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(54) **SCISSOR LIFT ASSEMBLY**

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See application file for complete search history.

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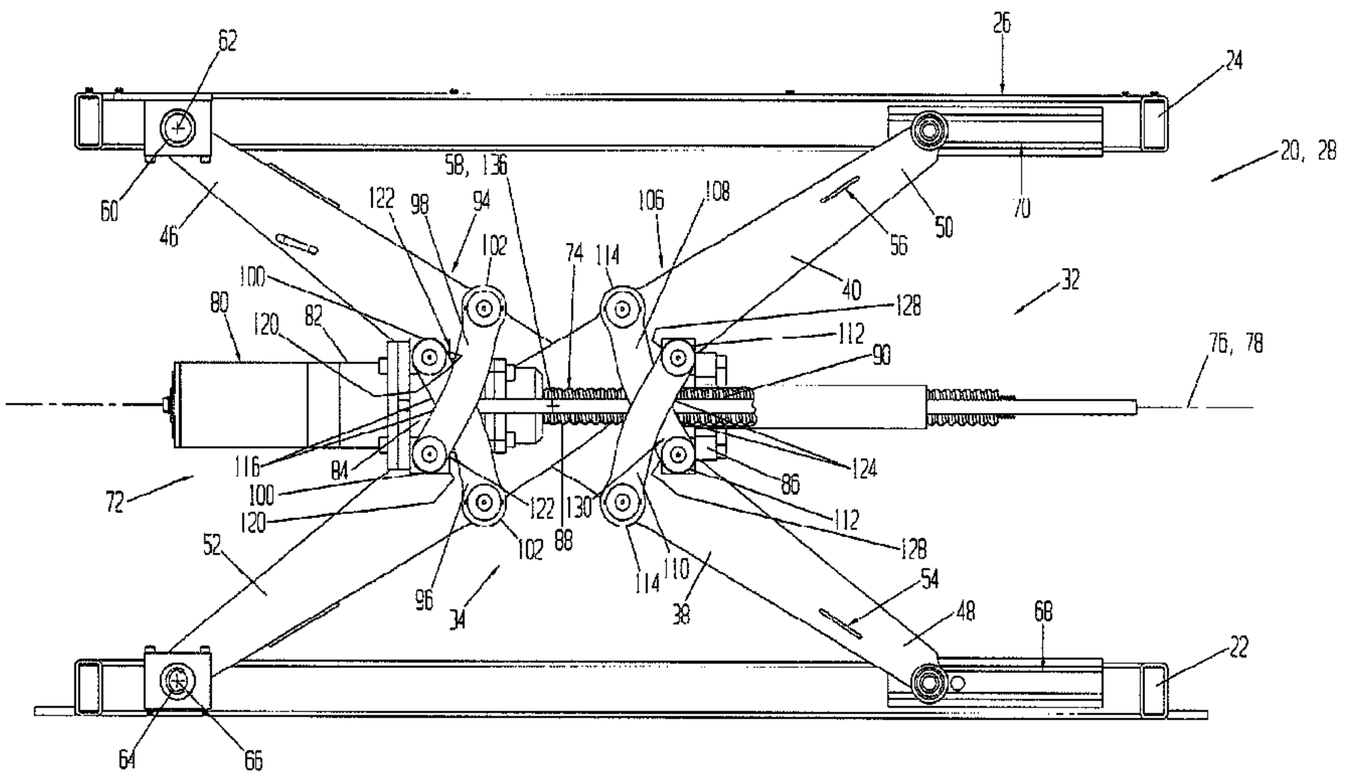
(57) **ABSTRACT**

A lift assembly includes a base and a platform at a relatively greater distance from the base in an extended state than in a contracted state. The lift assembly includes a pair of scissor arms with each arm having opposed first and second ends, and pivotably connected to each other about a central axis. The lift assembly includes a drive screw mechanism including a shaft defining a longitudinal axis, and further includes a drive motor, a block, and a collar. The lift assembly further includes first and second pairs of links. Each link has opposed first and second ends and an edge facing away from the central axis and defining a recess in the link. The collar and block are spaced from the central axis and indirectly coupled to the pair of scissor arms through a pair of links.

