March 14, 1967 J. E. FAWELL 3,308,966

TRAVELLING STABILIZED CRANE

Filed Sept. 3, 1965 4 Sheets-Sheet 1

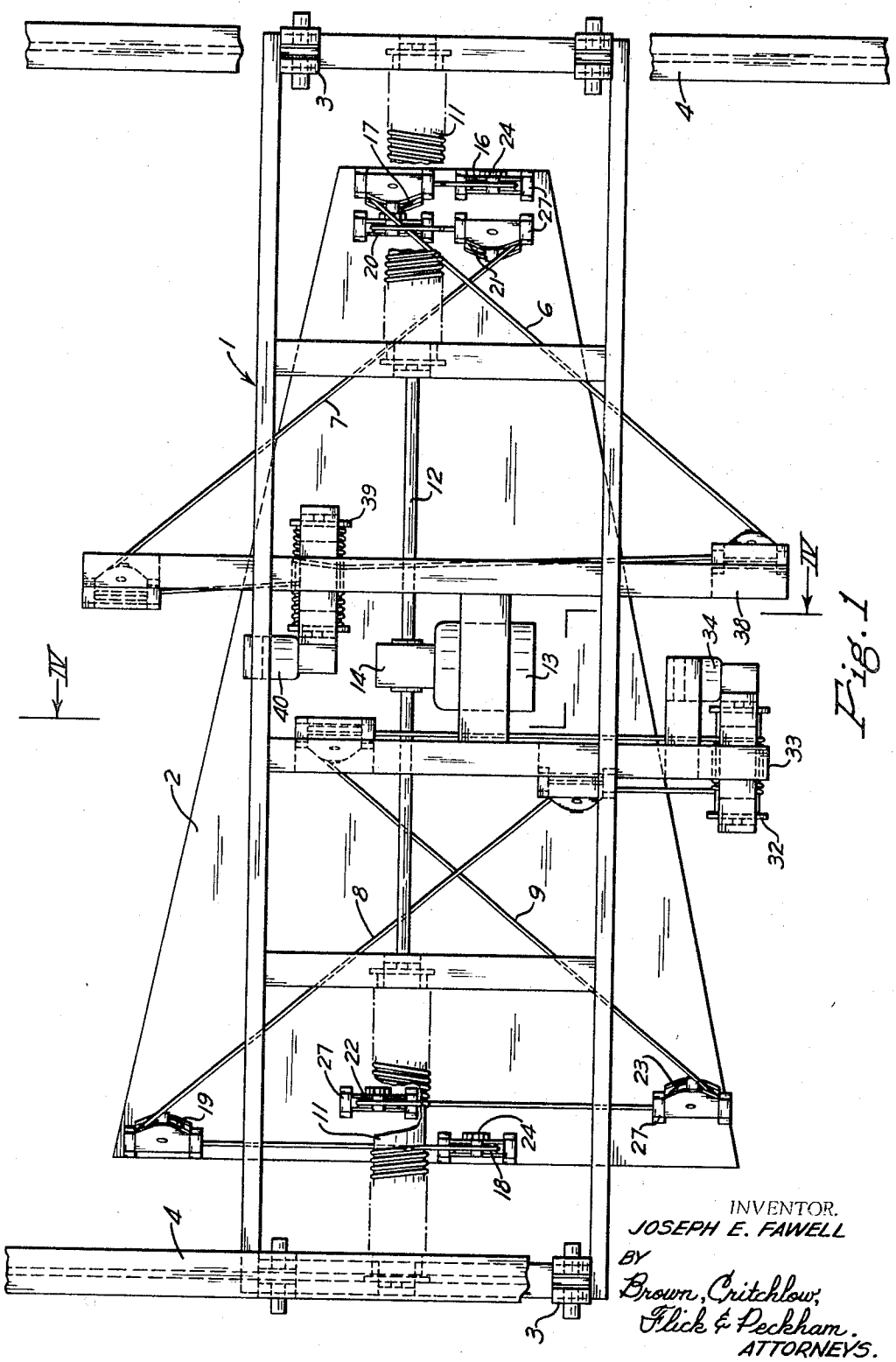


