Jan. 15, 1957 R. O. BALOGH 2,777,737

LADDER-SUPPORTED WORK PLATFORMS

Filed Jan. 14, 1953 4 Sheets-Sheet 1

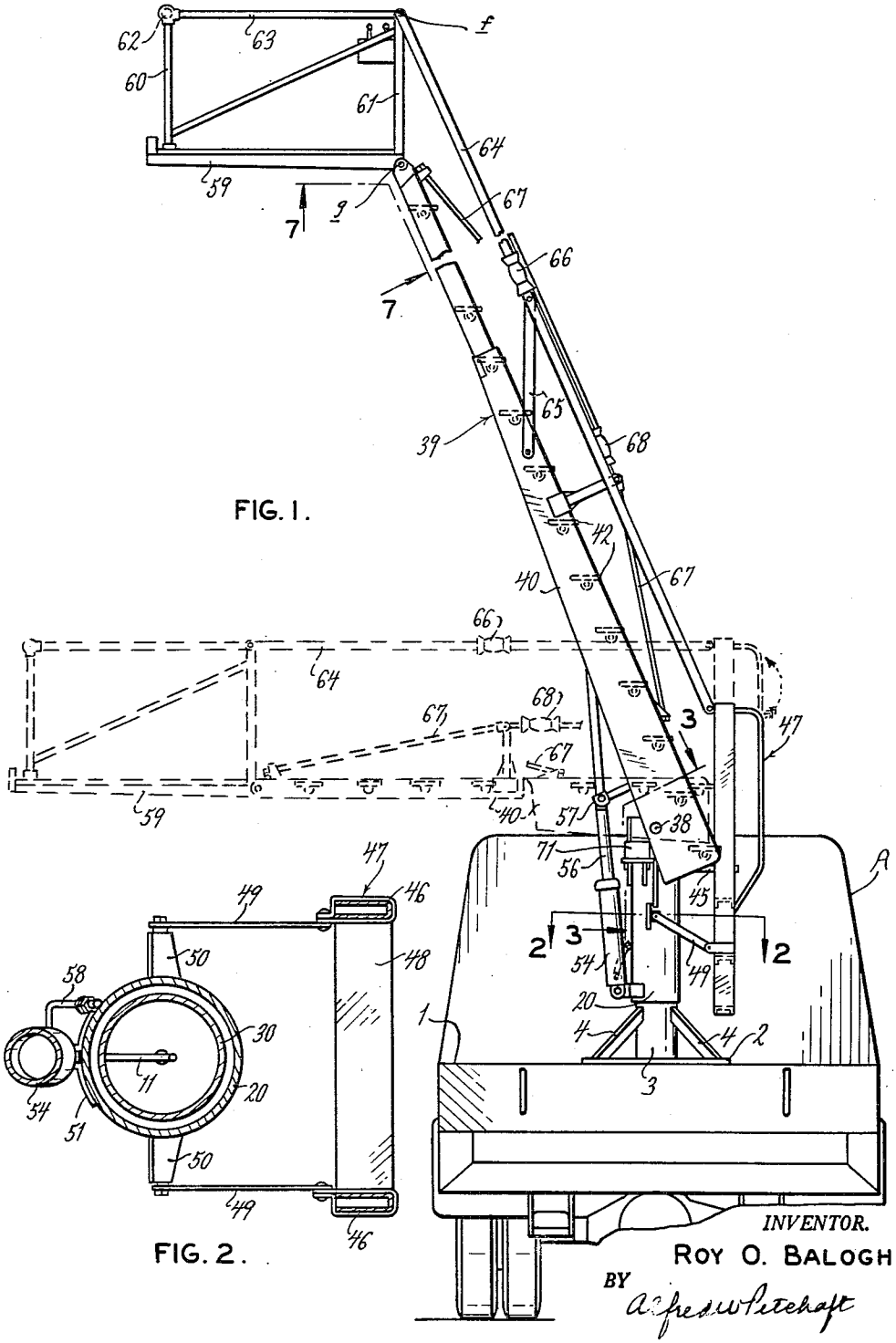


FIG. 1.

FIG. 2.

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LADDER-SUPPORTED WORK PLATFORMS

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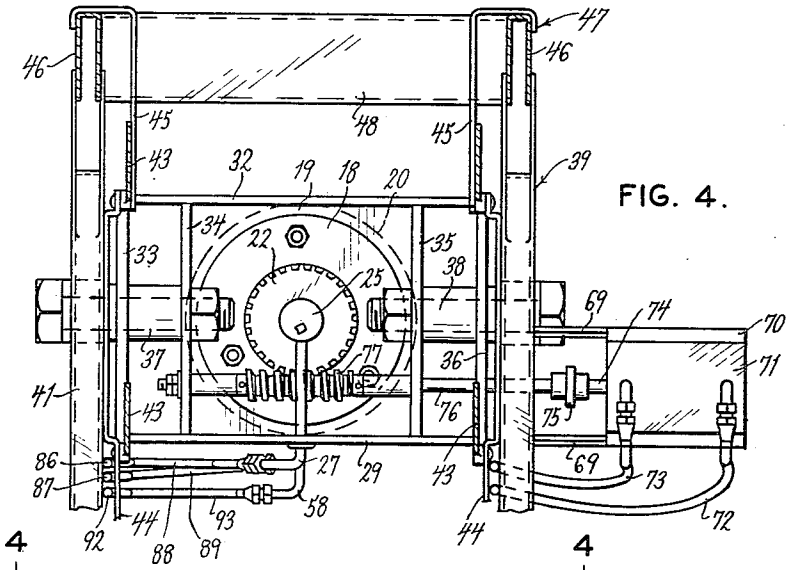


FIG. 4.

