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[54] **FLYING FORK-TYPE LIFTING MEMBER**

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[51] **Int. Cl.** **B66c 1/22**

[58] **Field of Search**. 294/63 R, 67 R, 67 A, 67 AA, 294/67 AB, 78 R, 81 R; 212/59 R, 71; 214/730, 731; 244/136

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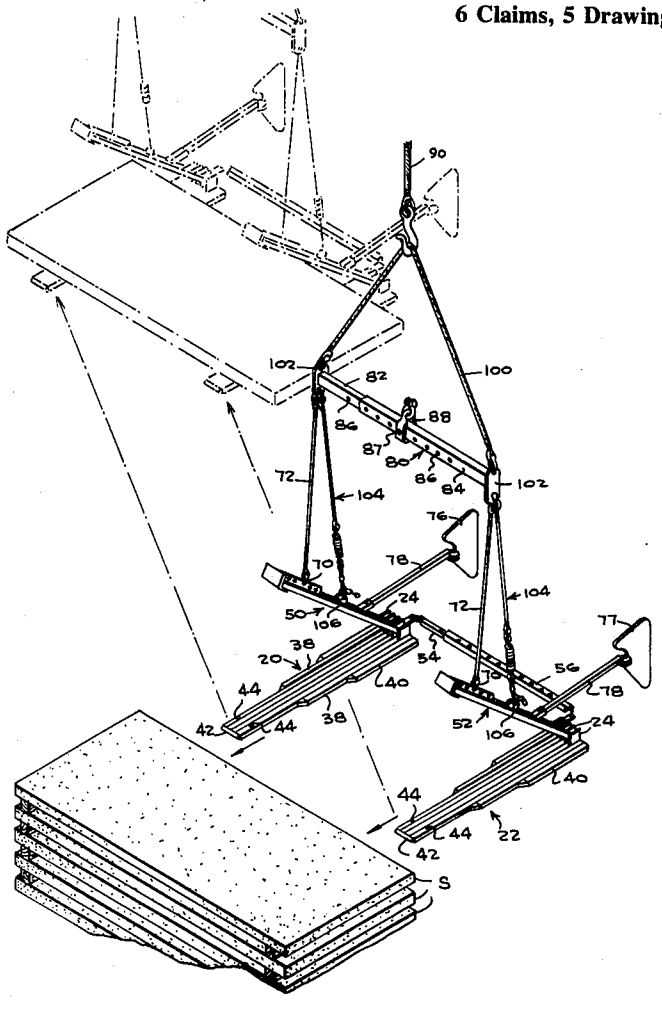
[57] **ABSTRACT**

A fork-type lifting means to be supported by a crane for lifting building components or the like is disclosed including a pair of horizontal parallel elongated load support arms each supportingly connected on one end to an upwardly inclined lifting arm with the lifting arms being supported by a transverse spacer lift bar from which heavy-load slings extend downwardly and are connected to the outer ends of the lift arms and from which light-load slings are connected to the lift arms at a point closer to the connection of the lift arms to the load support arms. The geometry of the device is such that the heavy-load slings support the device at approximately the center of gravity of the lifting means and a work load while the light-load slings support the device through its approximate geometric center of gravity when there is no load on the device. Another aspect resides in the employment of adjustable air foil means operable to rotate the device to face in a desired direction in accordance with the direction and force of any wind in which the device is being used.

