June 18, 1940. L. E. ERICKSON ET AL 2,204,671

EXTENSIBLE WORK TOWER

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Fig. 5

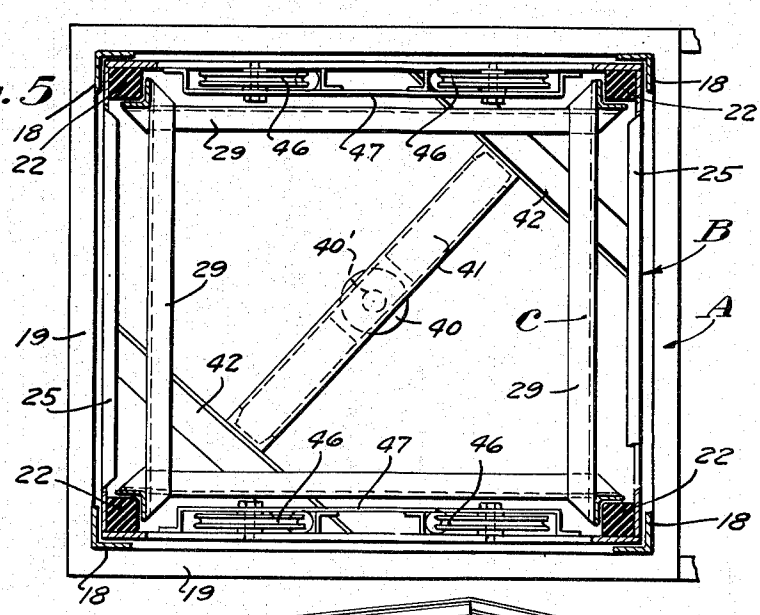
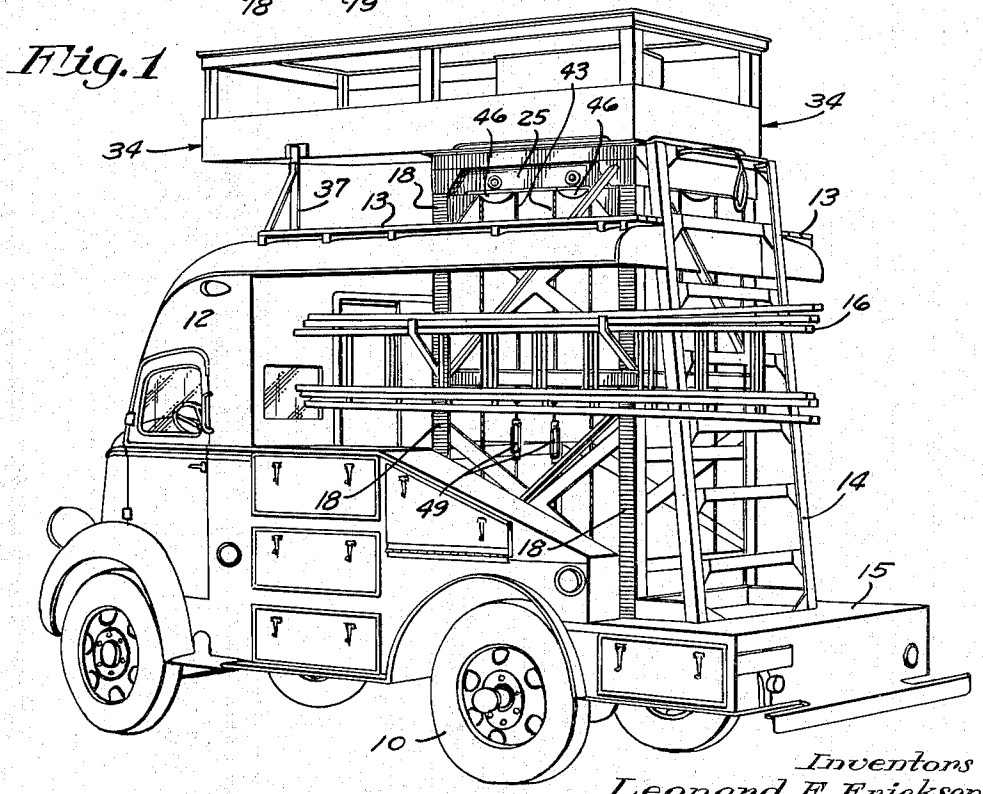


