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Bacon

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(54) **BELT-DRIVEN TRANSPORTATION SYSTEM**

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B66F 3/22 (2006.01)
B66F 3/00 (2006.01)
B66B 9/02 (2006.01)

(52) **U.S. Cl.**
USPC **254/122**; 254/126; 254/124; 187/269

(58) **Field of Classification Search**
USPC 254/122, 126, 124, 338; 269/131; 187/269
See application file for complete search history.

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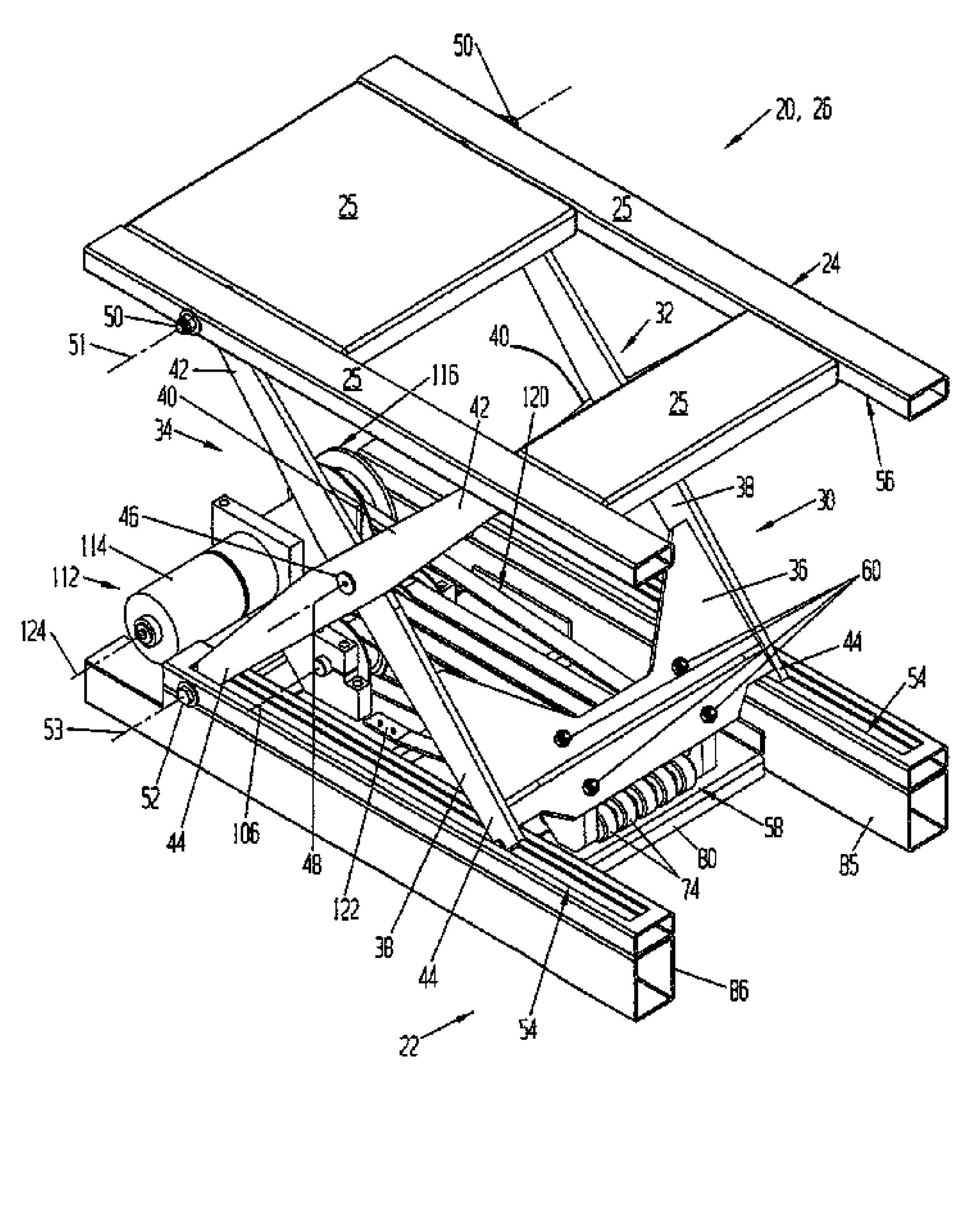
(57) **ABSTRACT**

A belt-driven transportation system including a first set of pulleys rotatably attached to a first member and a second set of pulleys rotatably attached to a second member. The first and second members have relative movement to each other. The system further includes a unitary belt that is guided through a path defined by the first and second sets of pulleys. A plurality of flange members maintain a proper positioning of the belt on the pulleys.

21 Claims, 15 Drawing Sheets



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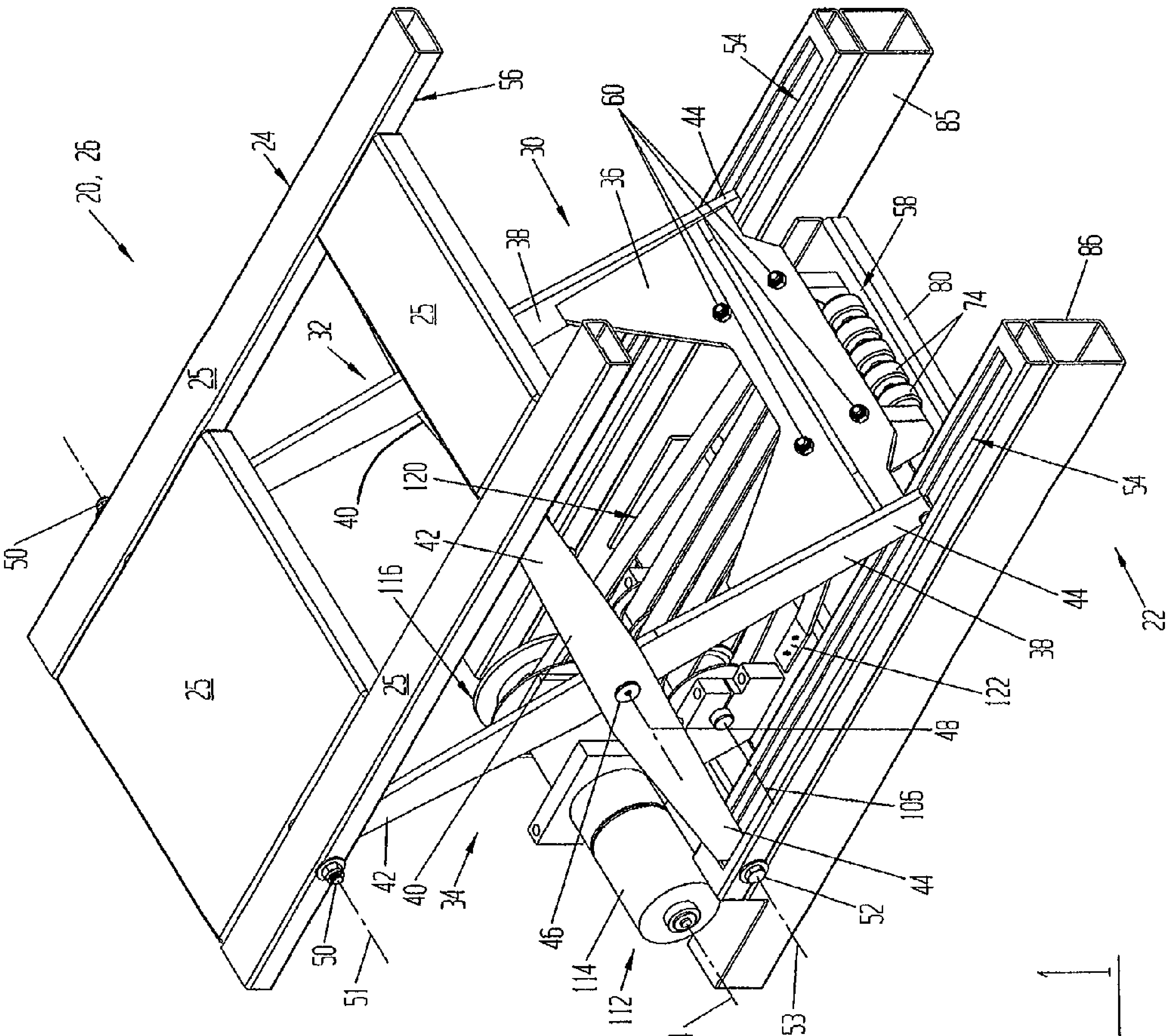
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FIG. 1

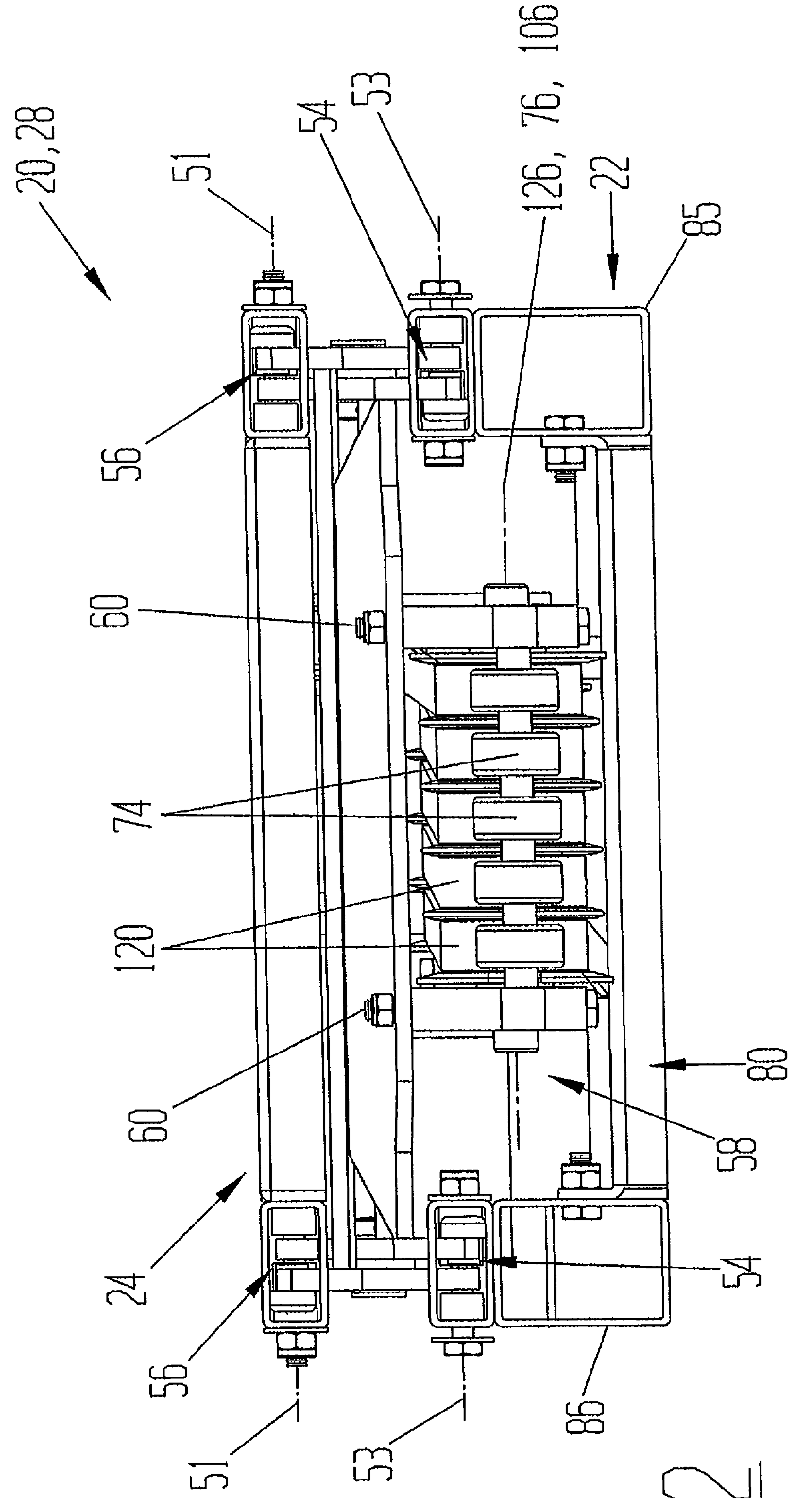
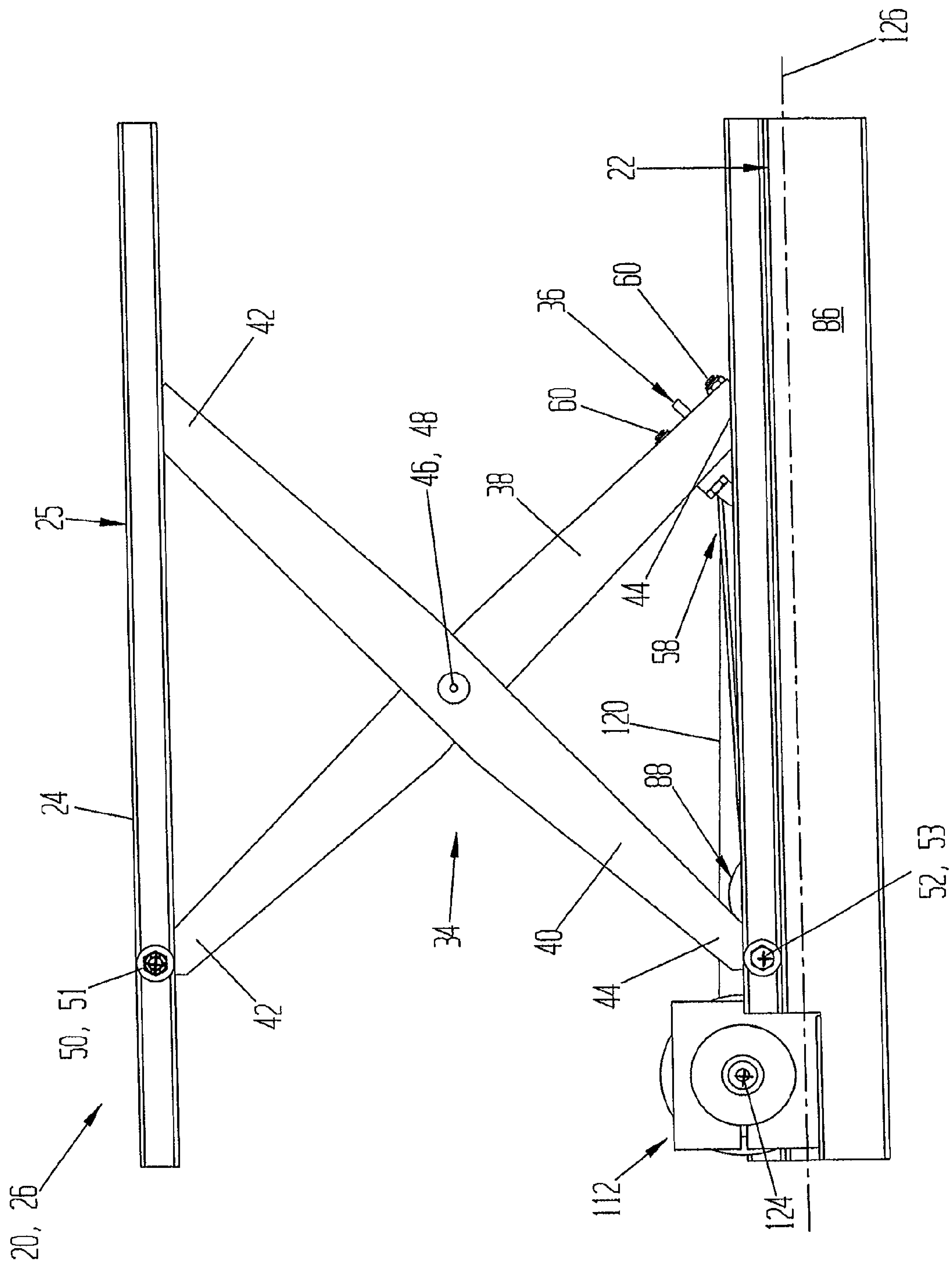


