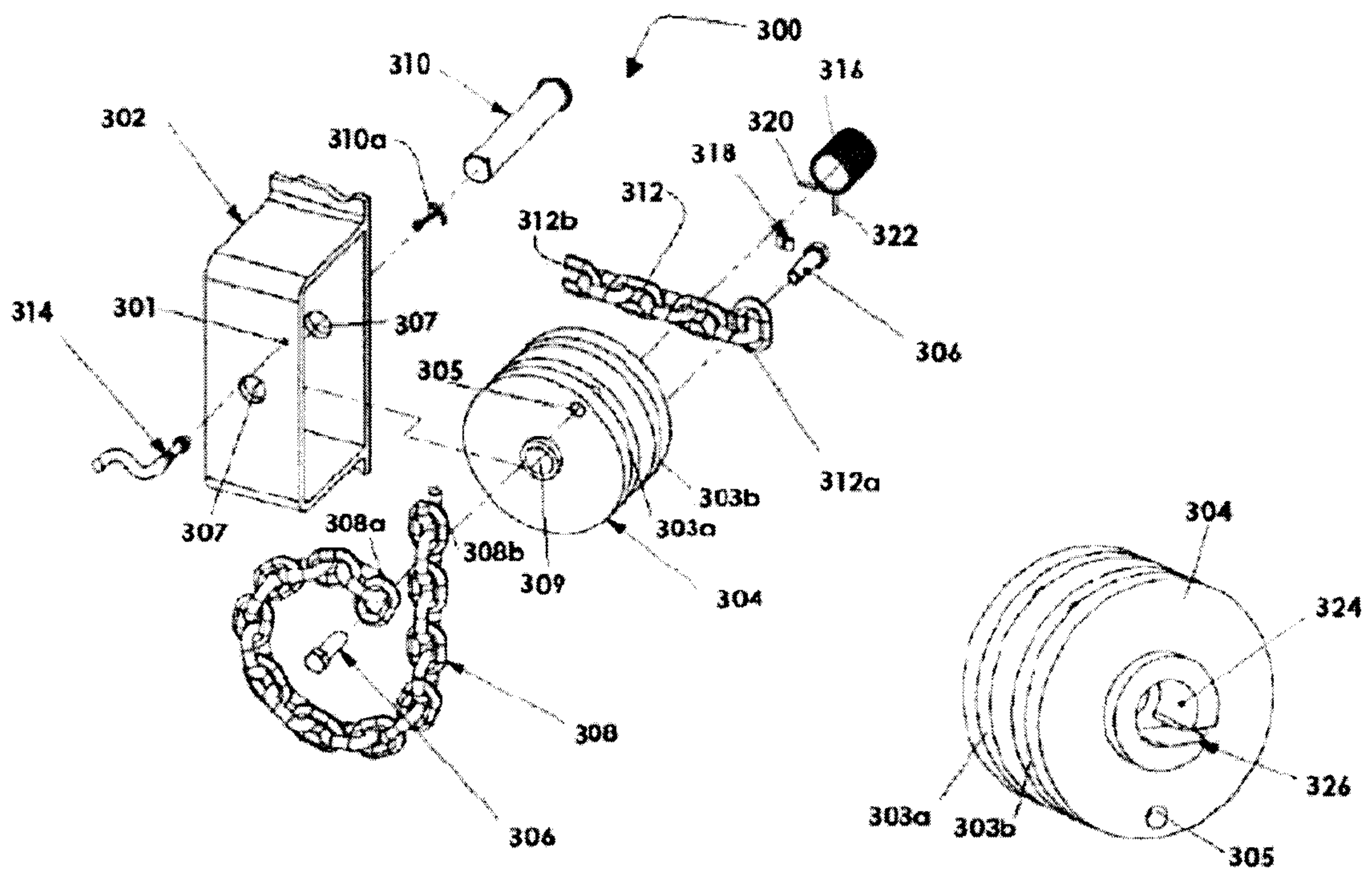
