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Coad et al.

[11] **3,785,462**

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[54] **SCISSOR LIFT AND DRIVE MECHANISM THEREFOR**

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[52] **U.S. Cl.** **187/18**, 254/122, 254/148

[51] **Int. Cl.** **B66f 3/22**

[58] **Field of Search** 187/18; 254/148, 254/122

[56] **References Cited**

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[57] **ABSTRACT**

A scissor lift having upper and lower platforms and actuated by a cable reeved so as to pull at least one set of the ends of the scissor together at its extended position and also reeved about a cam roller interposed between the arms and working toward the pivot connection during the portion of the motion in which the lift begins to extend.

3 Claims, 7 Drawing Figures

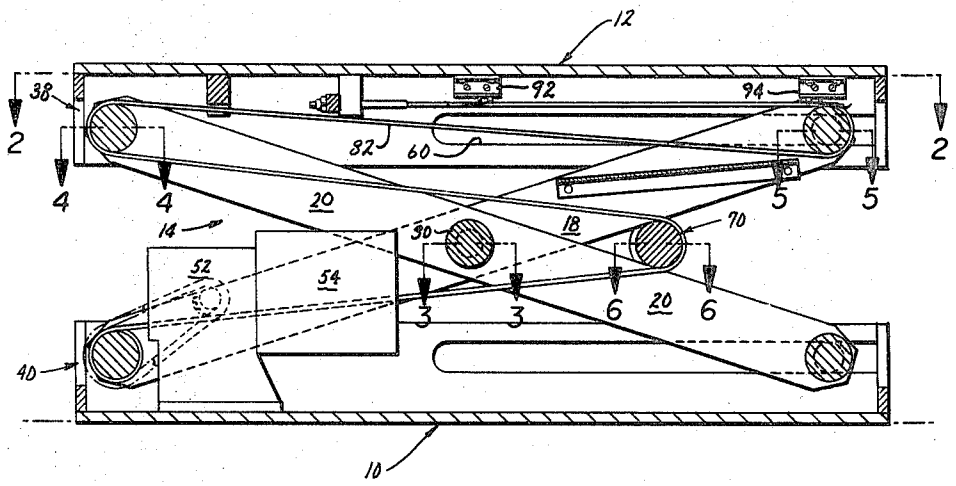

Fig. 2

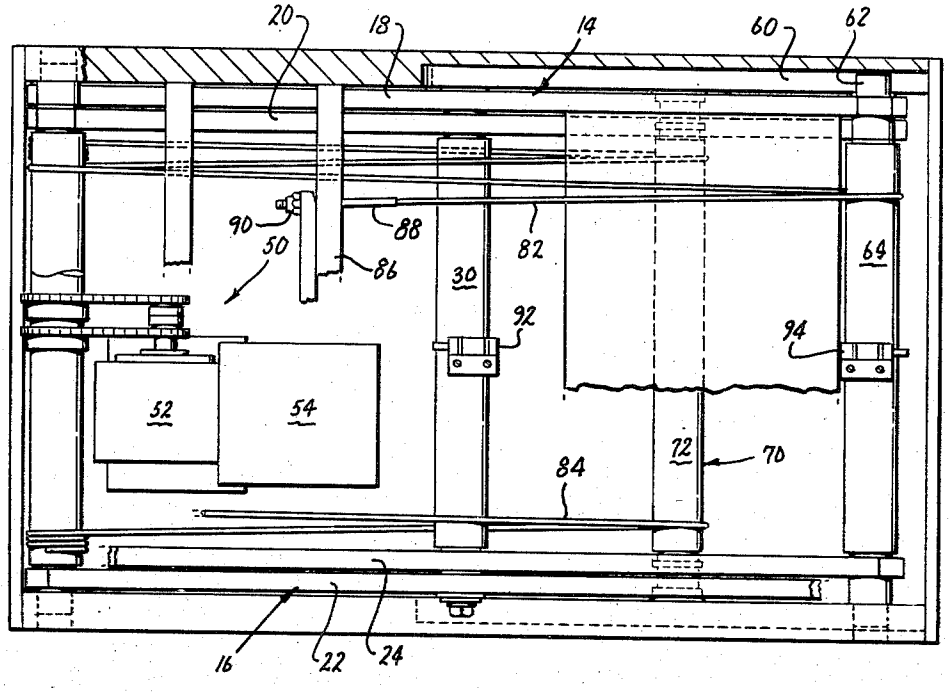
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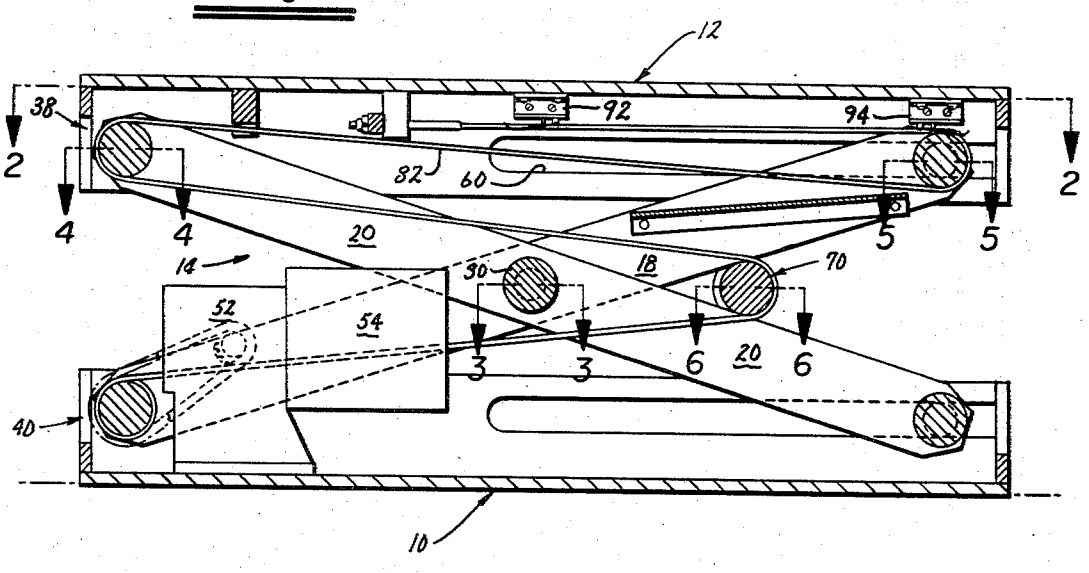
Fig. 1


12
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82
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Fig. 4

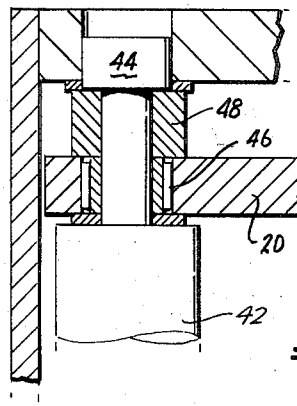


Fig. 3

Fig. 6

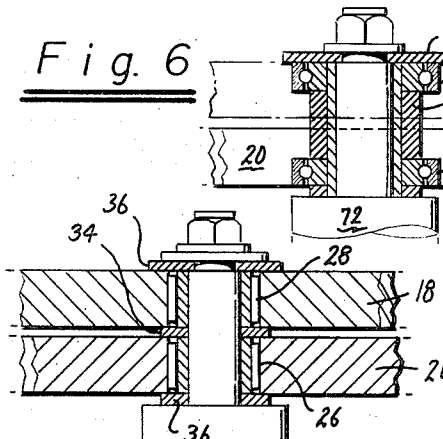
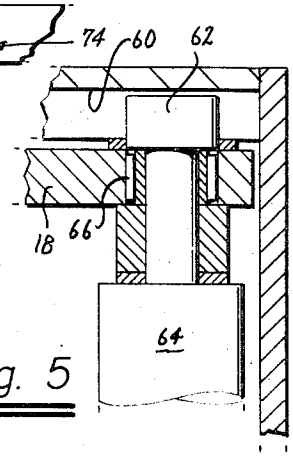