FIG. 2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112
124

FIG. 3

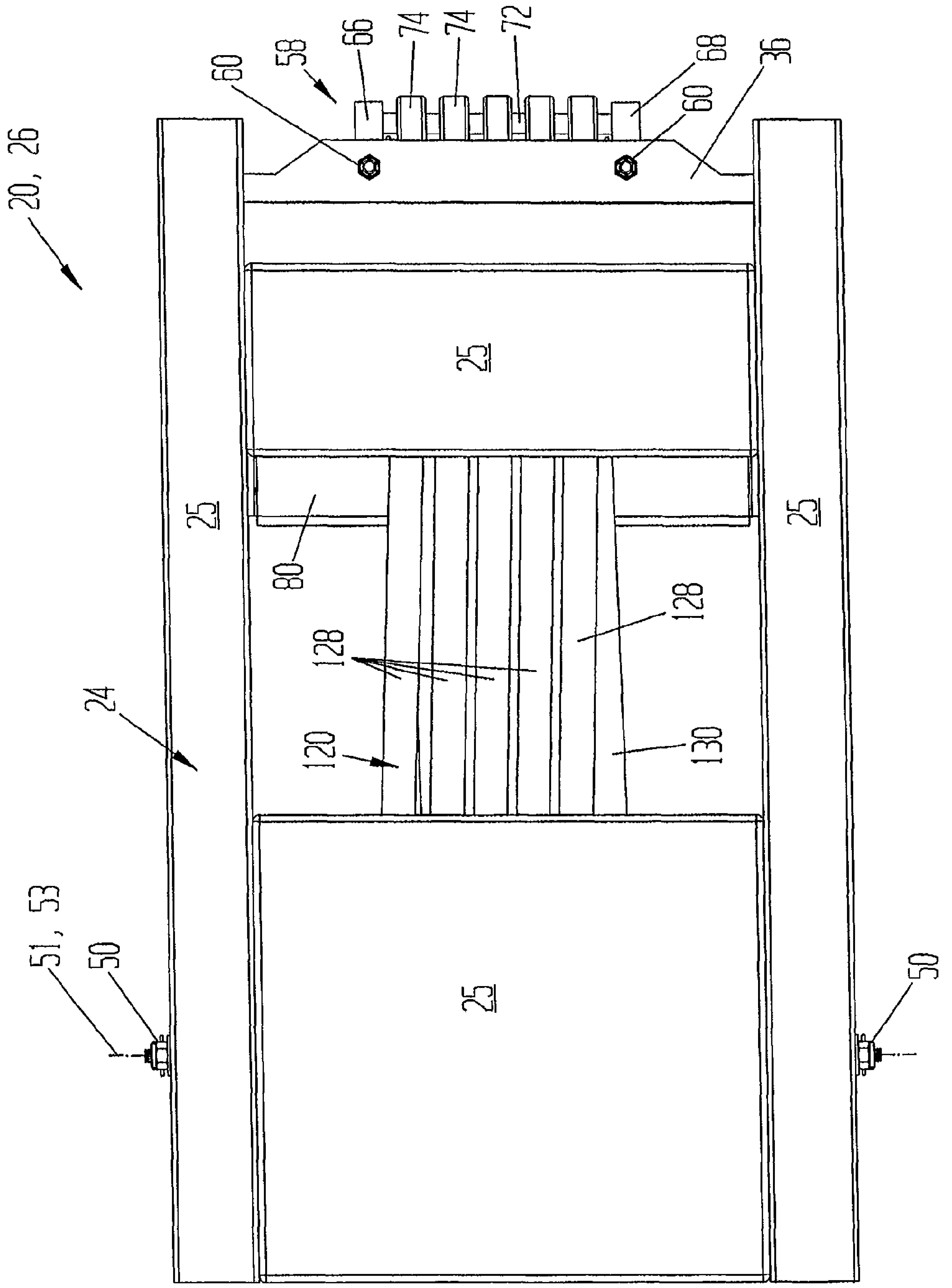
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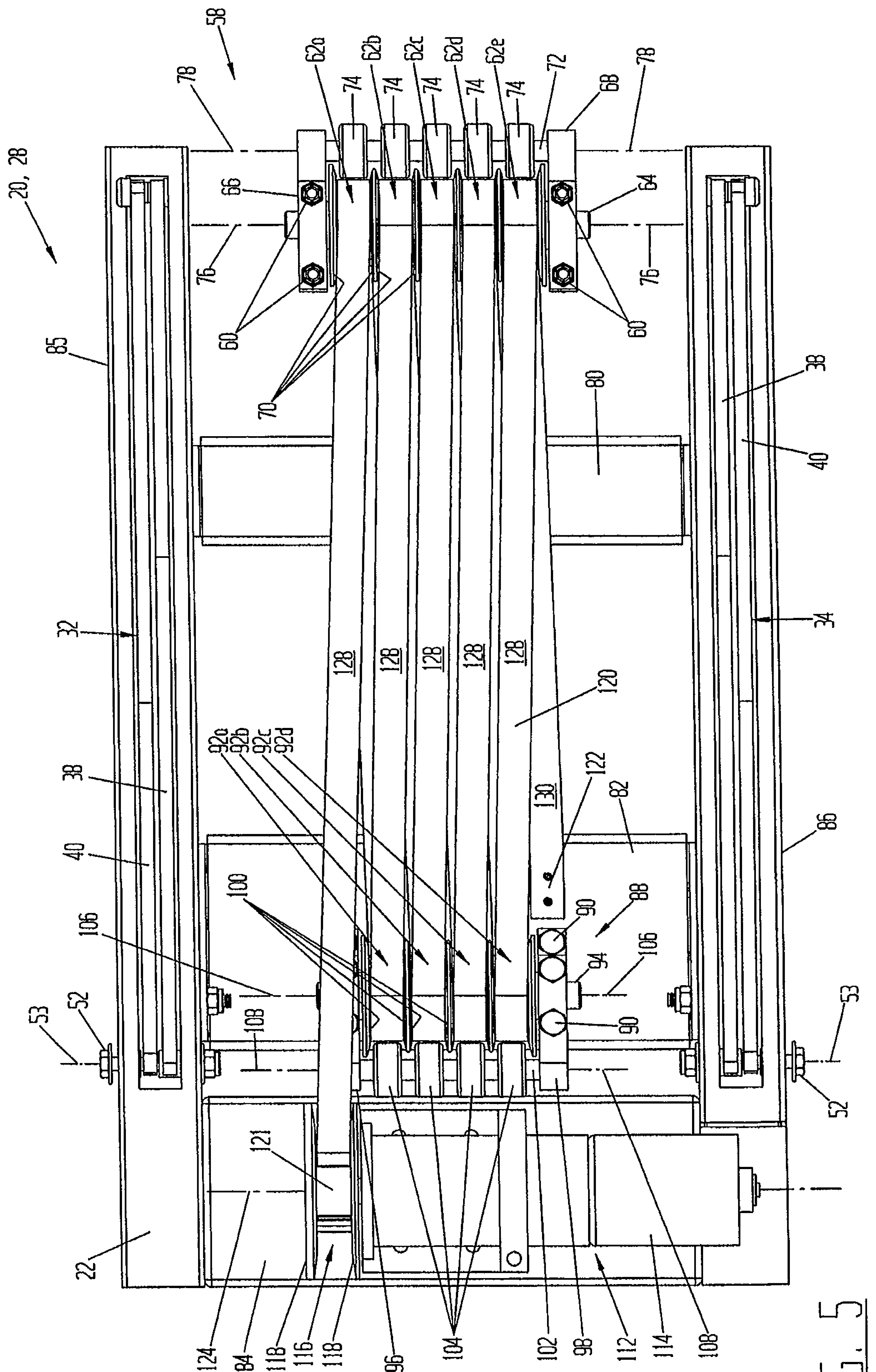
FIG. 4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92a
92b
92c
92d
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82
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FIG. 5

