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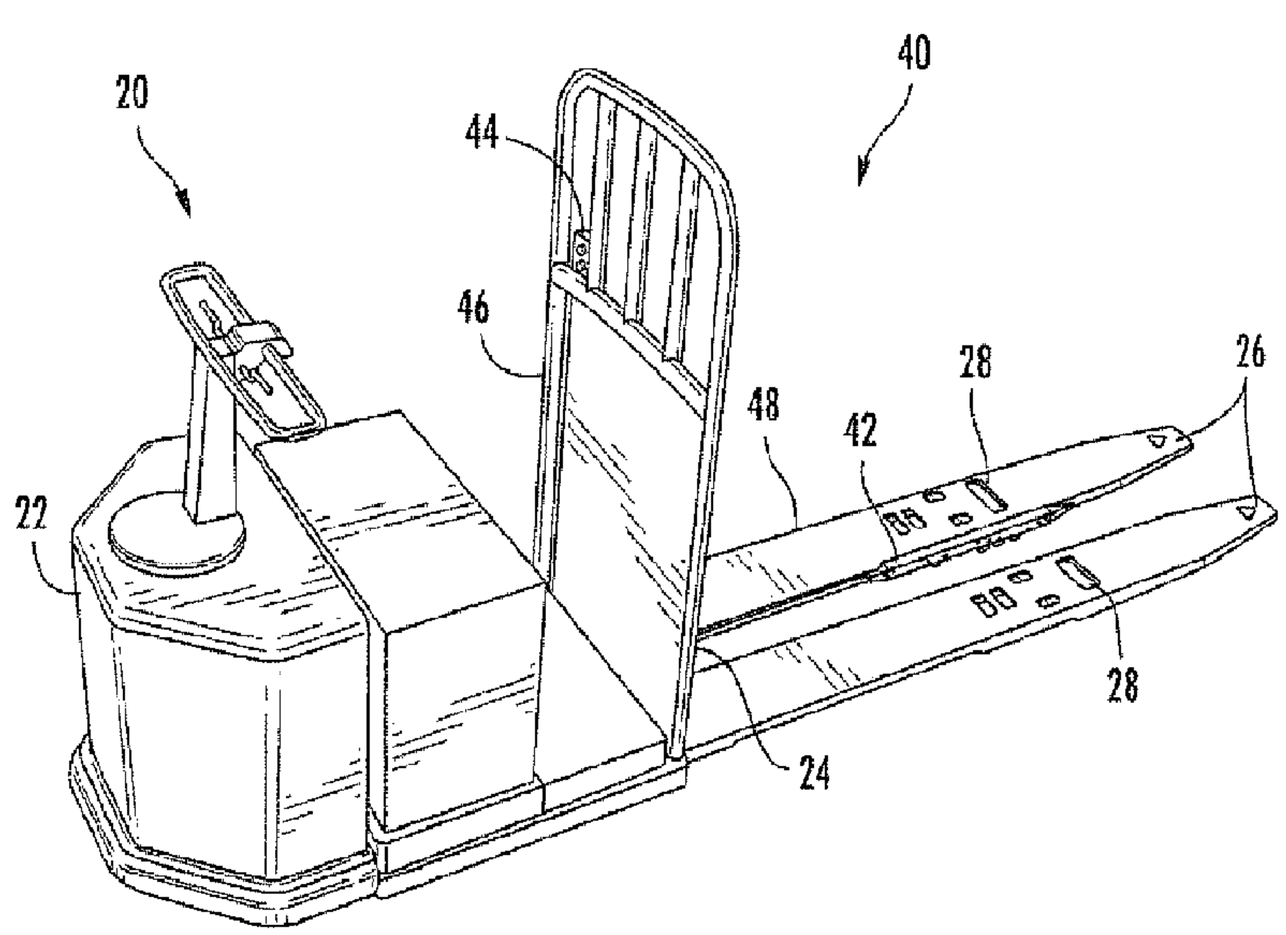

(57) **Abrégé/Abstract:**
A lift indicator assembly for a pallet truck includes a lift sensor assembly, and a lift status display for determining a lift condition of a load wheel of the pallet truck. The lift sensor assembly is to be carried by a fork of the pallet truck and includes a housing section, and a primary sensor assembly. The primary sensor assembly includes a first primary arm coupled to the housing section, and a first primary contact switch carried by the housing section and adjacent the first primary arm. The first primary contact switch has an engaged position and a disengaged position based on position of the first primary arm. The lift status display determines the lift condition of the load wheel based on position of the first primary contact switch.

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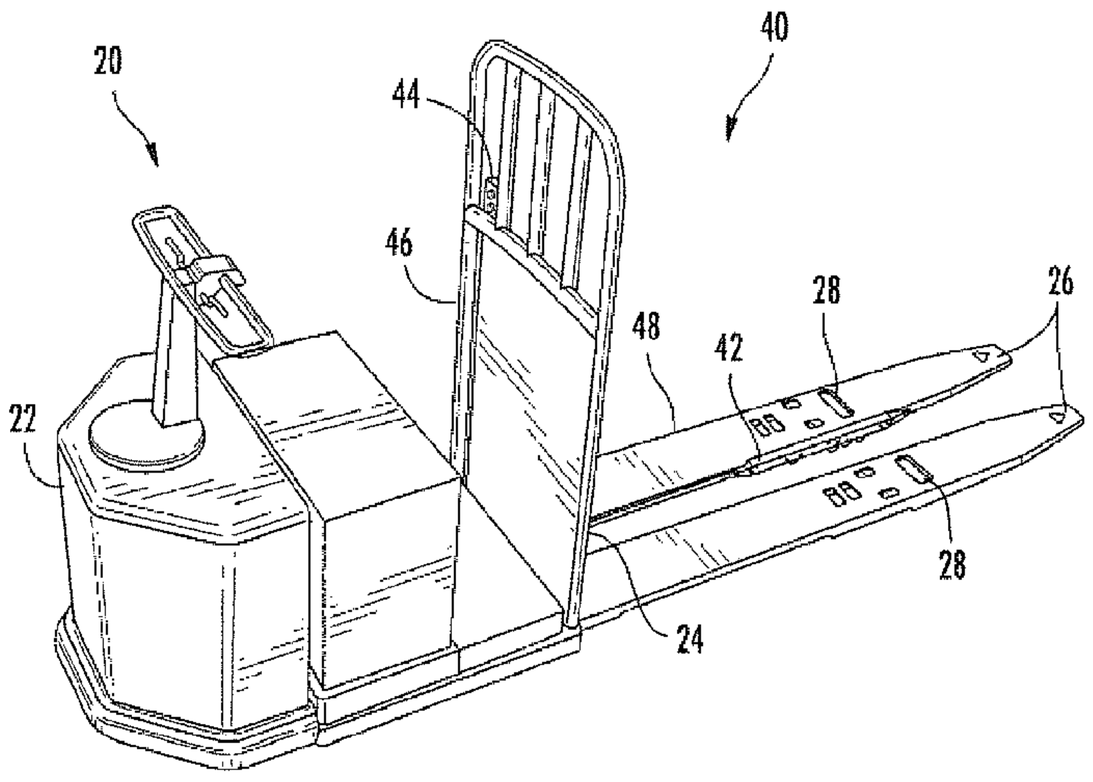

FIG. 1

(57) Abstract: A lift indicator assembly for a pallet truck includes a lift sensor assembly, and a lift status display for determining a lift condition of a load wheel of the pallet truck. The lift sensor assembly is to be carried by a fork of the pallet truck and includes a housing section, and a primary sensor assembly. The primary sensor assembly includes a first primary arm coupled to the housing section, and a first primary contact switch carried by the housing section and adjacent the first primary arm. The first primary contact switch has an engaged position and a disengaged position based on position of the first primary arm. The lift status display determines the lift condition of the load wheel based on position of the first primary contact switch.

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PALLET TRUCK WITH LIFT INDICATOR ASSEMBLY AND ASSOCIATED METHODS

Related Applications

[0001] This application claims the benefit of U.S. Provisional Application Serial No. 61/485,946 filed May 13, 2011.

Field of the Invention

[0002] The present invention relates to the field of pallet trucks, and more particularly, to a pallet truck with a lift indicator assembly to prevent damaging bottom deck boards of a pallet when lifting the pallet.

Background of the Invention

[0003] Pallet trucks are commonly used to load and unload pallets from a truck. A typical pallet includes a bottom deck, a top deck and support blocks. The support blocks are coupled between the bottom and top decks and define an opening therebetween for receiving lifting members of material handling equipment, such as forks from a pallet truck.

[0004] A typical pallet truck includes a cab, a vertical load plate on a front end of the cab, and a pair of forks or tines extending outwards from a lower end of the vertical load plate in a substantially horizontal direction. A load wheel is in each fork. The load wheel may also be referred to as a lift wheel. Each load wheel is coupled to a respective load wheel linkage that is pivotally coupled to the fork. The maximum lift of the forks may vary depending on the pallet truck, but a typical lift height is about 6 inches.

[0005] When an operator of the pallet truck extends the forks into an opening of a pallet, the operator cannot readily observe the position of the load wheels because of the boards in the top deck of the pallet and any load carried on the top deck. If the load wheels come to rest on a bottom deck board of the pallet, then downward movement of the load wheels to lift the forks results in separation of the bottom deck board from the pallet.

[0006] One approach to this problem is to mount light sensors on at least one of the forks, as disclosed in U.S. Patent No. 4,747,610. The light sensors detect the positions of the load wheels with respect to the bottom deck boards of the pallet. A disadvantage of light sensors is that they may fail to properly operate due to blockage of the light beams by dirt and debris.

Summary of the Invention

[0007] In view of the foregoing background, it is therefore an object of the present invention to provide a lift indicator assembly that reliably prevents bottom deck boards of a pallet from being damaged when lifted by a pallet truck.

[0008] This and other objects, advantages and features in accordance with the present invention are provided by a pallet truck comprising a cab, a vertical load plate on a front end of the cab, and at least one fork extending outwards from a lower end of the vertical load plate in a substantially horizontal direction for insertion into an opening in a pallet. The pallet includes a bottom deck, a top deck and support blocks coupled between the bottom and top decks to define the opening. A load wheel may be coupled to the at least one fork and may be configured for lifting the at least one fork and the vertical load plate.