Fig. 1

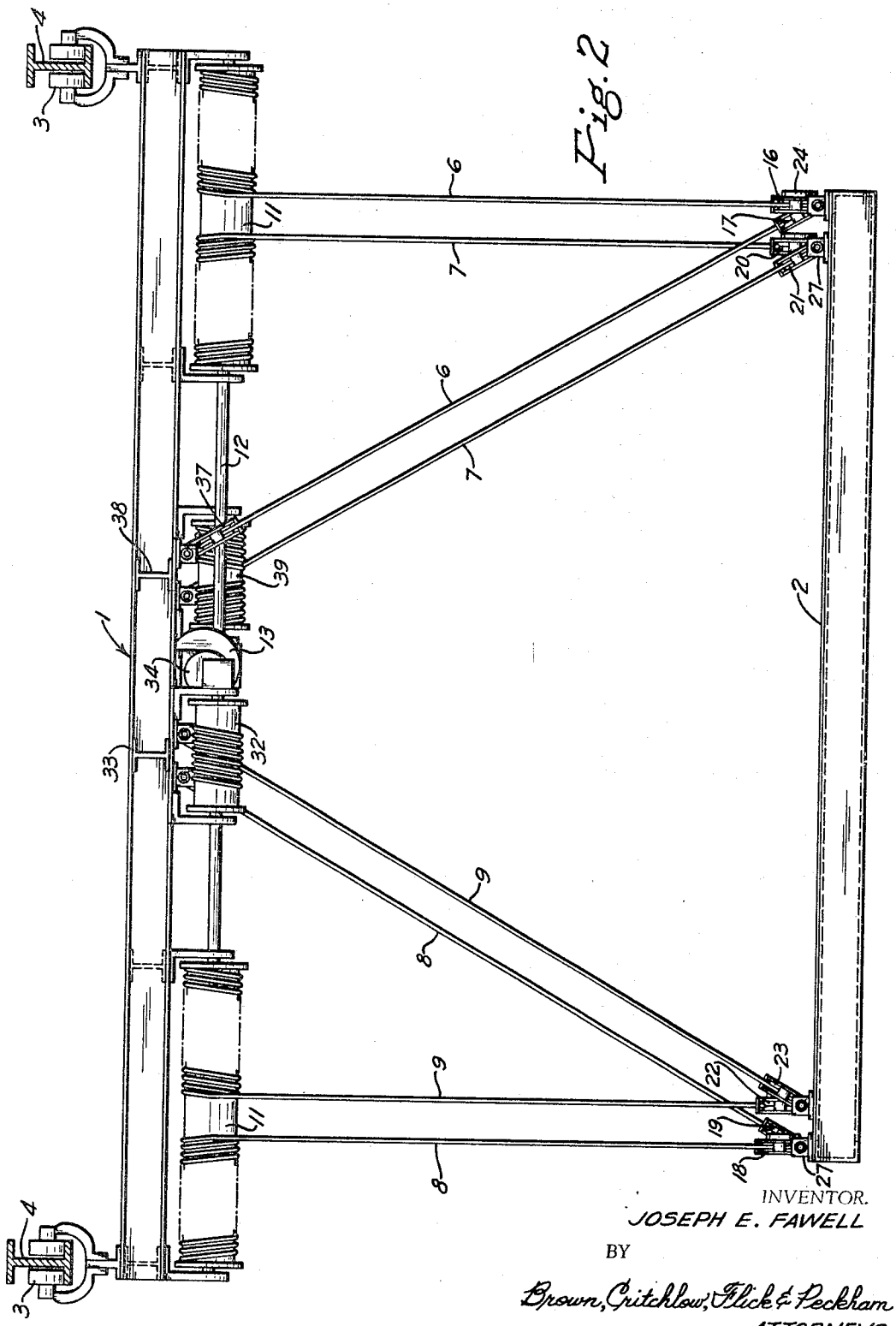
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TRAVELLING STABILIZED CRANE

