This invention relates to extendible lift mechanism for elevating a load. More particularly, this invention relates to such mechanism including an opposed pair of scissor mechanisms, each of which includes a pair of scissor arms pivotally connected together, where relative pivotal movement of the arms accompanies extension of the lift mechanism.

Such lift mechanisms, commonly known as “scissor lifts,” are widely used in material-handling applications. In material handling, there are many instances where a load must be shifted to different elevations, and a scissor lift provides a convenient and relatively inexpensive means for performing this operation.

A general object of this invention is to provide improved scissor-lift mechanisms, which is relatively simply constructed, but which nevertheless performs its lifting function in an entirely practical and satisfactory manner.

In the usual scissor lift, scissor arms interconnect a base frame and the platform or other means that carries the load, and these arms define a path of movement for the platform. Upward movement of the platform is produced by actuation of some power-operated means, such as an extendible ram. A more specific object of this invention is to provide an improved lift mechanism, featuring novel structure incorporating an extendible means, such as a ram, in the mechanism, whereby a relatively large amount of upward extension is possible with a relatively short ram.

A further object is to provide scissor-lift mechanism, operated by extendible means, such as a ram, which is relatively free of complicated linkage systems, but still capable of high extension with a short stroke ram.

According to this invention, an opposed pair of scissor mechanisms, or means, are provided, on opposite sides of the lift mechanism, each comprising a pair of scissor arms pivoted together. A torsion member, more specifically a torque tube, interconnects inner arms in the scissor mechanism adjacent where these inner arms are pivoted to outer arms in the scissor mechanisms. Extendible rams are connected at one set of ends to upwardly extending torque arms connected to the torsion member, and at their other set of ends to a brace bar joining together ends of the outer arms of the scissor mechanisms.

The scissor arms, and the rams, with the lift mechanism lowered, occupy positions only slightly inclined from horizontal. To produce upward extension of the lift, the rams are extended, with such being operable to twist the torsion member. This in turn, imparts a corresponding twist to the inner arms of the two scissor mechanisms, causing these arms to shift angularly relative to the outer arms.

By including the torque tube or torsion member between the inner arms, a balanced lifting force is imparted on opposite sides of the lift mechanism. Upward extension of the lift is the result of twisting the inner arms relative to the outer arms, rather than a direct lifting action. In this way, a relatively large amount of angular movement in the scissor mechanisms is possible. The structure is fully compacted when the lift mechanism is in its lowered position. The means producing upward extension is devoid of cams, linkages, and similar mechanisms, which in the usual scissor lift often cause breakdown problems.

Thus, a more specific object of the invention is to provide a scissor lift, including an opposed pair of scissor mechanisms, where upward extension of the lift is performed by an extendible ram occupying a substantially horizontal position with the lift mechanism in a lowered state, which is effective to twist inner scissor arms in the scissor mechanisms to produce a lifting action.

A further specific object is to provide such a scissor-lift mechanism, where a ram or rams comprise means producing extension of the lift, and this means is interconnected with inner scissor arms of an opposed pair of scissor mechanisms through upwardly extending torque arms joined to a torque tube that interconnects said inner arms.

These and other objects and advantages are attained by the invention, and the same is described hereinbelow in conjunction with the accompanying drawings, wherein:

FIG. 1 is a top plan view of a scissor lift constructed according to one embodiment of this invention, showing the lift in its lowered position;

FIG. 2 is a side elevation of the scissor lift in FIG. 1, showing in solid outline the lift in its lowered position, and showing in dashed outline the lift in its raised or extended position; and

FIG. 3 is a cross sectional view, on a slightly enlarged scale, taken along the line 3—3 in FIG. 2.

Referring now to the drawings, and describing the scissor lift or lift mechanism illustrated, first of all in general terms, the lift comprises a platform or work-supporting means 10, and beneath the platform a base frame 12. Interposed between the base frame and platform 10 are a pair of opposed scissor mechanisms or means 14, 16. In FIG. 2, the scissor lift as shown in solid lines is lowered, and in this condition of the lift, scissor means 14, 16 support the platform 10 at an elevation close to base frame 12. The scissor lift is shown extended in dashed outline in FIG. 2, and in this condition of the lift the scissor means are operable to support the platform a considerable height above the base frame.