[0009] A lift sensor assembly may be carried by the at least one fork and adjacent the load wheel, and may comprise a housing section, and a primary sensor assembly. The primary sensor assembly may comprise a first primary arm coupled to the housing section, and a first primary contact switch carried by the housing section and adjacent the first primary arm. The first primary contact switch has an engaged position and a disengaged position based on position of the first primary arm. A lift status display may

be configured for determining a lift condition of the load wheel based on position of the first primary contact switch.

[0010] Position of the first primary contact switch is advantageously used to determine the lift condition of the load wheel. If the first primary contact switch is in an engaged position when the fork is inserted into the pallet opening, then the pallet would be damaged if the load wheel were to lift the pallet. However, if the first primary contact switch is in a disengaged position when the fork is inserted into the pallet opening, then the pallet would not be damaged if the load wheel were to lift the pallet. The lift status display provides this information to an operator of the pallet truck.

[0011] The primary sensor assembly may further comprise a second primary arm coupled to the housing section, and a second primary contact switch carried by the housing section and adjacent the second primary arm. The second primary contact switch also has an engaged position and a disengaged position based on position of the second primary arm. The lift status display may be further configured for determining the lift condition of the load wheel based on position of the second primary contact switch in combination with the position of the first primary contact switch.

[0012] The first primary arm may be coupled to the housing section in front of the load wheel, and the second primary arm may be coupled to the housing section behind the load wheel. The first and second primary arms may be pivotally coupled to the housing section.

[0013] The bottom deck of the pallet comprises a plurality of spaced apart bottom deck boards. The at least one fork may have a wedge shape with an outermost tip extending in height above a thickness of the plurality of bottom deck boards. The primary sensor assembly may be adjacent the outmost tip so that when a lowermost surface of the at least one fork is contacting an upper surface of at least one of the bottom deck boards, the first primary arm moves downwards without contacting a bottom deck board so that the first primary contact switch is in the disengaged position.

[0014] The lift sensor assembly may further comprise an auxiliary sensor assembly comprising at least one auxiliary arm coupled to the housing section, and at least one auxiliary contact switch carried by the housing

section. The at least one auxiliary contact switch also has an engaged position and a disengaged position based on position of the at least one auxiliary arm. The lift status display may be further configured for determining the lift condition of the load wheel based on position of the at least one auxiliary contact switch in combination with the position of the first primary contact switch. The auxiliary sensor assembly is advantageously used to indicate a lift condition when the at least one fork is on the ground without engaging a pallet, as well as preventing false positives when engaging a pallet. False positives may occur if the spacing of the bottom deck boards in the pallet is such that the primary and auxiliary contact switches are simultaneously engaged, thereby indicating a lift condition even though the load wheel may be on one of the bottom deck boards. The spacing of the primary and auxiliary arms is selected with respect to the spacing of the bottom deck boards in the pallet to minimize the occurrence of false positives.

[0015] The lift status display may comprise at least one light for visually displaying the lift condition of the load wheel. The lift status display may comprise a controller for activating the at least one light based on the position of the first primary contact switch. An interface between the lift status display and the first primary contact switch may be a wired or wireless interface.

[0016] The lift sensor assembly may further comprise a biasing device for biasing the first primary arm away from the first primary contact switch.In addition, the lift indicator assembly may further comprise a load wheel inhibitor coupled to the lift status display to prevent the load wheel from lifting the at least one fork and the vertical load plate based on the determined lift condition of the load wheel.

[0017] Another aspect is directed to a method for providing a lift indicator assembly for a pallet truck comprising at least one fork extending in a substantially horizontal direction for insertion into an opening in a pallet, and a load wheel coupled to the at least one fork and configured for lifting the at least one fork. The method may comprise providing a lift sensor assembly as described above to be carried by the at least one fork. The method may further comprise providing a lift status display for determining

a lift condition of the load wheel based on position of the first primary contact switch.

Brief Description of the Drawings

[0018] FIG. 1 is a side perspective view of a pallet truck with a lift indicator assembly in accordance with the present invention.

[0019] FIG. 2 is a side view of a pallet truck and a lift status display associated therewith indicating a no lift condition in accordance with the present invention.

[0020] FIG. 3 is an enlarged partial exploded view of the load wheels of the forks resting on a bottom deck board of the pallet as shown in FIG. 2.

[0021] FIG. 4 is a side view of a pallet truck and a lift status display associated therewith indicating a lift condition in accordance with the present invention.

[0022] FIG. 5 is an enlarged partial exploded view of the load wheels of the forks not resting on a bottom deck board of the pallet as shown in FIG. 4.

[0023] FIG. 6 is a side perspective view of the lift sensor assembly and cable cover illustrating their placement on a fork in accordance with the present invention.

[0024] FIG. 7 is an interior side perspective view of the lift sensor assembly in accordance with the present invention.

[0025] FIG. 8 is an exploded view of the lift sensor assembly shown in FIG. 7.

[0026] FIG. 9 is a cut-away side view of a fork inserted into a pallet with a lift sensor assembly attached thereto indicating a lift condition in accordance with the present invention.

[0027] FIG. 10 is a cut-away side view of a fork inserted into a pallet with a lift sensor assembly attached thereto indicating a no lift condition in accordance with the present invention.

[0028] FIG. 11 is an enlarged cut-away side view of a contact switch being closed by the first arm of the primary lift sensor in accordance with the present invention.

[0029] FIG. 12 is a block diagram of the lift status display in accordance with the present invention.

[0030] FIG. 13 is a block diagram of the lift indicator assembly that further includes a load wheel inhibitor in accordance with the present invention.

[0031] FIG. 14 is a flowchart illustrating a method for providing a lift indicator assembly for a pallet truck in accordance with the present invention.

Detailed Description of the Preferred Embodiments

[0032] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

[0033] Referring initially to FIGS. 1-5, a pallet truck **20** is modified to include a lift indicator assembly **40**. The lift indicator assembly **40** includes a lift sensor assembly **42**, a lift status display **44**, and a cable **46** coupled therebetween. At least a portion of the cable **46** is protected by a cable cover **48**. The pallet truck **20** includes a cab **22**, a vertical load plate **24** on a front end of the cab, and a pair of forks or tines **26** extending outwards from a lower end of the vertical load plate in a substantially horizontal direction. A load or lift wheel **28** is in each fork **26**. Each load wheel **28** is coupled to a respective load wheel linkage **30** that is pivotally coupled to the fork **26**.

[0034] An operator drives a wheel positioned under the cab **22**, and operates a hydraulic pump to raise and lower the forks **26**. The hydraulic pump is coupled to a hydraulic cylinder that is coupled between the vertical load plate **24** and tie rods that extend through the forks **26** to the load wheel linkages **30**.

[0035] To raise the forks **26**, the hydraulic cylinder is actuated to move the vertical load plate **24** upwardly and to simultaneously pivot or move the load wheel linkages **30** downwardly to lower the load wheels **28**, which in turn raise and support the forward ends of the forks **26** above the ground.

The maximum lift of the forks **26** vary depending on the pallet truck, but a typical lift height is about 6 inches. To lower the forks **26** fluid in the hydraulic cylinder may be drained into a reservoir, so that the load wheels **28** are retracted and the forks are lowered by gravity. When the forks **26** are lowered, the load wheels **28** continue to support the forks on the ground.

[0036] The illustrated lift status display **44** is carried by the cab **22**, and the lift sensor assembly **42** is attached to an inside sidewall of one of the forks **16** adjacent the load wheel **28**. Alternatively, the lift sensor assembly **42** could be attached to an outside sidewall of one of the forks **26**. In both of these embodiments, the lift sensor assembly **42** is mounted external one of the forks **26**. Yet another embodiment is for the lift sensor assembly **42** to be mounted internal one of the forks **26**. The illustrated cable **46** runs along the sidewall of the fork **26** to the lift status display **44**. A cable cover **48** is positioned along the inside wall of the fork **26** to protect the cable **46**. Alternatively, if the lift sensor assembly **42** is internally mounted in one of the forks **26**, then the cable **46** would also be run internally.

[0037] The lift indicator assembly **40** provides a reliable way to prevent the operator of the pallet truck **20** from lifting the forks **26** while the load wheels **28** are resting on a bottom deck board **52** of a pallet **50**, as would be the case as shown in FIG. 2 and in the enlarged partial exploded view **60** in FIG. 3.

[0038] In this position, a red light **45** in the lift status display **44** is lit indicating that the load wheels **28** are resting on or near the bottom deck board **52**. The operator of the pallet truck **20** has inserted the forks **26** to a position that is at risk for breaking the bottom deck board **52** because the load wheel **28** is situated near or on top of the bottom deck board **50**. As a result, the load wheel linkages **30** and the load wheels **28** are to remain in a retracted position.

[0039] If the operator were to slightly back the pallet truck **20** out of the pallet **50** so that the load wheels **28** are no longer resting on the bottom deck board **52**, as would be the case as shown in FIG. 4 and in the enlarged partial sectional view **62** in FIG. 5, then a green light **47** in the lift status display **44** is lit.

[0040] The lift status display **44** is not limited to a red no lift light **45** and a green lift light **47.** Other techniques for communicating with the operator are readily acceptable, as appreciated by those skilled in the art. For example, a speaker may be used to communicate audible messages to the operator. This may be in addition to the lights **45, 47**. Alternatively, the audible massage may be selectively used in place of the lights **45, 47**. Even though the illustrated interface between the lift status display **44** and the lift sensor assembly **42** is a wired interface, the interface may alternatively be a wireless interface.

[0041] A wireless interface helps to simplify retrofit of a pallet truck **20** with a lift indicator assembly **40.** In this embodiment, transmitters in the lift sensor assembly **42** communicate with a receiver in the lift status display **44**, as readily appreciated by those skilled in the art.

[0042] Referring now to FIGS. 6-11, the lift sensor assembly **42** will be described in greater detail. Screws **68**, for example, may be used to secure the lift sensor assembly **42** and the cable cover **48** to the fork **26.** The illustrated lift sensor assembly **42** includes a primary sensor assembly **70** and an auxiliary sensor assembly **90**. The lift sensor assembly **42** is positioned so that the primary sensor assembly **70** is adjacent and slightly ahead of the load wheel **28** in the fork **26**.