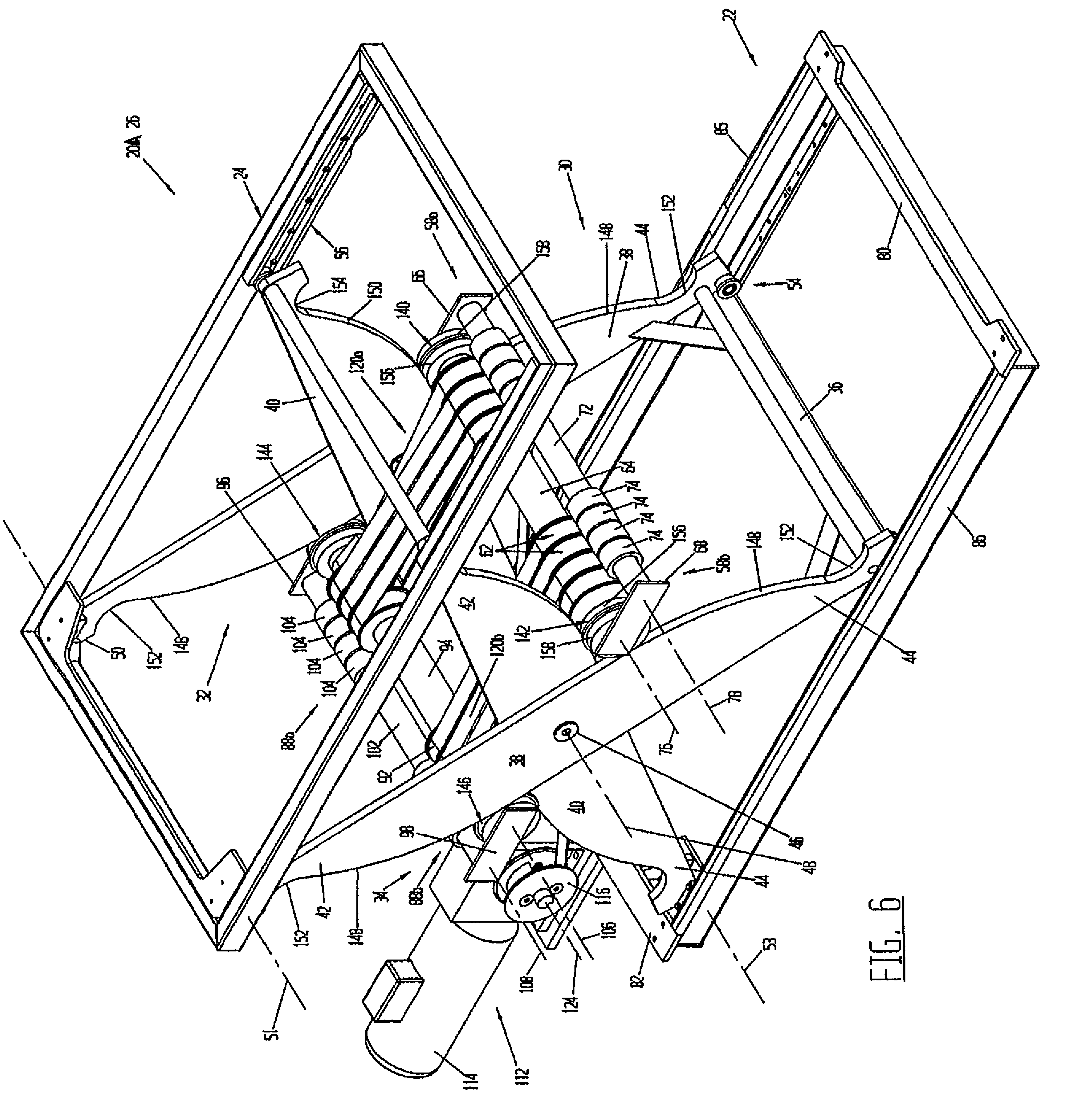

FIG. 6

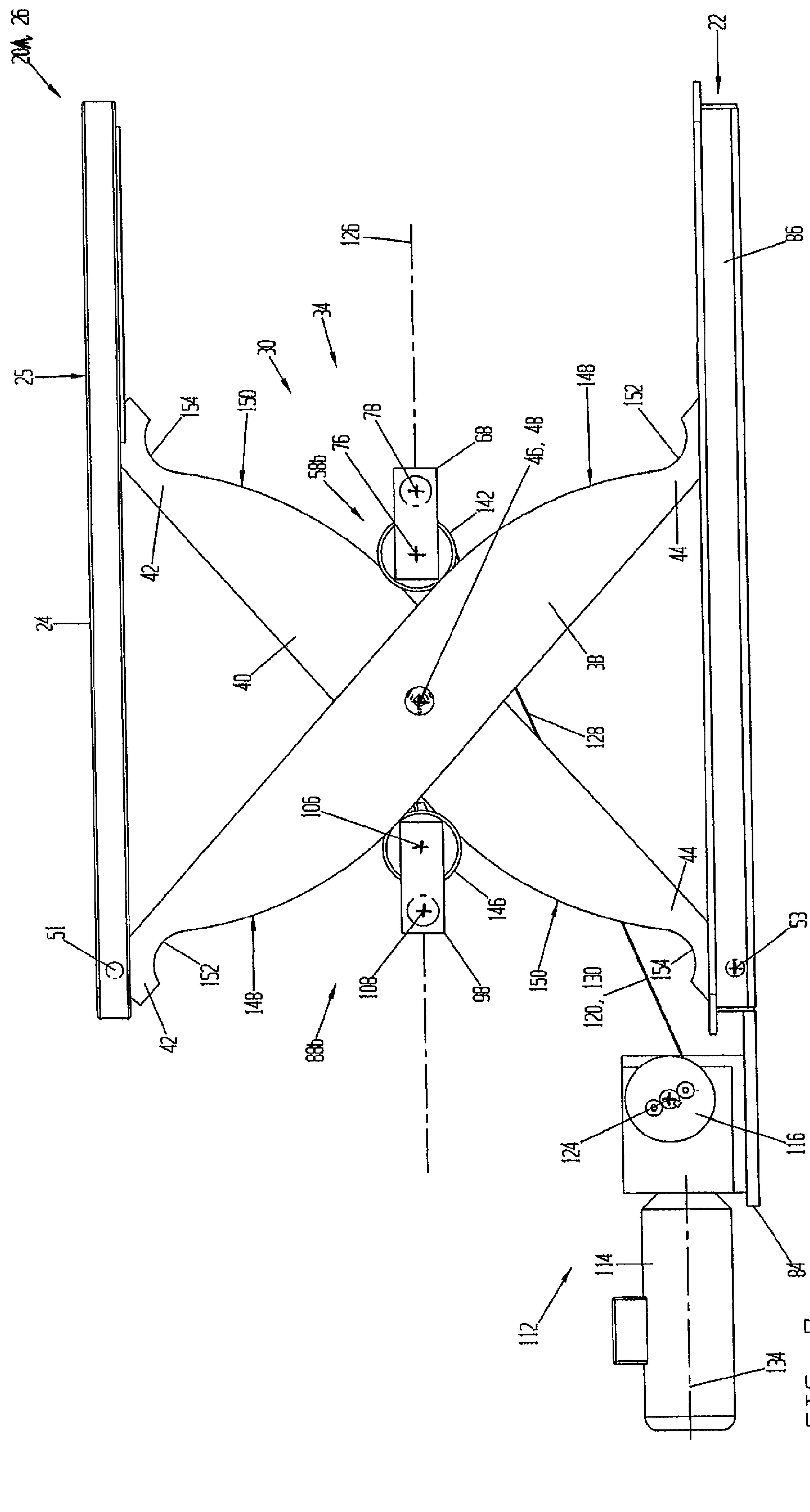
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FIG. 7

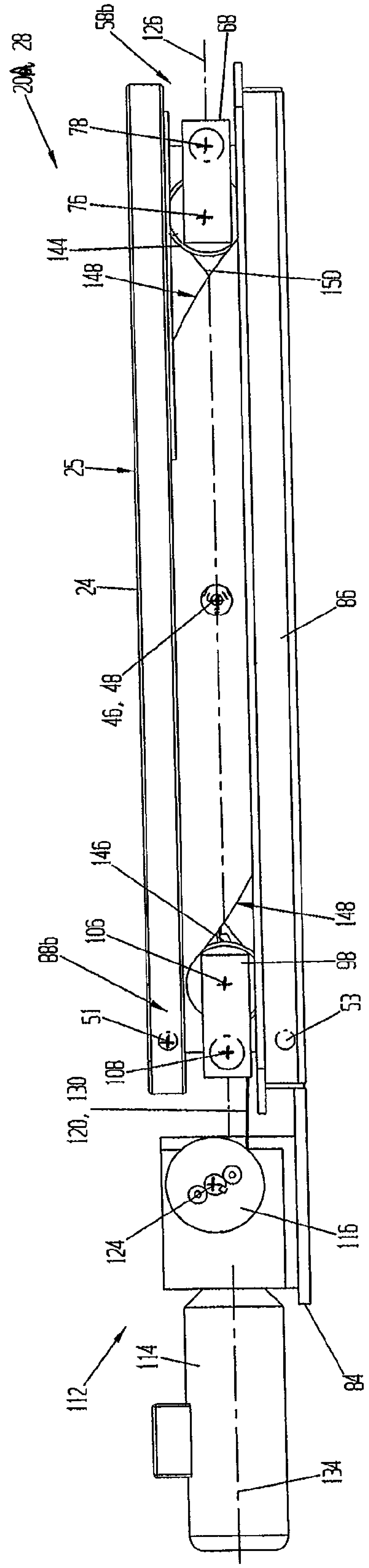
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FIG. 8

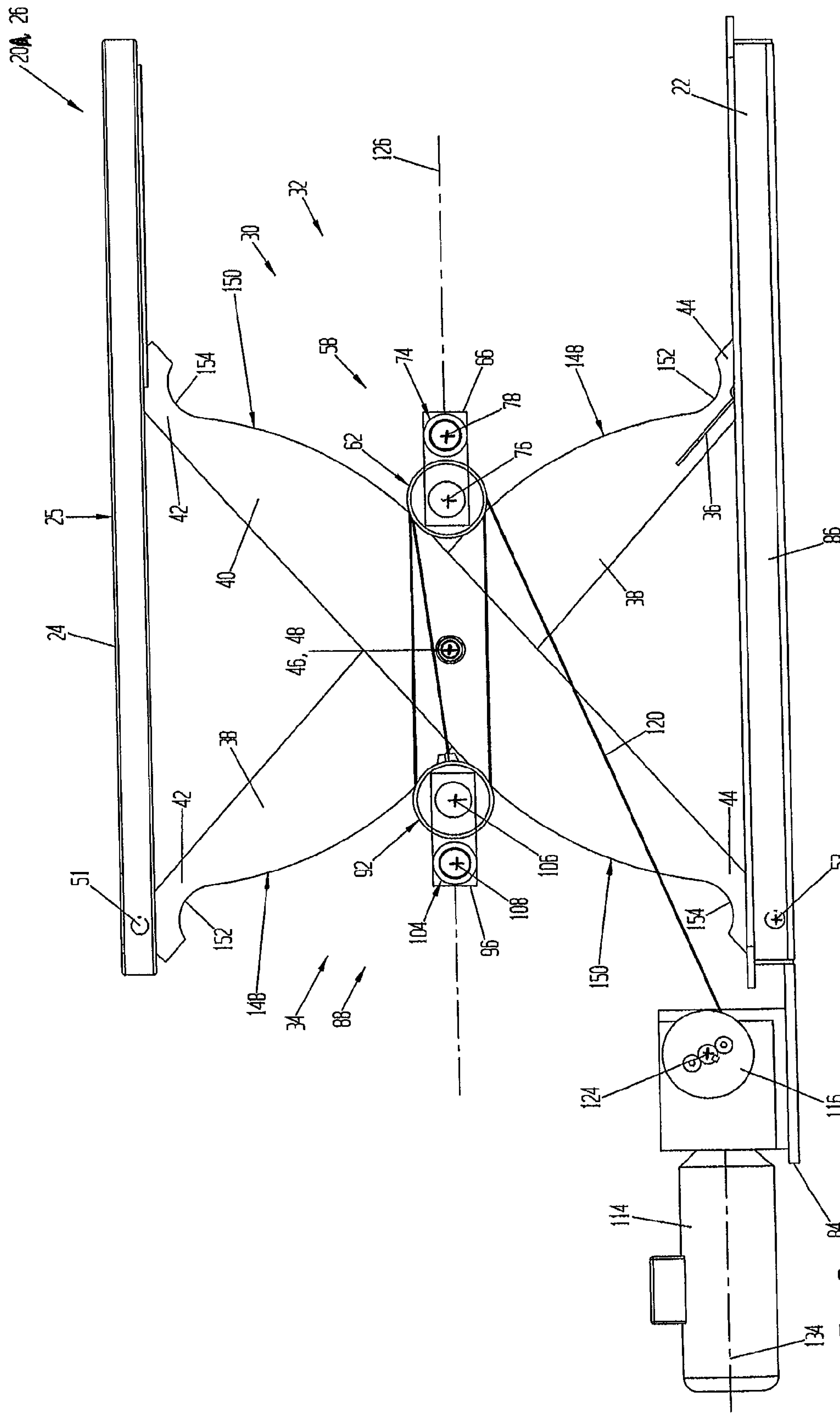
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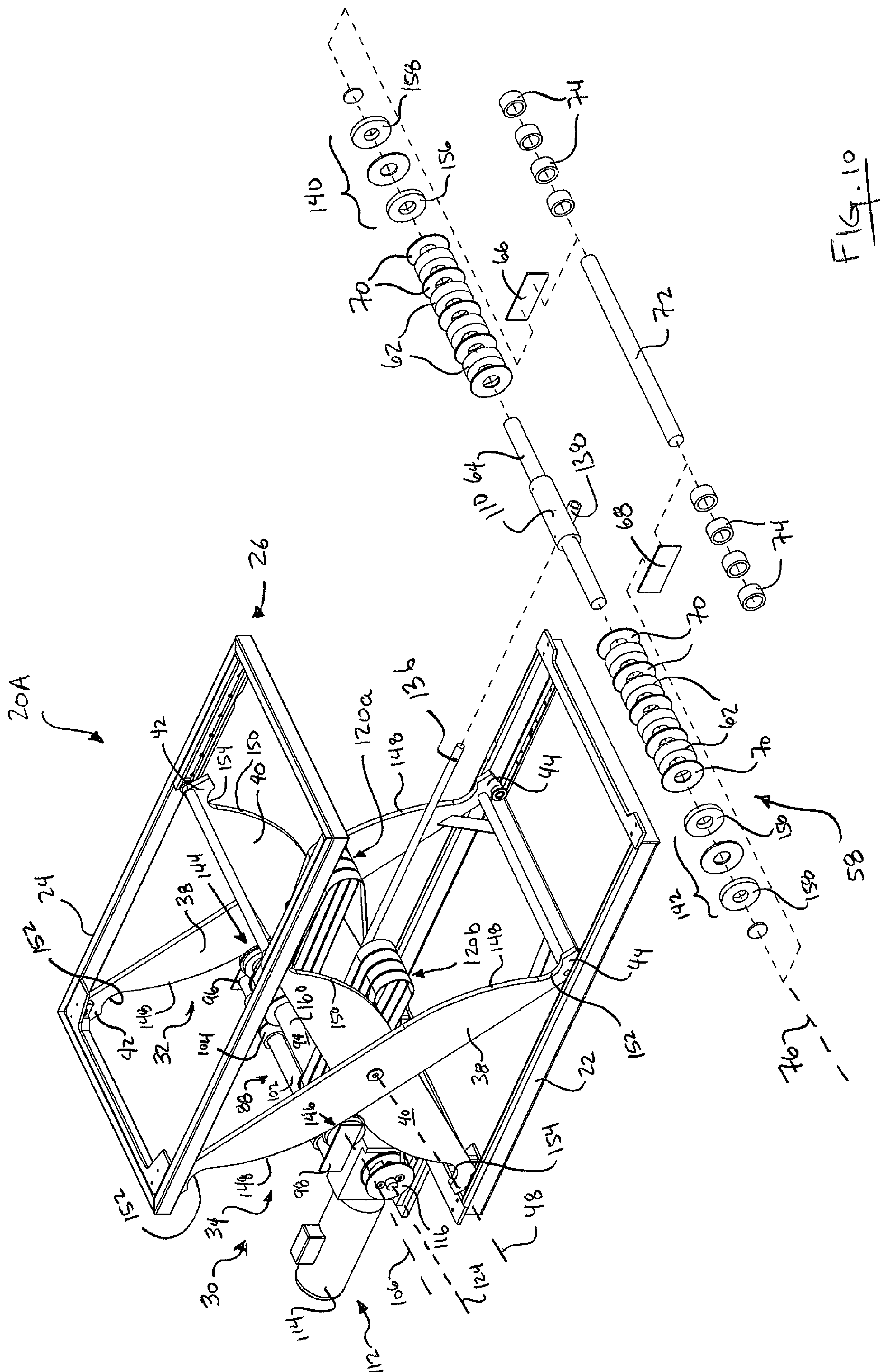
FIG. 9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120a
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FIG. 10