Base frame 12 may take any of a number of different forms. In the embodiment of the invention contemplated, the base frame comprises a pair of brackets 18, adjacent one end of the lift mechanism. These brackets normally rest on the floor. Elongated flat plates 20 may also be included, adjacent the other end of the lift mechanism, these plates also normally resting on the floor. The plates and brackets may be anchored, as by securing them to the floor.

Scissor mechanisms 14, 16 are similar in construction. Each comprises an inner arm, indicated for the two scissor mechanisms at 14a and 16a, and an outer arm, indicated for the two scissor mechanisms at 14b and 16b. The two arms of each scissor mechanism are provided, intermediate their ends, with a bushing 22. Bushing 22 for the two scissor mechanisms are mounted on the ends of a common shaft 23. Thus the arms of the two scissor mechanisms are pivotally interconnected, and are relatively pivotable about a common horizontal axis extending transversely of the arms.

With the scissor lift contracted, or in its lowered position, the two arms of each scissor mechanism are only slightly inclined from a horizontal position, as best illustrated by arms 14a and 14b in FIG. 2. The outer arm in each scissor mechanism, as shown in FIG. 2, has a left end only slightly more than its right end, and the inner arm in each scissor mechanism has a left end, as shown in FIG. 2, only slightly higher than its right end.

The outer scissor arms are pivotally connected, through their lowermost or left ends in FIG. 2, by pivot connections 24, to brackets 18. The uppermost or right ends of these outer arms have rollers 26 journaled thereon. These rollers ride on the underside of platform means 10.
during extension of the scissor lift, as will later be described in more detail. The right or lowermost ends of the inner scissor arms have rollers 28 journalled therein. The rollers ride to and fro on plate 20 during extension and contraction of the lift mechanism. The left or uppermost ends of these inner scissor arms are pivotally connected to platform means 10 by pivot connections 30.

Platform or work-supporting means 10 may comprise, as shown, a skeletal frame including longitudinals 32, transverse end members 34, and transverse brace members 36. All are suitably joined together, to form an integral structure. Each longitudinal 32 has the cross section indicated in FIG. 3, and includes flanges 38, 39 defining a groove extending along the underside thereof. Rollers 26 already mentioned in connection with the outer scissor arms are guided for movement longitudinally along platform means 10 by the flanges defining such grooves. To limit the play afforded rollers 26, bars 40 may be secured to flanges 38, as best seen in FIG. 3.

According to this invention, extension and contraction of the scissor lift is produced by twisting a torsion member extending between and interconnecting the inner arms of the two scissor mechanisms, at a point adjacent where these arms are interpivoted. Thus, the drawings in a torque rod, in the form of a hollow tube 42 is indicated, which is suitably joined at each of its ends to inner arms 14a, 16a. As will be noted in FIG. 2, the center of the torque tube is vertically aligned with, and slightly above, the pivot axis afforded by the bushings and shaft 23. The tube parallels shaft 23, and the periphery of the tube surrounds the shaft.

Joined to the torque tube, directly adjacent each inner scissor arm, and extending upwardly therefrom, and to the left in FIG. 2, are a pair of torque arms 44, 46. With the lift lowered, or in its contracted position, the arms do not project upwardly so far as to project above the top of platform means 10. Thus the arms are always clear of any load supported on the platform means.

Extending between and connected to the lowermost or left ends of outer arms 14b, 16b is a brace bar 48. This bar is used to mount one end of a set of extensible rams or jacks shown at 50, 51. Thus, pivot means 52 and lugs 53 provide a pivot connection between the cylinder ends of these rams and the brace bar. The rod ends of these arms are pivotally connected, as at 54, to the ends of torque arms 44, 46.