[0043] Even though the primary sensor assembly **70** is essentially used to determine whether the load wheel **28** is resting on or to close to a bottom deck board **52**, the auxiliary sensor assembly **90** permits the lift status display **44** to indicate a lift condition when the forks **26** are on the ground without engaging a pallet **50**, as well as preventing false positives when engaging a pallet.

[0044] False positives may occur if the spacing of the bottom deck boards **52** in the pallet **50** is such that the primary and auxiliary sensor assemblies **70, 90** are simultaneously engaged with a bottom deck board, thereby indicating a lift condition even though the load wheel **28** may be on one of the bottom deck boards. The spacing of primary and auxiliary wheels **76, 96** within the primary and auxiliary sensor assemblies **70, 90** is selected with respect to the spacing of the bottom deck boards in the pallet to minimize the occurrence of false positives.

[0045] In addition, the spacing of primary and auxiliary wheels **76, 96** within the primary and auxiliary sensor assemblies **70, 90** may also help to minimize false negatives. False Negatives may occur due to uneven floors where the primary wheels **76** in the primary sensor assembly **70** are engaged while the auxiliary wheels **96** in the auxiliary sensor assembly **90** are not engaged.

[0046] The lift sensor assembly **42** includes a forward housing section **110**, a rear housing section **120**, and an intermediate housing section **130** positioned therebetween. The forward and rear housing sections **110**, **120** are configured to lock in place the intermediate housing section **130**. The forward and rear housing sections **110, 120** slideably engage the intermediate housing section **130** from opposite ends.

[0047] The primary sensor assembly **70** includes first and second primary arms **72, 74** each carrying a contact wheel **76**. An arm may also be referred to as an actuator or linkage, for example. The contact wheels **76** may be optional. In lieu of a contact wheel, other types of contacting devices for contacting the ground as well contacting the bottom deck boards in the pallet may be used, such as a skid, for example. The first primaryarm **72** is coupled to the intermediate housing section **130** in front of the load wheel **28**, and the second primary arm **74** is coupled to the intermediate housing section behind the load wheel. The respective contact wheels **76** are facing towards each other based on how the first and second primary arms **72, 74** are coupled to the intermediate housing section **130**.

[0048] The first and second primary arms **72, 74** may be pivotally coupled to the intermediate housing section **130**, as illustrated. Alternatively, the first and second primary arms **72, 74** may be coupled to the intermediate housing section **130** so that they move in an up and down direction, or even in a slightly angled or non-vertical direction. As noted above, an arm may also be referred to as an actuator or a linkage.

[0049] Since the illustrated first primary arm **72** is the forward-most arm to make contact with the pallet **50**, it may also carry a guide wheel **78.** The guide wheel **78** assists with insertion of the forks **26** into an opening in a pallet **50**, as well as assisting with travel across the ground. As noted above, another type of contacting device may be used in lieu of a guide

wheel **78**, such as a skid, for example.

[0050] The auxiliary sensor assembly **90** also includes first and second auxiliary arms **92** and **94**, each optionally carrying a contact wheel **96**. The first and second auxiliary arms **92** and **94** are both on the same side of the load wheel **28**. The first auxiliary arm **92** is coupled to the intermediate housing section **130** and the second auxiliary arm **94** is also coupled to the intermediate housing section. The respective contact wheels **96** are facing away from each other based on how the first and second auxiliary arms **92, 94** are coupled to the intermediate housing section **130**.

[0051] The first and second auxiliary arms **92, 94** may also be pivotally coupled to the intermediate housing section **130**, as illustrated. Alternatively, the first and second auxiliary arms **92, 74** may be coupled to the intermediate housing section **130** so that they move in an up and down direction, or even in a slightly angled or non-vertical direction. The first and second auxiliary arms **92, 94** may be pivotally coupled while the first and second primary arms **72, 74** are non-pivotally coupled to the intermediate housing section **130**, or vice-versa.

[0052] Each primary and auxiliary arm **72, 74, 92, 94** has a contact switch **100** associated therewith. When the contact wheels **76, 96** are all resting on the ground, then the respective switches **100** are engaged in a closed position. Normally, a closed position by the switches **100** associated with the primary sensor assembly **70** indicates that the load wheels **28** are resting on a bottom deck board **52**. However, in this particular condition, when the forks **26** are not engaging a pallet **50**, then it is obviously ok to lift the forks if necessary prior to moving the pallet truck **20**.

[0053] Consequently, when the switches **100** associated with the contact wheels **96** of the auxiliary sensor assembly **90** are also in the engaged or closed position along with the switches **100** associated with the contact wheels **76** of the primary sensor assembly **70**, then the lift status display **44** interprets this condition as lift condition and activates the green light **47**. In addition to helping to prevent false positives, this is another advantage of the auxiliary sensor assembly **90** working in cooperation with the primary sensor assembly **70**.

[0054] As the forks **26** are inserted into an opening in a pallet **50**, the

primary sensor assembly **70** passes over a first bottom deck board **52**. Due to the wedge shaped design of the forks **26**, the tips of the forks extend in height above the thickness of the bottom deck boards. A thickness of the bottom deck board is about 0.75 inches, whereas a height of the tips of the forks **26** is about 1.25 inches. This provides a clearance gap of about 0.5 inches.

[0055] The resulting clearance gap causes the switches **100** associated with the primary sensor assembly **70** to become disengaged or open when the base **27** or lowermost surface of the forks **26** is resting on the upper surface of the bottom deck board **52**. In other words, the first and second primary arms **72, 74** are allowed to move downwards within the clearance gap. This distance is enough for the first and second primary arms **72, 74** to become disengaged with the switches **100**. Typically, movement of the first and second primary arms **72, 74** is within range of about 0.015 to 0.030 inches, for example, to become engaged or disengaged with the switches **100**. This lift scenario is best illustrated in FIG. 9, and the green light **47** in the lift status display **44** is activated.

[0056] However, if the operator were to continue inserting the forks **26** into the opening in the pallet **50** until the guide wheel **78** carried by the first primary arm **72** in the primary sensor assembly **70** contacts the next bottom deck board **52**, then the switch **100** associated therewith is engaged indicating that the load wheel **28** is resting on bottom deck board, or that the load wheel is too close to the bottom deck board. This means that the load wheel linkages **30** connected to the load wheel **28** would contact the bottom deck board when the forks **26** are lifted. This no lift scenario is best illustrated in FIG. 10, with a close-up view provided in FIG. 11. As a result, the red light **45** in the lift status display **44** is activated.

[0057] Size and spacing of the guide wheel **78** and the contact wheels **76, 96** are important. The guide wheel **78** and the contact wheels **76, 96** are about 2.25 inches in diameter, whereas the load wheel **28** is about 3.5 inches in diameter. In other embodiments, the diameter of the guide wheel **78** may be less than the diameter of the contact wheels **76, 96**. The guide wheel **78** is positioned partially ahead of the load wheel **28**. The contact wheel **76** carried by the first primary arm **72** is somewhat aligned with a

rear of the load wheel **28**. The spacing between the contact wheels **76** in the primary sensor assembly **70** is within a range of about 1-2 inches. This helps to prevent the scenario in which both contact wheels **76** in the primary sensor assembly **70** are resting on a bottom deck board, thus providing a false positive on the lift status display **44** when the contact wheels **96** in the auxiliary sensor assembly **90** are also contacting the ground or a bottom deck board.

[0058] Similarly, the contact wheel **96** carried by the first primary arm **92** in the auxiliary sensor assembly **90** is within a range of about 5-8 inches from the contact wheel **76** carried by the second primary arm **74** in the primary sensor assembly **90**. The spacing between the contact wheels **96** in the auxiliary sensor assembly **90** is within a range of about 5-8 inches. The contact wheels **96** in the auxiliary sensor assembly **90** advantageously help to prevent false positives which could occur based on the spacing of the bottom deck boards **52** in the pallet **50**. The various spacings will vary depending on the actual sizes of the intended pallets to be moved, as readily appreciated by those skilled in the art.

[0059] The guide wheel **78** and the contact wheels **76, 96** are preferably made out of rubber. This advantageously allows the flexibility of the guide wheel **78** and the contact wheels **76, 96** to deflect transverse loads when operating on an uneven or rough floor.

[0060] Referring back to FIG. 8, the first primary arm **72** moves about a shaft **80** that is also used to secure the arm to the intermediate housing section **130**. Similarly, the second primary arm **74** moves about a shaft **82** that is also used to secure the arm to the intermediate housing section **130**. Shafts **86** are used to secure the first and second auxiliary arms **92, 94** in the auxiliary sensor assembly **90**.

[0061] Each primary arm **72, 74** in the primary sensor assembly **70** has a biasing device associated therewith for biasing the primary arms away from their respective switches **100**. The biasing device may be a spring **84**, for example. The springs **84** are in a normally compressed state so that they normally push outwards on the first and second primary arms **72, 74**. Similarly, each auxiliary arm **92, 94** in the auxiliary sensor assembly **90** has a biasing device, such as a spring **84**, associated therewith. The springs **84**

are also in a normally compressed state so that they normally push outwards on the first and second auxiliary arms **92, 94**.

[0062] Each primary and auxiliary arm **72, 74, 92, 94** has a hard stop associated therewith. This prevents the arms **72, 74, 92, 94** from dropping too far and hyper-extending, as well as from being compressed too much as would be the case when the forks **26** of the pallet truck **20** quickly enter the opening in the pallet **50**. The later case also helps to prevent the switches **100** from being crushed.

[0063] Each switch **100** typically has two wires extending therefrom. Since there are four switches **100**, then the cable **46** includes at least 8 wires extending to the lift status display **44**. The wires may be configured as a ribbon cable. The lift status display **44** includes a logic controller **43** to interpret the open/closed states of each switch **100** in order to activate the appropriate red light **45** or the green light **47**.

[0064] Referring now to FIG. 12, the logic controller **43** within the lift status display **44** interfaces with individual wires in the cable **46** to determine a lift condition of the load wheel **28** based on whether the respective contact switches **100** are in an engaged position or in a disengaged position. The logic controller **43** activates the red light **45** or the green light **47** accordingly. Separately or in addition to, the logic controller **43** may also generate audio commands or signals to be communicated via a speaker **55**.