10 Claims, 6 Drawing Sheets



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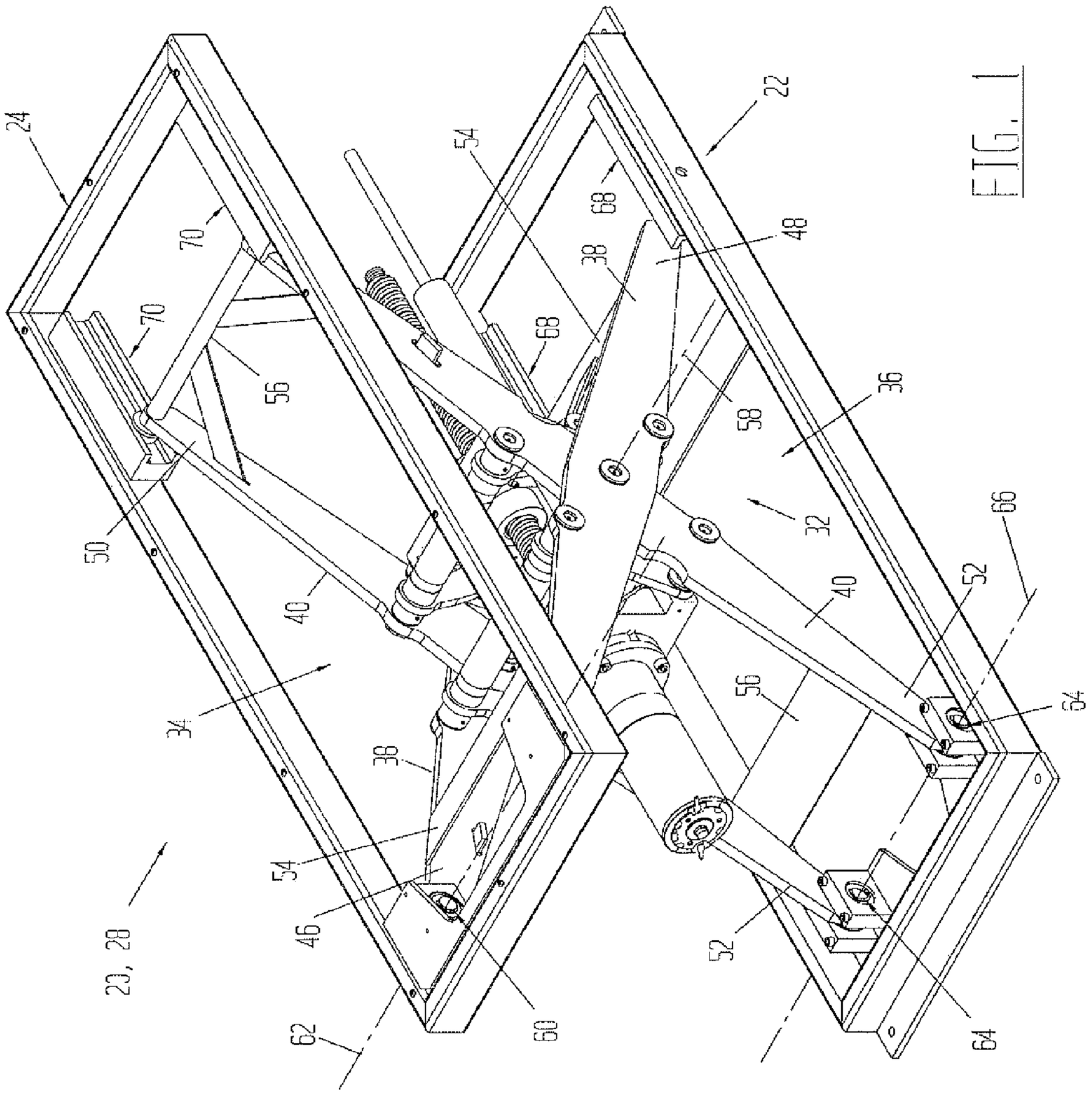
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FIG. 1

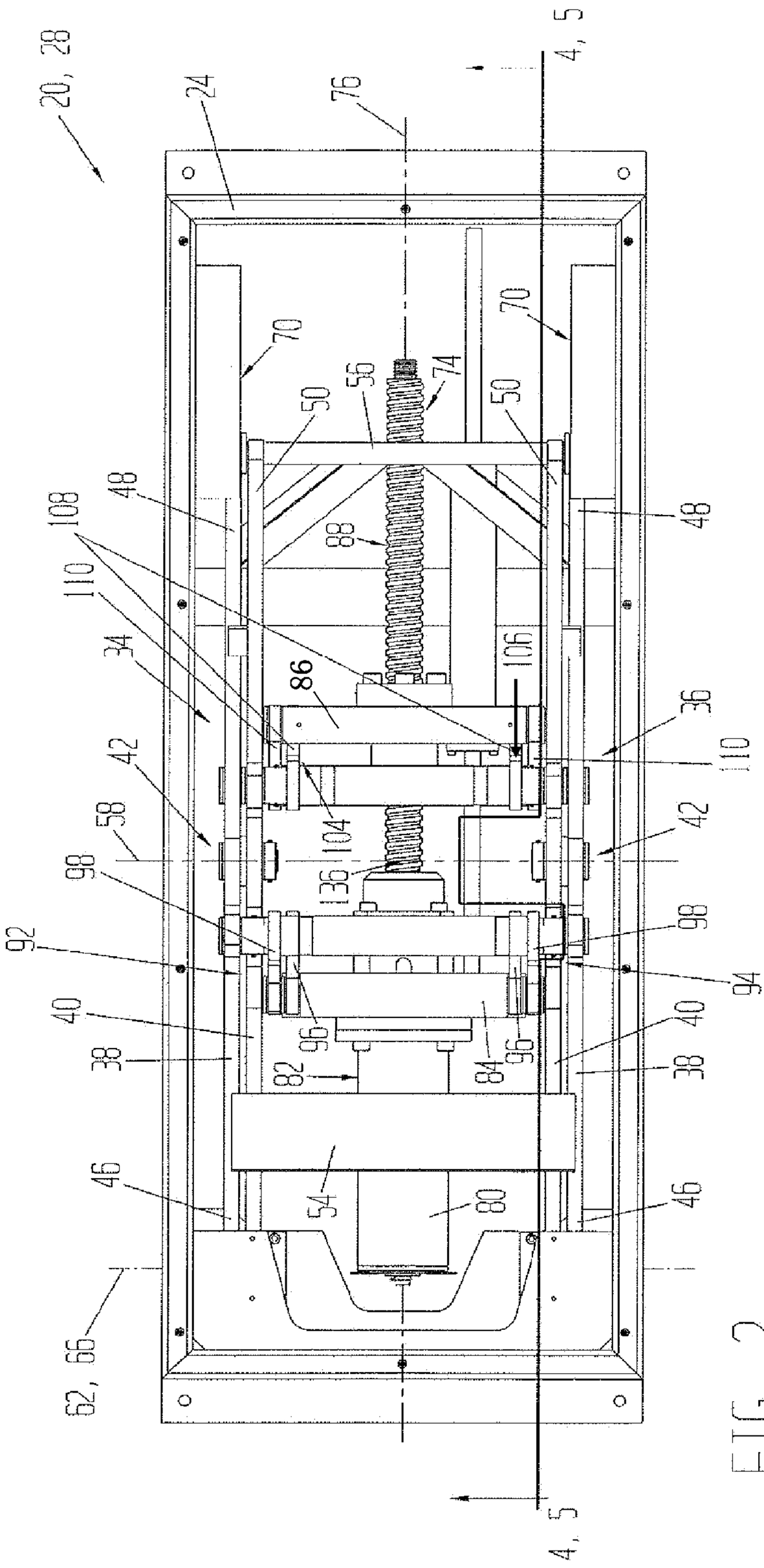
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FIG. 2