With the scissor lift contracted, brace bar 48 is directly adjacent brackets 18 of frame 12. This places the cylinder end of the rams or jacks close to the floor. The rams or jacks are almost horizontal, as best shown in FIG. 2. The rams or jacks are effective, upon their being extended, to twist the torque tube, by reason of their connection to the torque tube through arms 44, 46, with such in turn serving to twist the inner scissor arms relative to the outer scissor arms.

Torque is a turning movement, and the torque applied to the inner scissor arms upon the rams extending is the product of the force generated by the rams times the perpendicular distance of the rod ends of the rams from the pivot axis for the scissor arms. It will be noted that by having the center of the torque tube slightly above the pivot axis for the scissor arms, sufficient rigidity of the structure is achieved in the tube, clearance is retained, and the applied torque applied to the inner arms is increased above that which would be possible were the torque tube to be directly centered on the pivot axis for the arms.

In a fully extended position, the parts in the lift mechanism assume the position shown in dashed outline in FIG. 2. It will be noted that in the organization, since one end of the rams are mounted on bar 48, and this bar rises with pivotal movement of the outer scissor arms, the rods for the rams are assured clearance with respect to the torque tube. Further, the rams throughout have a position relative to the torque tube where they can exert maximum leverage on the torque tube. To further explain, it will be observed that were the rams to have cylinder ends that did not move, with the lift mechanism extended, the perpendicular distance of the rams (more specifically their rods) from the torque tube would be markedly less.

It will be apparent from this description, that the lift mechanism of the invention is relatively simply constructed. Rams having a relatively short stroke produce high extension in the lift mechanism. The structure is devoid of complicated linkages and cam arrangements. While an embodiment of the invention has been described, it is obvious that changes and variations are possible without departing from the invention. It is desired to cover all modifications and variations that would be apparent to one skilled in the art, and that come within the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. In extensible scissor-lift mechanism including a base frame and work-supporting means disposed over said base frame, scissor means operatively interposed between said base frame and supporting means comprising a pair of relative crosswise crossing scissor arms, and pivot means interconnecting the scissor arms intermediate their ends, for relative movement of the arms about a pivot axis for the arms, a torque rod connected to one of said scissor arms adjacent said pivot means with the axis thereof extending parallel to said pivot axis, said torque rod having a circumferential surface extending about said pivot axis, a torque arm connected to said torque rod extending laterally of the rod, an elongated extensible-contractable ram, and means connecting one end of said ram to said torque arm, said ram and torque arm being positioned relative to said torque rod whereby upon actuation of the ram said ram is twisted in a direction coinciding with the direction said one arm moves relative to the other upon extension of the scissor-lift mechanism.  

2. In scissor-lift mechanism which is extensible from a lowered position to a raised position and which includes a base frame and work-supporting means disposed over said base frame, scissor means operatively interposed between said base frame and supporting means comprising a pair of relatively moveable crossed scissor arms, and pivot means interconnecting the scissor arms intermediate their ends, for relative pivotal movement of the arms about a substantially horizontal pivot axis, one of said arms, viewing the scissor mechanism from one side, pivoting in a clockwise direction upon extension of said scissor-lift mechanism, a torque rod connected to said one of said arms adjacent said pivot means with the axis thereof extending parallel to said pivot axis, said torque rod having a circumferential surface extending about said pivot axis, a torque arm connected to said torque rod extending laterally of the rod and upwardly from said pivot axis, and an elongated extensible-contractable ram anchored at one end to an end of said one arm and connected at its other end to said torque arm, said ram occupying a substantially horizontal position with the lift mechanism in its lowered position and from its point of connection with the torque arm, viewing the scissor mechanism from said one side, extending to the left of said torque arm, said ram, viewing the mechanism from said one side,
producing clockwise torque in said torque rod upon extension of the ram.