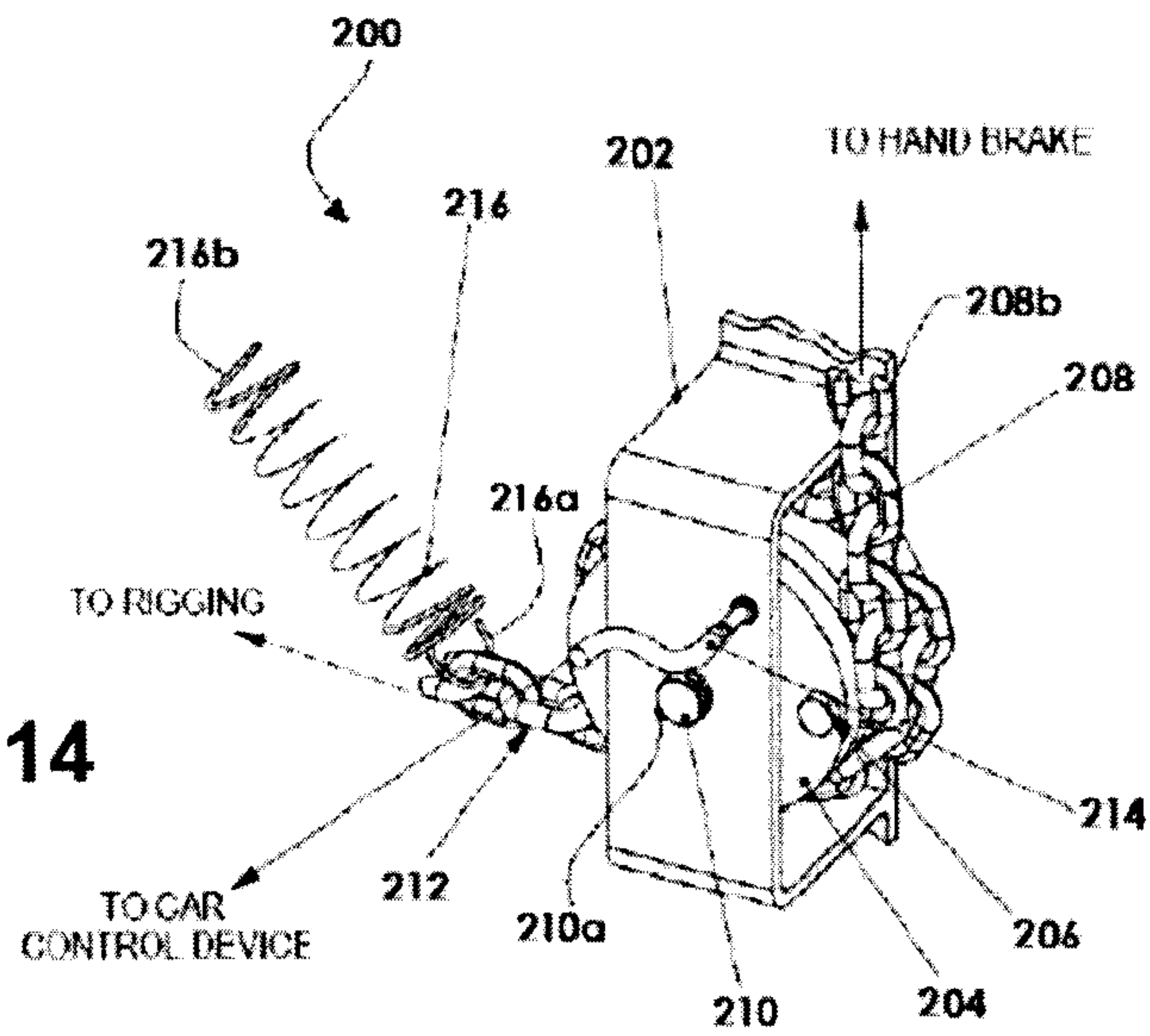