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Fig. 2



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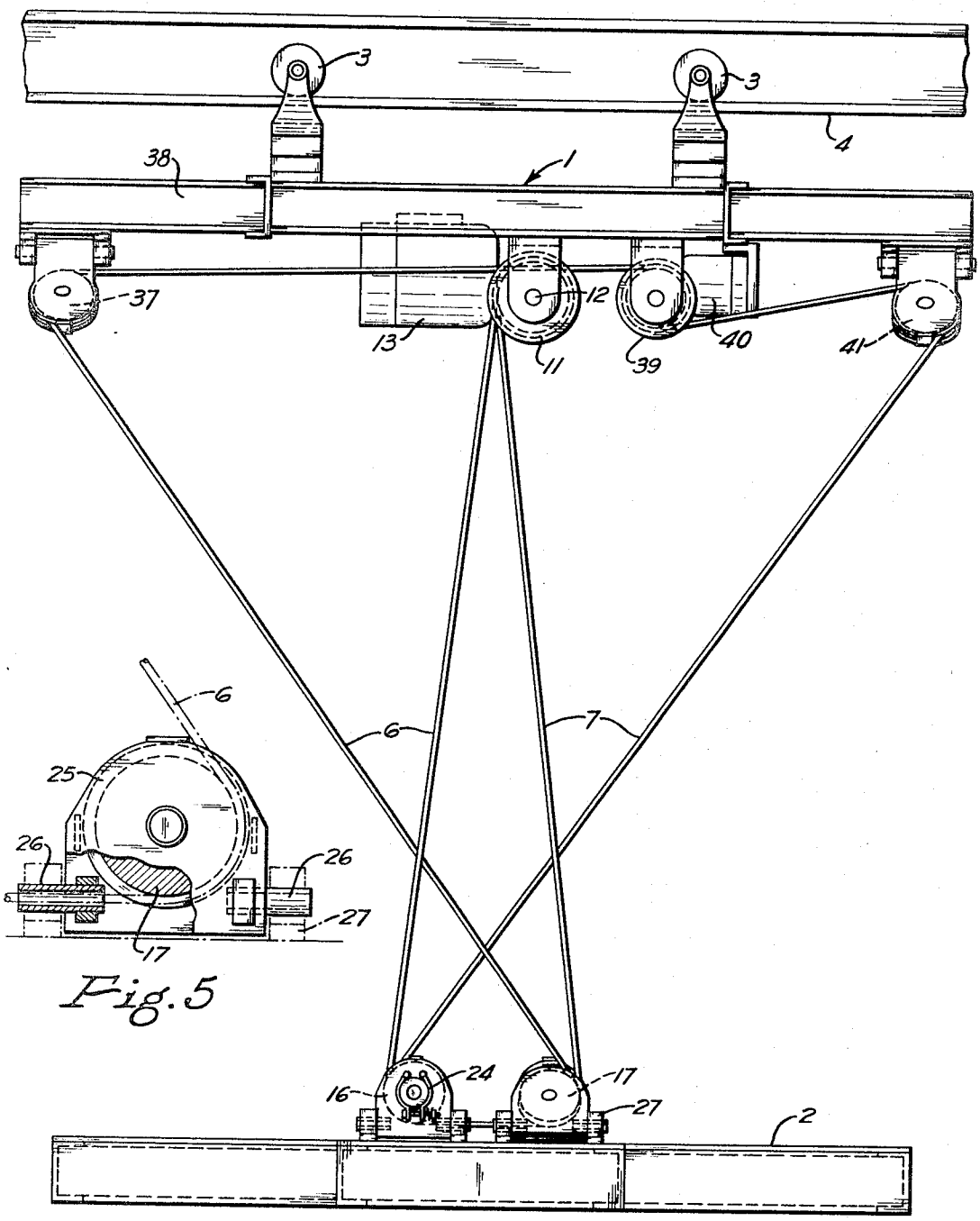