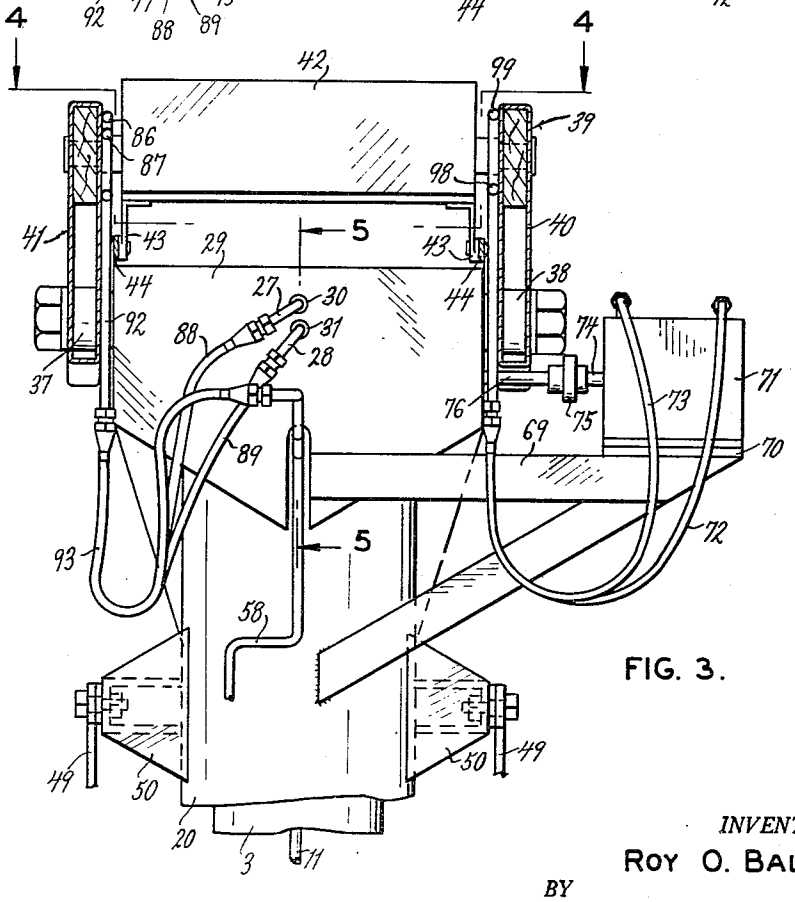


FIG. 3.

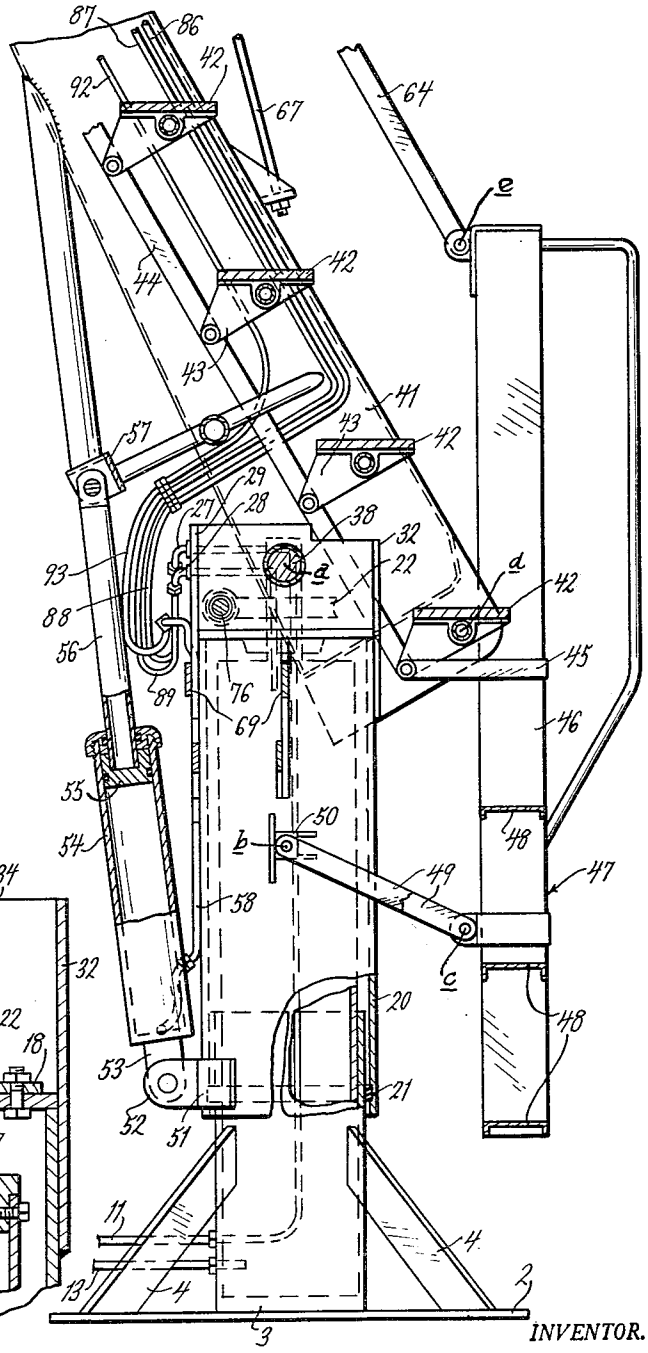
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LADDER-SUPPORTED WORK PLATFORMS