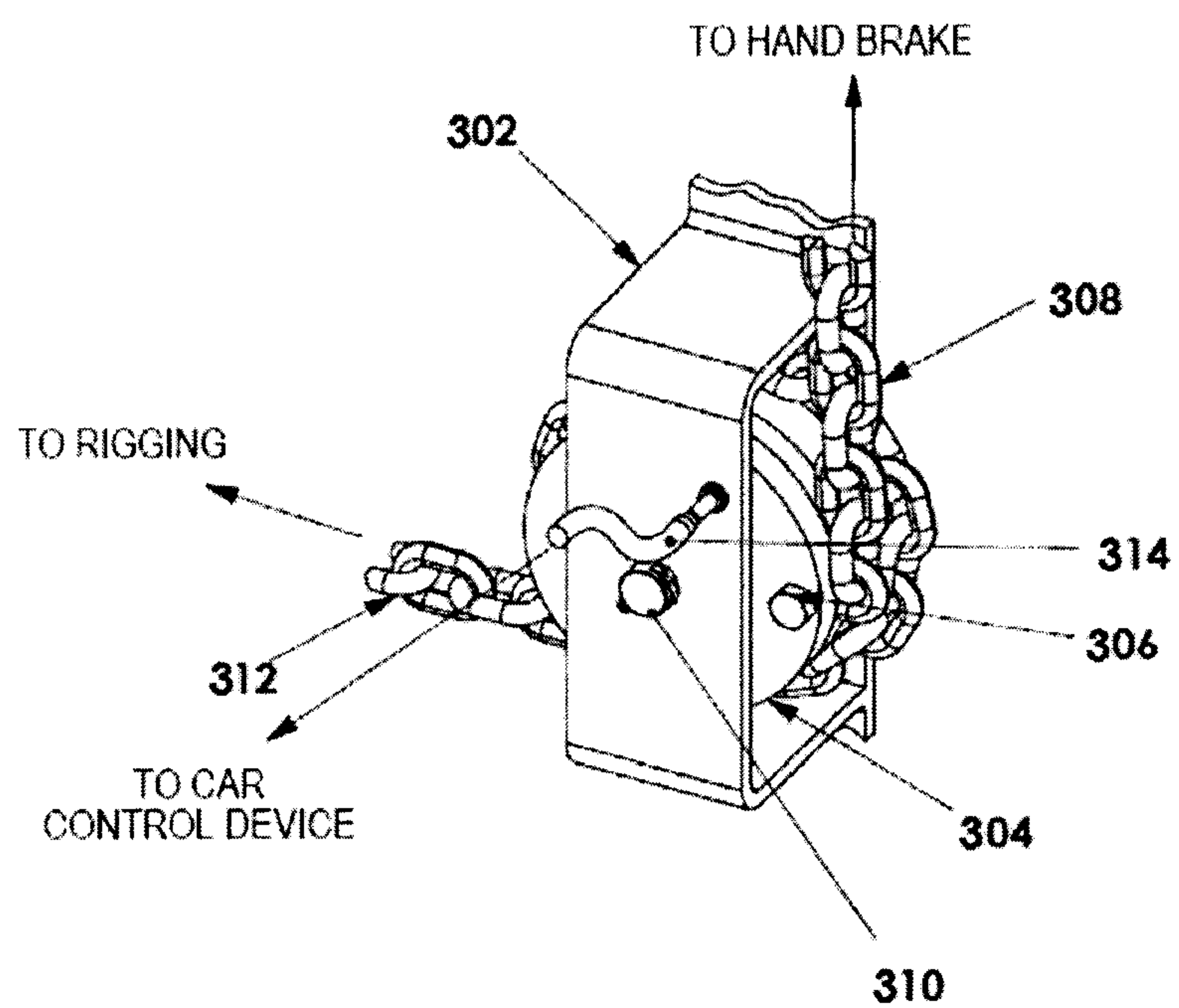