Fig. 5

Fig. 3

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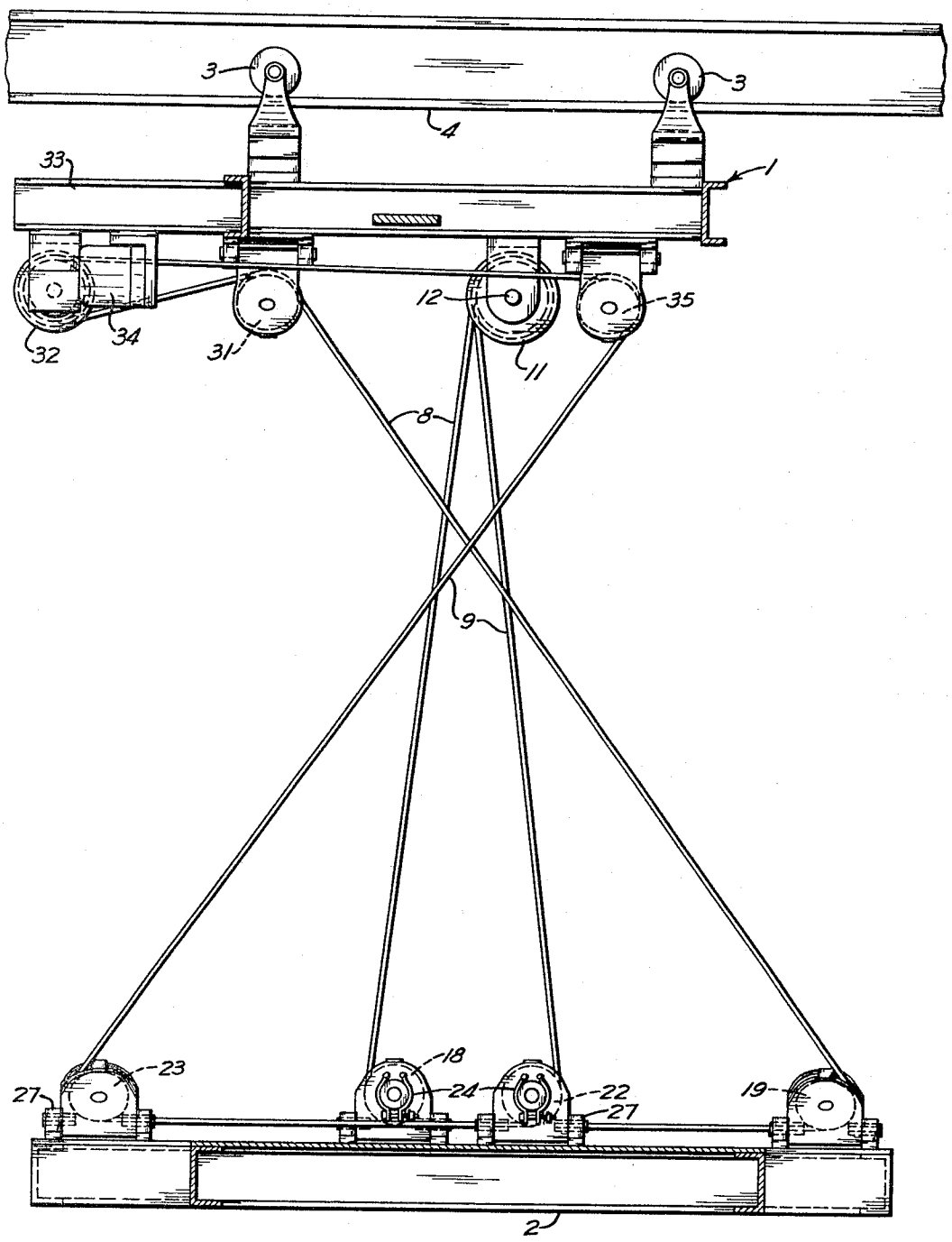


Fig. 4

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TRAVELLING STABILIZED CRANE

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14 Claims. (Cl. 212—14)

This invention relates to cranes of the type in which a load frame is suspended by cables from an overhead support that travels along rails or tracks, and more particularly to the positioning and control of the load frame relative to the overhead support.

One of the problems with travelling cranes, especially when the load frame can be raised a considerable distance, is that the frame tends to sway or swing out as it is carried over the ground. Also, an undesirable number of cables have been required in order to move the load frame out of its normal horizontal plane when that becomes desirable, thereby adding to the complexity and expense of the crane. Some attempts have been made to solve these problems but they have not been very satisfactory. The difficulties that have been encountered, in addition to requiring too many cables, have included a reeving of the cables that has required high capacity hoists for stability of the load frame or smaller hoists with a sacrifice of stability, and limitations on the minimum length of the overhead framework or the maximum length of the hoisting drums to maintain the fleet angle of the cables within acceptable limits as they raise and lower the load.