6 Claims, 5 Drawing Figures



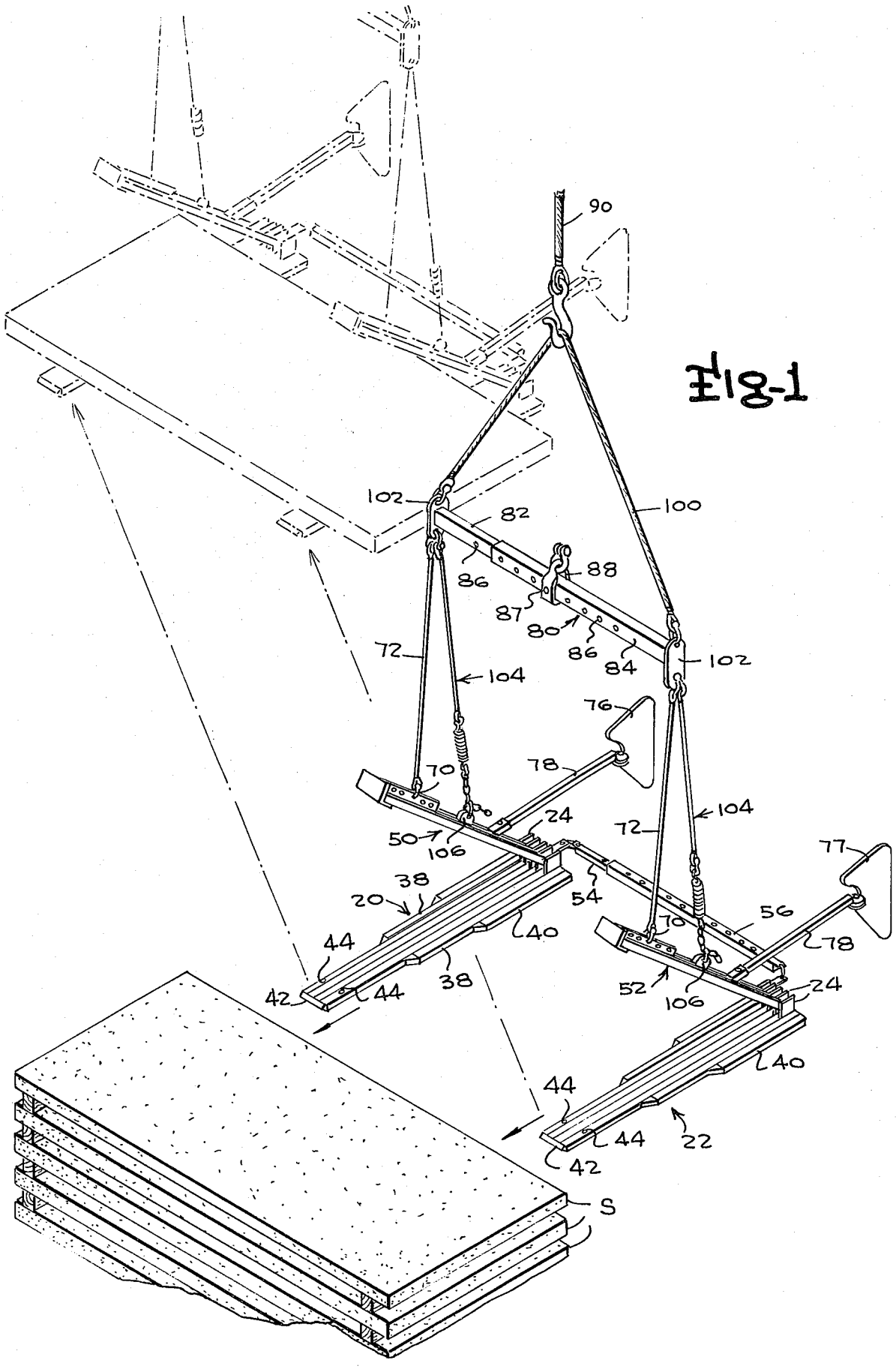