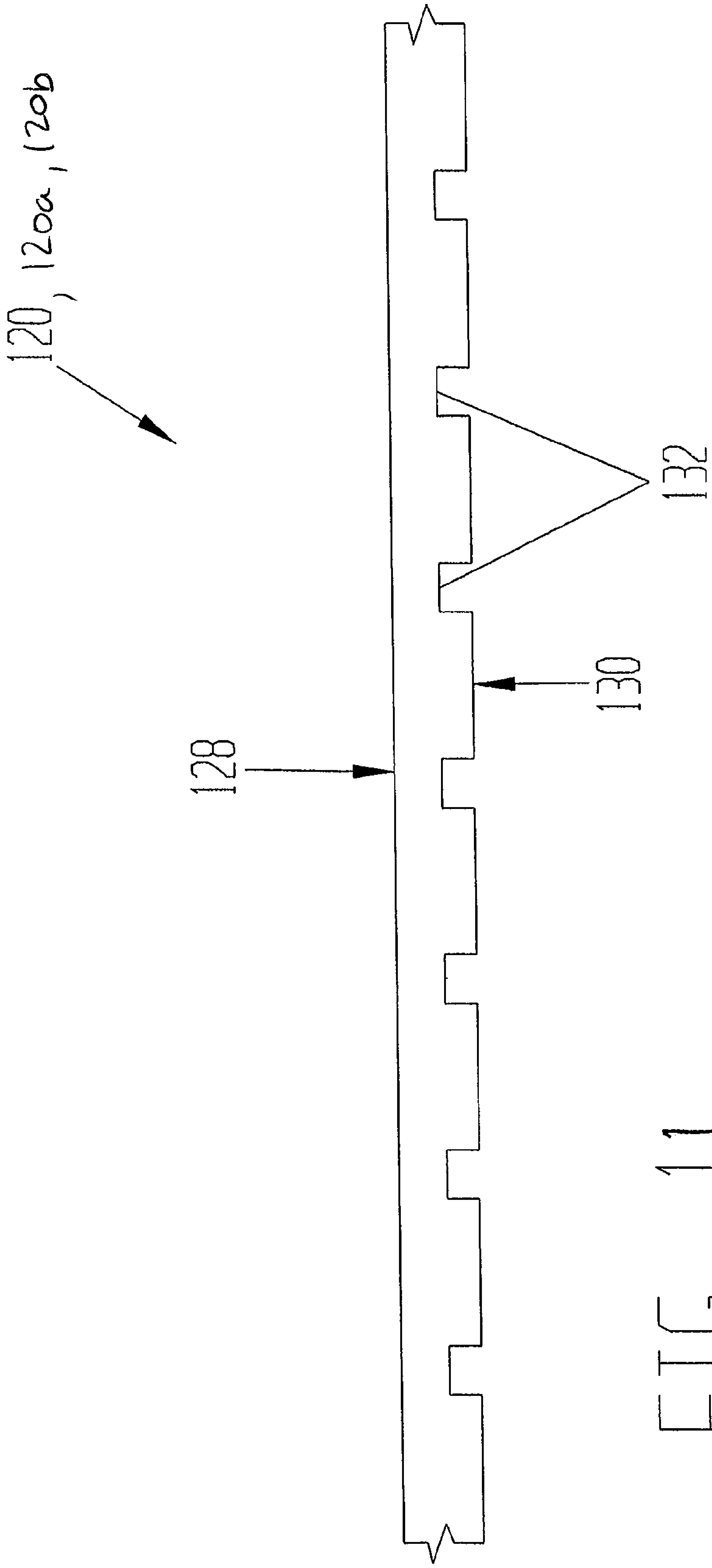

FIG. 11

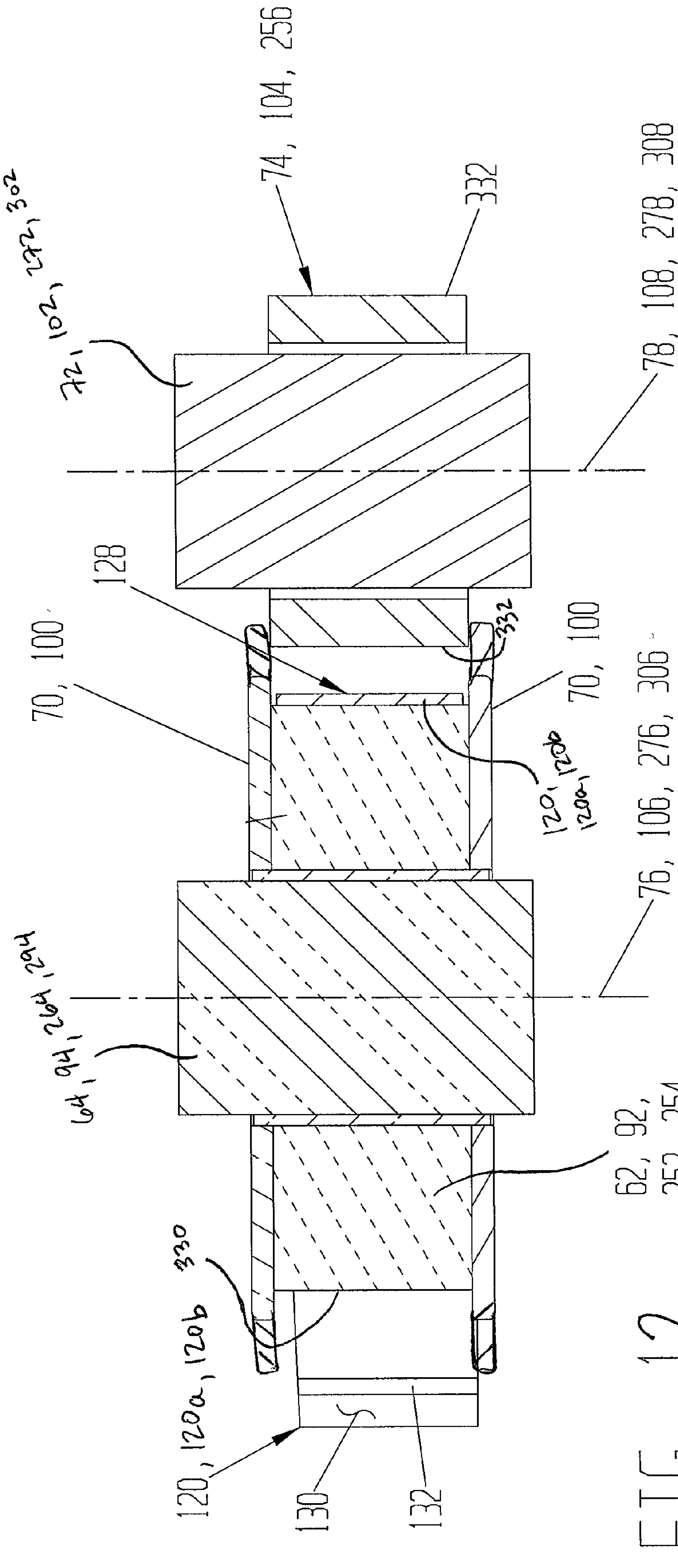
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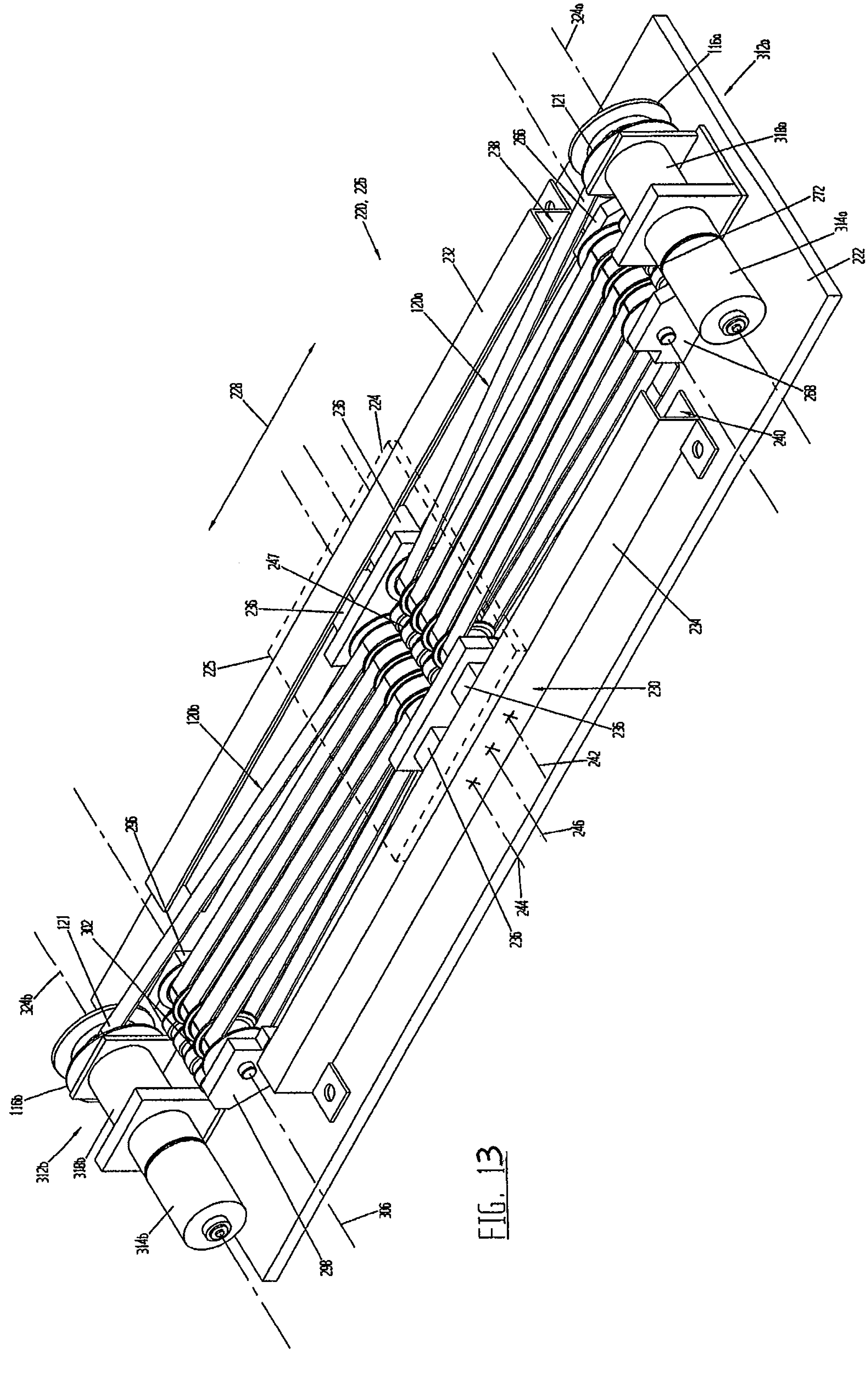
FIG. 12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318b
314b
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FIG. 13