[0065] As mentioned above, the interface between the lift status display **44** and the lift sensor assembly **42** may be a wireless interface. In lieu of the cable **46**, a receiver **49** with an antenna associated **51** therewith would receive coded signals from the respective contact switches **100**. As illustrated in FIG. 11, a transmitter **61** and a corresponding antenna **63** are associated with a contact switch **100** positioned adjacent the first primary arm **72**. In the wireless interface configuration, each contact switch **100** would have its own transmitter **61** associated therewith providing a unique coded signal when in the engaged position.

[0066] Referring now to FIG. 13, the lift indicator assembly **40** may further include a load wheel inhibitor **54** to prevent the load wheels **28** from lifting the forks **26** if the logic controller **43** determines that there is a no lift

condition. The load wheel inhibitor **54** advantageously prevents an operator of the pallet truck **20** from ignoring or overlooking display of the red light **47** on the lift status display **44**.

[0067] When the red light **47** is activated by the logic controller **43**, an inhibit signal is sent from the logic controller to the load wheel inhibitor **54**. The load wheel inhibitor **54** may be implemented in a number of different embodiments, as readily appreciated by those skilled in the art. For example, the load wheel inhibitor **54** may be configured to inhibit control of the hydraulic pump used to operate the ties rods that extend through the forks **26** to the load wheel linkages **30**. The load wheel inhibitor **54** thus overrides operator input to lift the forks **26** if an inhibit signal is generated by the logic controller **44**.

[0068] Another aspect is directed to a method for providing a lift indicator assembly **40** for a pallet truck **20** as described above. Referring now to the flowchart **200** illustrated in FIG. 14, from the start (Block **202**), the method comprises providing a lift sensor assembly **42** at Block **204** to be carried by a fork **26**.

[0069] The lift sensor assembly **42** comprises a housing section **130** and a primary sensor assembly **70**. The primary sensor assembly **70** includes a first primary arm **72** coupled to the housing section **130**, and a first primary contact switch **100** carried by the housing section **130** and adjacent the first primary arm.

[0070] The method further comprises at Block **206** providing a lift status display **44** for determining a lift condition of the load wheel **28** based on position of the first primary contact switch **100**. The method ends at Block **208**.

[0071] Many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is understood that the invention is not to be limited to the specific embodiments disclosed, and that modifications and embodiments are intended to be included.

THAT WHICH IS CLAIMED IS:

1. A pallet truck comprising:

a cab;

a vertical load plate on a front end of the cab;

at least one fork extending outwards from a lower end of said vertical load plate in a substantially horizontal direction for insertion into an opening in a pallet, with the pallet including a bottom deck, a top deck and support blocks coupled between the bottom and top decks to define the opening;

a load wheel coupled to said at least one fork and configured for lifting said at least one fork and said vertical load plate;

a lift sensor assembly carried by said at least one fork and adjacent said load wheel, and comprising

a housing section, and

a primary sensor assembly comprising

a first primary arm coupled to said housing section, and

a first primary contact switch carried by said housing section and adjacent said first primary arm, said first primary contact switch having an engaged position and a disengaged position based on position of said first primary arm; and

a lift status display configured for determining a lift condition of said load wheel based on position of said first primary contact switch.

2. The pallet truck according to Claim 1 wherein said primary sensor assembly further comprises:

a second primary arm coupled to said housing section; and

a second primary contact switch carried by said housing section and adjacent said second primary arm, said second primary contact switch

having an engaged position and a disengaged position based on position of said second primary arm;

wherein said lift status display is further configured for determining the lift condition of said load wheel based on position of said second primary contact switch in combination with the position of said first primary contact switch.

3. The pallet truck according to Claim 2 wherein said first primary arm is coupled to said housing section in front of said load wheel, and wherein said second primary arm is coupled to said housing section behind said load wheel.

4. The pallet truck according to Claim 1 wherein the bottom deck of the pallet comprises a plurality of spaced apart bottom deck boards; wherein said at least one fork has a wedge shape with an outermost tip extending in height above a thickness of the plurality of bottom deck boards; and wherein said primary sensor assembly is adjacent the outmost tip so that when a lowermost surface of said at least one fork is contacting an upper surface of at least one of the bottom deck boards, said first primary arm moves downwards without contacting a bottom deck board so that said first primary contact switch is in the disengaged position.

5. The pallet truck according to Claim 1 wherein said lift sensor assembly further comprises an auxiliary sensor assembly comprising:

at least one auxiliary arm coupled to said housing section; and

at least one auxiliary contact switch carried by said housing section and having an engaged position and a disengaged position based on position of said at least one auxiliary arm;

wherein said lift status display is further configured for determining the lift condition of said load wheel based on position of said at least one auxiliary contact switch in combination with the position of said first primary contact switch.

6. The pallet truck according to Claim 1 wherein said lift status display comprises at least one light for visually displaying the lift condition of said load wheel.

7. The pallet truck according to Claim 6 wherein said lift status display comprises a controller for activating said at least one light based on the position of said first primary contact switch.

8. The pallet truck according to Claim 1 wherein an interface between said lift status display and said first primary contact switch comprises a wired interface.

9. The pallet truck according to Claim 1 wherein said lift sensor assembly further comprises a biasing device for biasing said first primary arm section away from said first primary contact switch.

10. The pallet truck according to Claim 1 wherein said first primary arm is pivotally coupled to said housing section.

11. The pallet truck according top Claim 1 further comprising at least one primary wheel carried by said first primary arm.

12. The pallet truck according to Claim 11 further comprising a guide wheel carried by said first primary arm and adjacent said at least one primary wheel.

13. The pallet truck according to Claim 1 wherein said lift sensor assembly is attached to a sidewall of said at least one fork.

14. The pallet truck according to Claim 1 further comprising a load wheel inhibitor coupled to said lift status display and configured to prevent said load wheel from lifting said at least one fork and said vertical load plate based on the determined lift condition of said load wheel.