It is among the objects of this invention to provide a travelling crane, in which the load frame is stabilized against lateral and longitudinal movement relative to its overhead support, in which the frame can be tilted lengthwise or turned on its longitudinal axis by the same cables that raise and lower it, in which only four cables are required, in which the capacity of the hoisting means can be 50 percent of the maximum load that can be lifted, and in which the fleet angle of the cables with the hoisting drums does not vary materially as the frame is raised and lowered, regardless of the length of the overhead framework or the length of the drums.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which

FIG. 1 is a plan view of my crane;

FIG. 2 is a side view;

FIG. 3 is an enlarged view of the right-hand end of the crane as viewed in FIG. 2;

FIG. 4 is an enlarged vertical section taken on the line IV—IV of FIG. 1; and

FIG. 5 is an enlarged detail of one of the hinged sheaves.

Referring to the drawings, the top of the crane may be in the form of a horizontal rectangular framework or overhead support **1**, from which the vertically movable load frame **2** is suspended. The load frame may be provided with hooks or the like for attaching a load to it. The top framework can be supported above the ground in any suitable manner, such as by providing its opposite ends with trolleys **3** that travel along stationary rails **4**. The means for driving the crane along the rails is not shown as it can be any of the conventional means used for that purpose.

The load frame **2** is suspended from the overhead support by means of cables **6**, **7**, **8** and **9** that are controlled by rotatable drum means mounted on the support. Although a single drum may be used, for high-lift cranes two drums are preferred, with two of the cables hanging from each drum. There is one of these long hoisting drums **11** at each end of the support. They extend lengthwise of the support. They can be rotated by a single driving unit operatively connected to the central portion

of a shaft **12** connecting the two drums. The driving unit includes an electric motor **13** driving a gear train **14** connected with the center of the shaft. One side of the drums extends along the central longitudinal vertical plane of the framework so that the four cables hanging from the drums will leave them in that same vertical plane. If only one drum were used for all four cables, then sheaves mounted on the overhead support would receive the cables from that drum and suspend them in the correct locations. With the two hoisting drums shown, the ends of the cables are anchored to the outer ends of the drums and the cables are wound inwardly therefrom. Both cables on each drum are wrapped around it in the same direction.

The four cables extend from the hoisting drums down and around sheaves mounted on the ends of the load frame **2**, which normally is horizontal. Thus, below each hoisting drum there is a first pair of sheaves **16** and **17**, or **18** and **19**, spaced transversely of the frame, and also there is a second pair of sheaves **20** and **21**, or **22** and **23**, likewise spaced transversely of the frame.

As shown in FIG. 3, cable **6** hanging from one of the drums extends down around sheave **16** below it and then across the load frame and up around the other sheave **17** in the same pair. From there the cable extends up and across itself to the overhead support, with which the cable is connected. The other cable **7** at the same end of the frame extends down around sheave **20** in the underlying second pair, this sheave being the one closest to sheave **17**. The cable then extends transversely across the frame and up around the other sheave **21** in the second pair and then up across itself to the support, with which it also is connected.

Referring now to the opposite end of the load frame, as seen in FIG. 4, cable **8** extends from its drum down around sheave **18** below it. From there the cable extends across the frame and up around the other sheave **19** in the same pair and then up across itself for connection to the overhead support. The remaining cable **9** extends from the drum down around sheave **22**, which is the one closest to sheave **19**, and then across the frame and up around the remaining sheave **23** and back up across itself to a connection with the support. As the hoisting drums rotate to allow the load frame to descend, the cables unwind toward the opposite ends of the drums. Nevertheless, the fleet angle between each cable and its drum does not change appreciably because the load frame is continually moving down away from the drum, so the drum can be any desired length for holding any length of cable without the overhead framework having to be lengthened. Because of the double reeving of each cable, the capacity of the drums can be about half that required for single line pull.

For the load frame to remain horizontal as it is raised and lowered, it is necessary that all four cables be the same length between the two hoisting drums and the points of connection of the cables with the overhead support. For the same reason, it also is necessary that at any given time the angles at which the cables in either pair cross each other be the same as the angles between the other pair of crossed cables.