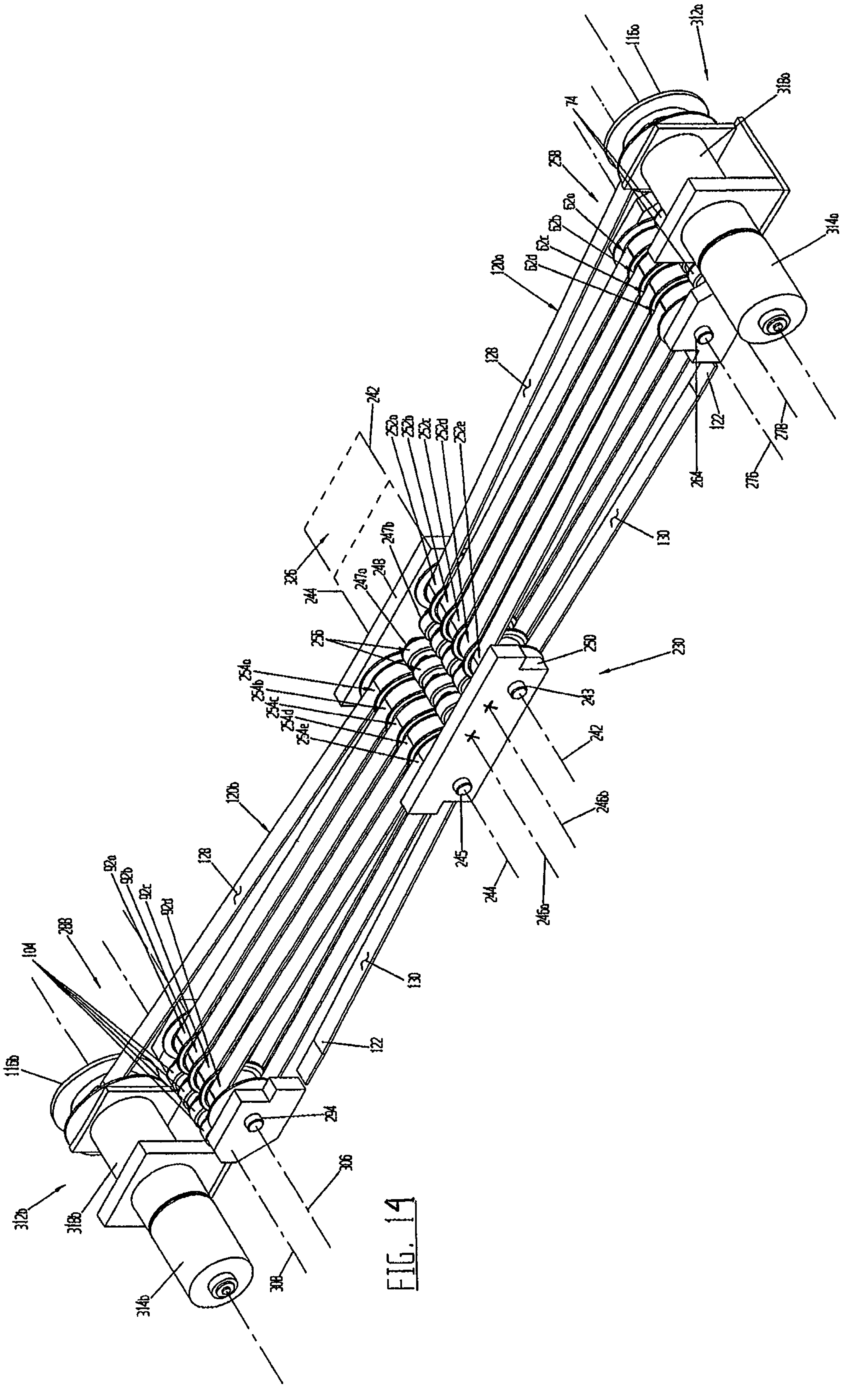

FIG. 14

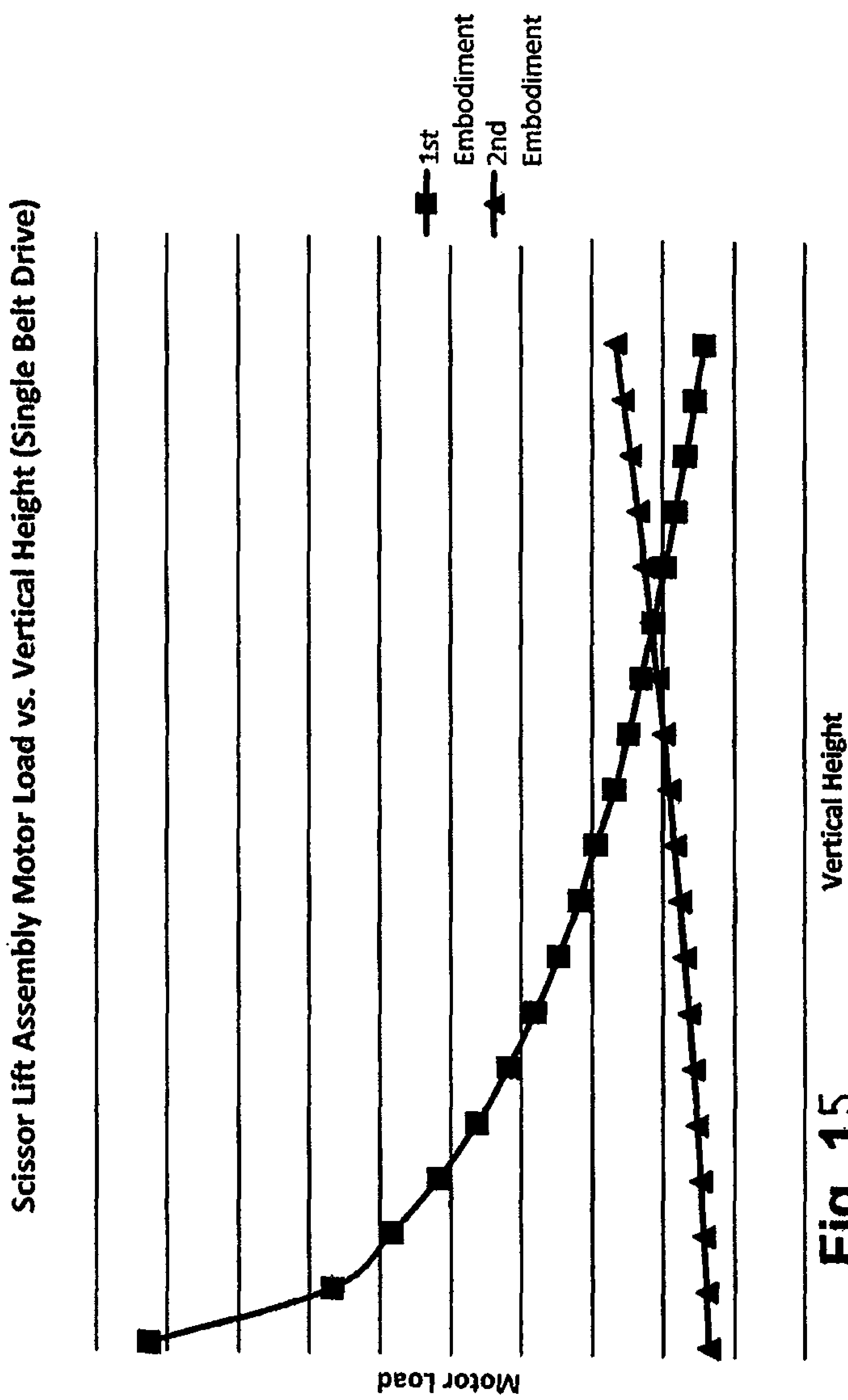
Scissor Lift Assembly Motor Load vs. Vertical Height (Single Belt Drive)
1st Embodiment
2nd Embodiment
Motor Load
Vertical Height

Fig. 15

BELT-DRIVEN TRANSPORTATION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

The subject patent application is a continuation-in-part of U.S. patent application Ser. No. 12/639,632, filed on Dec. 16, 2009, which is now U.S. Pat. No. 8,662,477, the disclosure(s) of which is/are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to belt-driven transportation systems, and particularly to such systems configured as lift assemblies and conveyor assemblies.

2. Description of the Related Art

Transportation systems such as lift assemblies are well known for moving items or people between two vertically differing locations. Transportation systems such as conveyor assemblies are well known for moving items or people between two horizontally differing locations. It is also known to move the platform or carriage of these systems through a belt-driven apparatus.

One well-known and useful type of lift assembly is the scissor-type, which moves between a lowered or contracted state, and an elevated or extended state as its load-supporting platform is moved between differing vertical locations. Such lift assemblies are commonly driven through hydraulic cylinders, screw-drive mechanisms or expandable pneumatic bladder arrangements, and some prior types of scissor lift assemblies are belt-driven. These prior lift assemblies, however, often require a substantial amount of power, particularly when moving from their lowermost contracted states, or are difficult to reliably, precisely control.

Further, some prior belt-driven transportation systems can be problematic to install or repair, and sometimes to operate, due to the belt being moved out of its guided position along its designed path over pulleys that it engages. Another problem with some types of belt-driven transportation systems is that they rely on traction between the belt and the pulleys to operate, which can lead to slippage under heavy loading and result in unintentional lift collapse. Additionally, some transportation systems of the types described above, particularly lift assemblies, undesirably require operating space that cannot be easily accommodated or interferes with carrying out the operation to which the system is applied. For example, some prior lift assemblies have platform heights in their fully contracted states that require the load to first be lifted a substantial vertical distance from the level of a floor, on which the base is positioned, to place it on the platform. Thus, it would be preferable to minimize the height of the platform in its fully contracted or lowered state.

A transportation system configured as a lift assembly or conveyor assembly that addresses at least one of the above-mentioned problems is desirable.

SUMMARY OF THE INVENTION

The present invention provides a scissors-type lift assembly including a base and a platform. The platform is coupled to the base for movement between elevated and lowered states in which the platform and the base are distant and proximate, respectively. A pair of first and second scissor arms each have upper and lower ends, respectively, which are coupled to the platform and the base. The pair of scissor arms pivotably connect to each other intermediate their respective upper and

lower ends about a central pivot axis. A first pulley arrangement has a plurality of first pulleys disposed about a first pulley shaft defining a first pulley axis. A second pulley arrangement has a plurality of second pulleys disposed about a second pulley shaft defining a second pulley axis with the first and second pulley axes disposed in a pulley plane and having lateral movement relative to each other as the lift assembly is moved between its the elevated and lowered states. A spool is rotatable about an axis fixed to the base. A unitary belt is guided through a path defined by the first and second pulleys with the belt having a first end engaged with the spool onto which the belt is wound and from which the belt is unwound and an opposing second end. The first pulley arrangement further includes a plurality of independently rotatable first flange members disposed about the first pulley shaft with at least one of the first flange members disposed between each of the first pulleys to sandwich the respective first pulleys and to maintain the belt on the path about the respective first pulleys. Similarly, the second pulley arrangement further includes a plurality of independently rotatable second flange members disposed about the second pulley shaft with at least one of the second flange members disposed between each of the second pulleys to sandwich the respective second pulleys and to maintain the belt on the path about the respective second pulleys.

There has thus been outlined, rather broadly, certain features of embodiments of the invention in order that the detailed descriptions thereof may be better understood, and in order that the present contribution to the art may be better appreciated. Additional or alternative features of embodiments of the invention are described in further detail below.

In this respect, before explaining embodiments of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be regarded as limiting.

To accomplish the above and related objects, the invention may be embodied in the forms illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that changes may be made in the specific constructions illustrated. Moreover, it is to be noted that the accompanying drawings are not necessarily drawn to scale or to the same scale. In particular, the scale of some of the elements of the drawings may be exaggerated to emphasize characteristics of the elements.

BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, features and attendant advantages of the present invention will become fully appreciated as the same becomes better understood when considered in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the several views.

FIG. **1** is a perspective view of a scissor-type lift assembly according to a first embodiment in an elevated state.

FIG. **2** is a front view of the lift assembly shown in FIG. **1** in a lowered state.

FIG. **3** is a side view of the lift assembly shown in FIG. **1** in an elevated state.

FIG. **4** is a top view of the lift assembly shown in FIG. **1** in a lowered state.

FIG. **5** is a top view of the lift assembly shown in FIG. **1** in a lowered state with its platform removed from view.

FIG. **6** is a perspective view of a scissor-type lift assembly according to a second embodiment in an elevated state.

FIG. **7** is a side view of the lift assembly shown in FIG. **6** in an elevated state.

FIG. **8** is a side view of the lift assembly shown in FIG. **6** in a lowered state.

FIG. **9** is a side view of the lift assembly shown in FIG. **6** in an elevated state, with the second pair of scissor arms removed from view.

FIG. **10** is a partially exploded view of the lift assembly shown in FIG. **6** in an elevated state.

FIG. **11** is a fragmented side view of a unitary belt used with any of the embodiments.

FIG. **12** is a fragmented, partially sectioned view of an exemplary pulley, retainer roller and unitary belt of any of the embodiments.

FIG. **13** is a perspective view of a conveyor or lift assembly according to a third embodiment, with its platform shown in phantom lines.

FIG. **14** is a perspective view of a variant of the conveyor or lift assembly shown in FIG. **13** with its platform, base and guide structure removed from view.

FIG. **15** is a graph comparing the motor loads of the first and second embodiments of the scissor lift assemblies (each with single belt drive) as they respectively move from their lowered to their elevated states.

While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the drawings and may herein be described in detail. It should be understood, however, that the drawings and detailed description thereto are not intended to limit the invention to the particular forms disclosed, but on the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the present invention as defined by the appended claims.

DETAILED DESCRIPTION

Referring FIGS. **1-5** there is show first embodiment scissor-type lift assembly **20** which has a base **22** and a platform **24**, each of which may be made of steel. Platform **24** has upwardly facing supporting surfaces **25**. Lift assembly **20** has an elevated state **26** in which the platform and base are distant from each other, and a lowered state **28** in which the lift assembly base and platform are proximal to each other. FIGS. **1** and **3** show lift assembly **20** in elevated state **26**, and FIGS. **2**, **4** and **5** show lift assembly **20** in lowered state **28**.

Disposed between and operatively connected to base **22** and platform **24** is scissor arm assembly **30** which includes first pair of scissor arms **32** and second pair of scissor arms **34**. Between the first and second pair of scissor arms is brace **36**, which extends between first arm **38** of each of the first and second pairs of scissor arms **32**, **34**. The first and second pairs of scissor arms **32** and **34** each further includes second arm **40**. Arms **38**, **40** may be made of steel. Upper end **42** of each first and second arm **38**, **40** engages platform **24**, and lower end **44** of each first and second arm **38**, **40** engages base **22**. Respective to each pair of scissor arms **32**, **34**, first and second arms **38**, **40** are pivotably connected to each other through a bolted connection **46** about pivot axis **48** of scissor arm assembly **30**.

Each first arm **38** has a bolted connection **50** to platform **24**, which defines pivot axis **51**, and each second arm **40** has a bolted connection **52** to base **22**, which defines pivot axis **53**. Base **22** includes guide tracks **54** in which lower ends **44** of the first arms **38** are slidably engaged, and platform **24** includes guide tracks **56** in which upper ends **42** of second arms **40** are slidably engaged.

Lift assembly **20** further includes first pulley arrangement **58** which is connected to brace **36** with bolts **60**. First pulley arrangement **58** includes a plurality of pulleys **62**. Five pulleys **62**, identified as pulleys **62***a* through **62***e* in FIG. **5**, are independently rotatable about shaft **64**, which extends between and is fixed to laterally spaced blocks or support members **66** and **68**, into which bolts **60** are threadedly received. Blocks **66**, **68** may be made of steel.

Adjacent pulleys **62** may have therebetween a bushing or other friction reducing member to facilitate their independent rotation relative to each other about the shaft **64**. Flange members **70** are disposed between each of the pulleys **62** which defines a belt engaging circumferential pulley surface **330** discussed further below in connection with FIG. **12**.

The first pulley arrangement **58** further includes a shaft **72** that is parallel with the shaft **64**, and about which are disposed independently rotatable retainer rollers **74**, one for each of the pulleys **62**. The shaft **72** also extends between and is fixed to laterally spaced blocks or support members **66** and **68**. Thus, the pulleys **62** and retainer rollers **74** are respectively rotatable about parallel axes of rotation **76** and **78** respectively defined by the shafts **64** and **72**. It is thus understood that the first pulley arrangement **58** moves relative to the base **22** with the first scissor arms **38** as the lift assembly **20** is moved between its elevated and lowered states **26**, **28**.

The base **22** includes laterally extending cross braces **80**, **82**, and **84** which extend between and are fixed to its opposite rails **85**, **86**. Attached to cross brace **82** is second pulley arrangement **88**, which is fixed to base **22** by means of bolts **90**. Second pulley arrangement **88** includes a plurality of pulleys **92**. Four pulleys **92**, identified as pulleys **92***a* through **92***d* in FIG. **5**, are independently rotatable about shaft **94**, which extends between and is fixed to laterally spaced blocks or support members **96** and **98**, into which bolts **90** are threadedly received.