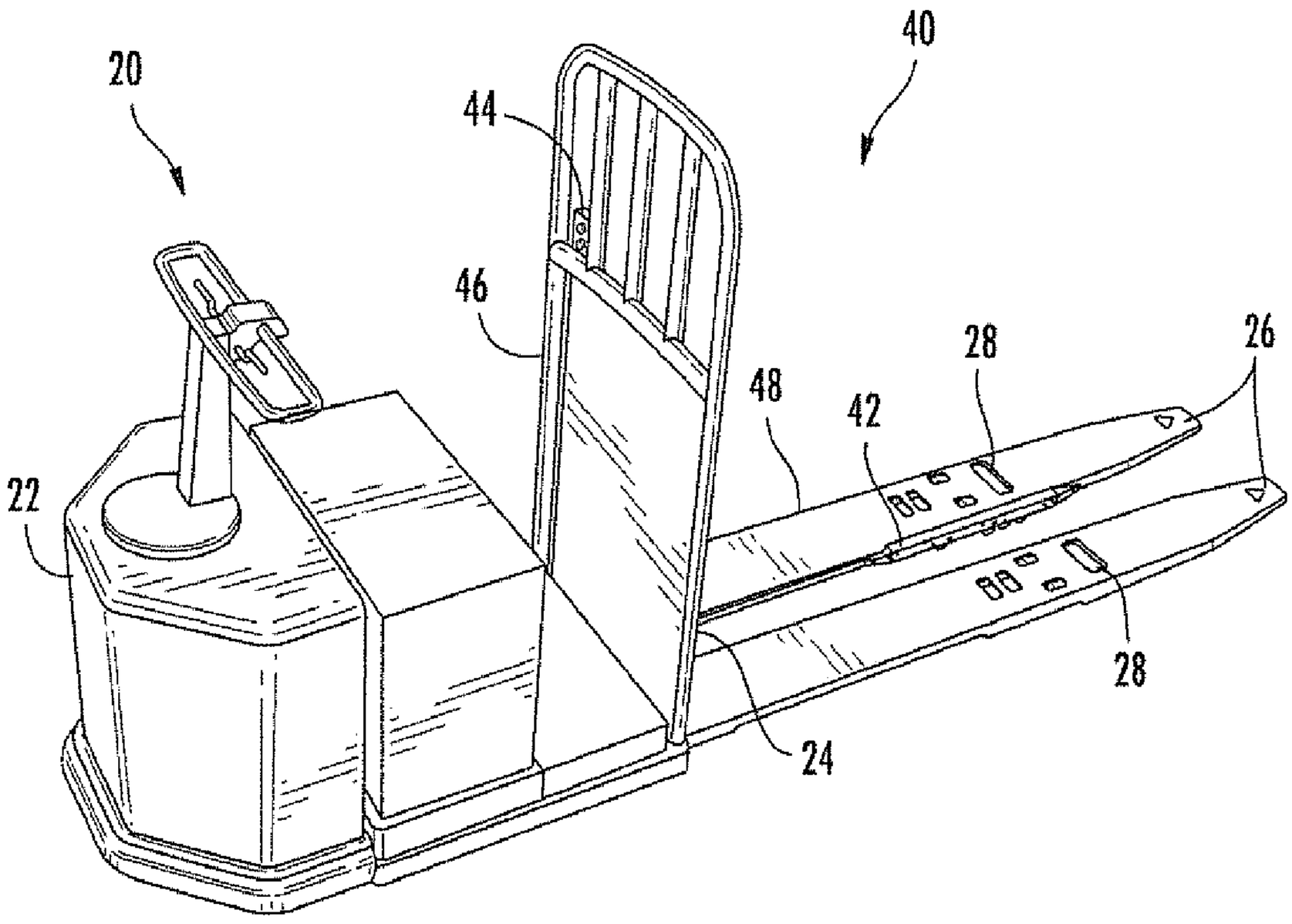


FIG. 1

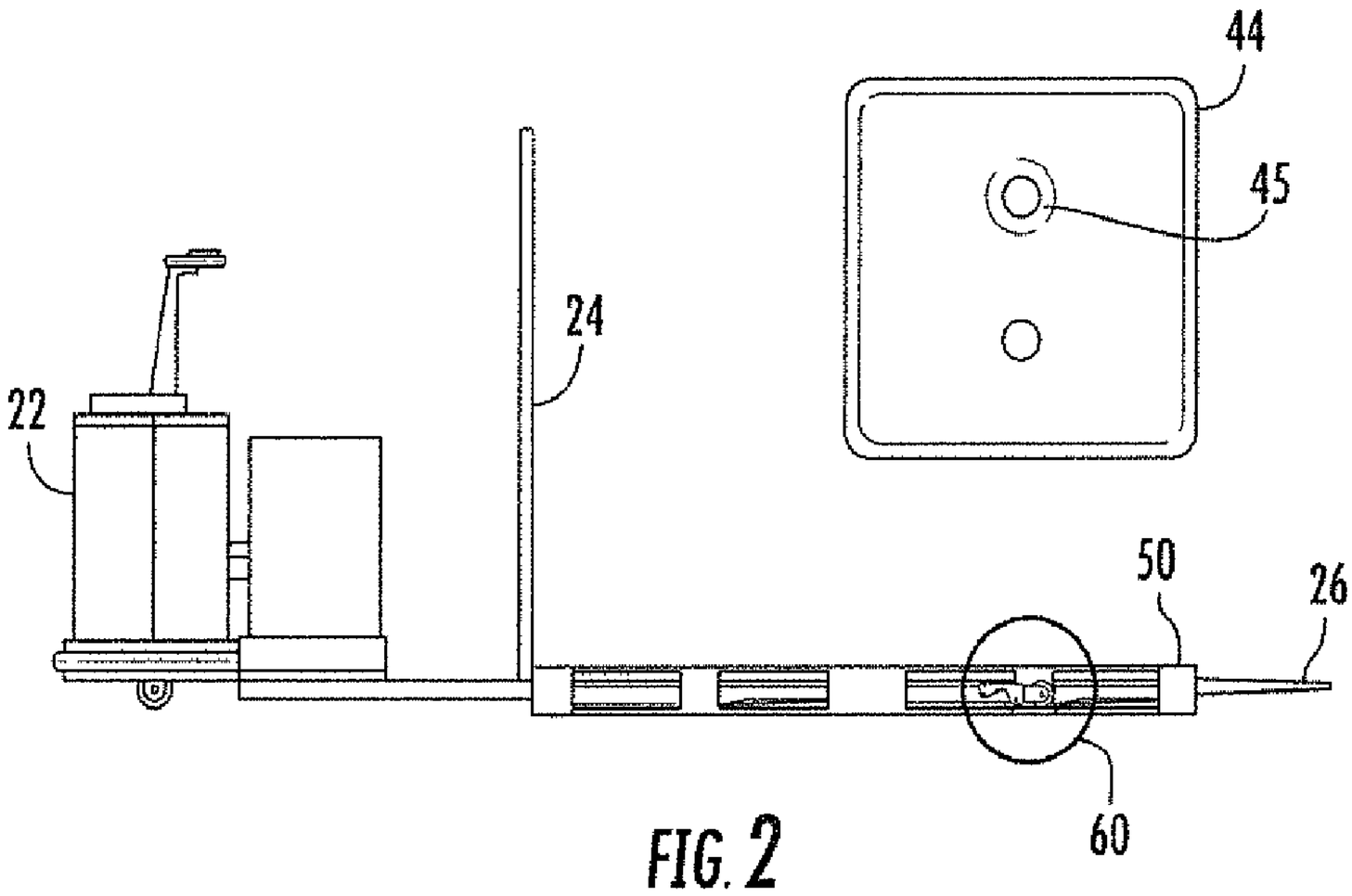


FIG. 2

FIG. 3

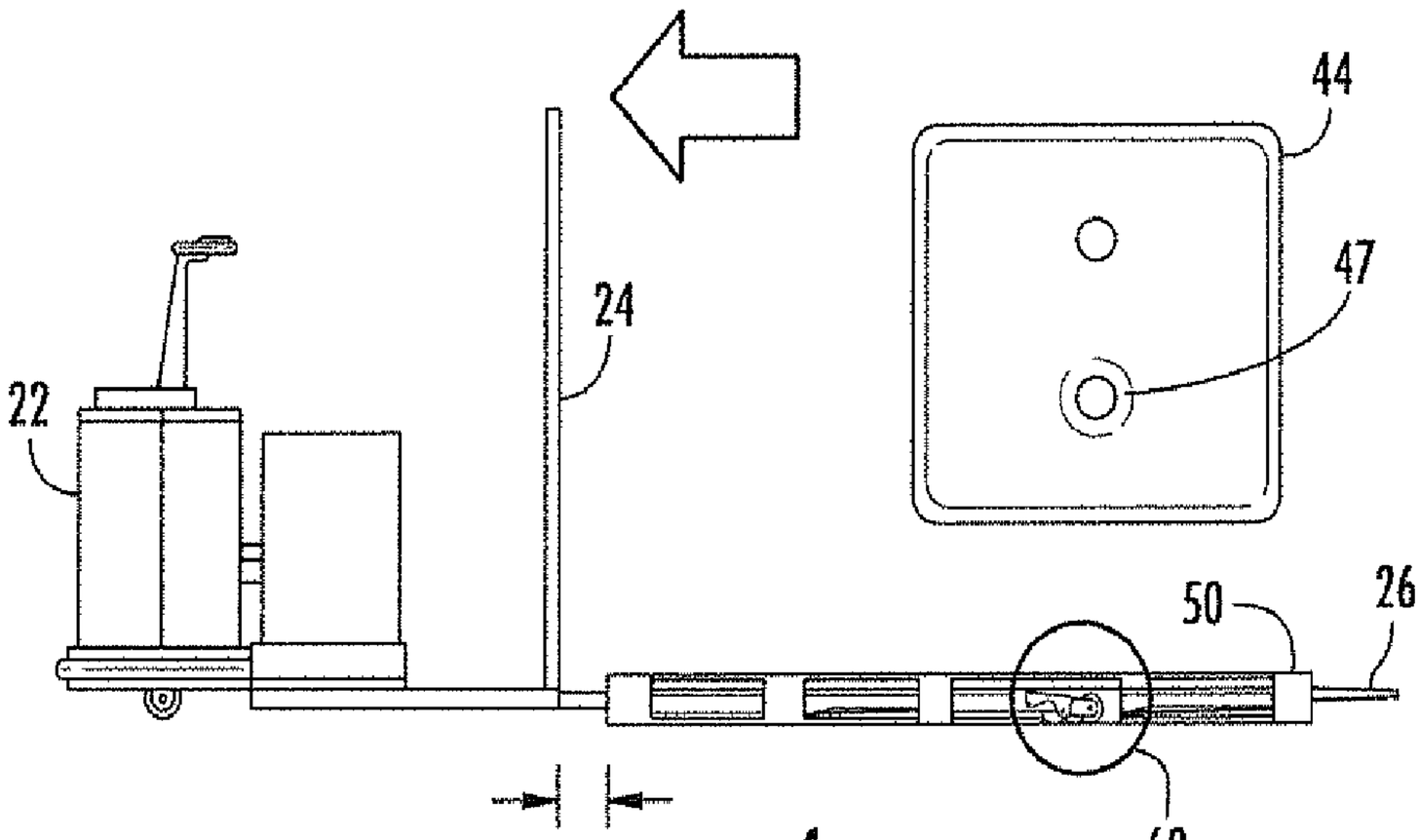


FIG. 4

FIG. 5

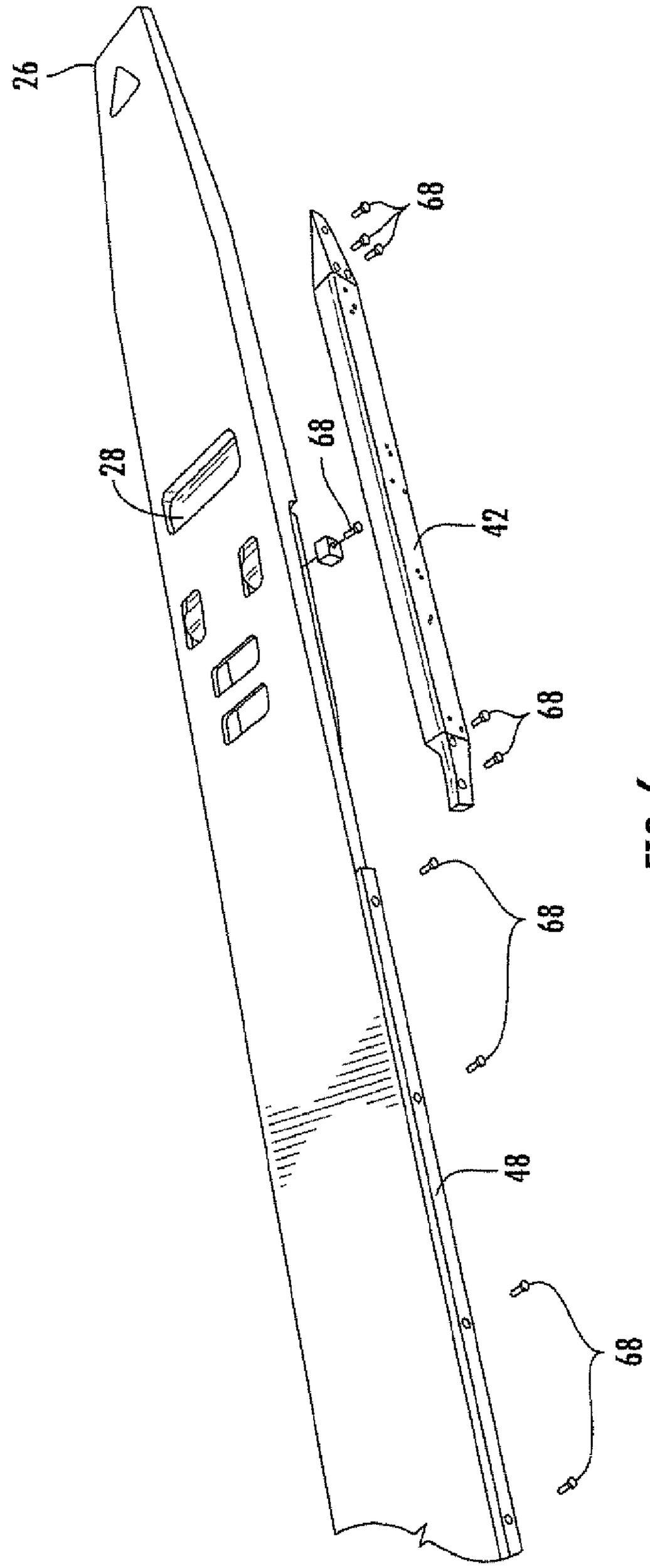


FIG. 6

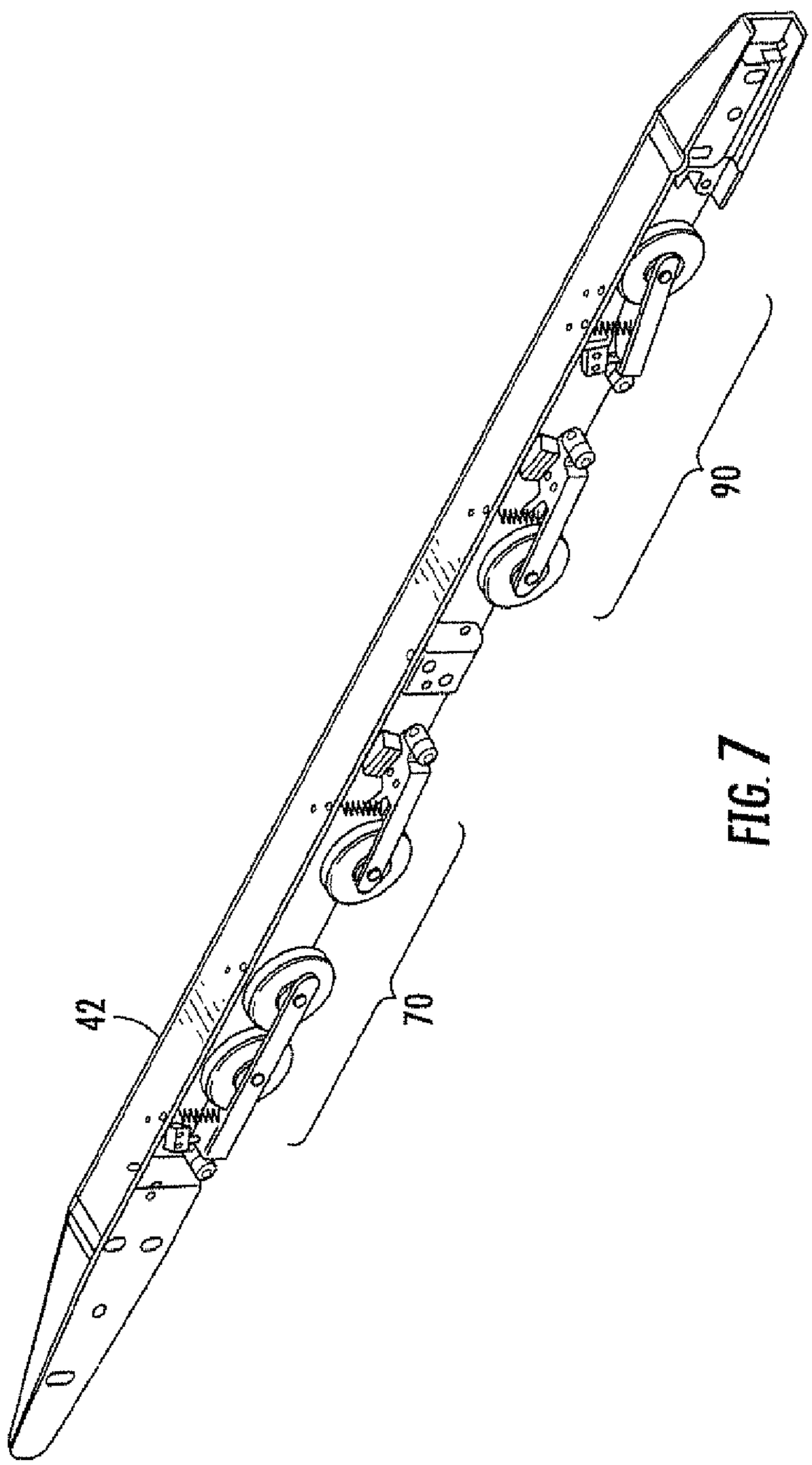


FIG. 7

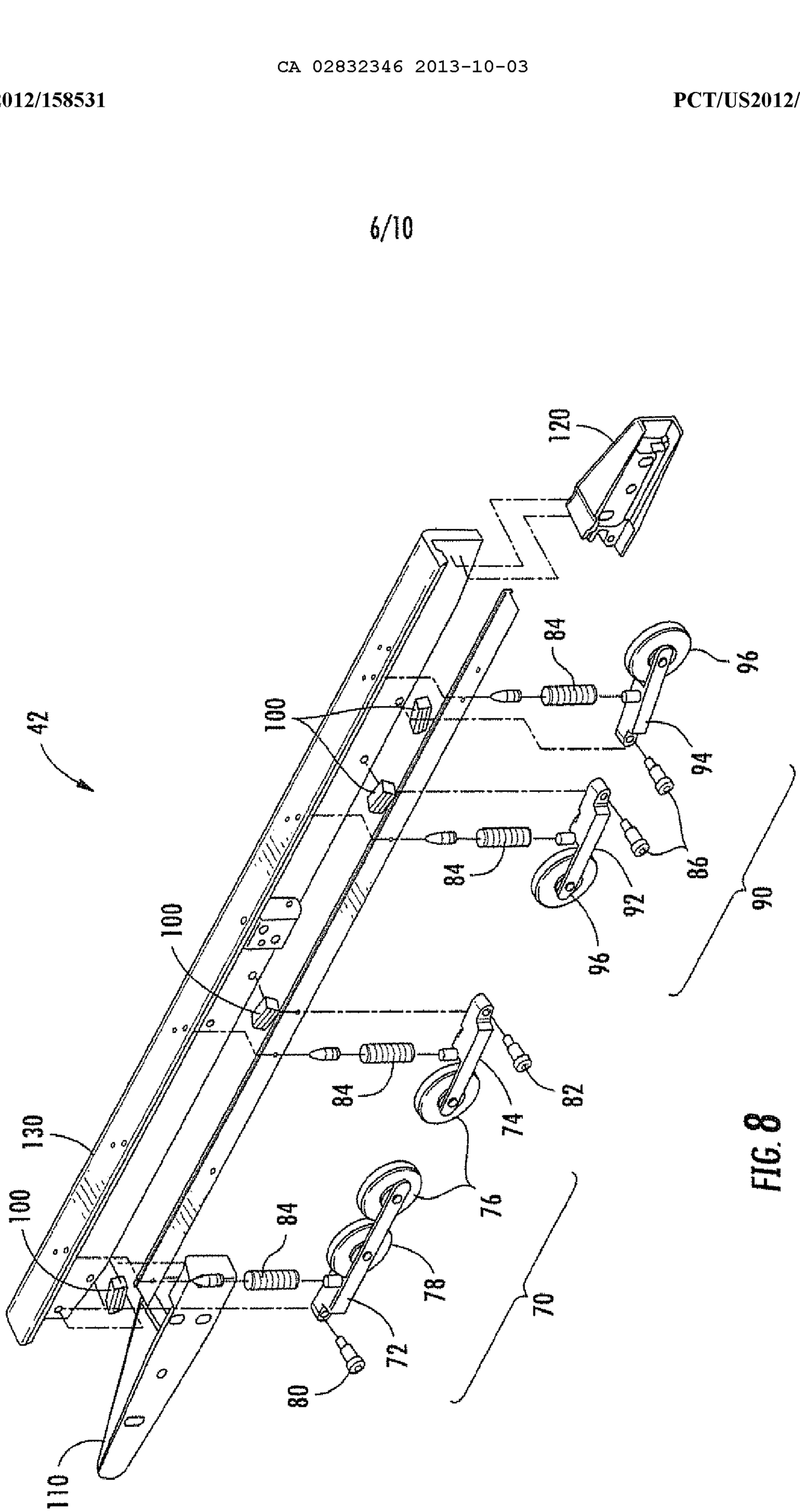

42
100
100
100
130
110
120
84
84
84
84
96
94