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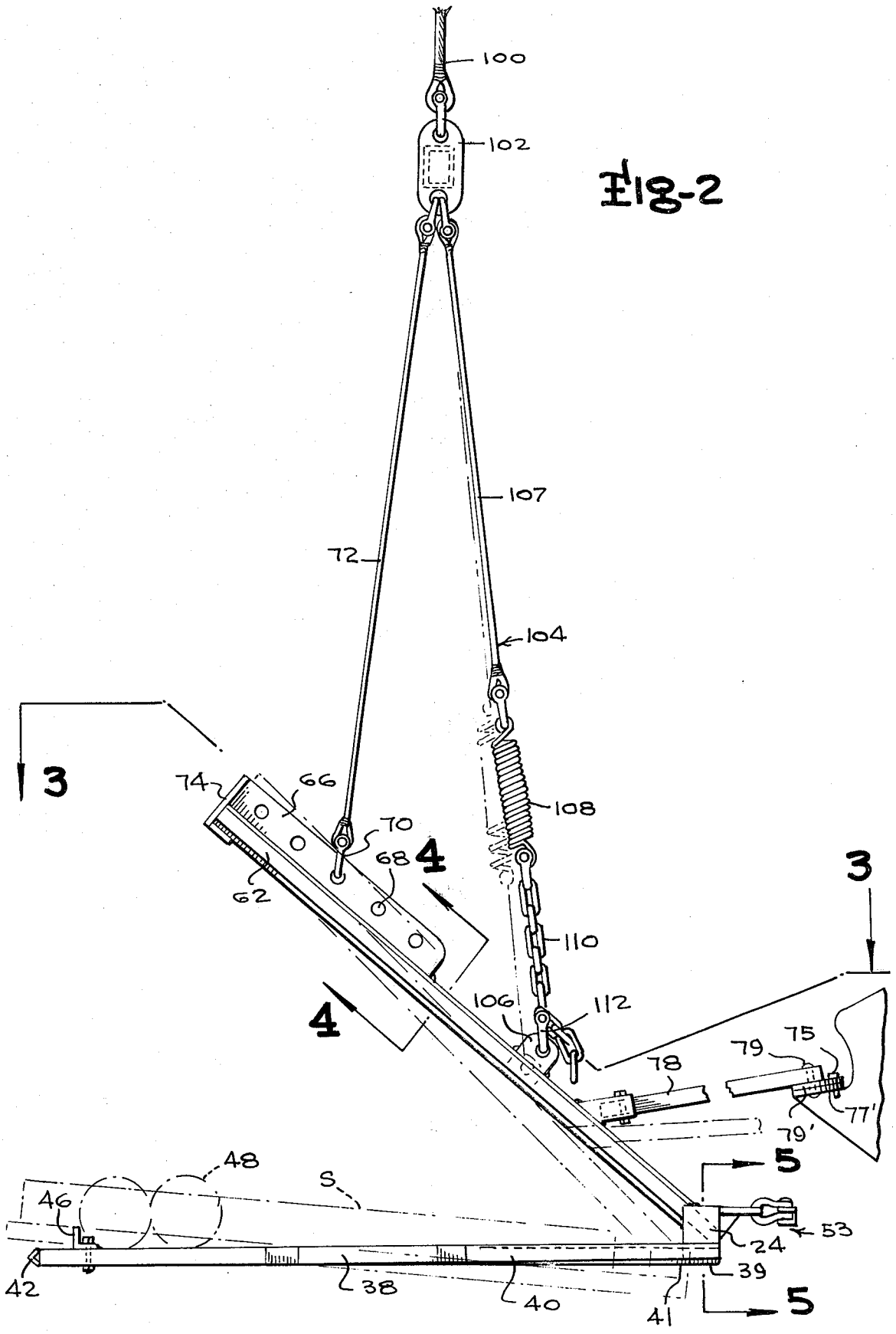
Fig-1