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FIG. 6.



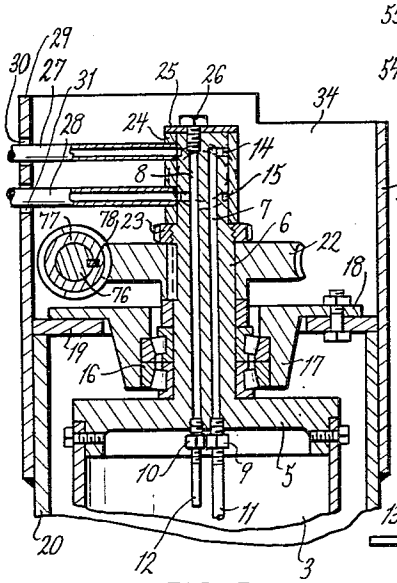


FIG. 5.

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LADDER-SUPPORTED WORK PLATFORMS

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FIG. 7.

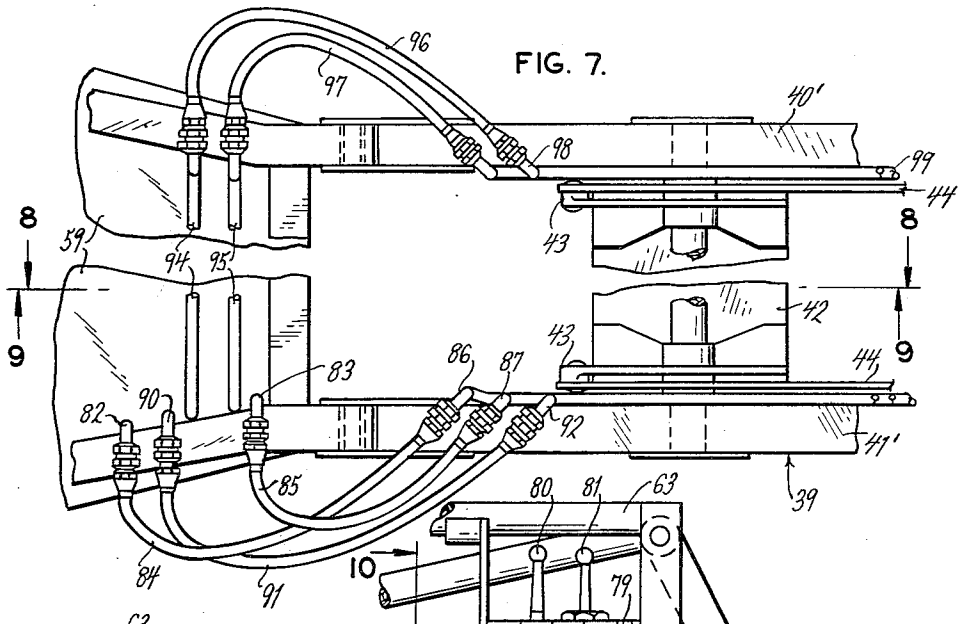


FIG. 8.