Due to the cable reeving just described, in which the two cables at each end of the load frame cross each other, the frame is held against swaying lengthwise of the track if the crane moves rather slowly along the track. The cables also reduce the sway considerably if the crane accelerates and moves rapidly or quickly decelerates. Swaying can be reduced still more under such conditions if the sheaves mounted on the load frame are prevented from rotating or at least have their rotation restrained. Although brakes could be applied to the sheaves to pre-

vent rotation, they could not be applied until the load frame and had been lifted to the desired height and they would have to be released before the frame could be lowered. Since for rapid operation of the crane it is desirable to move the crane along the track while the load frame is being lifted and lowered, it is preferred that drag brakes be used which will not prevent the cables from turning the sheaves as the frame is raised and lowered but will exert enough drag on the sheaves to prevent them from being rotated by the inertia of the load frame laterally when the crane moves rapidly along the track. Such brakes **24** are indicated in the drawings on sheaves **16**, **20**, **18** and **22**.

Swaying of the load frame lengthwise of itself can be overcome by extending the portions of the cables that extend upwardly from sheaves **17**, **19**, **21** and **23** inwardly to points near the middle of the overhead support instead of to points above the ends of the frame. This can be accomplished, thereby eliminating any need for additional cables, by hinging each of the four sheaves just mentioned to the load frame on a horizontal axis extending transversely of the frame. This also allows these sheaves to adjust to the changing inclination of the cables as the load frame is raised and lowered. All of these inclined portions of the cables should be the same length. By locating the hinge axis at the bottom of each sheave in line with the bottom of the other sheave in the same pair, the portion of the cable extending between the two sheaves will remain in proper alignment with both regardless of the degree of tilt of the hinged sheave. The hinging is accomplished by journaling the sheave in a bracket **25**, from opposite sides of the bottom of which tubular trunnions **26** project as best shown in FIG. 5. These trunnions are journalled in bearings **27** mounted on the load frame. The trunnions are so positioned relative to the groove in the sleeve that the portion of the cable leaving the bottom of the sheave for the adjacent sheave in the same pair will pass straight through one of the trunnions and in a straight line to the other sheave. This crane requires only four cables because of the presence and arrangement of the hinged sheaves.

Another feature of this invention is that the load frame can be rotated or tilted on a longitudinal axis when desired. To accomplish this, sheaves **18** and **22** are located close together, while sheaves **19** and **23** are located out at the corners of the frame. These four sheaves are symmetrically arranged relative to the longitudinal center line of the load frame. As shown in FIG. 4, the upper part of the inclined portion of cable **8** extending upwardly from hinged sheave **19** is connected with the overhead support partly by means of a sheave **31** suspended from the support and over which the cable extends outwardly to a drum **32** mounted on the bottom of a beam **33** projecting laterally from one side of the support. This drum is driven by a reversible electric driving unit **34** also supported by the beam. The portion of cable **9** that extends upwardly from hinged sheave **23** extends around a second upper sheave **55** connected to the overhead support and then extends outwardly across the other upper sheave and out to drum **32**. The two cables are wrapped in opposite directions around the drum. As a matter of safety in case one of the cables breaks, each one should be attached separately to the drum. Otherwise, the upper ends of the two cables could be joined together and merely wrapped around the drum enough times to provide a good frictional connection with it. Upper sheaves **31** and **35** are hinged to the overhead support so that they can adjust to the angle of the cables. They also serve as means for connecting the cables with the overhead support.

It will be seen that if the drum **32** is rotated in either direction, one cable will be unwound from the drum and the other will be wound onto it, thereby lengthening the first cable and shortening the other so that the load

frame is tilted or rolled sideways in one direction or the other. It is obvious that it requires but very little power to tilt the frame. To prevent the two cables at the opposite end of the frame from interfering with this movement, the first and second pairs of sheaves at that end are placed directly behind each other and the sheaves in each pair are located close together. Because of this, the frame can be tapered lengthwise as shown in FIG. 1. Another advantage of having the sheaves at one end of the load frame close together is that the result is, in effect, three point suspension of the frame, which has definite advantages in some uses of the crane.