Fig-2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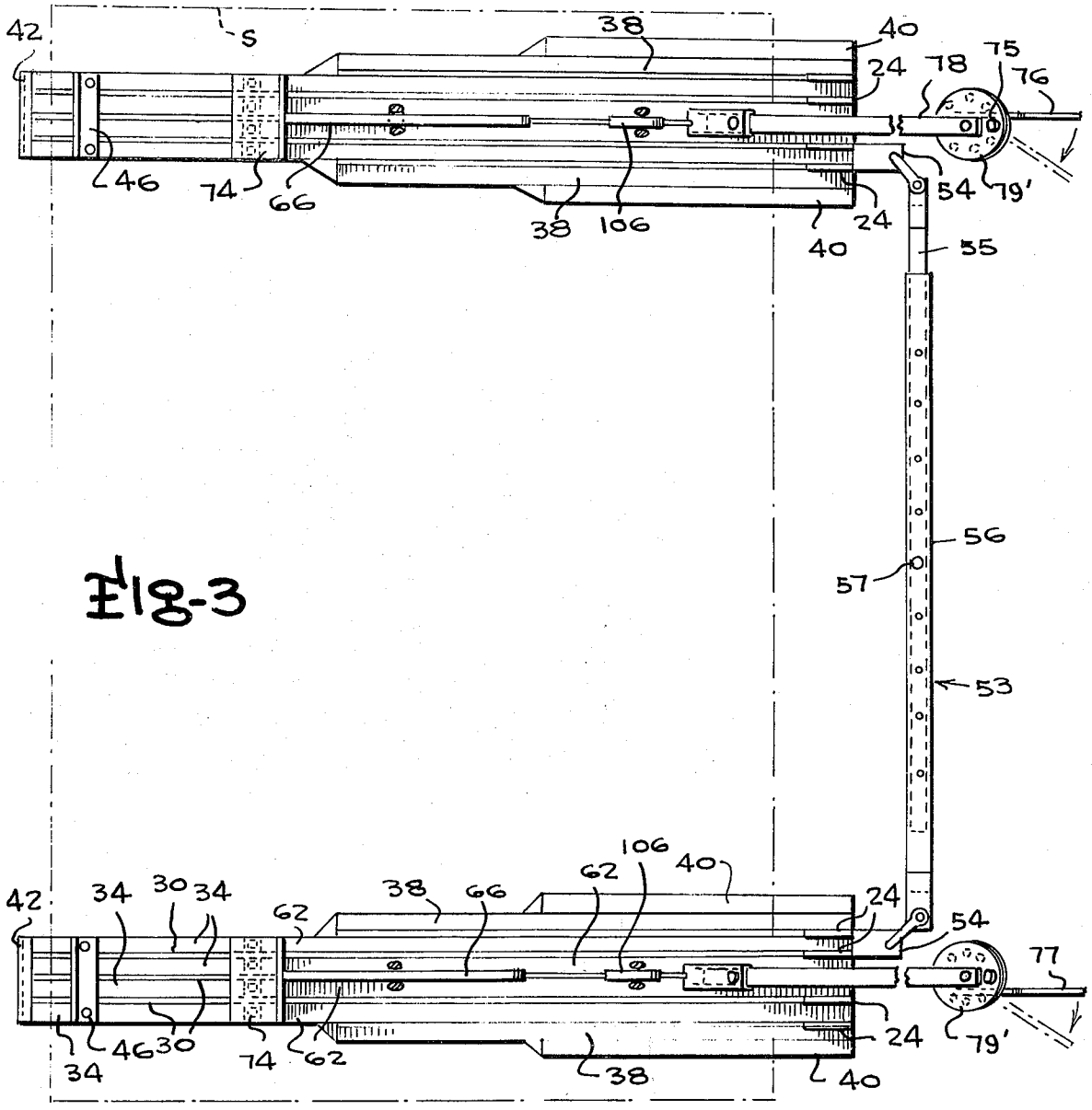

Fig-3

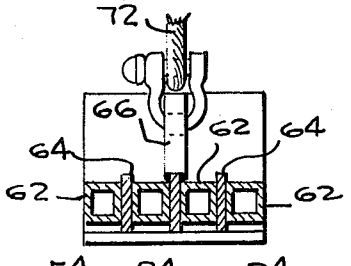

Fig-4

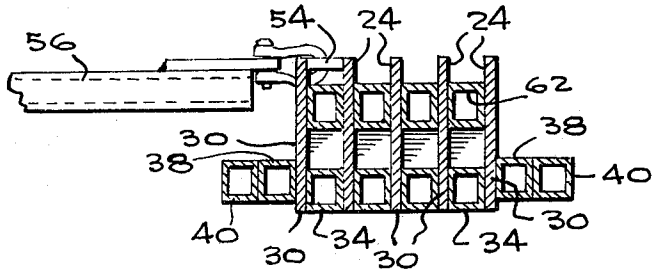

Fig-5

FLYING FORK-TYPE LIFTING MEMBER

This invention is in the field of hoisting equipment and is specifically directed to the field of hoisting means of particular use in the lifting and positioning of slabs and other building components in the construction of buildings or the like.