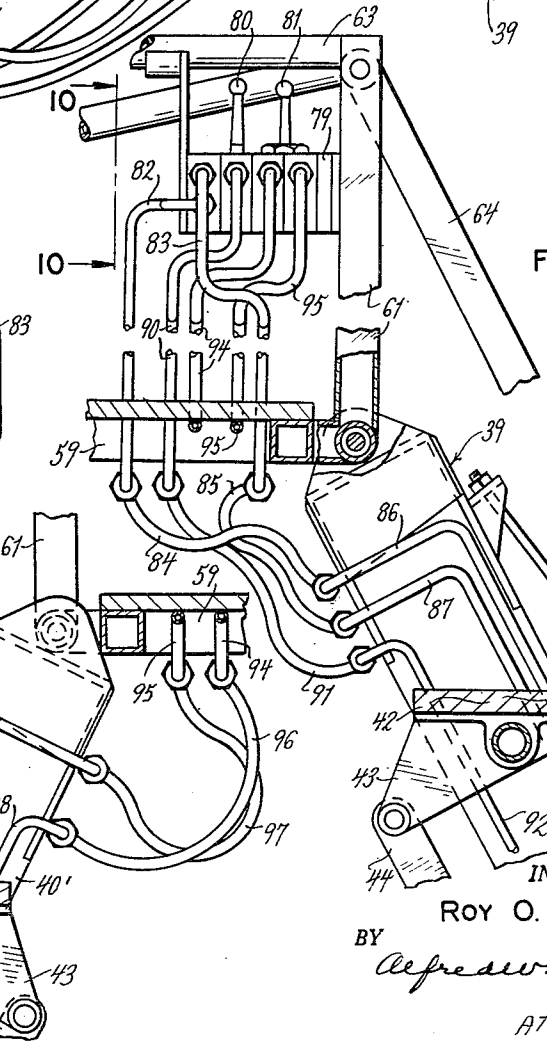


FIG. 10.

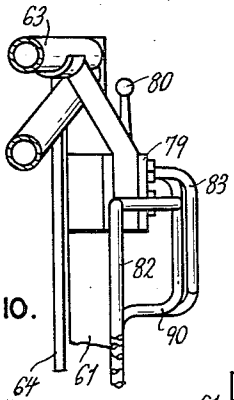


FIG. 9.

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LADDER-SUPPORTED WORK PLATFORMS

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Application January 14, 1953, Serial No. 331,241

7 Claims. (Cl. 304—29)

This invention relates in general to certain new and useful improvements in aerial ladders and, more particularly, to a ladder-supported work platform.

In servicing public utility lines, light poles, pole-mounted transformers, and similar installations, it is common practice to employ trucks which can travel quickly from one work-location to another and are equipped with aerial ladders adapted for rapid elevation so that a workman can ascend to the proper and convenient height for carrying out the installation or repair work required. For maximum utility, it is necessary that such ladders be capable of adjustment to various heights and positions of upward inclination, that is to say, angularity with respect to the ground. In addition, such ladders should be capable of traversing through a complete circle of 360°. Flexibility with respect to these movements and positions, however, is not fully and satisfactorily available in existing types of aerial ladders for the reason that the workman ordinarily must descend from the ladder to manipulate the driving and positioning mechanism of the ladder or a second workman, who is stationed below, must do so. The latter expedient of employing a second workman is, of course, expensive and is, furthermore, dangerous because existing aerial ladders are not designed to permit safe movement while a man is aloft, and because a man aloft on a ladder cannot securely anticipate the manipulations of the controls by his co-worker and is frequently caught partially off-balance. Furthermore, there is always the hazardous possibility that a co-worker below will accidentally touch the controls when the man aloft does not expect it or will erroneously operate the controls contrary to the instructions or signals of the man aloft, thereby causing serious accidents.

Another problem in connection with aerial ladders relates to the handling of heavy equipment aloft. At the present time, it is conventional practice to ascend the ladder and affix some kind of block and tackle and then descend the ladder to haul up or lower the equipment, such as a transformer, for instance, by hand or by a power-driven winch.

It is, therefore, the primary object of the present invention to provide a power-actuated vehicular aerial ladder which is capable of control from aloft and is constructed to provide a safe stable platform on which the workman can stand while the ladder is traversing and changing position.

It is another object of the present invention to provide an aerial ladder of the type stated which is adapted for elevating, lowering, and otherwise handling heavy pole-mounted equipment, such as transformers, distribution boxes, line switches, and the like.

With the above and other objects in view, my invention resides in the novel features of form, construction, arrangement, and combination of parts presently described and pointed out in the claims.

In the accompanying drawings (four sheets)—

Figure 1 is a rear end elevational view of a truck

equipped with an aerial ladder constructed in accordance with and embodying the present invention;

Figures 2 and 3 are fragmentary sectional views taken along lines 2—2 and 3—3, respectively, of Figure 1;

Figures 4 and 5 are fragmentary sectional views taken along lines 4—4 and 5—5, respectively, of Figure 3;

Figure 6 is a fragmentary side elevational view, partly broken away and in section, of the aerial ladder showing in particular detail the base pedestal thereof;

Figure 7 is a fragmentary plan view taken from the under side of the upper end of the aerial ladder showing in particular detail the flexible conduit connections between the ladder and platform;

Figures 8 and 9 are fragmentary sectional views taken along lines 8—8 and 9—9, respectively, of Figure 7; and

Figure 10 is a fragmentary sectional view taken along line 10—10 of Figure 8.

Referring now in more detail and by reference characters to the drawings, which illustrate a preferred embodiment of the present invention, A designates a conventional utility truck having a rearwardly extending floor 1. Rigidly mounted upon the floor 1 is a circular metal base plate 2 and welded upon the upper face thereof is a vertical tubular post 3 stabilized by four angularly disposed brace bars 4. The base plate 2, post 3, and brace bars 4 are preferably welded together as an integral unit for convenient mounting upon any standard truck or vehicle.