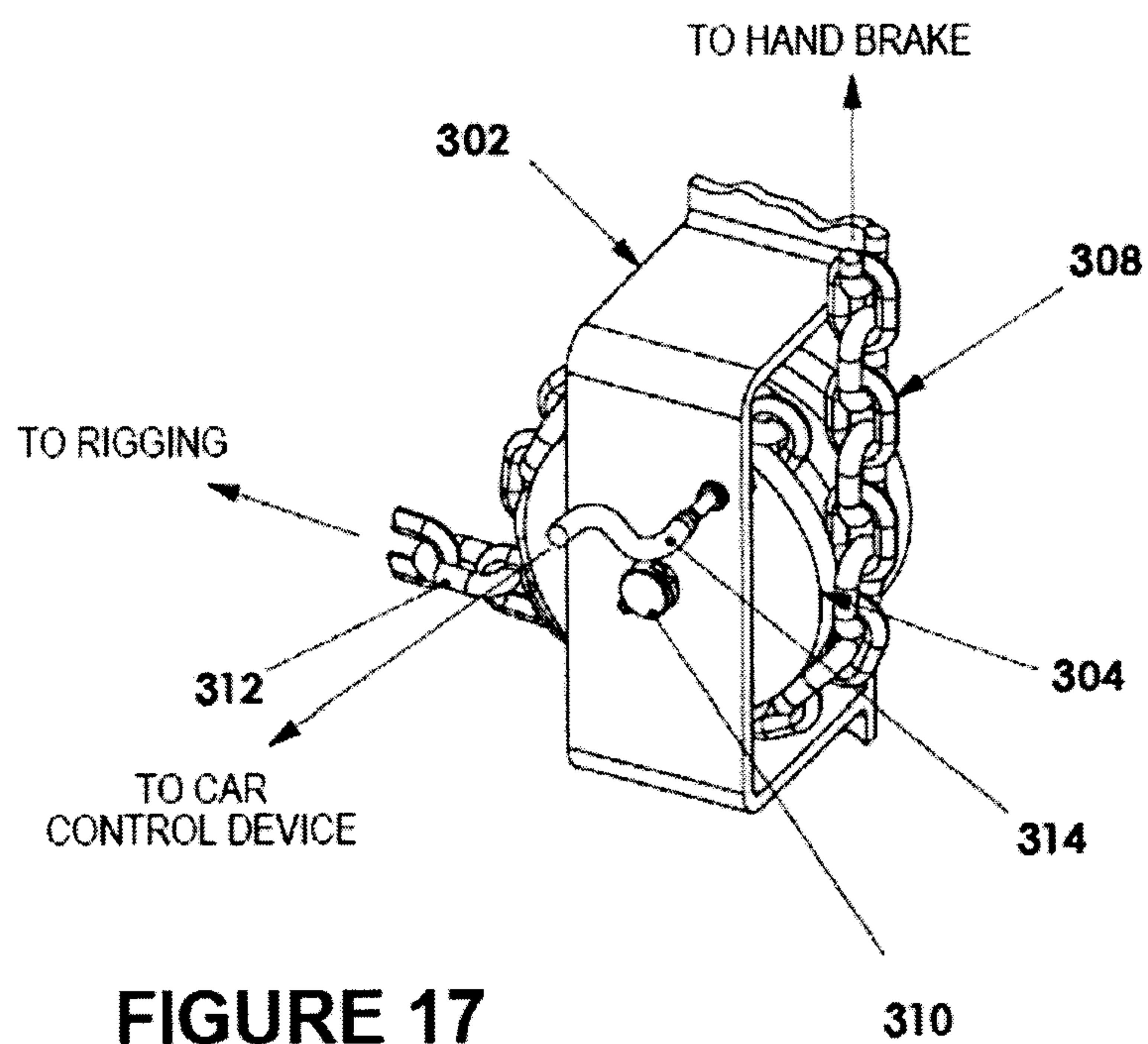