Adjacent pulleys **92** may have therebetween a bushing or other friction reducing member to facilitate their independent rotation relative to each other about the shaft **94**. Flange members **100** are disposed between each of the pulleys **92** which defines a belt engaging circumferential pulley surface **330** discussed further below in connection with FIG. **12**.

The second pulley arrangement **88** further includes the shaft **102** that is parallel with the shaft **94**, and about which are disposed independently rotatable retainer rollers **104**, one for each of the pulleys **92**. The shaft **102** also extends between and is fixed to laterally spaced blocks or support members **96** and **98**. Thus, the pulleys **92** and retainer rollers **104** are respectively rotatable about parallel axes of rotation **106** and **108** respectively defined by the shafts **94** and **102**.

The lift assembly **20** further includes a motor drive assembly **112**, which includes a reversible servo or stepper motor **114**, which is in driving, co-axial engagement with a spool or pulley **116**, which has opposed flanges **118** between which is defined a belt engaging portion. A unitary belt **120** having opposite first and second ends **121**, **122** is guided along a path defined by the pulleys **62** and **92**, and a first end **121** of belt **120** is connected to the spool **116** such that rotation of the spool **116** about its axis of rotation **124** will either wind the belt **120** onto the spool or unwind the belt **120** from the spool **116**. A spool axis of rotation **124** is substantially parallel with the pulley axes **76** and **106**.

A plane **126** is defined by the pulley axes **76** and **106**, and maintains a substantially horizontal orientation, parallel with the platform surfaces **25**. As best seen in FIG. **3**, the plane **126** is disposed within the height defined by the base **22**. The first and second pulley arrangements **58**, **88** move toward and away from each other in the plane **126** as the lift assembly **20** is moved between its elevated and lowered states **26**, **28**. Relative to lift assembly **20**, the plane **126** is stationary in this embodiment.

Referring now to FIG. **11**, it can be seen that the belt **120** is substantially flat and has an outer side **128** and an opposite inner side **130**. The inner side **130** is provided with a plurality of longitudinally spaced and laterally extending grooves **132** which define ribs on the inner side **130** of the belt **120**, thereby facilitating the belt's ability to wrap itself about the pulleys and the spool. The belt **120** can be any of a number of commercially available belts of suitable width, length and material properties that may be selected based on the requirements of the application for which lift assembly **20** is to be used.

Referring to FIG. **5**, the elongate unitary belt **120** extends from about the spool **116** rightwardly to the first pulley arrangement **58** where it is wrapped about the pulley **62***a*, and from the pulley **62***a* the belt **120** reverses course and at a slight return angle returns toward the second pulley arrangement **88** where it is then wrapped about the pulley **92***a*. From the pulley **92***a* the belt **120** reverses course and at a slight return angle returns toward the first pulley arrangement **58** where it is wrapped about the pulley **62***b*. From the pulley **62***b* the belt **120** reverses course and at a slight return angle returns toward the second pulley arrangement **88** where it is wrapped about the pulley **92***b*. From the pulley **92***b* the belt **120** reverses course and at a slight return angle returns toward the first pulley arrangement **58** where it is wrapped about the pulley **62***c*. From the pulley **62***c* the belt **120** reverses course and at a slight return angle returns toward the second pulley arrangement **88** where it is wrapped about the pulley **92***c*. From the pulley **92***c* the belt **120** reverses course and at a slight return angle returns toward the first pulley arrangement **58** where it is wrapped about the pulley **62***d*. From the pulley **62***d* the belt **120** reverses course and at a slight return angle returns toward the second pulley arrangement **88** where it is wrapped about the pulley **92***d*. From the pulley **92***d* the belt **120** returns in a direction toward the first pulley arrangement **58** and wraps about the pulley **62***e*, and reverses course returning toward the second pulley arrangement **88** and its second end **122** is affixed to the cross brace **82** of the base **22**. The return angle along which belt **120** extends between the first and second pulley arrangements **58**, **88** is relative to their parallel pulley axes **76**, **106**, and will vary slightly as the lift assembly **20** moves between its elevated state **26** in which the return angle is at a maximum, and its lowered state **28** in which the return angle is at a minimum. The belt's ability to accommodate the return angles is facilitated in part by the belt engaging circumferential pulley surface **330** of the pulleys **62** and **92**.

One of ordinary skill in the art will recognize that first pulley arrangement **58**, which is attached by its blocks **66** and **68** to scissor arm assembly **30**, is biased rightwardly as shown in FIG. **5** and away from second pulley arrangement **88** which is affixed to base **22**, to maintain an amount of tension on belt **120**. The first and second pulley arrangements **58**, **88** are biased apart from each other under the weight of scissor arm assembly **30**, platform **24**, and any load on the platform. Thus, axes **76**, **106** are biased laterally apart from each other in plane **126**. Pulleys **92** and pulley **62** may be of a common diameter, and thus the lengths of belt **120** extending therebetween on opposite sides of plane **126** respectively lay in common planes parallel to plane **126**.

As belt **120** is wound onto spool **116**, the length of the path along which belt **120** is guided about pulley **62** and **92** becomes shortened, and axes **106** and **76** are moved laterally within plane **126** towards one another as the lower ends **44** of first arms **38** are moved leftwardly towards lower ends **44** of second arms **44**, thereby changing the angle at which the elongate first and second arms **38**, **40** are crossed, and platform **24** is moved upwardly towards its elevated state **26**.

Conversely, as belt **120** is unwound from about spool **116**, the weight of scissor arm assembly **30**, platform **24**, and any load it bears, urges scissor arm assembly **30** towards a collapsed state, in which the angle at which the elongate first and second scissor arms **38**, **40** are crossed changes such that first pulley arrangement **58** is moved rightwardly away from second pulley arrangement **88**, and lift assembly **20** is moved towards its lowered state **28**.

Referring now to FIGS. **6-12**, there is shown a second embodiment of the scissor-type lift assembly **20**A, which is similar in some respects to the first embodiment of the scissor lift assembly **20** such that corresponding components are provided with common reference numerals.

The scissor lift assembly **20**A includes a motor drive assembly **112** in which a reversible servo or stepper motor **114** is oriented along a drive axis **134** that is substantially perpendicular to a spool drive axis **124**. The output shaft of motor **114** extends into a gear drive unit in which the spool driving output shaft that defines axis **124** extends laterally in opposite directions from the gear drive housing. Each laterally extending end of the output shaft has a spool **116** affixed thereto. In other words, there are two spools **116** rotatable about the spool drive axis **124** with one on each side of the output shaft.

As best shown in FIGS. **6** and **10**, the lift assembly **20**A includes a unitary belt **120***a*, **120***b*. In particular, the unitary belt includes a pair of first and second drive belts **120***a*, **120***b*, which work in parallel. In other words, the unitary belt is further defined as a first drive belt **120***a* and further including a second drive belt **120***b* to define a dual-belt configuration. One of the spools **116** is dedicated to the first drive belt **120***a* and the other spool **116** is dedicated to the second drive belt **120***b*. The two drive belts **120***a*, **120***b* can provide a measure of safety beyond the single belt arrangement shown in the first embodiment of the lift assembly **20**. The depicted dual-belt configuration of the lift assembly **20**A protects the user and the lifted load from injury or damage due to failure of one of the drive belts **120***a* and **120***b*. It is to be understood that the first embodiment of the lift assembly **20** may be outfitted with a dual belt drive like that shown in the second embodiment of the scissor lift assembly **20**A. Conversely, the second embodiment of the scissor lift assembly **20**A may be outfitted with a single belt drive like that shown in the first embodiment of the lift assembly **20**.

In the second embodiment of the scissor lift assembly **20**A, the first and second pulley arrangements **58**, **88** are disposed between the first and second scissor arms **38**, **40** of the first and second pairs of scissor arms **32**, **34**. The first and second pairs of scissor arms **32**, **34** each have upper **42** and lower **44** ends respectively coupled to the platform **24** and the base **22** as discussed in greater detail above. The pair of scissor arms **32**, **34** are pivotably connected to each other intermediate their respective upper **42** and lower **44** ends about a central pivot axis **48**. As with the first embodiment, the platform **24** of this embodiment is coupled to the base **22** for movement between elevated and lowered states in which the platform **24** and the base **22** are distant and proximate, respectively.

The first pulley arrangement **58** includes a pulley arrangement **58***a* associated with the first drive belt **120***a* and another pulley arrangement **58***b* associated with the second drive belt **120***b*. Each first pulley arrangement **58***a* and **58***b* has a plurality of first pulleys **62** that are independently rotatably disposed on a common first pulley shaft **64** extending between and fixed to laterally spaced blocks or support members **66** and **68**. The first pulley shaft **64** defines a first pulley axis **76** about which the first pulleys **62** rotate. The first plurality of pulleys **62** includes two groups of first pulleys **62** spaced from each other with one of the groups supporting the first drive belt **120***a* and the other of the group supporting the second drive belt **120***b*. The separation of the two groups may be performed in any suitable manner. As illustrated, the first pulley shaft **64** includes a first spacer **110** for separating the groups of the first pulleys **62**. The first spacer **110** is further defined as a centrally located enlarged section of the shaft **64**.

Similarly, the second pulley arrangement **88** includes a pulley arrangement **88***a* associated with first drive belt **120***a* and another pulley arrangement **88***b* associated with second drive belt **120***b*. Each second pulley arrangement **88***a* and **88***b* has a plurality of second pulleys **92** that are independently rotatably disposed on a common second pulley shaft **94** extending between and fixed to laterally spaced blocks or support members **96** and **98**. The second pulley shaft **94** defines a second pulley axis **106** about which the second pulleys **92** rotate. The first **76** and second **106** pulley axes are disposed in a pulley plane and laterally move relative to each other as the lift assembly **20**A is moved between its elevated and lowered states. The second plurality of pulleys **92** includes two groups of second pulleys **92** spaced from each other with one of the groups supporting the first drive belt **120***a* and the other of the group supporting the second drive belt **120***b*. As mentioned above, the separation of the two groups may be performed in any suitable manner. As illustrated, the second pulley shaft **94** includes a second spacer **160** for separating the groups of the second pulleys **92**.

The first drive belt **120***a* is guided through a path defined by the first and second pulleys with the belt **120***a* having a first end engaged with the spool **116** onto which the belt **120***a* is wound and from which the belt **120***a* is unwound. The first drive belt **120***a* also includes an opposing second end that is fixed to one of the pulley arrangements. Similarly, the second drive belt **120***b* is guided through a path defined by the first and second pulleys with the belt **120***b* having a first end engaged with another spool **116** onto which the belt **120***b* is wound and from which the belt **120***b* is unwound. The second drive belt **120***b* also includes an opposing second end that is fixed to one of the pulley arrangements.

As discussed above relative to the first embodiment and as shown best in FIGS. **10** and **12**, adjacent pulleys **62** may have therebetween a bushing or other friction reducing member to facilitate their independent rotation relative to each other about the shaft **64**. The first pulley arrangement **58***a*, **58***b* further includes a plurality of independently rotatable first flange members **70** disposed about the first pulley shaft **64**. As shown in FIG. **12**, the first flange members **70** may also ride on the bushing. At least one of the first flange members **70** is disposed between each of the first pulleys **62** to sandwich the respective first pulleys **62** and to maintain the belt **120***a* on the path about the respective first pulleys **62**. Similarly, the second pulley arrangement **88***a*, **88***b* further includes a plurality of independently rotatable second flange members **100** disposed about the second pulley shaft **94**. At least one of the second flange members **100** is disposed between each of the second pulleys **92** to sandwich the respective second pulleys **92** and to maintain the belt **120***b* on the path about the respective second pulleys **92**.

The first **70** and second **100** flange members have an annular washer-like configuration. Preferably, the first **70** and second **100** flange members include smooth outer surfaces to allow relative movement between the flange members **70**, **100** and the pulleys **62**, **92**. The first flange members **70** are independently mounted about the first shaft **64** in between the first pulleys **62**. Similarly, the second flange members **100** are independently mounted about the second shaft **94** in between the second pulleys **92**. The first flange members **70** are independently rotatable relative to the first pulleys **62** and each other, and the second flange members **100** are similarly independently rotatable relative to the second pulleys **92** and each other. In other words, during operation of the lift assembly **20**A, the first **70** and second **100** flange members automatically find an equilibrium state as the flange members **70**, **100** are free to rotate relative to the pulleys **62**, **92**. The equilibrium state may be rotating in either direction at any desired speed or may be stationary or may even be a combination of the two depending on the particular dynamics occurring at the time. There may also be multiple flange members **70**, **100** disposed between the pulleys **62**, **92**.

As shown in FIG. **10**, a lateral guide **136** is mounted between the first **64** and second **94** pulley shafts to maintain the pulley plane and to guide the lateral movement of the first **58** and second **88** pulley arrangements relative to each other. In the preferred embodiment, the second pulley shaft **94** is fixedly mounted to the lateral guide **136** and the first pulley shaft **64** is slidably disposed about the lateral guide **136**. As illustrated, the lateral guide **136** is configured as a straight shaft. As also illustrated, the first pulley shaft **64** includes a collar **138** slideably engaging the shaft-like structure of the lateral guide **136**. It should be appreciated, that the lateral guide **136** may be of any suitable configuration.

At each of the opposite distal ends of the first pulley shaft **64**, between the laterally outermost first pulleys **62** and the adjacent block **66**, **68**, there is provided a first cam follower or roller rotatable about the first pulley axis **76**. The first cam followers **140** and **142** respectively engage cam surfaces of the first and second pairs of scissor arms **32** and **34** during movement of the lift assembly **20**A. Each of the first cam followers **140**, **142** include two adjacent, relatively rotatable roller elements **156**, **158**.