At its upper end, the post 3 is provided with a transverse top wall 5 which is integrally provided with an upwardly extending tubular sleeve 6 having two longitudinally extending parallel passages 7, 8, internally threaded at their lower ends for receiving conventional coupler fittings 9, 10, respectively, connecting to oil lines 11, 12, which, in turn, extend axially downwardly through the hollow interior of the post 3. As will be seen by reference to Figure 6, the oil line 11 extends outwardly through the lower portion of the post 3 for connection to the main supply of oil under pressure, which may be of any conventional type and is, therefore, not specifically shown. The oil line 12, on the other hand, is relatively short and terminates adjacent the upper portion of the post 3, so that returning oil from the hydraulic system will discharge directly into the hollow interior of the post 3 and will return from the lower portion thereof through the return line 13. Thus, a substantial portion of the hollow interior of the post 3 will serve as a sump or oil reservoir. At their upper ends, the oil passages 7, 8, open laterally into undercut peripheral grooves 14, 15, respectively.

Press-fitted or otherwise mounted externally upon the lower portion of the sleeve 6 and resting endwise upon the upper face of the top wall 5 is a self-aligning roller thrust bearing 16, which, in turn, rotatably supports an annular collar 17 having a horizontal peripheral flange 18 bolted rigidly to a horizontal rectangular top plate 19, which is, in turn, welded to, and extends symmetrically across, the upper end of a tubular post-sleeve 20 extending downwardly and concentrically around the post 3, terminating just above the upper end of the brace bars 4 and being journalled at its lower end by means of an internal bearing ring 21.

Keyed or otherwise rigidly mounted upon the sleeve 6, directly above the thrust bearing 16, is a stationary worm gear 22 held in place by a retaining nut 23. Rotatably mounted upon the upwardly projecting end of the sleeve 6 above the retainer nut 23 is an oil distribution sleeve 24 which is preferably lapped to provide a relatively oil-tight rotating seal and is preferably, but not necessarily, held in place on the sleeve 6 by means of a circular top plate 25 and retainer bolt 26. Rigidly mounted

in, and extending radially outwardly from, the sleeve 24 is an oil conduit line 27 and an oil return line 28 which are positioned for communication with the oil grooves 14, 15, respectively. Welded upon the upper end of the post-sleeve 20 and to one longitudinal margin of the top plate 19 and extending symmetrically outwardly on opposite sides of the center line thereof is a vertical apron plate 29 provided with apertures 30, 31, for respectively clearing the oil lines 27, 28. Similarly welded to the upper end of the post-sleeve 20 and the other longitudinal edge of the top plate 19 in diametrally opposed parallel relation to the apron plate 29 is a back plate 32. Also welded to the top plate 19 and to the plates 29, 32, are four transversely extending parallel plates 33, 34, 35, 36, forming, in effect, an open-topped box-like head frame which is rigidly carried by the post-sleeve 20. The plates 33, 34, and the plates 35, 36, respectively, support axially aligned transversely extending pintles 37, 38, and journaled thereon at its lower end is a main ladder 39 consisting of two spaced parallel side rails 40, 41, having di-electric upper end portions 40', 41', respectively, the latter preferably being made of wood. The rails 40, 41, are provided with a plurality of uniformly spaced tilting steps 42, each of which is provided with downwardly extending bellcrank ears 43 for interconnection by link bars 44. At its lower end, the link bars 44 are pivotally connected to horizontal arms 45 welded or otherwise rigidly attached to the vertical side rails 46 of a depending access or companion-ladder 47 preferably having three horizontal steps 48 and being connected adjacent its lower end of swinging links 49 to brackets 50 welded to, and projecting radially outwardly from, opposite sides of the post-sleeve 20. It will be noted that the rails 46 extend upwardly for a substantial distance above the lower end of the main ladder 39, as best seen in Figure 6 and for purposes hereinafter more fully appearing.

Also welded to the lower end of the post-sleeve 20 on the opposite sides thereof with respect to the companion ladder 47 is a radially outwardly projecting bracket plate 51 having outwardly extending spaced parallel ears 52 for receiving and rockably supporting an end fitting 53 formed rigidly on, and extending axially downwardly from the lower end of a hydraulic cylinder 54, which is conventionally provided with an internal piston 55 and upwardly projecting piston rod 56 swingably connected at its upper end to a braced framework 57, in turn, rigidly mounted upon the under side of the main ladder 39. The cylinder 54 is hydraulically connected at its lower end to an oil line 58 which is a part of the hydraulic control system presently to be more fully described.

Swingably mounted upon the upper end of the main ladder 39 is a rectangular work platform 59 provided at its four corners with upwardly extending forward railing posts 60 and rear railing posts 61. At their upper ends, the railing posts 60 are connected by a forward railing 62 and each of the railing posts 60 is furthermore connected to one of the rear railing posts 61 by a side railing 63 to form a U-shaped top railing, which is, in effect, closed across the front and sides but is open to the rear to permit ready access from the main ladder 39.