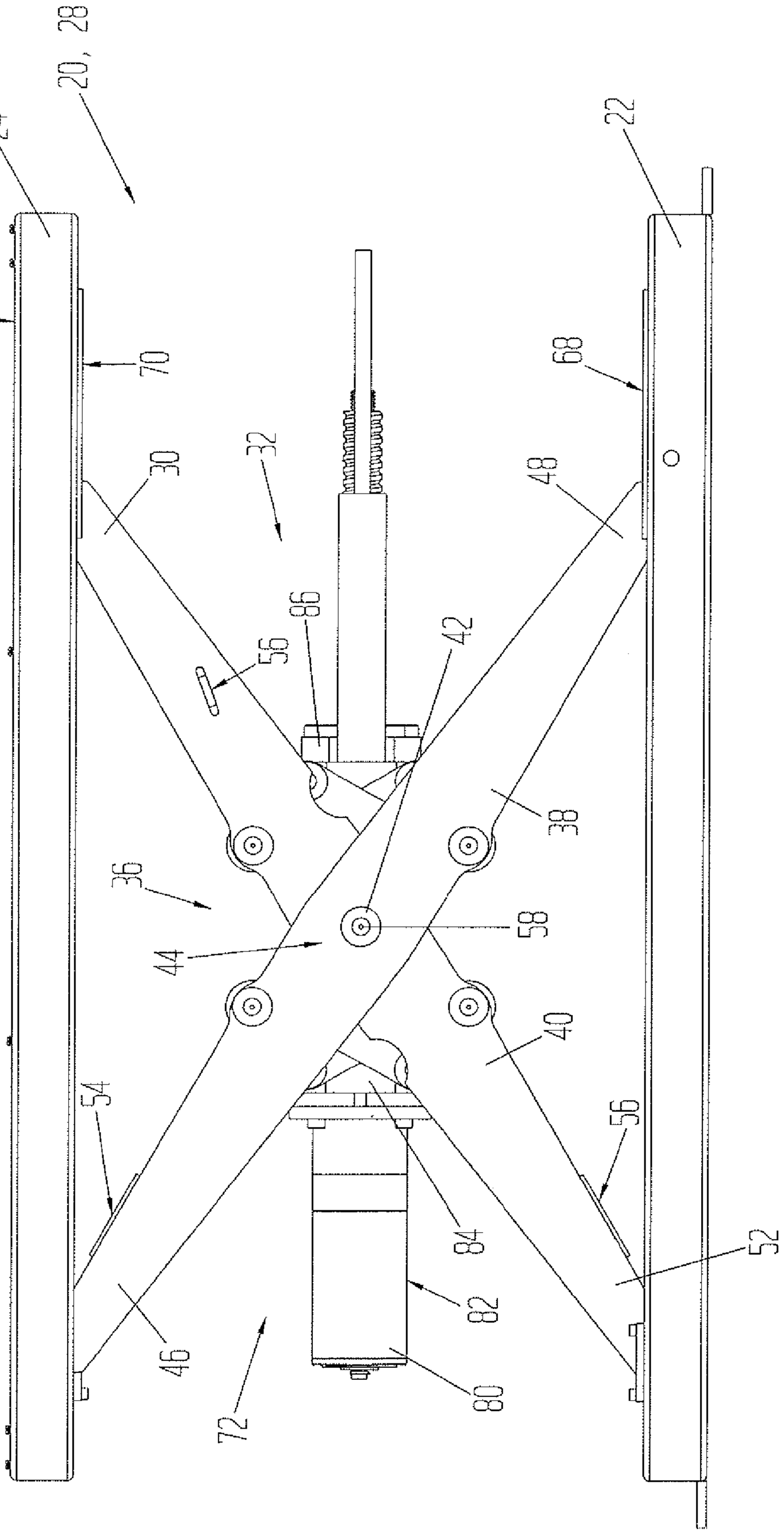
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FIG. 3