FIGURE 15

FIGURE 16

12/14



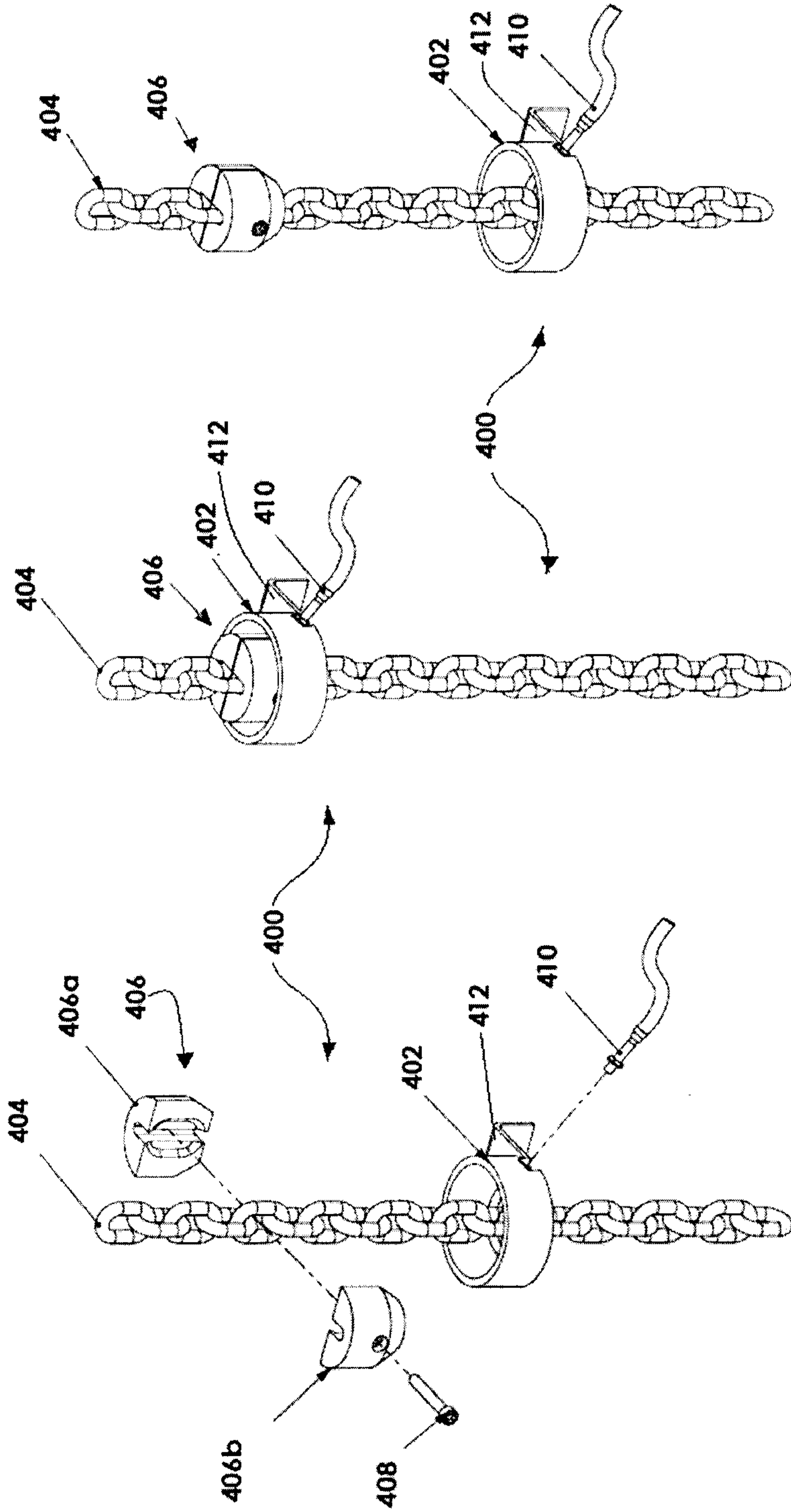


FIGURE 21