The rear railing posts 61 are furthermore pivotally connected at their upper ends to side rods 64 which extend rearwardly and downwardly in upwardly spaced parallel relation to the rails 40 of the main ladder 39 and at their lower ends are pivotally connected to the upwardly projecting ends of the side rails 46 of the companion ladder 47. Intermediate their ends, each of the side rods 64 is rockably provided with a vertical brace link 65. Furthermore, the side rods 64 are actually formed in two sections endwise connected by conventional strain insulators 66. Also, if desired, the side rails 40, 41, of the main ladder 30 may be reinforced by truss-forming guy rods 67 which include strain insulators 68.

When the piston 55 is hydraulically propelled to its extended position, the main ladder 39 will be swung upwardly to the position shown in full lines in Figure 1 and the companion ladder 47 will extend downwardly in a substantially vertical position while, at the same time, all of the steps 42 will be maintained in substantially horizontal position by the action of the link bars 44 and the work platform 59 will be held in horizontal position by the action of the side rods 64. When pressure is released from the cylinder 54, the weight of the ladder will cause the piston 55 to shift downwardly to original position and the main ladder will swing downwardly into horizontal position, as shown in dotted lines in Figure 1. In this position, the companion ladder 47 is shifted to its uppermost position. The work platform 59 and ladder steps 52 will remain in horizontal position during the downward swinging movement and the companion ladder 47 will swing upwardly and rearwardly approximately along the arcuate path indicated by the dotted-line arrow in Figure 1, remaining at all times in truly vertical position. When the main ladder 39 finally reaches horizontal or fully lowered position, the upper surfaces or treads of the ladder steps 42 will be substantially in the same plane as the upwardly presented surface or floor of the work platform 59.

This maintenance by the platform 59 and steps 44 of horizontal position and by the companion ladder 47 and side rails 46 of vertical position is the unique result of the existence of two separate linkage parallelograms having a common base-line along the companion ladder 47. That is to say, the pivot points *a* and *b*, as shown in Figure 6, lie along a straight-line and the pivot points *c*, *d*, and *e* similarly lie along a second straight-line parallel to the straight-line between pivot points *a*, *b*. Furthermore, a straight-line between pivot points *a*, *d*, is equal and parallel to a straight-line between pivot points *b*, *c*. Finally, a straight-line between pivot points *f* and *g* (see Figure 1) is equal and parallel to the straight-line between pivot points *d*, *e*. Thus, the pivot points *a*, *b*, *c*, *d*, form one parallelogram and the pivot points *d*, *e*, *f*, *g*, form a second parallelogram, both parallelograms being based in common along the straight-line between pivot points *c*, *d*, *e*, and having the pivot point *d* in common. Since the pivot points *a*, *d* and *g* are all on the same member, i. e. the side rails 41 of the main ladder 39, the angle between the straight-lines between the pivot points *a*, *d* and *d*, *g*, respectively, will be constant and the parallelograms will, in effect, move simultaneously. The fact that the side rails 46 are connected to pivot point *d* through the link 45 and bellcrank ear 43 of the lowermost step 42, merely introduces a tertiary and incidental linkage parallelogram which has no basic effect upon the above described geometrical relationships but rather introduces a co-acting means for maintaining the horizontal positions of the steps 42.

Also welded rigidly to the post-sleeve 20 and extending radially outwardly therefrom in substantially parallel relation to the plates 29, 32, are V-shaped brackets 69, and welded to, and extending horizontally between, the brackets 69 is a plate 70 for supporting a conventional hydraulic motor 71, which is provided with flexible oil conduits 72, 73. The hydraulic motor 71 is further provided with a drive shaft 74, which is operatively connected through a conventional shaft coupling 75 to a jack shaft 76 which is journaled in and extends through the plates 34, 35, 36, and is provided approximately midway between the plates 34, 35, with a worm 77 which is held rigidly in place by a key 78 and meshes with the worm gear 22, as best seen in Figures 4 and 5.

Mounted upon one of the rear railing posts 61 of the work platform 59 is a conventional hydraulic control valve 79 having two valve control levers 80, 81. Inasmuch as the interior mechanism of the hydraulic control valve 79 is substantially conventional, it is not shown or described in detail herein. It is sufficient merely to point out that

the control valve 79 is connected through a pressure supply line 82 and a return line 83 to flexible conduits 84, 85, respectively, which extend loosely beneath the work platform 59 in the region of its pivotal connection to the main ladder 39 and are, in turn, connected by pressure lines 86, 87, which extend downwardly along the inside of one of the side rails 40 for connection, respectively, by means of flexible conduits 88, 89, to the oil lines 27, 28. One chamber of the control valve 79, which is associated with the control lever 80, is similarly connected by an oil pressure line 90, a flexible conduit 91, a pressure line 92, and a flexible conduit 93 to the oil line 58 through which oil pressure is supplied to the lifting cylinder 54. This particular chamber of the control valve 79 is so arranged that when the valve control 80 is shifted in one direction, oil pressure will be admitted from the line 82 to the line 90 and, contrariwise, when the valve control lever 80 is shifted to an opposite position, the oil under pressure in the line 90 will be permitted to flow backwardly to the return line 83.