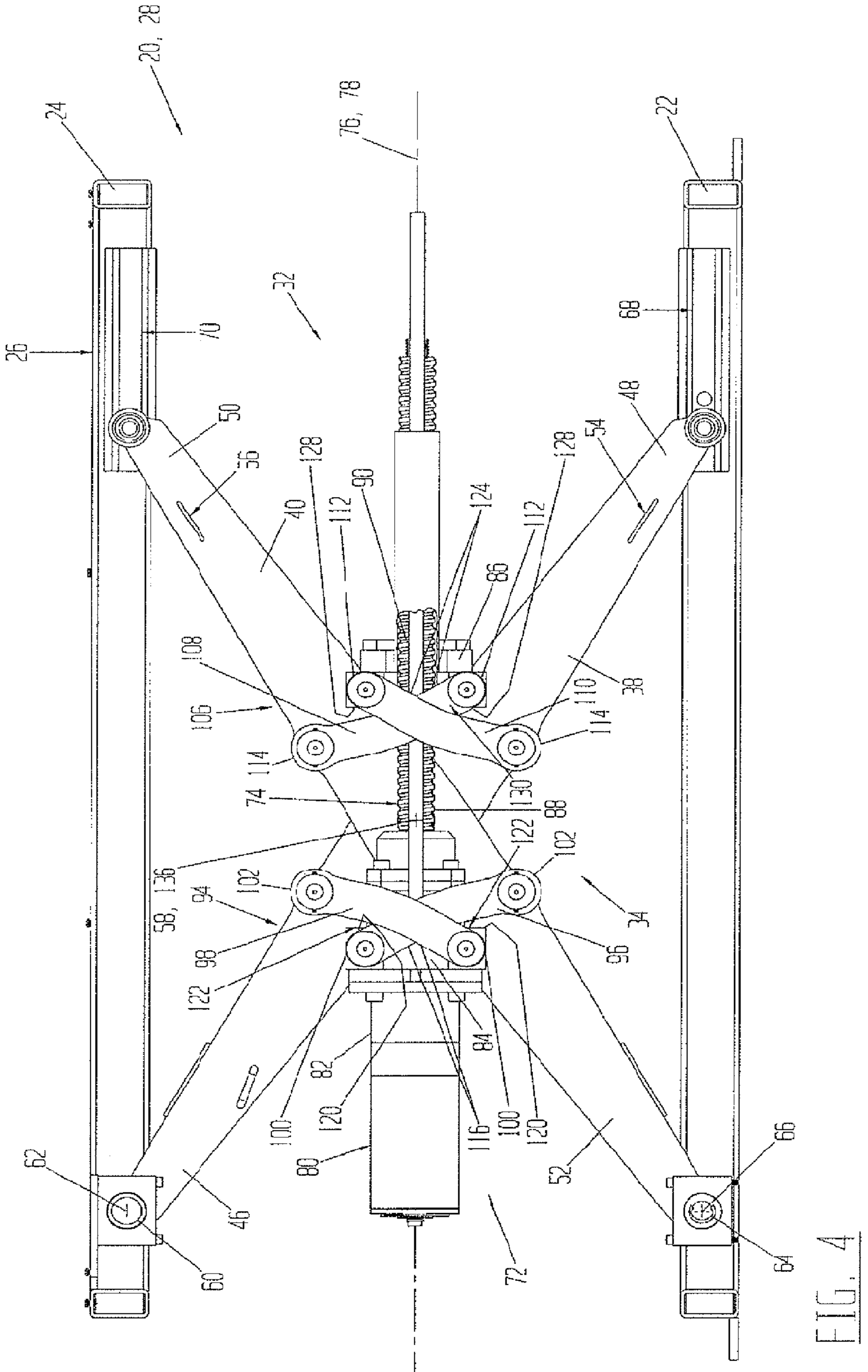
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FIG. 4