A further feature of this invention is that the load frame can be tilted lengthwise when desired, which is done by raising or lowering its narrow end while the opposite end of the frame is stationary. To permit this independent action of cables **6** and **7**, the portion of cable **6** that extends upwardly from hinged sheave **17** passes around an upper sheave **37** suspended from one projecting end of a cross beam **38** in the overhead support. From this sheave the cable extends across the support to a drum **39** which, with its driving unit **40**, is mounted on the bottom of the support. The portion of cable **7** that extends upwardly from hinged sheave **21** extends around another upper sheave **41** supported by the opposite projecting end of the cross beam, and then extends inwardly to the same drum. The ends of the cables are attached to the drum and are wound around it in the same direction, so that when the drum is rotated to wind up the cables the underlying end of the load frame will be raised, but when the drum rotates in the opposite direction the end of the frame will be lowered. Upper sheaves **37** and **41** like the other pair of upper sheaves, are hinged to their support and therefore line up with the inclined cables.

The portions of all of the cables that extend downwardly from the upper sheaves are maintained the same length for any given vertical position of the horizontal frame by spacing the various sheaves in such manner that the horizontal distance between the vertical axial plane of upper sheave **35** and the axis of lower sheave **23** is the same as the horizontal distance between the vertical axial plane of any of the lower sheaves on the opposite end of the frame and the axis of the upper sheave **37** or **41** farthest from that plane, and by spacing the sheaves in each upper pair the same distance apart lengthwise of the overhead support as seen in FIG. 2 as the two pairs of sheaves at the nearest end of the load frame.

The load frame of the crane described herein is stabilized against swinging sideways and lengthwise by means of only four cables, which also form the hoisting cables and the means for tilting the frame lengthwise and rolling it on a longitudinal axis. No other cables or snubbing lines are required. Economies in the manufacture of the crane therefore are achieved.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A travelling crane comprising an overhead support, a vertically movable normally horizontal load frame below said support, rotatable drum means mounted on said support, two pairs of cables attached to said drum means with one pair suspended from each end of said support, a first pair of sheaves spaced transversely of the load frame and mounted thereon below each end of the support, a second pair of sheaves spaced transversely of the load frame and mounted thereon adjacent each first pair, one cable in each pair extending from the overhead support down around one of the sheaves in the underlying first pair and then across the load frame and

up around the other sheave in the same pair and up across itself to a connection with said support, the other cable in each pair extending from said support down around the sheave in the underlying second pair that is adjacent said other sheave and then across the load frame and up around the other sheave in the second pair and up across itself to a connection with said support, and means for rotating the drum means to raise and lower the load frame by means of the four cables.

2. A travelling crane as recited in claim 1, in which said drum means are a pair of axially aligned drums extending lengthwise of the overhead support near the middle of its ends, and said driving means is a single driving unit for rotating the drums in unison.

3. A travelling crane as recited in claim 1, in which the four sheaves at each end of the load frame are arranged symmetrically relative to its longitudinal center line.

4. A travelling crane as recited in claim 1, including brakes for restraining rotation of at least one sheave in each pair.

5. A travelling crane as recited in claim 1, in which the portions of said cables that extend upwardly from said other sheaves to connection with the overhead support are inclined from the load frame up toward the central portion of the support to restrain swinging of the frame lengthwise.

6. A travelling crane as recited in claim 5, in which said inclined portions of all four cables are the same length while the load frame is horizontal.

7. A travelling crane as recited in claim 5, including means hinging said other sheaves to the load frame on axes extending transversely of the frame so that the hinged sheaves can adjust to the angle of inclination of said inclined portions of the cables.

8. A travelling crane as recited in claim 5, including means hinging each of said other sheaves to the load frame on an axis at the bottom of the sheave extending transversely of the frame substantially in line with the bottom of the other sheave in the same pair.

9. A travelling crane comprising an overhead support, a vertically movable normally horizontal load frame below said support, rotatable drum means mounted on said support, two pairs of cables attached to said drum means with one pair suspended from each end of said support, a first pair of sheaves spaced transversely of the load frame and mounted thereon below each end of the support, a second pair of sheaves spaced transversely of the load frame and mounted thereon adjacent each first pair, an upper pair of sheaves spaced transversely of said support and supported thereby, one cable extending from one end of the overhead support down around one of the sheaves in the underlying first pair and then across the load frame and up around the other sheave in the same pair and up across itself to a connection with said support, the other cable at the same end of said support extending therefrom down around the sheave in the underlying second pair that is adjacent said other sheave and then across the load frame and up around the other sheave in the second pair and up across itself to a connection with the support, one of the cables at the other end of the overhead support extending therefrom down around one of the sheaves in the underlying first pair and then across the load frame and up around the other sheave in the same pair and up across itself and around one of said upper sheaves and toward the other upper sheave, the remaining cable extending from said support down around the sheave in the underlying second pair that is adjacent said other sheave in the adjacent first pair and then across the load frame and up around the other sheave in the second pair and up across itself and around said other upper sheave and toward said one upper sheave, a normally stationary drum supported by said support, the cables that extend around said upper sheaves extending to and being attached to said drum, means for rotating said drum means to raise and lower the load frame by means of the four cables, and means for rotating said normally stationary drum to raise and lower one end of the frame relative to its opposite end.