3. In extensible scissor lift mechanism which is extensible from a lowered to a raised position, and which includes a base frame, and elevatable work-supporting means disposed over said base frame, an opposed pair of scissor means operatively interposed between the base frame and work-supporting means, each of said scissor means comprising a pair of crossed scissor arms, and pivot means interconnecting the scissor arms intermediate their ends for relative pivotal movement about a substantially horizontal axis, a pair of scissor means having inner scissor arms which are parallel to each other, and outer scissor arms which are parallel to each other, and said inner and outer arms being approximately horizontal with the scissor-lift mechanism contracted, an elongated torque rod interconnecting said inner scissor arms and extending between the arms in a direction substantially paralleling the pivot axis for the various arms, a torque arm connected to said torque rod extending laterally and upwardly from the torque rod, a brace bar extending between the outer scissor arms interconnecting one set of ends thereof, and an elongated extensible-contractable ram for producing extension of the scissor-lift mechanism, said ram occupying a substantially horizontal position with the scissor-lift mechanism in its lowered position, said ram being pivotally connected at one end to said brace bar, and at its other end to said torque arm.

4. In extensible scissor-lift mechanism including a base frame and work-supporting means disposed over said base frame, an opposed pair of scissor means operatively interposed between said base frame and supporting means comprising a pair of relatively movable crossed scissor arms and pivot means interconnecting the scissor arms intermediate their ends for relative movement of the arms about a pivot axis for the arms, a torsion member connected to one of said scissor arms adjacent said pivot means with the axis thereof extending in the same direction as said pivot axis, a torque arm connected to said torsion member extending laterally of the torsion member and upwardly from said pivot axis, a brace member mounted on and extending laterally from one end of the other of said scissor arms movable with said other arm on movement of the arm, and an elongated extensible-retractable ram for producing extension of the scissor-lift mechanism, said ram being pivotally connected at one end to said bracing member whereby its said one end moves with the bracing member and having its other end pivotally connected to said torque arm.

6. In scissor-lift mechanism which is extensible from a lowered position to a raised position and which includes a base frame and work-supporting means disposed over said base frame, an opposed pair of scissor means operatively interposed between said base frame and supporting means, each of said scissor means comprising a pair of crossed and relatively movable scissor arms and pivot means interconnecting the scissor arms intermediate their ends for relative pivotal movement about a pivot axis for the arms, the inner scissor arms of said pair of scissor means being disposed parallel to each other, a torque rod connected at one end to one of said inner scissor arms and at its other end to the other of said inner scissor arms with the axis of said rod extending parallel to said pivot axis, said torque rod having a circumferential surface extending about said pivot axis, at least one torque arm connected to said torque rod extending laterally of the rod, at least one elongated extensible-contractable ram and means connecting one end of said ram to said torque arm, said ram and torque arm being positioned relative to said torque rod whereby, upon actuation of the ram, said rod is twisted in a direction coinciding with the direction said inner arms move relative to the outer arms upon extension of the scissor-lift mechanism.

5. In extensible scissor-lift mechanism which is extensible from a lowered to a raised position and which includes a base frame and elevatable work-supporting means disposed over said base frame, scissor means operatively interposed between said base frame and supporting means comprising a pair of relatively movable crossed scissor arms and pivot means interconnecting the scissor arms intermediate their ends for relative movement of the arms about a pivot axis for the arms, a torsion member connected to one of said scissor arms adjacent said pivot means with the axis thereof extending in the same direction as said pivot axis, a torque arm connected to said torsion member extending laterally of the torsion member and upwardly from said pivot axis, a brace member mounted on and extending laterally from one end of the other of said scissor arms movable with said other arm on movement of the arm, and an elongated extensible-retractable ram for producing extension of the scissor-lift mechanism, said ram being pivotally connected at one end to said bracing member whereby its said one end moves with the bracing member and having its other end pivotally connected to said torque arm.

References Cited by the Examiner

UNITED STATES PATENTS

2,471,901 5/1949 Ross ---------- 254--122 X
2,883,079 4/1959 Binns -------------- 214--512

WILLIAM FELDMAN, Primary Examiner.

O. M. SIMPSON, Assistant Examiner.