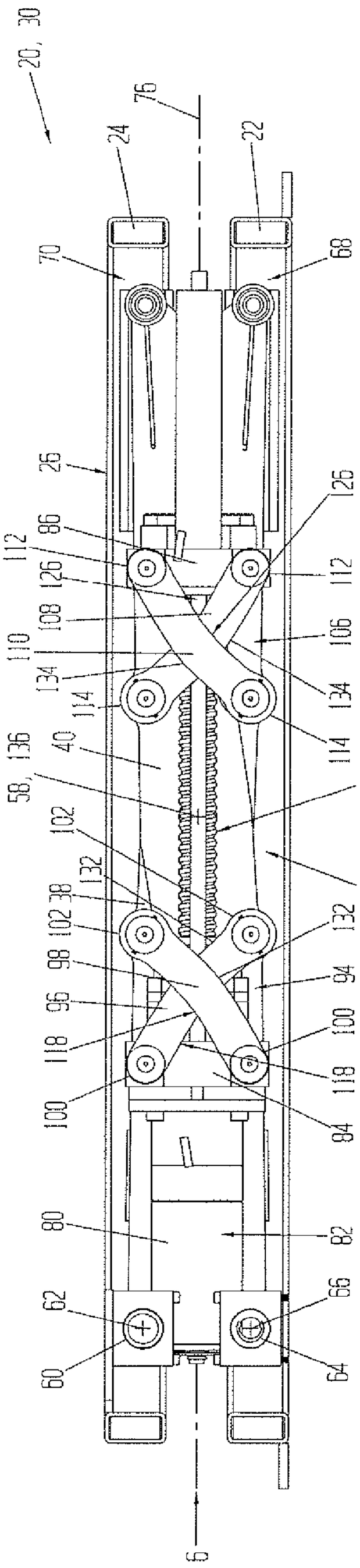
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FIG. 5

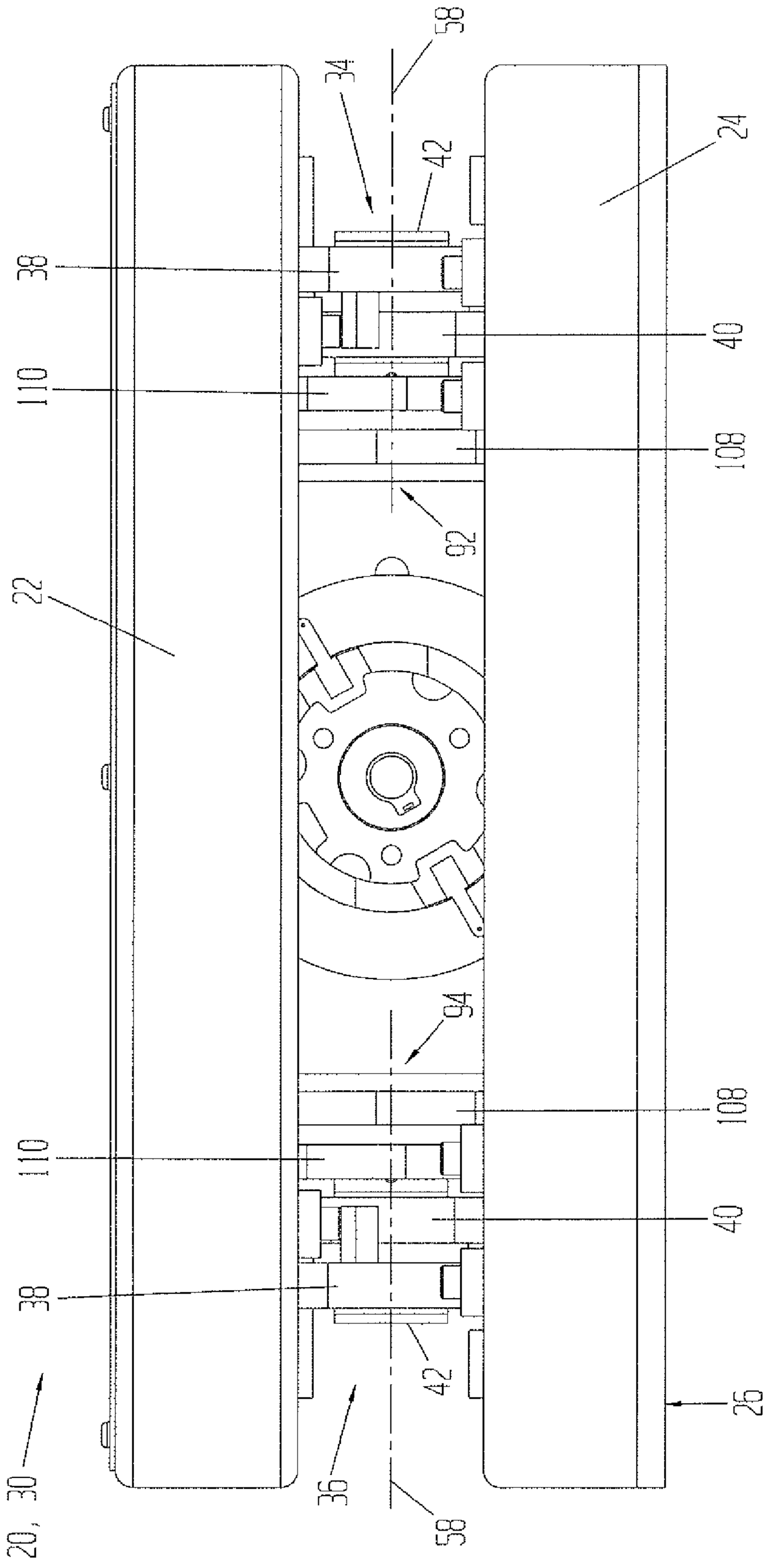

FIG. 6

SCISSOR LIFT ASSEMBLY

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

Scissor-type lift assemblies are well known for moving its platform, which supports items or people, between two vertically differing locations as it moves between a lowered or contracted state and an elevated or extended state. It is known to drive such lift assemblies with screw-drive mechanisms. These prior lift assemblies, however, can be problematic in that they may 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 scissor-type life 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 positions, to place it on the platform. Thus, it would be preferably to minimize the height of the platform in its fully contracted or lowered state.