At each of the opposite distal ends of the second pulley shaft **94**, between the laterally outermost second pulleys **92** and the adjacent block **96**, **98**, there is provided a second cam follower or roller rotatable about the second pulley axis **106**. The second cam followers **144** and **146** respectively engage cam surfaces of the first and second pairs of scissor arms **32** and **34** during movement of the lift assembly **20**A. Like the first cam followers **140**, **142**, each of the second cam follower **144**, **146** includes two adjacent, relatively rotatable roller elements **156**, **158**.

In each of the cam followers **140**, **142**, **144**, **146**, roller element **156** is located laterally inboard of roller element **158** and is in rolling contact with an edge of a second scissor arm **40**, and laterally outboard roller element **158** is in rolling contact with an edge of a first scissor arm **38**. Thus, the roller elements **156**, **158** of each cam follower **140**, **142**, **144**, **146** rotate in opposite directions as they roll along their respective scissor arm edges.

Each inboard roller element **156** of a cam follower **140**, **142**, **144**, **146** engages a cam surface **150** defined on an edge of a second scissor arm **40** of the first and second pairs of scissor arms **32**, **34**. Similarly, each outboard roller element **158** of a cam follower **140**, **142**, **144**, **146** engages a cam surface **148** defined on an edge of a first scissor arm **38** of the first and second pairs of scissor arms **32**, **34**. The upper **42** and lower **44** ends of the first and second scissor arms each include a recess **152**, **154**. The cam surfaces **148**, **150** extend from the central pivot axis and terminate at the respective recesses **152**, **154**.

The axes of rotation **76** and **106** of the first and second pulley arrangements **58**, **88** lie in a plane **126**, the orientation of which is maintained throughout movement of the lift assembly **20**A between its elevated and lowered states. In lift assembly **20**A, the plane **126** remains substantially horizontal, and also includes the pivot axis **48**. Here, as opposed to the first embodiment of the lift assembly **20**, the plane **126** is not fixed relative to the base **22**, but rather moves vertically up and down with movement of the lift assembly **20**A between its elevated and lowered states **26**, **28**.

The tension on the belts **120***a* and **120***b* maintains the cam followers **140**, **142** and **144**, **146** of the first and second pulley arrangements **58** and **88** in engagement with the surfaces **150** and **148** of the first and second arms **38** and **40** of the first and second pairs of scissor arms **32**, **34**. The cam surfaces **148**, **150** are designed to easily facilitate an initial movement of the lift assembly **20**A from its lowered state **28** to minimize additional loading on the motor **114** than would otherwise be required in the absence of the cam surfaces being so designed. As shown, the cam surfaces **148**, **150** establish, in the lowered state **28**, a gradual slope along which the roller elements **56**, **58** are forced to roll in response to the belts **120***a*, **120***b* being wound onto their respective spools **116**. The slope increases somewhat as the lift assembly **20**A is moved out of its lowered state **28** and axes **96**, **106** are pulled laterally toward each other in the plane **126**. Once the lift assembly **20**A has been moved from its initial, lowered state **28**, the cam surfaces **148**, **150** engaged by the followers **140**, **142**, **144**, **146** change their slopes such that the load on the motor **114** is maintained at an approximately constant level, and an increased rate of change in height of the platform **24** results.

As best shown in FIGS. **6**, **9-10** and **12**, a plurality of first retention rollers **74**, each having a circumferential surface **332**, are disposed in proximity to a respective circumferential surface **330** of the first pulleys **62**. The first retention rollers **74** are also adjacent a respective portion of the belt **120***a*, **120***b* for maintaining a position of the belt **120***a*, **120***b* on the circumferential surface **330** of the first pulleys **62**. A first roller shaft **72** is mounted near the first pulley shaft **64** with the first retention rollers **74** rotatably supported on the first roller shaft **72**. The support members **66**, **68** interconnect the pulley shaft **64** with the roller shaft **72** to maintain a relative orientation between the shafts **64**, **72**.

As shown in FIG. **12**, each of the first retention rollers **74** are retained axially along the first roller shaft **72** by respective first flange members **70**. In other words, the first flange members **70** are large enough radially to capture the first retention rollers **74** and create a somewhat closed space between the two circumferential surfaces **330**, **332** to capture the belt **120***a*, **120***b*. It should be appreciated that the relative radial size of the first flange members **70** can vary and may or may not create a closed space so long as the belt **120***a*, **120***b* is adequately retained.

Similarly, a plurality of second retention rollers **104**, each having a circumferential surface **332**, are disposed in proximity to a respective circumferential surface **330** of the second pulleys **92**. The second retention rollers **104** are also adjacent a respective portion of the belt **120***a*, **120***b* for maintaining a position of the belt **120***a*, **120***b* on the circumferential surface **330** of the second pulleys **92**. A second roller shaft **102** is mounted near the second pulley shaft **94** with the second retention rollers **104** rotatably supported on the second roller shaft **102**. The support members **96**, **98** interconnect the pulley shaft **94** with the roller shaft **102** to maintain a relative orientation between the shafts **94**, **102**.

As also shown in FIG. **12**, each of the second retention rollers **104** are retained axially along the second roller shaft **102** by respective second flange members **100**. As discussed above, the second flange members **70** are also large enough radially to capture the second retention rollers **74** and create a somewhat closed space between the two circumferential surfaces **330**, **332** to capture the belt **120***a*, **120***b*. It should be appreciated that the relative radial size of the second flange members **70** can vary and may or may not create a closed space so long as the belt **120***a*, **120***b* is adequately retained.

FIG. **15** provides a qualitative comparison between the first embodiment of the scissor lift assembly (e.g., lift assembly **20**) and an comparably sized second embodiment of the scissor lift assembly (e.g., lift assembly **20**A), the latter having the cam surfaces **148**, **150** substantially configured as shown in FIGS. **6-12** and described above. The first and second embodiments of the scissor lift assemblies compared through the plotted curves of FIG. **15** each have a single belt drive, as described above, and a common number of first and second pulleys **62**, **92** in their respective first and second pulley arrangements **58**, **88**. Additionally, the comparison is through a range between lowered and elevated states that are respectively established at common platform heights, and the loads borne by their respective platforms are identical.

The motor load is derived as a function of the tension force in the segment of the belt **120** extending from about the spool **116**. FIG. **15** shows, in raising the platform from the lift assembly lowered or contracted state **28** (at the left side of the graph) to the lift assembly elevated or extended state **26** (at the right side of the graph) the second embodiment scissor lift substantially reduces the motor loading vis-à-vis the first embodiment lift assembly up to a height substantially past the mid-point of platform travel, where the two lines intersect. After this height is reached, the motor load of the second embodiment of the lift assembly is comparatively higher, but not substantially so. Indeed, the second embodiment of the lift assembly motor load has only gradual, substantially linear increases as it moves from the lowered to the elevated state. On the other hand, the first embodiment of the lift assembly shows a dramatic initial reduction in motor loading immediately after moving from its lowered state, with further, more gradual and substantially linear motor load reduction occurring in the latter portions of upward platform travel towards the elevated state.

Clearly, it would be desirable to avoid the initial, comparatively much higher motor loading in moving from the lift assembly lowered state as the second embodiment lift assembly allows, for the substantially greater initial loading comes with attendant increases in energy use and stresses on the belt and other lift assembly components. However, it is contemplated that a second embodiment of the scissor lift assembly will likely have greater cost than a comparable first embodiment of the scissor lift assembly. On the other hand, the relatively flatter motor load curve of the second embodiment of the scissor lift assembly will likely reduce the need for an expensive motor control system.

Those of ordinary skill in the art will recognize that, in either of the first and second embodiments of the scissor lift assemblies, motor loading can be reduced by correspondingly increasing the number of first and second pulleys **62**, **92** of the first and second pulley arrangements **58**, **88** over which belt **120** is wrapped, with belt **120** being correspondingly lengthened to accommodate its increased path. This reduction in motor loading/belt tension would, however, result in comparatively slower travel between the lift assembly contracted and elevated states.

Returning to FIGS. **6-12**, the cam surfaces **148** of the second embodiment of the scissor lift assembly **20**A are each contoured near opposite ends **42**, **44** of the first arms **38** to define the recesses **152**. Similarly, the cam surfaces **150** are each contoured near opposite ends **42**, **44** of the second arms **40** to define the recesses **154**. In the lowered state **28** of lift assembly **20**A, as shown in FIG. **8**, the cam followers **140**, **142**, **144**, **146** are received in spaces defined by the recesses **152** and **154** to minimize the total height of lift assembly **20**A between the bottom most part of its base **22** and the load supporting surfaces **25** of the platform **24** in lowered state **28**.

The first and second pulley arrangements **58** and **88** of the second embodiment of the lift assembly **20**A, respectively, further include the shafts **72**, **102**, that are fixed to and extend in parallel with the shafts **64**, **94** between the laterally spaced blocks or support members **66**, **68** and **96**, **98**. The blocks **66**, **68**, **96**, **98** are preferably structured and interconnected to maintain a consistent orientation of the axes **78** and **108** relative to the plane **126**. They may, for example, both lie in the plane **126** as shown. Between the first and second pulley arrangements **58**, **88**, a pair of blocks (e.g. **66** and **96**, or **68** and **98**) may be linked together laterally outside the adjacent pair of scissor arms **32** or **34**, for example.

Referring now to FIGS. **13** and **14** there is shown a conveyor or lift assembly **220**, a third embodiment of the present invention. Assembly **220** includes base **222**, and as a conveyor assembly may also include platform **224** (shown in phantom lines in FIG. **13**) defining support surface **225**. Conveyor or lift assembly **220** has a centered state **226** and is arranged to provide conveying or lifting movement longitudinally in the directions indicated by double-headed arrow **228**. A load supported by carriage **230** is thus moved longitudinally through operation of assembly **220**. The load may be supported by platform **224** and moved substantially horizontally as a conveyor or, alternatively, a load supported by carriage **230** may be moved substantially vertically, as a lift or elevator.

Carriage **230**, to which platform **224** may be attached, is disposed between a pair of longitudinally extending rails **232** and **234**. Carriage **230** is provided with bearing elements **236** that are received in and supported by guide tracks **238**, **240** of rails **232**, **234**. Bearing elements **236** support the load placed on surface **225** of platform **224** when assembly **220** is in a substantially horizontal orientation, or otherwise constrain the movement of carriage **230** away from base **222**. Base **222**, platform **224**, and rails **232**, **234** may be made of steel.

In FIGS. **13** and **14**, the longitudinal direction is that indicated by arrow **228**, the lateral direction being substantially perpendicular thereto in the directions of carriage pulley axis **242** defined by shaft **243**, carriage pulley axis **244** defined by shaft **245**, and carriage retainer roller axis **246** defined by shaft **247**. Shafts **243**, **245**, and **247** extend between and are fixed to a pair of laterally spaced blocks **248**, **250** to which bearings **236** are attached at the laterally outward sides thereof. Referring to FIG. **14**, a variation of assembly **220** is shown that includes a pair of retainer roller axes **246***a* and **246***b* associated with a pair of shafts **247***a* and **247***b* extending between and fixed to blocks **248**, **250**, instead of the single shaft **247** and axis **246**. Platform **224** may be attached to blocks **248**, **250**.

Respectively disposed about shafts **243** and **245** are like-numbered pluralities of independently rotatable carriage pulleys **252** and **254** which may be identical to above-discussed pulleys **62**, **92**. Disposed about shaft **247** (or about shafts **247***a* and **247***b*) are a plurality of retention rollers **256** which may be identical to above-discussed retention rollers **74**, **104**. Where a single shaft **247** carries retention rollers **256**, there are a like number of retention rollers **256** and pairs of carriage pulleys **252** and **254**, each retention roller disposed between and having a common relationship with each pair of carriage pulleys. In the variation shown in FIG. **13**, there is a retention roller **256** associated with each one of carriage pulley **252**, **254**. The relationship between each pulley and its retention roller is as discussed above, and discussed further below.

Assembly **220** further includes first pulley arrangement **258**, shown on the right side of FIGS. **13** and **14**. First pulley arrangement **258** includes shaft **264** defining axis **276** about which is disposed a plurality of independently rotatable pulleys **62**. Shaft **264** extends between and is fixed to a laterally spaced pair of blocks **266**, **268** which are affixed to base **222**. First pulley arrangement **258** further includes shaft **272** defining axis **278**. Shaft **272** extends between and is fixed to blocks **266**, **268**, and is parallel to shaft **264**. Disposed about shaft **272** is a plurality of independently rotatable retention rollers **74**, one for each pulley **62**.

Referring to the left side of FIGS. **13** and **14**, assembly **220** further includes a second pulley arrangement **288** which is similar in configuration to first embodiment pulley assembly **258**. Second pulley arrangement **288** includes shaft **294** defining axis **306** about which is disposed a plurality of independently rotatable pulleys **92**, with shaft **294** extending between and fixed to laterally spaced blocks **296**, **298** which are affixed to base **222**. Second pulley arrangement **288** further includes shaft **302** defining axis **308**. Shaft **302** extends between and is fixed to blocks **296**, **298**, and is parallel to shaft **294**. Disposed about shaft **302** is a plurality of independently rotatable retention rollers **104**, one for each pulley **92**. Blocks **248**, **250**, **266**, **266**, **296**, and **298** may be made of steel.