FIGURE 20

FIGURE 19

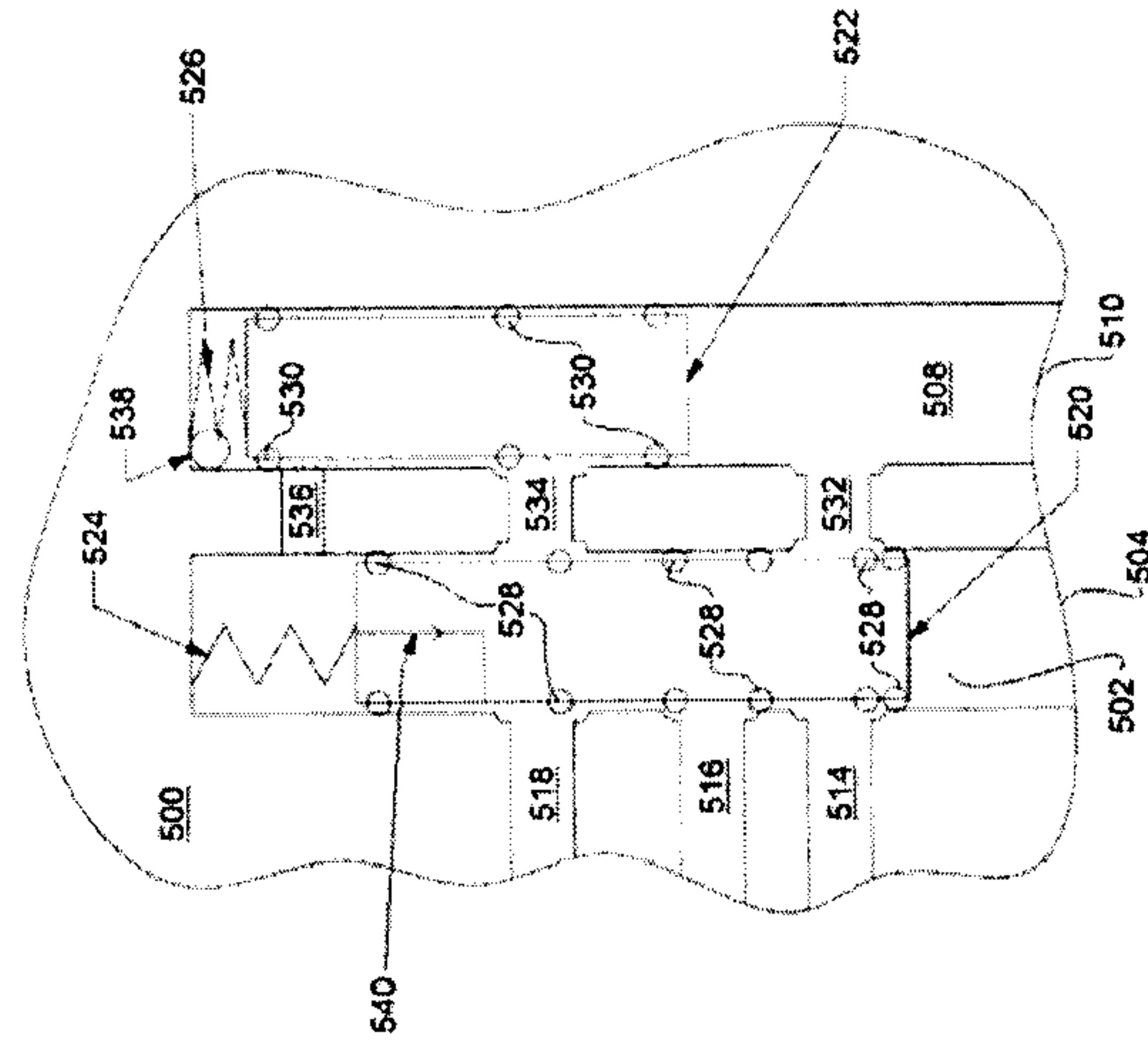


Figure 22