Similarly, another chamber of the control valve 79 is connected by means of the oil pressure lines 94, 95, flexible conduits 96, 97, and oil lines 98, 99, to the flexible oil lines 72, 73, respectively, of the hydraulic motor 71. When the control lever 81 is in neutral position, no oil will flow through either of the oil lines 94, 95. However, when the control lever 81 is shifted to one of its alternative positions, oil pressure will be permitted to flow from the main pressure line 82 through the line 94 to turn the hydraulic motor 71 in one direction and the oil returning from the motor 71 will flow through the line 95 and the chambers of the valve 79 to the oil return line 83. Contrariwise, when the control lever 81 is shifted to its opposite or alternative position, the flow of the oil is reversed in the lines 94, 95, and the direction of rotation of the hydraulic motor 71 is correspondingly reversed. As the motor 71 rotates, the worm 77 will rotate and propel the post-sleeve 20 and all of the structure carried thereby rotationally around the post 3. It will, of course, be evident that by changing the direction of rotation of the hydraulic motor 71, the direction of rotation of the post-sleeve 20 can be correspondingly changed.

It will thus be evident that a workman, while standing on the work platform 59, can readily raise and lower the work platform by appropriate manipulation of the control lever 80 and can cause the work platform to come to rest at any position of elevation between the lowermost and uppermost limits of its travel, and, similarly, by appropriate manipulation of the control lever 81 can cause the entire ladder assembly and the work platform 59 supported on the end thereof to swing around or traverse in a circular arc to any position which may be desired. With reference to the circular or traversing movement, it should also be noted that the work platform 59 can move through a complete circle of 360° and can continue to circle in one direction as long as may be desired. Furthermore, the work platform 59 can be swung back and forth at will and to any degree which may be required by simple manipulation of the control lever 81.

Inasmuch as the work platform 59 is always maintained in horizontal position, it is possible to use the work platform 59 as an elevator in lifting heavy objects, such as transformers and the like, which must be mounted at the top of a line pole, for example. Similarly, because the steps 42 also remain horizontal in all positions of the main ladder 39, it is possible for a workman to descend from the work platform 59 regardless of its position of relative elevation. It will, therefore, be evident that the workman can manipulate the work platform 59 and main ladder 39 while aloft to maneuver himself into any desired position for accomplishing some particular task. Since the workman himself can manipulate the controls which effect movement of the main ladder 39 and work platform 59, he is always prepared for any movement which he may initiate and is, therefore, not subjected to the hazard of unexpected, unauthorized, or accidental movements of the main ladder 39 and work platform 59.

It should be understood that changes and modifications in the form, construction, arrangement, and combination of the several parts of the ladder-supported work platform may be made and substituted for those herein shown and described without departing from the nature and principle of my invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A ladder supported work platform comprising an upright pedestal, a support member rotatably mounted on the pedestal, a ladder swingably mounted at its one end upon the support member for movement from a substantially horizontal position to an upwardly inclined position, a plurality of flat-topped steps rockably mounted in the ladder in spaced parallel relation to each other, first link means pivotally interconnecting all of said steps for maintaining the flat tops of said steps in horizontal position, a work platform hingedly mounted upon the other end of the ladder, second link means operatively connecting the work platform and the pedestal for maintaining the work platform in horizontal position, and an access ladder mounted upon the upright pedestal in outwardly spaced substantially parallel relation thereto by parallelogram linkage, said access ladder being pivotally connected at vertically spaced points to the first and second link means.

2. A ladder supported work platform comprising an upright pedestal, a support member rotatably mounted on the pedestal, a ladder swingably mounted at its one end upon the support member for movement from a substantially horizontal position to an upwardly inclined position, said ladder consisting of two spaced parallel rails and a plurality of flat-treaded steps rockably mounted between the rails in spaced parallel relation to each other, an elongated bar pivotally connected to each of the steps and extending therebetween, a work platform hingedly mounted upon the other end of the ladder, link means operatively connecting the work platform and the pedestal for maintaining the work platform in horizontal position, and an access ladder mounted upon the upright pedestal in outwardly spaced substantially parallel relation thereto by parallelogram linkage, said access ladder being pivotally connected at vertically spaced points to the elongated bar and link means.

3. A ladder supported work platform comprising an upright pedestal, a support member rotatably mounted on the pedestal, a ladder swingably mounted at its one end upon the support member for movement from a substantially horizontal position to an upwardly inclined position, a work platform hingedly mounted upon the other end of the ladder, link means operatively connecting the work platform and the pedestal for maintaining the work platform in horizontal position, and an auxiliary substantially vertical access-ladder pivotally connected adjacent its upper end to the ladder and mounted adjacent its lower end on the support member by means of a swinging link for substantially vertical movement as the ladder swings up and down, said auxiliary ladder also being pivotally connected to the link means associated with the work platform.