Fig. 5



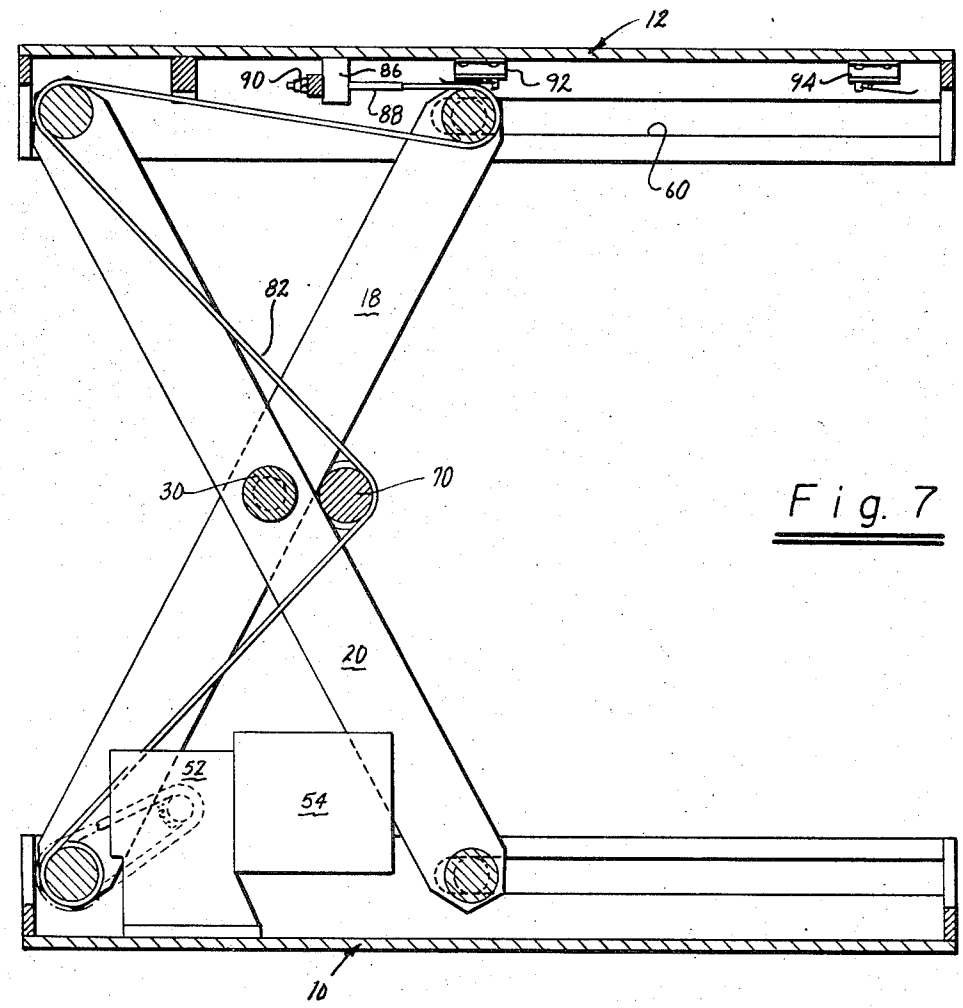


Fig. 7

SCISSOR LIFT AND DRIVE MECHANISM THEREFOR

BACKGROUND OF THE INVENTION

This invention relates to a novel scissor lift and drive mechanism therefor and more particularly to improved arrangement for actuating the same.