Modern construction techniques frequently employ a crane hook and associated work engaging and supporting means for the lifting of prefabricated slabs which can either be external wall elements, internal wall elements, floor elements or other building parts to high levels. It is necessary to detach the slab or other load lifted from its supporting means carried by the crane hoist either prior to or following connection of the slab to the building per se and it is consequently necessary that such devices enable an accurate positioning of the load.

The necessity for accurately positioning the load is of particular criticality in the positioning of floor slabs or the like for attachment to the building while being supported by the support means. It is also essential that the load remain extremely stable during a fastening operation to the building frame or the like both for obtaining a satisfactory connection of the fastened means and for the safety of the riggers performing the fastening function.

Another problem with some of the prior art lifting devices is that they are extremely heavy and consequently cumbersome and frequently difficult to use. Moreover, such heavy lifting devices frequently lessen the maximum weight of materials that can be carried by the crane with which the devices are associated since all cranes have a total lifting capacity.

Many widely different devices have evolved for the purpose of enabling the lifting and handling of slabs or similar building components. For example, supporting loops, frames, slings, clamps, harnesses, hooks and various other devices have been employed with varying degrees of success. Frequently, the prior known devices have suffered from a lack of versatility in that they cannot be used for lifting loads having substantially different weights or different types of loads. Some of the prior devices are easily imbalanced by gravity and/or wind forces so as to orient the load in a manner making it difficult or impossible to connect the load to the building portion to which it is to be attached or to properly unload the load without damage if it is to be merely deposited at a work area. The shifting of the center of gravity of some lifting devices when used in conjunction with pipe or heavy loads also sometimes results in an accidental hazardous dumping of the load.

Not only is an accidental dumping of the load hazardous to those in the vicinity, complete destruction of the accidentally dropped load as well as whatever it falls on frequently occurs with the cost of such damage being extremely high.

While other slings, clamps, and hooks have been devised for satisfactorily lifting loads, many of these require substantial manipulation during the fastening and unfastening of the lifting components by highly paid riggers.

Other known lifting devices require the employment of loops or eyes fitted in the load and which are removed following the lifting operation. The holes necessarily made in the lifted member in which such loops or eyes are mounted normally serve no useful purpose following positioning of the lifted member and can be an eyesore requiring time consuming and costly filling or covering after the lifting operation is completed.

Other prior crane suspended fork-type lifting devices have employed parallel arms inserted under slabs or the like for enabling a lifting of the slabs. Unfortunately, many of the prior devices of this type have a center of gravity spaced a substantial distance from the center of gravity of the combined device and load. Consequently, if the slabs are supported in a horizontal manner during a lifting operation, as is the most usual case, the lifting arms do not remain in a horizontal orientation following unloading of the slab. Consequently, it is difficult to maneuver the empty lifting means for movement beneath a subsequent slab to be lifted.

Therefore, there has been a substantial need for a fork-type lifting member capable of maintaining its work lifting arms in horizontal orientation both when loaded and when unloaded.

For these reasons, it is the primary object of this invention to provide a new and improved lifting means for lifting and positioning structural elements.

Yet another object of the invention is the provision of new and improved fork-type lifting means having work lifting arms which remain in generally horizontal orientation when the device is supported in an unloaded condition or in a loaded condition.

Still another object of the subject invention is the provision of new and improved fork-type lifting means capable of compensating for wind forces to which the device is subjected at a particular building site.

Yet another object of the invention is the provision of new and improved lifting means which requires a minimum of labor for operation and which eliminates the need for slings, special connectors, hooks, eyes or the like for supporting the lifted means.

The manner in which the foregoing objects are achieved by the preferred embodiment of the invention will be better understood when the following detailed description is considered in conjunction with the appended drawings in which:

FIG. 1 is a perspective view of the preferred embodiment for practice of the invention;

FIG. 2 is a side elevation view of the preferred embodiment;

FIG. 3 is a sectional view taken along lines 3—3 of FIG. 2;

FIG. 4 is a sectional view taken along lines 4—4 of FIG. 3; and

FIG. 5 is a sectional view taken along lines 5—5 of FIG. 2.