86
92
90
96
82
74
76
78
72
80
70

FIG. 8

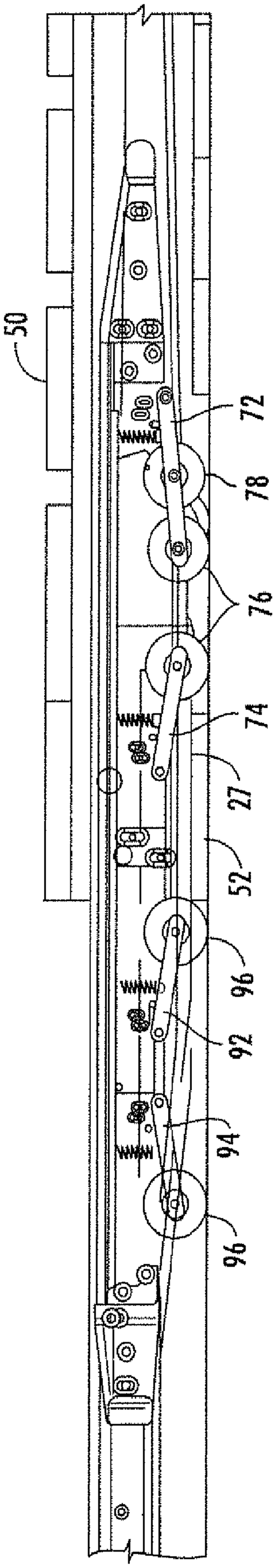


FIG. 9

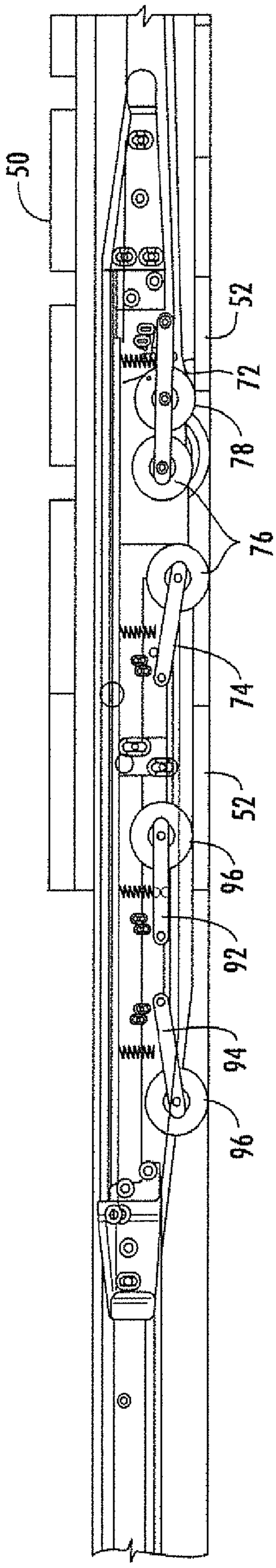


FIG. 10

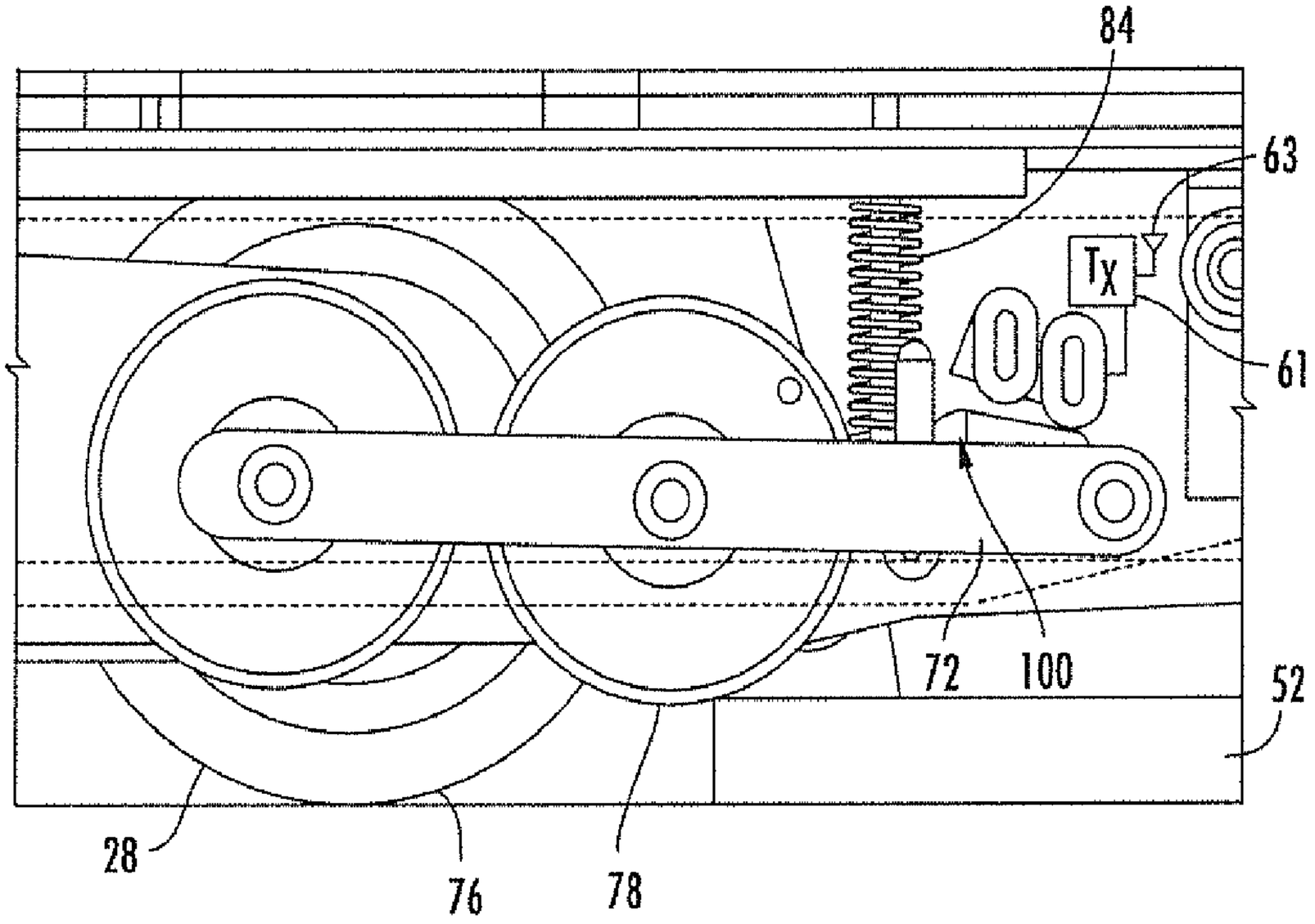


FIG. 11

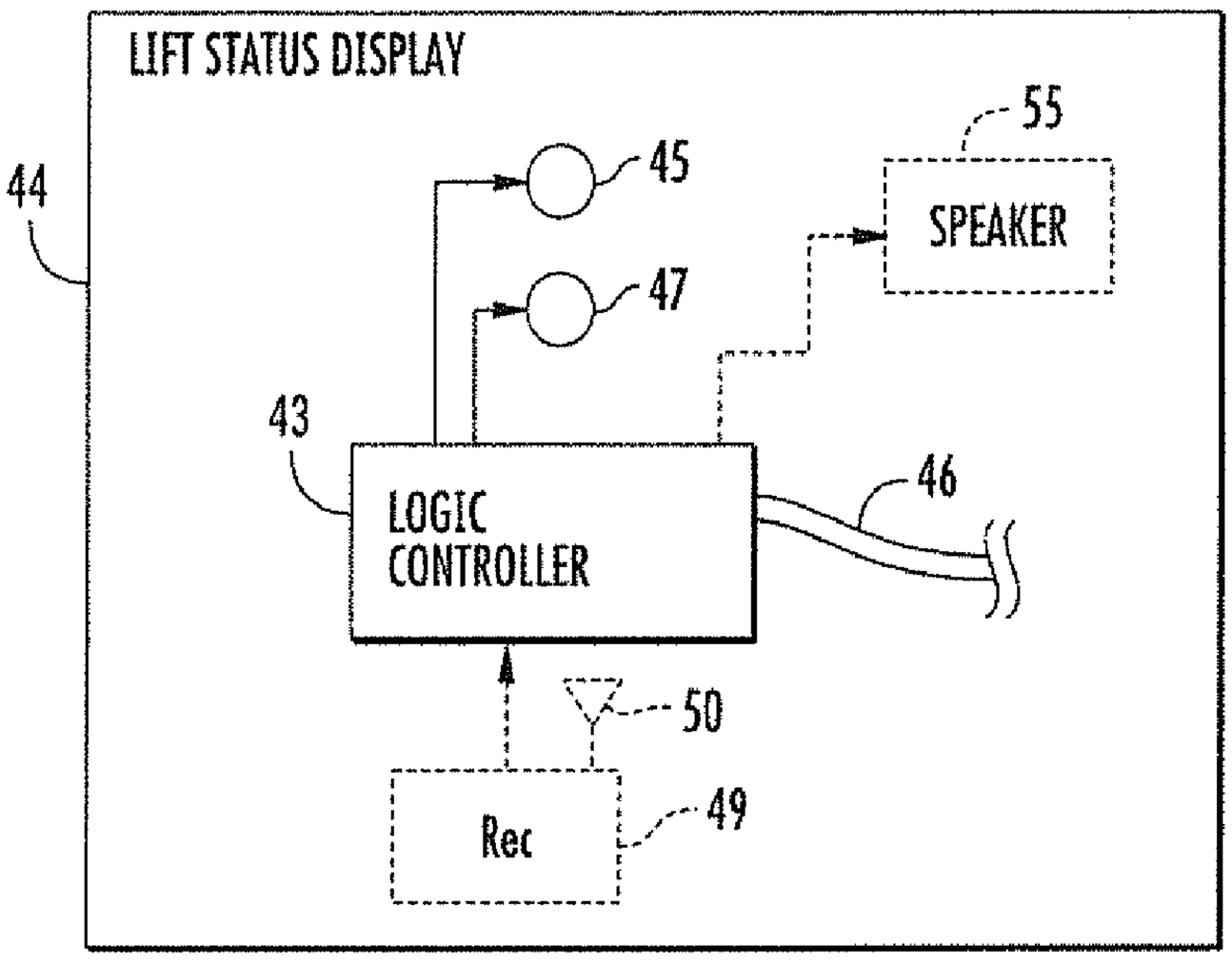

LIFT STATUS DISPLAY
44
45
47
55
SPEAKER
43
LOGIC CONTROLLER
46
50
Rec
49

FIG. 12

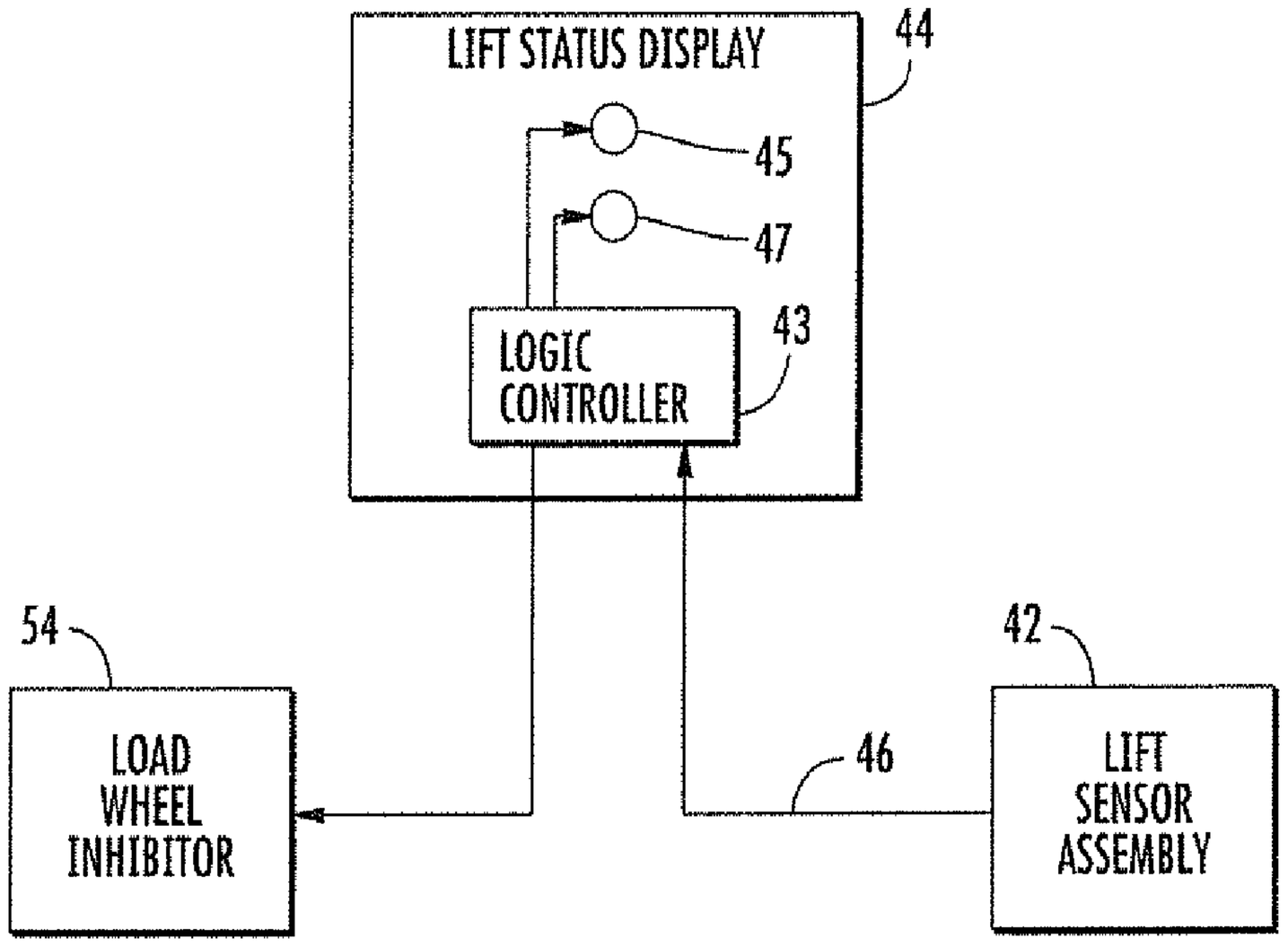