A scissor-type lift assembly that addresses this problem, and is configured to minimize the height of its load-supporting platform surface in its contracted or lowered state, is desirable.

SUMMARY OF THE INVENTION

The present invention provides a scissors-type lift assembly including a base and a platform, the lift assembly having extended and contracted states, with the platform at a relatively greater distance from the base in the extended state than in the contracted state. The lift assembly further includes a pair of scissor arms each having opposed first and second ends and pivotably connected to each other about a central axis located between their respective first and second ends. The first end of each scissor arm is coupled to the base, and the second end of each scissor arm is coupled to the platform. The lift assembly also has a drive screw mechanism that includes a shaft, a drive motor rotatably coupled to the shaft, a block threadedly engaged with the shaft, and a collar relative to which the shaft is rotatable. The block has longitudinal movement relative to the shaft urged by rotation of the shaft, and the collar is longitudinally fixed relative to the shaft. The lift assembly further includes first and second pairs of links, each link having opposed first and second ends between which extends an edge of link that faces away from the central axis and defines a recess in the link. The collar and the block are each spaced from the central axis and indirectly coupled to both of the pair of scissor arms through a pair of links, the links of each of the first and second pairs of links crossed between their respective first and second ends.

The configurations of the links through which the collar and block are connected to the scissor arms allows the scissor arms to fold relatively flatter in the lift assembly lowered or contracted state without substantial sacrifice of platform height in the elevated state. Any portion of the drive screw mechanism that would otherwise interfere with these links, were they instead straight, is provided with clearance that allows continued motion of the scissor arms.

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, and wherein:

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

FIG. **2** is a top view of the lift assembly shown in FIG. **1** in an elevated state;

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

FIG. **4** is a partially fragmented, sectional side view of the lift assembly shown in FIG. **2** along line **4**,**5**-**4**,**5** thereof, in an elevated state showing the orientation of the first and second pairs of links;

FIG. **5** is a sectional side view of the lift assembly shown in FIG. **2** along line **4**,**5**-**4**,**5** thereof, in a lowered state showing the orientation of the first and second pairs of links; and

FIG. **6** is an enlarged end view of the lift assembly shown in FIG. **5** in a lowered state.

While the invention is susceptible to various modifications and alternative forms, a specific embodiment thereof is 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 form 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 to FIGS. **1**-**5**, there is shown a first embodiment of a 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 **26**. Base **22** and platform **24** may be made of steel. Lift assembly **20** has an extended or elevated state **28** in which the platform and base are distant from each other, and a contracted or lowered state **30** in which the lift assembly base and platform are proximal

to each other. FIGS. **1-4** show lift assembly **20** in elevated state **28**, and FIGS. **5** and **6** show lift assembly **20** in lowered state **30**.

Disposed between and operatively connected to base **22** and platform **24** is scissor arm assembly **32** which includes first pair of crossed scissor arms **34** and second pair of crossed scissor arms **36**. Each pair of crossed scissor arms **34**, **36** respectively includes an elongate first arm **38** and an elongate second arm **40**, which are pivotably connected to each other via a bolted connection **42** at a middle region **44** between their opposite ends. Each first arm **38** has an upper end **46** and an opposite lower end **48**, and each second arm **40** has an upper end **50** and a lower end **52**. The pairs of crossed scissor arms **34**, **36** are substantially identical, but minor images of each other, with their first arms **38** laterally inboard of their second arms **40**.

Extending laterally between and rigidly fixed to the two first arms **38** are first braces **54**, and extending laterally between and rigidly fixed to the two second arms **40** are second braces **56**. Arms **38**, **40** and braces **54**, **56** may be made of steel. Upper ends **46** and **50** of the respective first arms **38** and second arms **40** engage platform **24**, and lower ends **48** and **52** of the respective first arms **38** and second arms **40** engage base **22**. The pivotable connections **42** of each of the first and second pairs of crossed scissor arms **34**, **36** define laterally-extending pivot axis or central axis **58** of scissor arm assembly.

At its upper end **46**, each first arm **38** has a bolted connection **60** to platform **24** which defines pivot axis **62**, and at its lower end **52** each second arm **40** has a bolted connection **64** to base **22**, which defines pivot axis **66**. Base **22** includes substantially horizontally extending guide tracks **68** along which the lower ends **48** of the first arms **38** slidably travel, and platform **24** includes substantially horizontally extending guide tracks **70** along which the upper ends **50** of the second arms **40** slidably travel.

Disposed laterally between its first **34** and second **36** pairs of crossed scissor arms **38**, **40**, lift assembly **20** further includes a drive screw mechanism **72** that includes a reversibly rotatable shaft **74** having a longitudinal axis **76** that extends in a direction substantially perpendicular to pivot axis **58** of scissor arm assembly **32**, with axes **58** and **76** defining a substantially horizontal imaginary plane **78** that remains located between imaginary horizontal planes containing base **22** and platform **24** at all lift assembly positions between its extended and contracted states **28**, **30**.