Turning initially to FIG. 1, the preferred embodiment of the invention basically consists of a first generally horizontal load support arm 20 and a second load support arm 22 respectively oriented in parallel aligned relationship with respect to each other. Since the first and second load support arms 20 and 22 are identical in construction, the same designators are employed in describing the components of each arm.

Turning now to FIGS. 3 and 5, each of the load support arms 20 and 22 is formed of three longitudinally extending centrally positioned vertical frame plates 30 with four box frame members 34 being welded between and adjacent the longitudinally extending vertical frame plates 30 as illustrated in FIG. 5 to provide a lightweight high strength structure in an obvious manner. Five bracket plates 24 are welded between the box

frame members 34 on one end of the arms 20 and 22 for enabling the arms to be supported by the bracket plates.

Additionally, wing braces are formed outwardly of the two outside box frame members 34 by two interconnected welded box frame members 38 and 40 as illustrated in FIG. 3. It should be noted that the box frame members 38 are of greater length than the outermost box frame members 40.

Additional strength is imparted to each of the load support arms by virtue of the fact that the wing braces are cambered with respect to the box frame members 34 and the vertical frame plates 30 as provided by the fact that the lower surface 39 of the wing brace at the supported end of the load support arm is spaced a distance above the lower surface 41 of the box frame members 32 as illustrated in FIG. 2. The outer end of each of the load support arms is defined by an inclined angle member 42 which presents a pointed surface easily insertable between elements such as stacked slab components S as illustrated in FIG. 1.

In addition, apertures 44 are provided near the outer ends of the outermost box frame members 34 for permitting the attachment of a load retaining angle plate 46 to the top of the arms 20 and 22 for permitting the lifting of pipe or the like 48 as illustrated in phantom in FIG. 2.

Support for the first and second arms 20 and 22 is provided via bracket plates 24 by a first lift arm 50 and a second lift arm 52 in a manner best illustrated in FIG. 1. The first and second lift arms 50 and 52 are identical in construction and identical numerical designators are consequently employed for the various corresponding parts of each of the lift arms.

Specifically, each of the lift arms 50 and 52 includes four longitudinally extending box frame members 62 unitarily welded with three longitudinal frame plates 64 (FIG. 4). The innermost ends of the box frame member 62 extend between the upwardly extending vertical plates 24 on the supported ends of the load support arms 20 and 22 and are welded thereto so that the lift arms provide support for the load support arms in an obvious manner.

A hanger plate 66 oriented in a vertical plane extends upwardly from the upper surface of the outer end of each of the lift arms and includes a plurality of apertures in which a supporting shackle 70 on the lower end of a heavy-load sling 72 can be positioned. An outer end plate comprising an angle member 74 is welded to the outer end of each of the lift arms as best illustrated in FIG. 2.

A stabilizer frame, generally designated 53, is connected to tabs 54 on the rearmost portions of the load support arms 20 and 22 and comprises first and second telescoping members 55 and 56 held in adjusted position by a pin 57 received in aligned apertures in the telescoping members 55 and 56 in a manner that will be made obvious from inspection of FIG. 3.

Hoisting means for the load support arms and the lifting arms, etc., includes a spacer lift bar 80 formed of telescopically related spacer bar components 82 and 84 which are provided with a plurality of adjustment apertures 86 that are alignable to vary the length of the spacer bar with the adjusted bar being held in position by a slip pin or bolt 87. Additionally, a center shackle bracket 88 is also held in position by the slip pin or bolt 87 to be usable in some instances when light loads are being lifted by a hoist cable and hook assembly 90.

However, the spacer lift bar 80 is normally lifted by means of a spreader cable 100 supported by the crane hook assembly 90 as shown in FIG. 1 and having opposite ends connected by shackles to end plates 102 welded to the ends of the spacer bar components 82 and 84.

The spacer lift bar 80 supports the lift arms 50, 52 and the load support arms 20, 22 by means of previously mentioned heavy load slings 72 which are supported from the end plates 102 and have their lower ends connected by shackles 70 to the hanger plates 66 welded to the upper surface of the outer ends of the lift arms 50 and 52.