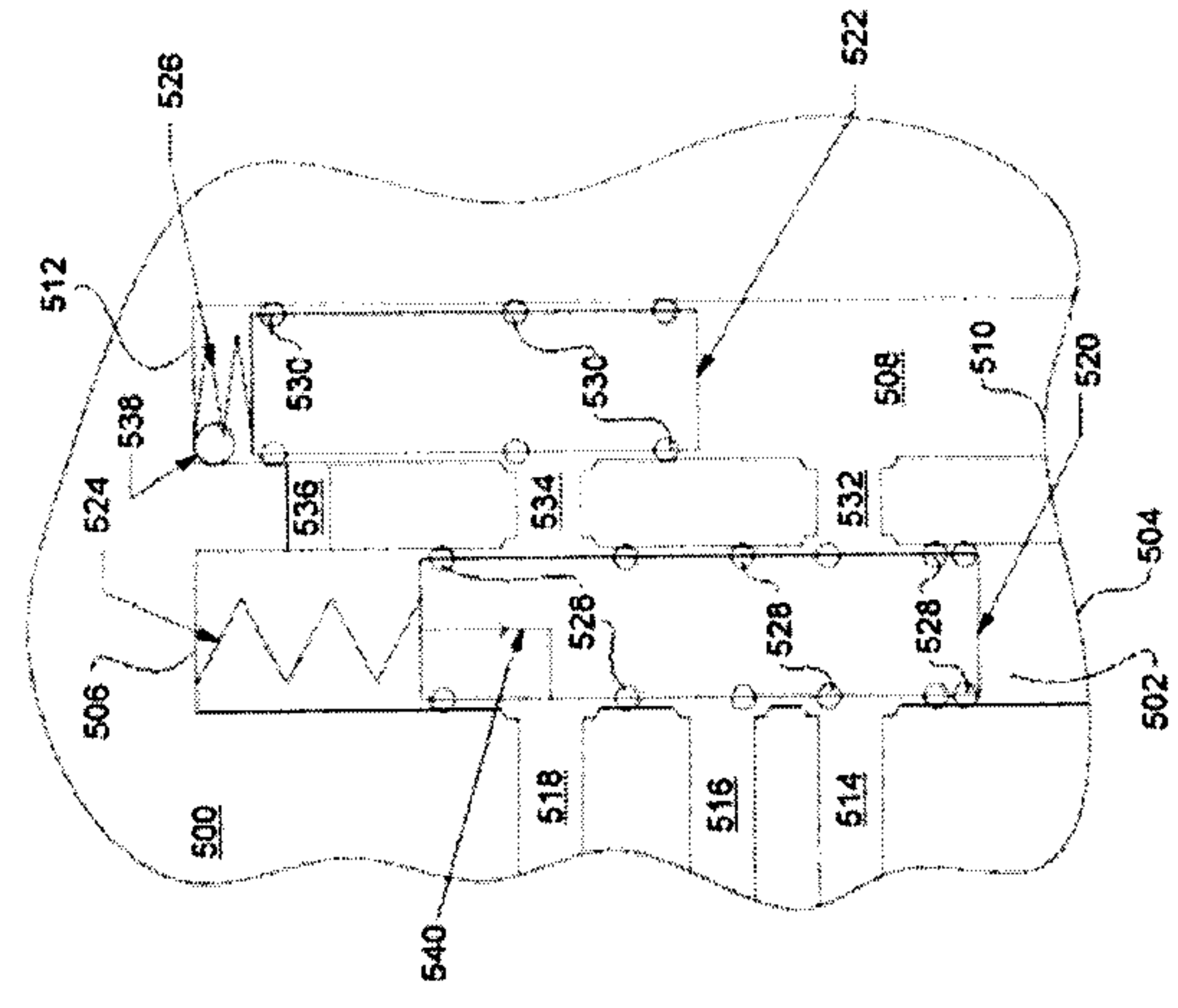


Figure 23

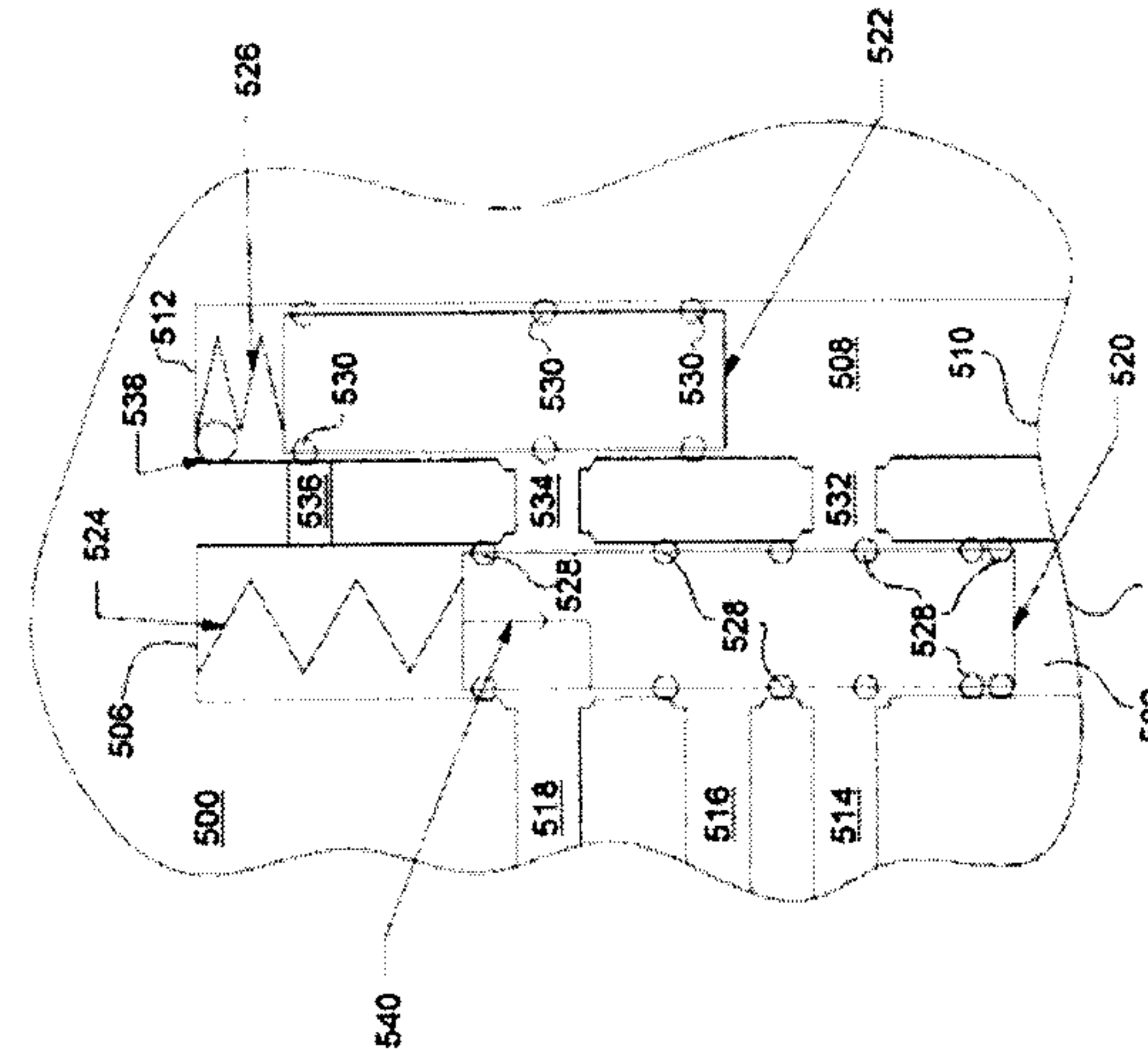


Figure 24

10

13

12

SD NO 2

TRACED NO 1072

24

AAR

3

22

16

28

15

Input from
Air Brake

208