LIFT STATUS DISPLAY
44
45
47
LOGIC CONTROLLER
43
54
LOAD WHEEL INHIBITOR
46
42
LIFT SENSOR ASSEMBLY

FIG. 13

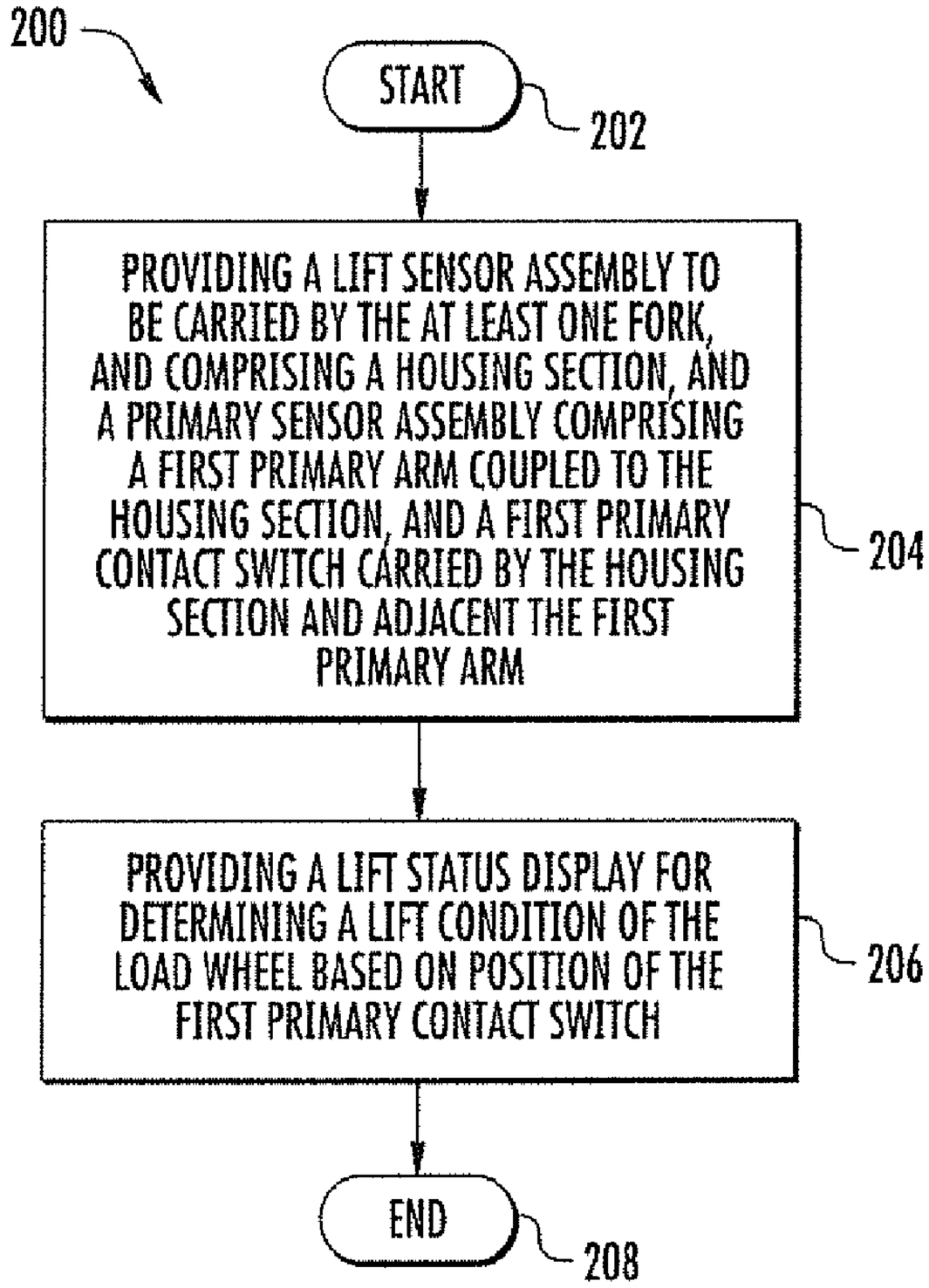
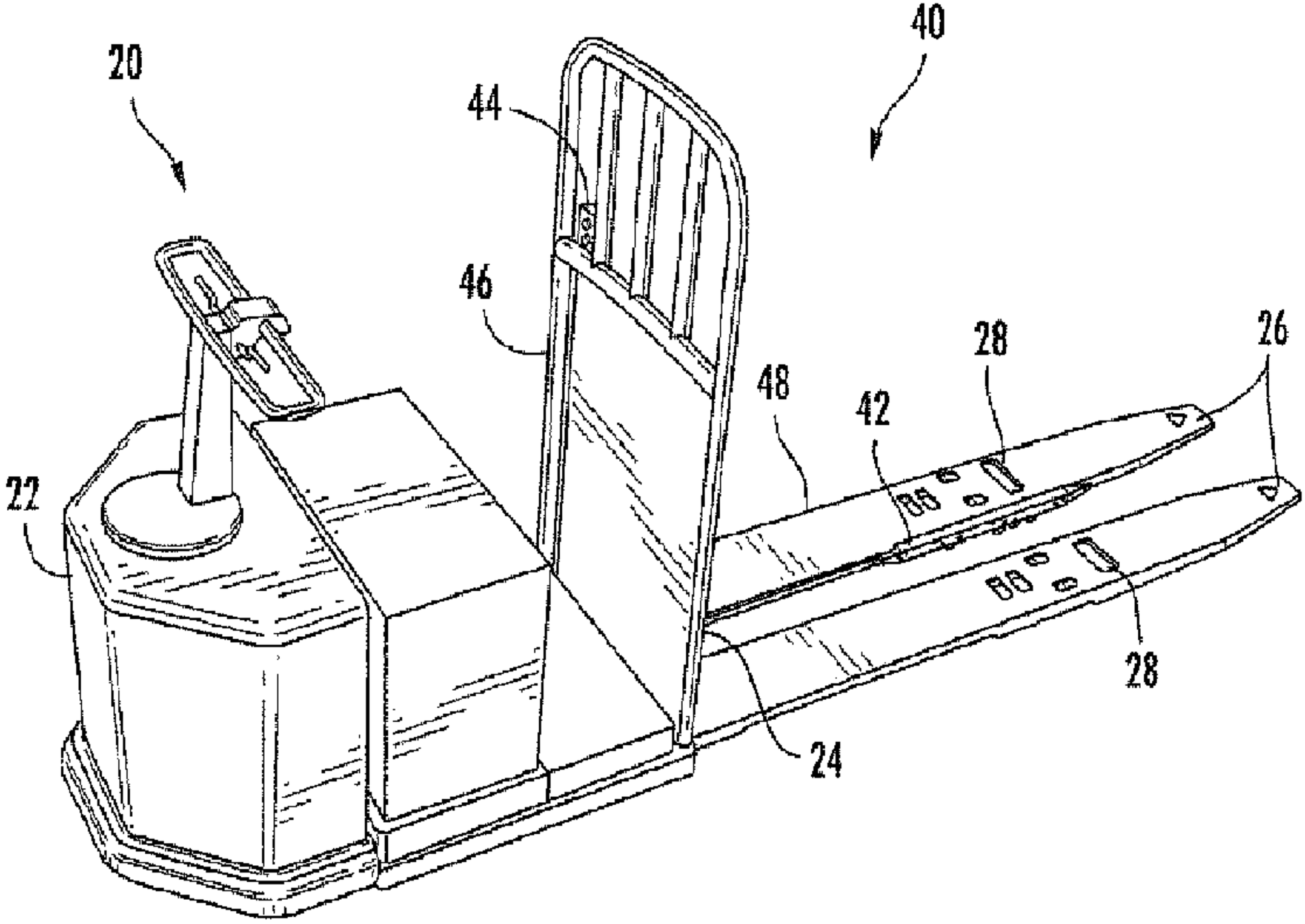

200
START
202
PROVIDING A LIFT SENSOR ASSEMBLY TO BE CARRIED BY THE AT LEAST ONE FORK, AND COMPRISING A HOUSING SECTION, AND A PRIMARY SENSOR ASSEMBLY COMPRISING A FIRST PRIMARY ARM COUPLED TO THE HOUSING SECTION, AND A FIRST PRIMARY CONTACT SWITCH CARRIED BY THE HOUSING SECTION AND ADJACENT THE FIRST PRIMARY ARM
204
PROVIDING A LIFT STATUS DISPLAY FOR DETERMINING A LIFT CONDITION OF THE LOAD WHEEL BASED ON POSITION OF THE FIRST PRIMARY CONTACT SWITCH
206
END
208

FIG. 14


20
40
44
46
48
42
28
26
22
86
86
28
24