Similarly, first and second light-load sling members 104 are also connected to the end plates 102 and extend downwardly for connection to a light-load bracket 106 welded to the upper surface of the lift arms 50 and 52. The light-load slings 104 include an upper relatively inelastic cable portion 107 connected at its lower end to a coil spring 108 which is connected to a chain 110 connected to the bracket 106 by a conventional shackle 112.

First and second airfoil members 76 and 77 of identical construction are mounted on support rods 78 extending from the first and second lift arms 50 and 52 respectively as shown in FIG. 1. Each of the airfoils is mounted for adjustable rotation about a pin 79 on the outer ends of the arms 78 to be held in fixed position by a retaining pin 75 extending through aligned apertures in a fixed disc 79' on the outer ends of arms 78 and a rotatable disc 77' fixed to each airfoil. The adjusted position of the airfoils is determined in accordance with the direction and force of the wind in which the apparatus is to be used. By properly adjusting the orientation of the airfoils about the axis of pivot 79, the wind can serve to rotate the hoisting means, etc., to face in a desired direction so as to eliminate the need for using guide lines. The advantages provided by the airfoils are of particular importance when the apparatus is being used for lifting construction slabs or the like for installation at substantial heights.

The manner in which the invention functions under both heavy loads and light loads while retaining the load support arms 20 and 22 in generally horizontal orientation will be understood with reference to FIG. 2 of the drawings. Under a heavy load condition such as when a heavy slab S is supported by the arms 20 and 22, the center of gravity of the entire apparatus supported from the spacer lift bar 80 will be in fairly close alignment with the connection of the shackle 70 to the hanger plate 66. The connection of the shackle 70 is in close proximity to the vertical plane passing through the center of gravity of the entire structure suspended beneath the bar 80 and the arms 20 and 22 will consequently assume the position illustrated in dotted lines in FIG. 2. The slight inclination is necessary in order to insure the maintenance of the supported slab on the arms 20 and 22. Under light load conditions, the spring 108 is compressed and the apparatus assumes the position illustrated in FIG. 2 in which the majority of the weight of the unloaded or lightly loaded lifting means is supported by the light-load sling 104. However, upon the application of a heavy load, the sling 108 is elongated to pivot the apparatus so that the heavy-load sling

72 provides the majority of the support for the entire lifted structure.

While only the preferred embodiment of the invention has been disclosed, it should be understood that the spirit and scope of the invention is to be determined solely in light of the appended claims.

I claim:

1. A flying fork-type lifting means capable of being suspended from a crane or the like for engaging and lifting structural slabs, pipe or similar materials, said lifting member comprising first and second elongated generally horizontal parallel load support arms, each of said horizontal parallel load support arms having a free outer end and a supported end, first and second lift arms respectively having one end supportingly connected to the supported end of said first and second load support arms and extending upwardly at an acute angle above said first and second load support arms, spacer frame means connected between said load support arms for maintaining a fixed spacing between the supported ends of said first and second load support arms and hoisting means supportingly connected to said lift arms for enabling a unitary vertical balanced movement of said load support arms, said lift arms and said spacer frame means along with any items supported by said load support arms while maintaining said load support arms in general horizontal orientation, wherein said spacer frame means comprises first and second spacer frame components telescopically associated with each other and means connecting said spacer frame components in adjusted position for achieving a desired overall length for said spacer frame means, wherein said hoisting means includes a transverse horizontal spacer lift bar having first and second ends respectively positioned above said first and second lift arms, said transverse horizontal spacer lift bar comprising first and second telescopic bar members and means for fixedly connecting said first and second telescopic bar members in fixed positions of adjustment for providing a desired length for said lift bar, first and second heavy-load supporting sling members respectively connected between said first and second ends of said horizontal spacer lift bar and outer portions of said first and second lift arms, the lower ends of said heavy-load supporting sling members being connected to said first and second lift arms in a vertical plane extending substantially through the center of gravity of said lifting member and any heavy-load supported on said load support arms, first and second light-load sling members respectively connected to said first and second ends of said horizontal spacer lift bar and having lower ends connected respectively to said first and second lift arms at a location on said lift arms between the connection of said heavy-load slings to said lift arms and the juncture of said lift arms and said load support arms in a vertical plane extending substantially through the center of gravity of said lifting member when there is no load on said load support arms wherein said first and second light-load sling means each comprises a relatively non-stretchable portion and a spring portion connected thereto, said spring portion being of such strength as to resist elongation when said load support arms are not supporting a work load, but elongating upon the application of a work load to said load support arm so that the end of said load support arm connected to said lift arm pivots downwardly a small amount to result in a positioning of the center of gravity of said lifting member and work carried thereby in a vertical plane in which said heavy load bearing slings are substantially positioned so that said heavy-load bearing sling provides balanced support for said load support arms and airfoil means mounted on said lifting means and being reactive with air flow over said lifting means for providing a torsional positioning force for orienting said lifting means in a desired rotational position about a vertical axis.