Heretofore, such mechanisms have found use for adjustably elevating various heavy structures. Such uses include various jacking operations, such as auto jacks, platform and container lifts and the like. Inherent in the motion cycle of the scissor lift or lazy tong mechanism, is difficulty of applying a single actuating drive to any single moveable part thereof without having, at one limit of travel of that part, an approach sufficiently close to a dead center and consequent low mechanical advantage that the required actuating force becomes unacceptably high. This causes high stress in the apparatus and requires a drive mechanism capable of power delivery sufficiently high to overcome the low mechanical advantage, resulting in higher than desirable power and structure requirements as well as increased costs. In addition, conventional lift drive mechanisms are so constructed as to add to the load carried by the device and it is therefore necessary to employ heavier structural elements to withstand the additional load from the drive mechanism itself. There is therefore, a need for a new and improved scissor lift and drive mechanism therefor.

SUMMARY OF THE INVENTION AND OBJECTS

In general, it is the object of the present invention to provide an improved scissor lift mechanism and drive therefor which will overcome the above limitations and disadvantages.

Another object of the invention is to provide a scissor lift and drive of the above character having a combination of driving elements which together provide for a substantially constant and compensated mechanical advantage between the full limits of travel of the lift so that the variable and torque requirements of prior art devices are eliminated.

Another object is to provide a scissor lift and drive mechanism therefor of the above character which reduces the structural load stress of the scissor mechanism itself.

Another object of the invention is to provide a scissor lift and drive mechanism of the above character which is noncritical in alignment and which remains substantially self-aligning after assembly.

In general, the foregoing objects are achieved by providing a scissor lift mechanism having a base platform and elevatable platform interconnected by sets of spaced pairs of scissor arms pivoted intermediately their ends and pivotally connected to each platform such that movement of the respective platforms is accomplished by collapse of the scissor arms about their pivots, one side of the ends of the scissor arms being connected for sliding motion along each of the platforms to accomodate the opening of the scissors while maintaining the platforms in spaced parallel positions. A combination cable and roller cam drive characterized by a substantially constant mechanical advantage is employed for raising and lowering the platforms with respect to each other. The cable is driven by a winch roller mounted on one of the platforms and reeved to pass over roller pulleys connected to each of the ends

of scissor arms at one platform. The roller cam is positioned to drive the closed sides of the scissor arms apart by working toward the pivot interconnecting each of the scissor arms with decreasing mechanical advantage during the first portion of the lifting cycle while the roller pulleys are pulled together with increasing mechanical advantage during the last portion of the lifting cycle, the combination serving to provide a substantially constant mechanical advantage during the lift and therefore a substantially constant load to the winch.

These and other features and objects of the invention will become apparent from the following description and claims when taken in conjunction with the following drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view partly in cross section of the scissor lift and drive mechanism constructed in accordance with the present invention and shows the same in a partially raised position.

FIG. 2 is a top plan view partly in cross section and partly broken away taken along the lines 2—2 of FIG. 1.

FIG. 3 is a cross-section view taken along the lines 3—3 of FIG. 1.

FIG. 4 is a cross-sectional view taken along the lines 4—4 of FIG. 1.

FIG. 5 is a cross-sectional view taken along the lines 5—5 of FIG. 1.

FIG. 6 is a cross-sectional view taken along the lines 6—6 of FIG. 1.

FIG. 7 is an elevation view similar to that of FIG. 1 showing the scissor lift mechanism of the present invention in a raised position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 1 through 6, there is shown preferred embodiment of the scissor lift mechanism and drive therefor of the present invention which generally includes the first and second platforms 10, 12 which it is desired to maintain in spaced parallel planes and to separate or lift the upper platform 12 with respect to the lower. Means are provided for forming first and second sets 14, 16 of scissor arms 18, 20, 22, 24 interconnected on opposite sides of each of the platforms. As will be evident from reference to FIG. 2 each of the scissor arms and associated cable and pulley assemblies which will be hereinafter described are substantially identical and therefore the description herein will be given with reference to a single scissor arm 14 and associated drive therefor, the description being sufficient to clearly pertain to each of the sets of scissor arms. FIG. 3 shows a detail view of the pivot connection between the arms of each set, which includes first and second bearings 26,28 mounted on each end of a spacing shaft 30 together with washers 32, 34, 36 interposed between the arms and the shaft to provide adequate clearance.