Extending between first pulley arrangement **258** and carriage **230** is first drive belt **120***a*, which is guided over a path defined by pulleys **62** and **252**. As shown, there are four pulleys **62** in first pulley arrangement **258**, identified as **62***a-d*, and five carriage pulleys **252**, identified as carriage pulleys **252***a-e*. Elongate unitary belt **120***a* extends from about spool **116***a* leftwardly to carriage **230** where it is wrapped about carriage pulley **252***a*, and from pulley **252***a* belt **120***a* reverses course and at a slight return angle returns toward first pulley arrangement **258** where it is then wrapped about pulley **62***a*. From pulley **62***a* belt **120***a* reverses course and at a slight return angle returns toward carriage **230** where it is wrapped about pulley **252***b*. From pulley **252***b* belt **120***a* reverses course and at a slight return angle returns toward first pulley arrangement **258** where it is wrapped about pulley **62***b*. From pulley **62***b* belt **120***a* reverses course and at a slight return angle returns toward carriage **230** where it is wrapped about pulley **252***c*. From pulley **252***c* belt **120***a* reverses course and at a slight return angle returns toward first pulley arrangement **258** where it is wrapped about pulley **62***c*. From pulley **62***c* belt **120***a* reverses course and at a slight return angle returns toward carriage **230** where it is wrapped about pulley **252***d*. From pulley **252***d* belt **120***a* reverses course and at a slight return angle returns toward first pulley arrangement **258** where it is wrapped about pulley **62***d*. From pulley **62***d* belt **120***a* returns in a direction toward carriage **230** and wraps about pulley **252***e*, and reverses course returning toward first pulley arrangement **258** and its second end **122** is affixed to base **222**. The return angle along which belt **120***a* extends between the carriage **230** and the first pulley arrangement **258** is relative to their parallel pulley axes **242**, **276** and will vary slightly as carriage **230** moves longitudinally in the directions indicated by arrow **228**, the return angle being at a maximum when carriage **230** is rightmost and being at a minimum when carriage **230** is leftmost, as viewed in FIGS. **13** and **14**. The belt's ability to accommodate the return angles is facilitated in part by the belt engaging circumferential pulley surface **330** of pulleys **62** and **252** discussed further below in connection with FIG. **12**.

Extending between second pulley arrangement **288** and carriage **230** is second drive belt **120***b*, which is guided over a path defined by pulleys **92** and **254**. As shown, there are four pulleys **92** in second pulley arrangement **288**, identified as **92***a-d*, and five carriage pulleys **254**, identified as carriage pulleys **254***a-e*. Elongate unitary belt **120***b* extends from about spool **116***b* rightwardly to carriage **230** where it is wrapped about carriage pulley **254***a*, and from pulley **254***a* belt **120***b* reverses course and at a slight return angle returns toward second pulley arrangement **288** where it is then wrapped about pulley **92***a*. From pulley **92***a* belt **120***b* reverses course and at a slight return angle returns toward carriage **230** where it is wrapped about pulley **254***b*. From pulley **254***b* belt **120***b* reverses course and at a slight return angle returns toward second pulley arrangement **288** where it is wrapped about pulley **92***b*. From pulley **92***b* belt **120***b* reverses course and at a slight return angle returns toward carriage **230** where it is wrapped about pulley **254***c*. From pulley **254***c* belt **120***b* reverses course and at a slight return angle returns toward second pulley arrangement **288** where it is wrapped about pulley **92***c*. From pulley **92***c* belt **120***b* reverses course and at a slight return angle returns toward carriage **230** where it is wrapped about pulley **254***d*. From pulley **254***d* belt **120***b* reverses course and at a slight return angle returns toward second pulley arrangement **288** where it is wrapped about pulley **92***d*. From pulley **92***d* belt **120***b* returns in a direction toward carriage **230** and wraps about pulley **254***e*, and reverses course returning toward second pulley arrangement **288** and its second end **122** is affixed to base **222**. The return angle along which belt **120***b* extends between the carriage **230** and the second pulley arrangement **288** is relative to their parallel pulley axes **244**, **306** and will vary slightly as carriage **230** moves longitudinally in the directions indicated by arrow **228**, the return angle being at a maximum when carriage **230** is leftmost and being at a minimum when carriage **230** is rightmost, as viewed in FIGS. **13** and **14**. The belt's ability to accommodate the return angles is facilitated in part by the belt engaging circumferential pulley surface **330** of pulleys **92** and **254** discussed further below in connection with FIG. **12**.

As described above, first end **121** of each belt **120** is attached to its respective spool **116** and is wound onto or unwound from the spool **116**, which changes the length of the path over which the belt **120** extends, the path being defined by the respective pulleys over which it is wrapped. The second end **122** of each belt **120** is affixed to base **222** adjacent the respective first or second pulley arrangement.

Assembly **220** includes a first motor drive assembly **312***a* which is arranged for pulling belt **120***a* rightward through rotation of its motor **314***a* which may be rotatable in only a single direction. As shown, the direction of rotation of motor **314***a* of motor drive assembly **312***a* when pulling carriage **230** rightwardly as belt **120***a* is wound onto spool **116***a*, is clockwise. In motor drive assembly **312***a*, the output shaft of motor **314***a* may extend through a clutch housing **318***a* that includes a one way clutch which allows belt **120***a* to be unwound from spool **116***a* as carriage **230** is pulled leftwardly by second motor drive assembly **312***b* when motor **314***a* is de-energized.

Similarly, second motor drive **312***b* of assembly **220** is arranged for pulling belt **120***b* leftwardly through rotation of its motor **314***b* which may be rotatable in only a single direction. As shown, the direction of rotation of motor **314***b* of motor drive assembly **312***b* when pulling carriage **230** leftwardly as belt **120***b* is wound onto spool **116***b*, is counterclockwise. In motor drive assembly **312***b*, the output shaft of motor **314***b* may extend through a clutch housing **318***b* that includes a one way clutch which allows belt **120***b* to be unwound from spool **116***b* as carriage **230** is pulled rightwardly by first motor drive assembly **312***a* when motor **314***b* is de-energized.

One of ordinary skill in the art will recognize that motor drive assemblies **312***a* and **312***b* are individually and exclusively energized to move a load supported by carriage **230** in one of the two directions indicated by arrow **228**. Movement of carriage **230** rightward as shown in FIGS. **13** and **14**, for example, involves energizing motor drive assembly **312***a* which will wind belt **120***a* onto spool **116***a*, shortening the path over which it extends over pulleys **62** and **252**, thus moving axis **242** towards axis **276**. Axes **242** and **276** can, of course, define a plane in which the axes can move laterally toward and away from each other. As carriage **230** is moved leftward as belt **120***b* is wound onto spool **116***b*, belt **120***a* is unwound from about spool **116***a* of motor drive assembly **312***a* as the clutch in clutch housing **318***a* allows relative rotation between spool **116***a* and motor **314***a*, thereby lengthening the path over which belt **120***a* extends over pulleys **62** and **252**.

Referring now again to FIG. **12**, the relationship between each pulley **62**, **92**, **252**, or **254** and its associated retention roller **74**, **104**, or **256** is discussed in further detail. There is a gap between the circumferential surface **330** of the pulley and a circumferential surface **332** of the retention roller through which the belt **120** is fed. The retention roller **74**, **104**, **256** prevents the belt **120** from becoming disengaged from the pulley **62**, **92**, **252**, **254** during installation and operation of the lift or conveyor assembly **20**, **20**A, **220**. Notably, the proximity of the circumferential surfaces **330**, **332** of the pulley **62**, **92**, **252**, **254** and retention roller **74**, **104**, **256** is such that the gap therebetween is sufficient to allow a space between the outer surface **128** of the belt **120** and the surface **332** of the retention roller **74**, **104**, **256**. As discussed above, preferably, the retention roller **74**, **104**, **256** extends partially between the opposed flange members **70**, **100**, thereby creating a closed gap and assisting in capturing the belt **120**, **120***a*, **120***b* between the flange members **70**, **100**. Further, as readily understood from the above description, the reversing path of a belt **120**, **120***a*, **120***b* over a series of any plurality of pulleys causes the belt to be directed at different return angles on the top and bottom sides of the pulleys. Although the belt may angle slightly between the pulleys along the path, the configuration of the flange members and retention rollers allows the circumferential surface **330** of the pulleys to be relatively flat, as opposed to a more expensive crowned or barrel-shaped configuration. In other words, each of the first pulleys **62** includes a belt engaging circumferential surface **330** that is substantially flat, and each of the second pulleys **92** similarly includes a belt engaging circumferential surface **330** that is substantially flat.

As to a further discussion of the manner of usage and operation of the present invention, the same should be apparent from the above description. With respect to the above description then, it is to be realized that the optimum dimensional relationships for the parts of the invention, to include variations in size, materials, shape, form, function and manner of operation, assembly and use, are deemed readily apparent and obvious to one skilled in the art, and all equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention.

Therefore, the foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed is:

1. A scissors-type lift assembly comprising:

a base;

a platform coupled to said base for movement between elevated and lowered states in which said platform and said base are distant and proximate, respectively;

a pair of first and second scissor arms each having upper and lower ends respectively coupled to said platform and said base, said pair of scissor arms pivotably connected to each other intermediate their respective upper and lower ends about a central pivot axis;

a first pulley arrangement having a plurality of first pulleys disposed about a first pulley shaft defining a first pulley axis with each of said first pulleys having a first belt engaging circumferential surface that is substantially flat;

a second pulley arrangement having a plurality of second pulleys disposed about a second pulley shaft defining a second pulley axis with each of said second pulleys having a second belt engaging circumferential surface that is substantially flat, and said first and second pulley axes disposed in a pulley plane and having lateral movement relative to each other as said lift assembly is moved between its said elevated and lowered states;

a spool rotatable about an axis fixed to said base; and

a unitary belt guided through a path defined by said first and second pulleys with said belt having a first end engaged with said spool onto which said belt is wound and from which said belt is unwound and an opposing second end;

said first pulley arrangement further including a plurality of independently rotatable first flange members disposed about said first pulley shaft with each of said first flange members extending outwardly beyond said first belt engaging circumferential surfaces of said first pulleys, and at least one of said first flange members disposed between each of said first pulleys to sandwich said respective first pulleys and to maintain said belt on said path and said first belt engaging circumferential surfaces about said respective first pulleys; and

said second pulley arrangement further including a plurality of independently rotatable second flange members disposed about said second pulley shaft with each of said second flange members extending outwardly beyond said second belt engaging circumferential surfaces of said second pulleys, and at least one of said second flange members disposed between each of said second pulleys to sandwich said respective second pulleys and to maintain said belt on said path and said second belt engaging circumferential surfaces about said respective second pulleys.

2. The scissors-type lift assembly as set forth in claim **1** wherein said first and second flange members have an annular washer-like configuration.

3. The scissors-type lift assembly as set forth in claim **2** wherein said first and second flange members include smooth outer surfaces.

4. The scissors-type lift assembly as set forth in claim **1** wherein said first flange members are independently rotatable relative to said first pulleys and each other, and wherein said second flange members are independently rotatable relative to said second pulleys and each other.

5. The scissors-type lift assembly as set forth in claim **1** further including a lateral guide mounted between said first and second pulley shafts to maintain said pulley plane and to guide said lateral movement of said first and second pulley arrangements relative to each other.

6. The scissors-type lift assembly as set forth in claim **5** wherein said second pulley shaft is fixedly mounted to said lateral guide and said first pulley shaft is slidably disposed about said lateral guide.

7. The scissors-type lift assembly as set forth in claim **6** wherein said first pulley shaft includes a collar slideably engaging said lateral guide.

8. The scissors-type lift assembly as set forth in claim **1** wherein said unitary belt is further defined as a first drive belt and further including a second drive belt to define a dual-belt configuration.

9. The scissors-type lift assembly as set forth in claim **8** wherein said first plurality of pulleys includes two groups of first pulleys spaced from each other with one of said groups supporting said first drive belt and the other of said group supporting said second drive belt.

10. The scissors-type lift assembly as set forth in claim **9** wherein said first pulley shaft includes a first spacer separating said groups of said first pulleys.

11. The scissors-type lift assembly as set forth in claim **8** wherein said second plurality of pulleys includes two groups of second pulleys spaced from each other with one of said groups supporting said first drive belt and the other of said group supporting said second drive belt.

12. The scissors-type lift assembly as set forth in claim **11** wherein said second pulley shaft includes a second spacer separating said groups of said second pulleys.

13. The scissors-type lift assembly as set forth in claim **1** wherein said upper and lower ends of said first and second scissor arms each include a recess, and wherein each of said first and second scissor arms includes a cam surface extending from said central pivot axis and terminating at respective recesses.

14. The scissors-type lift assembly as set forth in claim **13** further including a first cam follower disposed at each distal end of said first pulley shaft with said first cam follower engaging said cam surfaces during said movement of said lift assembly and engaging said recesses when in said lowered state.

15. The scissors-type lift assembly as set forth in claim **13** further including a second cam follower disposed at each distal end of said second pulley shaft with said second cam follower engaging said cam surfaces during said movement of said lift assembly and engaging said recesses when in said lowered state.

16. The scissors-type lift assembly as set forth in claim **1** further including a plurality of first retention rollers each having a circumferential surface disposed in proximity to a respective circumferential surface of said first pulleys and adjacent a respective portion of said belt for maintaining a position of said belt on said circumferential surface of said first pulleys.

17. The scissors-type lift assembly as set forth in claim **16** further including a first roller shaft mounted near said first pulley shaft with said first retention rollers rotatably supported on said first roller shaft.

18. The scissors-type lift assembly as set forth in claim **16** wherein each of said first retention rollers are retained axially along said first roller shaft by respective first flange members.

19. The scissors-type lift assembly as set forth in claim **1** further including a plurality of second retention rollers each having a circumferential surface disposed in proximity to a respective circumferential surface of said second pulleys and adjacent a respective portion of said belt for maintaining a position of said belt on said circumferential surface of said second pulleys.

20. The scissors-type lift assembly as set forth in claim **19** further including a second roller shaft mounted near said second pulley shaft with said second retention rollers rotatably supported on said second roller shaft.

21. The scissors-type lift assembly as set forth in claim **19** wherein each of said second retention rollers are retained axially along said second roller shaft by respective second flange members.

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