2. The invention of claim 1 wherein said first and second load support arms include a plurality of parallel frame plates extending along the length of said first and second horizontal load support arms, box frame means extending along the length of said work load support arms between said frame plate means and welded to said plate means.

3. The invention of claim 2 wherein said airfoil means include first and second airfoil members, first and second airfoil support arms supportingly connected on one end to said first and second airfoil members and fixedly connected on an opposite end respectively to said first and second lift arms.

4. The invention of claim 3 wherein said airfoil members are connected to said airfoil supporting arms by adjustable means permitting rotational adjustment of said airfoil members in a desired direction in accordance with the prevailing wind conditions in which said lifting means is to be used.

5. The invention of claim 2 wherein said first and second lift arms comprise a plurality of longitudinal frame plates extending parallel to each other along the length of said lift arms, a plurality of box frame members interleaved with said longitudinally extending frame plates and welded to said longitudinally extending frame plates and vertical bracket plates extending upwardly from between the box frame members of said load support arms on one end of said load support arms with said box frame members of said lift arms being interleaved with said vertical bracket plates and welded to said vertical bracket plates.

6. A flying fork-type lifting means capable of being suspended from a crane or the like for engaging and lifting structural slabs, pipe or similar materials, said lifting member comprising first and second elongated generally horizontal parallel load support arms, each of said horizontal parallel load support arms having a free outer end and a supported end, first and second lift arms respectively having one end supportingly connected to the supported end of said first and second load support arms and extending upwardly at an acute angle above said first and second load support arms, said first and second load support arms including a plurality of parallel frame plates extending along the length of said first and second horizontal load support arms, box frame means extending along the length of said load support arms between said frame plate means and welded to said plate means, spacer frame means connected between said load support arms for maintaining a fixed spacing between the supported ends of said first and second load support arms, hoisting means supportingly connected to said lift arms for enabling a unitary vertical balanced movement of said load support arms, said lift arms and said spacer frame means along with any items supported by said load support arms while maintaining said load support arms in general horizontal orientation, said hoisting means including first and second light-load sling means each com-

prising a relatively non-stretchable portion and a spring portion connected thereto, said spring portion being of such strength as to resist elongation when said load support arms are not supportiong a work load, but elongating upon the application of a work load to said load support arm so that the end of said load support arm connected to said lift arm pivots downwardly a small amount to result in a positioning of the center of gravity of said lifting member and work carried thereby in a vertical plane in which said heavy load bearing slings are substantially positioned so that said heavy-load bearing sling provides balanced support for said load support arms, wherein said first and second lift arms comprise a plurality of longitudinal frame plates extending parallel to each other along the length of said lift arms, a plurality of box frame members interleaved with said longidutinally extending frame plates and welded to said longitudinally extending frame plates and vertical bracket plates extending upwardly from between the box frame members of said load support arms on one end of said load support arms with said box frame members of said lift arms being interleaved with said vertical bracket plates and welded to said vertical bracket plates and airfoil means mounted on said lifting member and being reactive with air flow over said lifting means for providing a positioning force for orienting said lifting means in a desired position, said airfoil means including first and second airfoil members, first and second airfoil support arms supportingly connected on one end to said first and second airfoil members and fixedly connected on an opposite end respectively to said first and second lift arms wherein said airfoil members are connected to said airfoil supporting arms by adjustable means permitting rotational adjustment of said airfoil members in a desired direction in accordance with the prevailing wind conditions in which said lifting means is to be used.

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