Drive screw mechanism **72** includes a reversible drive motor **80**, such as a stepper or servo motor, to which shaft **74** is rotatably coupled. Drive screw mechanism **72** includes a housing **82** defining a collar **84** to which motor **80** is fixed, with shaft **74** being rotatable relative to collar **84**, but longitudinally fixed relative to collar **84**.

Drive screw mechanism further includes a shaft-receiving block **86** through which shaft **74** extends, with shaft **74** and block **86** operatively engaged such that relative rotation therebetween induces relative longitudinal movement therebetween along axis **76**. As shown, shaft **74** and block **86** may each be respectively provided with helical screw threads **88**, **90** that are directly interengaged with each other to transform their relative rotation into their relative longitudinal movement. Alternatively, shaft **74** and block **86** may form a ballscrew device (not shown) of a type well-known in the art, with each of the shaft **74** and the block **86** provided with corresponding helical ball grooves (not shown) that form a channel through which in which a plurality of balls (not shown) move, the shaft **74** and block **86** being threadedly engaged with each other through the balls and grooves. Relative to axis **76**, the balls of such a ballscrew are captured within the axial length of block **86**, with block **86** adapted to provide a channel extending between the axial ends of its grooved portion to return the balls from one end of the block's helical groove to the other. Regardless of the type of screw providing threaded engagement between shaft **74** and block **86**, the screw pitch is selected to prevent the shaft **74** from being backdriven. That is to say, lift assembly **20** maintains its established when shaft **74** is not being driven by motor **80**, regardless of the load exerted on shaft **74** by block **86**.

Lift assembly **20** further includes, relative to the first **34** and second **36** pairs of crossed scissor arms **38**, **40**, a first pair of collar links **92** and a second pair of collar links **94**, respectively. In other words, the first pair of collar links **92** is associated with first pair of crossed scissor arms **34**, and the second pair of collar links **94** is associated with second pair of crossed scissor arms **36**. The two pairs of collar links **92**, **94** are identical to each other and located on opposite lateral sides of shaft longitudinal axis **76**. Each of the first **92** and second **94** pairs of collar links includes a curved first collar link **96** and a curved second collar link **98**, the first **96** and second **98** collar links of each pair of collar links **92**, **94** elongate and crossed. Further, the first **96** and second **98** collar links of each pair of collar links **92**, **94** are substantially identical, but mirror images of each other relative to shaft longitudinal axis **76**.

Relative to each pair of collar links **92**, **94**, each collar link **96**, **98** has a first end **100** and an opposite second end **102**, with collar link first ends **100** pivotably attached to collar **84**. Relative to each pair of collar links **92**, **94**, the pivotal connection between collar **84** and the first end **100** of each first collar link **96** is above and vertically aligned with the pivotal connection between collar **84** and the first end **100** of each second collar link **98**. Relative to each pair of collar links **92**, **94**, each collar link second end **102** is pivotably attached to one of a first and second scissor arm **38**, **40**. Relative to each pair **34**, **36** of crossed scissor arms **38**, **40**, the pivotal connection between its second scissor arm **40** and the second end **102** of the first collar link **96**, is below and vertically aligned with the pivotal connection between its first scissor arm **38** and the second end **102** of the second collar link **98**.

Lift assembly **20** further includes, relative to the first **34** and second **36** pairs of crossed scissor arms **38**, **40**, a first pair of block links **104** and a second pair of block links **106**, respectively. In other words, the first pair of block links **104** is associated with first pair of crossed scissor arms **34**, and the second pair of block links **106** is associated with the second pair of crossed scissor arms **36**. The two pairs of block links **104**, **106** are identical to each other and located on opposite lateral sides of shaft longitudinal axis **76**. Each of the first **104** and second **106** pairs of block links includes a curved first block link **108** and a curved second block link **110**, the first **108** and second **110** block links of each pair of block links **104**, **106** elongate and crossed. Further, the first **108** and second **110** block links of each pair of block links **104**, **106** are substantially identical, but mirror images of each other relative to shaft longitudinal axis **76**.

Relative to each pair of block links **104**, **106**, each block link **108**, **110** has a first end **112** and an opposite second end **114**, with block link first ends **112** pivotably attached to block **86**. Relative to each pair of block links **104**, **106**, the pivotal connection between block **86** and the first end **112** of each first block link **108** is below and vertically aligned with the pivotal connection between block **86** and the first end **112** of each second block link **110**. Relative to each pair of block links **104**, **106**, each block link second end **114** is pivotably attached to one of a first and second scissor arm **38**, **40**.

Relative to each pair **34**, **36** of crossed scissor arms **38**, **40**, the pivotal connection between its second scissor arm **40** and the second end **114** of the first block link **108**, is above and vertically aligned with the pivotal connection between its first scissor arm **38** and the second end **114** of the second block link **110**.

The collar **84** and the block **86** are each spaced from the central pivot axis **58** along shaft longitudinal axis **76**. Collar **84** is indirectly coupled to the first **34** and second **36** pairs of scissor arms **38**, **40** through the first **92** and second **94** pairs of collar links **96**, **98**, the collar links **96**, **98** crossed between their first **100** and second **102** ends. Block **86** is similarly indirectly coupled to the first **34** and second **36** pairs of scissor arms **38**, **40** through the first **104** and second **106** pairs of block links **108**, **110**, the block links **108**, **110** crossed between their first **112** and second **114** ends.