4. A ladder supported work platform comprising an upright pedestal, a support member rotatably mounted on the pedestal, a ladder swingably mounted at its one end upon the support member for movement from a substantially horizontal position to an upwardly inclined position, said ladder consisting of two spaced parallel rails and a plurality of flat-treaded steps rockably mounted between the rails in spaced parallel relation to each other, an elongated bar pivotally connected to each of the steps and extending therebetween, a work platform hingedly mounted upon the other end of the ladder, link means operatively connecting the work platform and the pedestal

for maintaining the work platform in horizontal position, and an auxiliary access-ladder pivotally connected adjacent its upper end to the ladder and shiftably mounted adjacent its lower end on the support member for vertical movement as the ladder swings up and down, said elongated bar being pivotally connected to the access-ladder intermediate the points of attachment thereof to the ladder and support member.

5. An aerial ladder comprising an upright supporting member having horizontal pivot means, a ladder pivotally mounted adjacent one end upon the pivot means for swinging movement from a substantially horizontal position upwardly to a substantially upright position, said ladder having an integral portion which extends outwardly and rearwardly with respect to the pivot means when the ladder is in horizontal position, said portion furthermore being adapted to extend downwardly and rearwardly with respect to the pivot means when the ladder is in upright position, second horizontal pivot means operatively mounted in said overhanging portion of the ladder, links means swingably mounted upon the supporting member and extending rearwardly therefrom, an access ladder pivotally connected to the rearward ends of the link means and to the second pivot means of the ladder in such a manner that the link means is substantially parallel to a line between the first and second pivot means and the distance between the centers of the pivot points of the link means is substantially equal to the distance between the centers of the first and second pivot means, said access ladder extending upwardly for a substantial distance beyond the second pivot means, and a work platform hingedly mounted upon the free end of the ladder and having an upright post pivotally connected to one end of a link bar which is, in turn, pivotally connected at its other end to the upper end of the access ladder, said link bar and work platform being so connected that the pivot points define a parallelogram whereby the upright post of the work platform is always parallel to the access ladder and the work platform is accordingly held in a selected position with respect to the supporting member irrespective of changes in angular position of the ladder.

6. An aerial ladder comprising an upright supporting member having a main pivot, a main ladder pivotally mounted adjacent one of its ends upon the main pivot for swinging movement from a substantially horizontal position upwardly to a substantially upright position, said main ladder having an integral portion which extends outwardly and rearwardly with respect to the main pivot when the main ladder is in horizontal position, said portion furthermore being adapted to extend downwardly and rearwardly with respect to the main pivot when the main ladder is in upright position, a second pivot operatively mounted in said overhanging portion of the main ladder, a third pivot operatively mounted on the supporting member in downwardly spaced relation to the main pivot, a link swingably mounted on the third pivot and extending rearwardly therefrom, an access ladder pivotally connected intermediate its ends to the second pivot and extending upwardly and downwardly therefrom, said access ladder being provided adjacent its lower end with a fourth pivot which is operatively connected to the rearward end of the link, said access ladder further being provided at its upper end with a fifth pivot, said main ladder also being provided at its outer end with a sixth pivot, a work platform hingedly mounted upon the sixth pivot and having a rigid upright post which is, in turn, provided at its upper end with a seventh pivot, and a link bar pivotally connected at its opposite ends to the fifth and seventh pivots, said main, second, third, and fourth pivots being so positioned in relation to each other as to define one parallelogram and said second, fifth, sixth and seventh pivots being so positioned in relation to each other as to define a second parallelogram, whereby the work platform is maintained in a selected angular position in relation to the supporting member irrespective of changes in position of the main ladder.

7. An aerial ladder comprising an upright supporting member having a main pivot, a main ladder pivotally mounted adjacent one of its ends upon the main pivot for swinging movement from a substantially horizontal position upwardly to a substantially upright position, said main ladder having an integral portion which extends outwardly and rearwardly with respect to the main pivot when the main ladder is in horizontal position, said portion furthermore being adapted to extend downwardly and rearwardly with respect to the main pivot when the main ladder is in upright position, a second pivot operatively mounted in said overhanging portion of the main ladder, a third pivot operatively mounted on the supporting member in downwardly spaced relation to the main pivot, a link swingably mounted on the third pivot and extending rearwardly therefrom, an access ladder pivotally connected intermediate its ends to the second pivot and extending upwardly and downwardly therefrom, said access ladder being provided adjacent its lower end with a fourth pivot which is operatively connected to the rearward end of the link, said access ladder further being provided at its upper end with a fifth pivot, said main ladder also being provided at its outer end with a sixth pivot, a work platform hingedly mounted upon the sixth pivot and having a rigid upright post which is, in turn, provided at its upper end with a seventh pivot, and a link bar pivotally connected at its opposite ends to the fifth and seventh pivots, said main, second, third, and fourth pivots being so positioned in relation to each other as to define one parallelogram and said second, fifth, sixth and seventh pivots being so positioned in relation to each other as to define a second parallelogram, said second, fourth and fifth pivots being located along a straight-line parallel to a single straight-line which is parallel to the line between the main and third pivots, said single straight-line forming the base of one parallelogram and when extended forming the base of the second parallelogram, whereby the work platform is maintained in a selected angular position in relation to the supporting member irrespective of changes in position of the main ladder.

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