One side of each pair of scissor arm pairs is connected to a fixed pivot to the respective platform as indicated 38, and 40. FIG. 4 shows the upper one of the connections as an example of the construction and preferrably incudes a roller pulley 42 journaled in a bearing 44 and supporting the respective arm 22 on a second bearing 46 that both the associated arm and the roller are free to rotate, the roller also serving together

with spacer block **48** as a structural spacer for that pair of arm ends.

As shown in FIG. **2** the lower connection is illustrated and includes a double gear chain drive **50** connected through a worm gear transmission **52** to an electric motor **54** to provide sufficient reduction and adequate torque to permit use of common small electric motor having a rotary shaft output. The worm gear drive also serves as an automatic braking function since it cannot be backdriven. Together, the motor, worm gearing, chain drive and roller make up a cable winch drive to which the drive cables of the lift mechanism of the present invention are attached.

Each of the other ends of the scissor arms is slidably connected to the respective platform for reciprocating motion thereon as shown in FIG. **5.** Thus, a slot **60** is provided in each side of the upper platform **12** for accepting a sliding block or bearing **62** into which a roller pulley **64** is mounted on suitable bearings. Other bearings **66** provide a connection to a respective end of the associated scissor arm. The lower scissor arm is similarly connected so that the upper platform is free to be elevated, the scissor mechanism serving to maintain the platforms parallel interconnected for motion towards and away from each other, the associated change in spacing of the respective upper arms and lower arms being accomodated by movement by sliding blocks in the respective slots.

Referring now particularly to FIGS. **1** and **6,** means is provided for forming a cam roller **70** for wedging one side of the collapsed scissor arms apart during the initial portion of the lift cycle and consists of a roller pulley **72** having a pair of roller bearings **74, 76** mounted at each end thereof. Each pair of roller bearings **74, 76** are spaced apart by a space block **78** such that each outer bearing **76** bears upwardly upon the outer one of the respective arms while the inner bearing **74** bears downwardly upon the inner ones of the respective arms. Oversized washers **80** are mounted on the outside of the end bearings to maintain lateral positioning of the cam roller by riding along the outside of the outer arms. Since the cam roller is supported in each of the four bearings **74, 76** it is also free for rotation itself and serves thereby as a moveable roller pulley as will be described.

A flexible cable drive is provided and includes a pair of suitable stretch-free wire cables **82, 84** attached to the winch roller and reeved first around the cam roller in a sense such as to cause the cam roller to work towards or away from the pivot connection **30** of the scissor arms. From there each cable is reeved back around the roller pulley **42** above the winch which serves as a turning block. The cable is then reeved around moveable roller pulley **64** and then set to a dead eye such as a member **86** mounted to the upper platform and through which the cable end terminates in a threaded swaged connection **88** adapted for adjustable tensioning by a pair of lock nuts **90.**

Limit switches **92** and **94** are provided at each end of the desired travel of pulley **64** in the slots and are adapted to be contacted by the roller as the same reaches the limit of travel in either direction to open the circuit to motor **54** and cause the mechanism to stop.

The operation of the lift and drive of the present invention is best seen from reference to FIGS. **1** and **7.** As shown in FIG. **1** in the first portion of the cycle the cable works primarily to drive cam roller **70** toward the scissor pivot of each of the rollers, wedging the scissor arms upwardly. Since the amount of upward motion is small compared to movement of the cam roller, the mechanical advantage is large. As the roller nears the pivot, however, its rate of movement and mechanical advantage is reduced. During its motion, the cam roller also serves as a one of two moving blocks in a block and tackle formed by itself and moveable roller pulley **64,** as well as a turning block, the later being its primary function as it approaches the scissor pivot. As best illustrated in FIG. **7** in the later part of the cycle the upper moveable roller operates as a single part block and tackle with additional mechanical advantage due to reduction of the increment of lift movement as the same nears its upper limit of travel.