Between the opposed first **100** and second **102** ends of each collar link **96**, **98** extends an edge **116** that faces away from pivot axis **58**, edge **116** defining a recess **118** in its respective collar link **96**, **98**. A portion **120** of collar **84** that would otherwise interfere with the movement of a collar link **96**, **98** were edge **116** instead straight, is now provided with clearance **122** when portion **120** and that collar link are in closest proximity throughout the entire range between the lift assembly extended **28** and contracted **30** states, which is the depicted embodiment occurs in extended state **28**. Similarly, Between the opposed first **112** and second **114** ends of each block link **108**, **110** extends an edge **124** that faces away from pivot axis **58**, edge **124** defining a recess **126** in its respective block link **108**, **110**. A portion **128** of block **86** that would otherwise interfere with the movement of a block link **108**, **110** were edge **124** instead straight, is now provided with clearance **130** when portion **128** and that block link are in closest proximity throughout the entire range between the lift assembly extended **28** and contracted **30** states.

In all positions of lift assembly **20** in and between its extended **28** and contracted **30** states, edge **116**, **124** of each respective link **96**, **98**, **108**, **110**, extends away from pivot axis **58** from that link's second end **102**, **114** to its first end **100**, **112**. Edges **116**, **124** may be curved or arcuate as shown, or may be formed of straight segments, either configuration of an edge **116**, **124** defining the recess **118**, **126** that provides the resulting clearance **122**, **130**. The opposed edge **132**, **134** of each collar or block link extending between its first **100**, **112** and second **102**, **114** ends, that faces toward pivot axis **58** may complement the recess-defining edge **116**, **124**, the two opposed edges **116**, **124**, **132**, **134** defining each respective link **96**, **98**, **108**, **110** as a substantially curved member, as shown.

Shaft longitudinal axis **76** defines opposite longitudinally outward directions originating at the point **136** therealong where it crosses the central pivot axis **58**. Respective to each link **96**, **98**, **108**, **110**, its first end **100**, **112** pivotal connection to collar **84** or block **86** is further longitudinally outward than its second end **102**, **114** pivotal connection to a first **38** or second **40** scissor arm in both the extended state **28** and in the contracted state **30**.

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 lift assembly comprising:

a base;

a platform, said lift assembly having extended and contracted states, said platform at a greater distance from said base in said extended state than in said contracted state;

a pair of scissor arms each having opposed first and second ends with said scissor arms being pivotably connected to each other about a central axis located between respective first and second ends, said first end of each scissor arm being coupled to said base and said second end of each scissor arm being coupled to said platform;

a drive screw mechanism comprising a shaft defining a longitudinal axis, a drive motor rotatably coupled to said shaft, a block threadedly engaged with said shaft and having longitudinal movement relative to said shaft urged by rotation of said shaft, and a collar relative to which said shaft is rotatable, said collar longitudinally fixed relative to said shaft; and

first and second pairs of links with each link having opposed first and second link ends and an edge extending between said first and second link ends, with said edge facing away from said central axis and defining a recess in said link;

said collar and said block each spaced from said central axis and indirectly coupled to both of said scissor arms through said first and second pairs of links, each of said links of said first and second pairs of links being crossed between said first and second link ends, and each link of said first pair of links is pivotably attached to said collar at said first link end and pivotably attached to one of said scissor arms at said second link end, and each link of said second pair of links is pivotably attached to said block at said first link end and pivotably attached to one of said scissor arms at said second link end.

2. The lift assembly of claim **1**, wherein said edge is arcuate in shape.

3. The lift assembly of claim **2**, wherein each link is curved between said first and second link ends.

4. The lift assembly of claim **1**, wherein with said lift assembly in said extended state, said edge extends away from said central axis from said second link end to said first link end.

5. The lift assembly of claim **4**, wherein with said lift assembly in said contracted state, said edge extends away from said central axis from said second link end to said first link end.

6. The lift assembly of claim **1**, wherein said longitudinal axis is substantially perpendicular to said central axis, said longitudinal axis defining opposite longitudinally outward directions originating at a point therealong where said longitudinal axis crosses said central axis, wherein said first link end of each link of said first pair of links and said first link end of each link of said second pair of links form a first pivotal connection and said second link end of each link of said first pair of links and said second link end of each link of said

second pair of links form a second pivotal connection, and wherein, respective to each said link, said first pivotal connection being further longitudinally outward than said second pivotal connection in said contracted state.

7. The lift assembly of claim **6**, wherein said first pivotal connection is further longitudinally outward than said second pivotal connection in said extended state.

8. The lift assembly of claim **1**, wherein said motor is fixed to said collar.

9. The lift assembly of claim **1**, wherein with said lift assembly in said contracted state, said edge extends away from said central axis from said second link end to said first link end.

10. The lift assembly of claim **1**, wherein a portion of said drive screw mechanism is disposed between and spaced from said first and second pairs of links, and said portion of said drive screw mechanism is further disposed between said first and second link ends in said extended state.

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