10. A travelling crane as recited in claim 9, in which said upper sheaves and said other sheaves below them are hinged to their supports on axes extending transversely of the overhead support.

11. A travelling crane comprising an overhead support, a vertically movable normally horizontal load frame below said support, rotatable drum means mounted on said support, two pairs of cables attached to said drum means with one pair suspended from each end of said support, a first pair of sheaves spaced transversely of the load frame and mounted thereon below each end of the support, a second pair of sheaves spaced transversely of the load frame and mounted thereon adjacent each first pair, an upper pair of sheaves spaced transversely of said support and supported thereby, one cable extending from one end of the overhead support down around one of the sheaves in the underlying first pair and then across the load frame and up around the other sheave in the same pair and up across itself to a connection with said support, the other cable at the same end of said support extending therefrom down around the sheave in the underlying second pair that is adjacent said other sheave and then across the load frame and up around the other sheave in the second pair and up across itself to a connection with the support, one of the cables at the other end of the overhead support extending therefrom down around one of the sheaves in the underlying first pair and then across the load frame and up around the other sheave in the same pair and up across itself and around one of said upper sheaves and past the other upper sheave, the remaining cable extending from said support down around the sheave in the underlying second pair that is adjacent said other sheave in the adjacent first pair and then across the load frame and up around the other sheave in the second pair and up across itself and around said other upper sheave and away from said one upper sheave, a normally stationary drum supported by said support at one side of both upper sheaves, the cables that extend around said upper sheaves being wrapped around said drum in opposite directions, means for rotating said drum means to raise and lower the load frame by means of the four cables, and means for rotating said normally stationary drum to shorten one of the cables attached thereto and to lengthen the other cable, whereby to rock the frame on a longitudinal axis.

12. A travelling crane as recited in claim 11, in which said upper sheaves and said other sheaves below them are hinged to their supports on axes extending transversely of the overhead support.

13. A travelling crane as recited in claim 11, in which the end of the load frame supported by the cables connected to said normally stationary drum is much wider than the opposite end of the frame.

14. A travelling crane comprising an overhead support, a vertically movable normally horizontal load frame below said support, rotatable drum means mounted on said support, two pairs of cables attached to said drum means with one pair suspended from each end of said support, a first pair of sheaves spaced transversely of the load frame and mounted thereon below each end of the support, a second pair of sheaves spaced transversely of the load frame and mounted thereon adjacent each first pair, the axes of all four pairs of sheaves extending in a direction generally lengthwise of said support, one cable in each pair extending from the overhead support down around one of the sheaves in the underlying first pair and then across the load frame and up around the other sheave in the same pair and up across itself to a connection with said support, the other cable in each pair extending from said support down around the sheave in the underlying second pair that is adjacent said other

sheave and then across the load frame and up around the other sheave in the second pair and up across itself to a connection with said support, the portions of said cables that extend upwardly from said other sheaves to connection with the overhead support being inclined from the load frame up toward the central portion of the support to restrain swinging of the frame lengthwise, means for rotating the drum means to raise and lower the load frame by means of the four cables, brakes for restraining rotation of at least one sheave in each of said pair of sheaves, and means hinging said other sheaves to the load frame on axes extending transversely of the frame so that the hinged sheaves can adjust to the angle of inclination of said inclined portions of the cables.

References Cited by the Examiner

UNITED STATES PATENTS

2,811,262	10/1957	Schaitberger	212—126
3,081,884	3/1963	Minty	212—14
3,102,642	9/1963	Zweifel	212—15
3,179,259	4/1965	McLean	212—11

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