In summary, the cam roller urges the platform upward with large mechanical advantage due to the wedge action in the first part of the cycle and a gradual transition occurs when the cam roller and moveable pulley operate as a double block and tackle together with wedges or inclined plane action both of the cam roller and of the sliding block to which the moveable pulley is mounted. Finally, the action of the cam roller diminishes and the mechanical advantage residing in the single moveable block and the sliding wedge or inclining action of the movable pulley.

To those skilled in the art to which the present invention pertains it will be apparent that many modifications and changes of the present structure will fall within the general scope of the present invention by way of example, both the movable platform and winch drive may be located on the same platform and aside from being connected to the element with which they are designed to move none of the pulleys need be coincident with the shafts on which they are shown as located in the foregoing description.

In the present embodiment the location of the pulleys was deemed expedient as a matter of design rather than necessity. In addition it will be apparent that the roller cam may be arranged for operation such that it travels together with the one part block and tackle or pulley system or it may be arranged to operate in opposition thereto without departing from the spirit and scope of the present invention. Thus such reversals of parts and changes in layout are to be taken as within the scope of the teachings of the present invention and claims.

We claim:

1. A scissor lift and drive mechanism comprising means forming first and second platforms, means forming first and second pivotally interconnected pairs of scissor arms having first ends pivotally mounted in spaced parallel planes on said first platform, said last named means including means interconnecting at least one first end of each of said scissor arms for sliding movement toward the other first end to thereby close the gap therebetween and to extend the second ends of said arms away from the first ends and from said first platform to provide thereby a lifting action, said second platform being mounted on the second ends of said arms to be lifted thereby and including means mounting at least one of said second ends of said arms for sliding motion on said platforms to and from the other second end to accomodate closing of the second ends thereof as the same are activated into extended position, a cam roller interposed between the first and second ends of each of said scissor arms on one side

thereof and having means thereon for permitting sliding motion along said arms toward the extremeties thereof when the same are lowered and toward the pivotal connection therebetween as the same are raised, first pulley means disposed on said first platform approximate to said other first end, second pulley means disposed on the second platform at a position approximate said other second end, said roller cam being disposed on that side of said scissor lift mechanism away from said first and second pulley means, third pulley means connected to said one second end, means for driving one of said first or third pulleys, cable means connected to said driven pulley and reeved about said cam roller and said second pulley means and thence about said third or first pulley means, respectively, and means connecting the end of said cable to the first or second platform, respectively.

2. A scissor lift and drive mechanism comprising means forming first and second platforms, means forming first and second pivotally interconnected pairs of scissor arms having first ends pivotally mounted in spaced parallel planes on said first platform, said last named means including means interconnecting at least one first end of each of said scissor arms for sliding movement toward the other first end to thereby close the gap therebetween and to extend the second ends of said arms away from the first ends and from said first platform to provide thereby a lifting action, said second platform being mounted on the second ends of said arms to be lifted thereby and including means mounting at least one of said second ends of said arms for sliding motion on said platform to and from the other second end to accomodate closing of the second ends thereof as the same are activated into extended position, a cam roller interposed between the first and second ends of each of said scissor arms on one side thereof and having means thereon for permitting sliding motion along said arms toward the extremeties thereof when the same are lowered and toward the pivotal connection therebetween as the same are raised, movable pulley means attached to at least one of the second ends of said scissors arms, cable means having a fixed end attached to the first or second platform and a running end reeved about said cam roller and said movable pulley means so as to cause each of the same to work inwardly toward the pivotal connection of said arms as the same is actuated, and means on the second or first platform, respectively, to apply a tension force along the length of said cable means for actuating said arms.

3. A scissor lift as in claim 2 wherein said cam roller is arranged to operate in the same direction as said moveable pulley.

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