Fig. 1



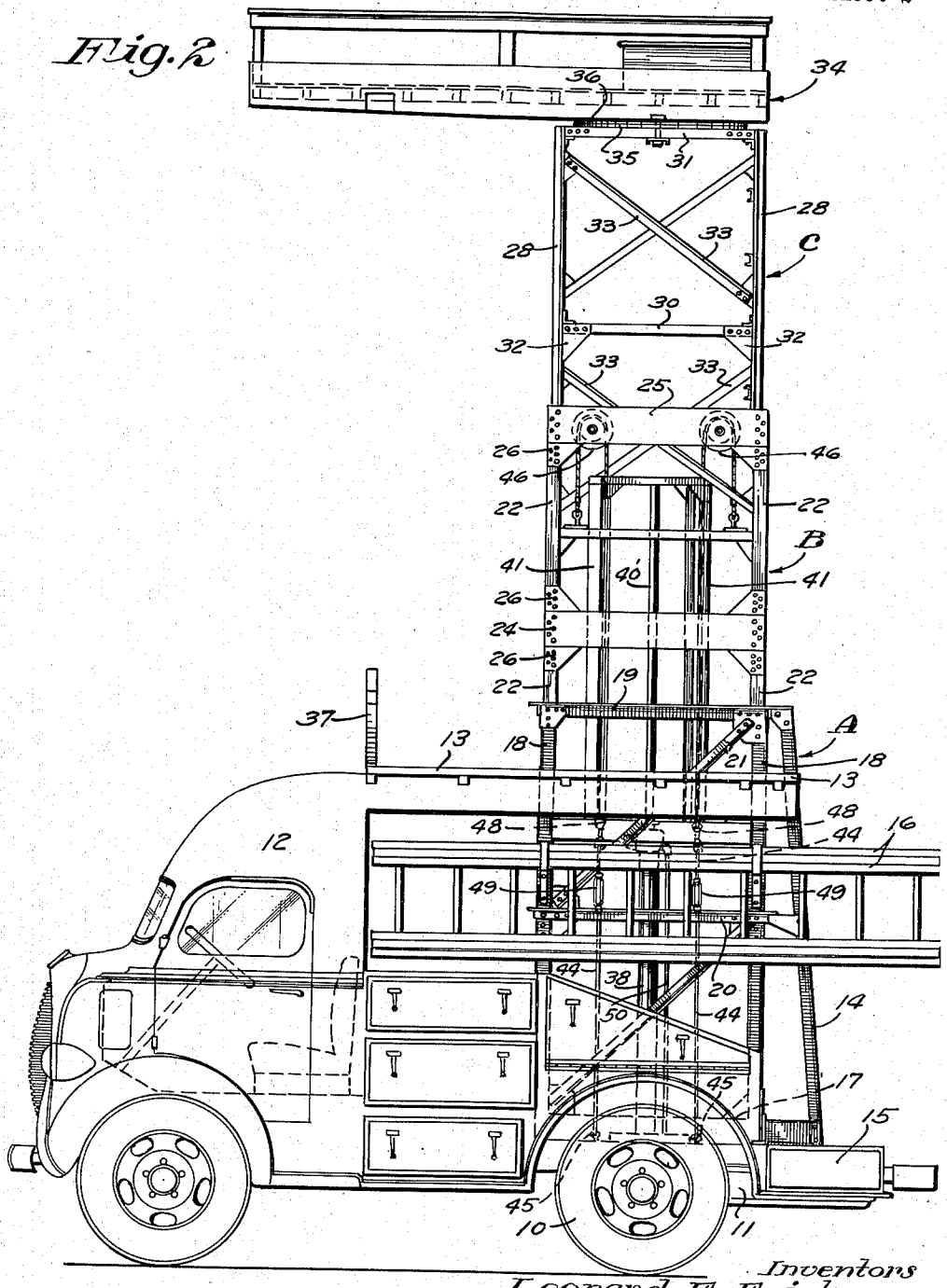
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EXTENSIBLE WORK TOWER

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Fig. 2



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Fig. 3

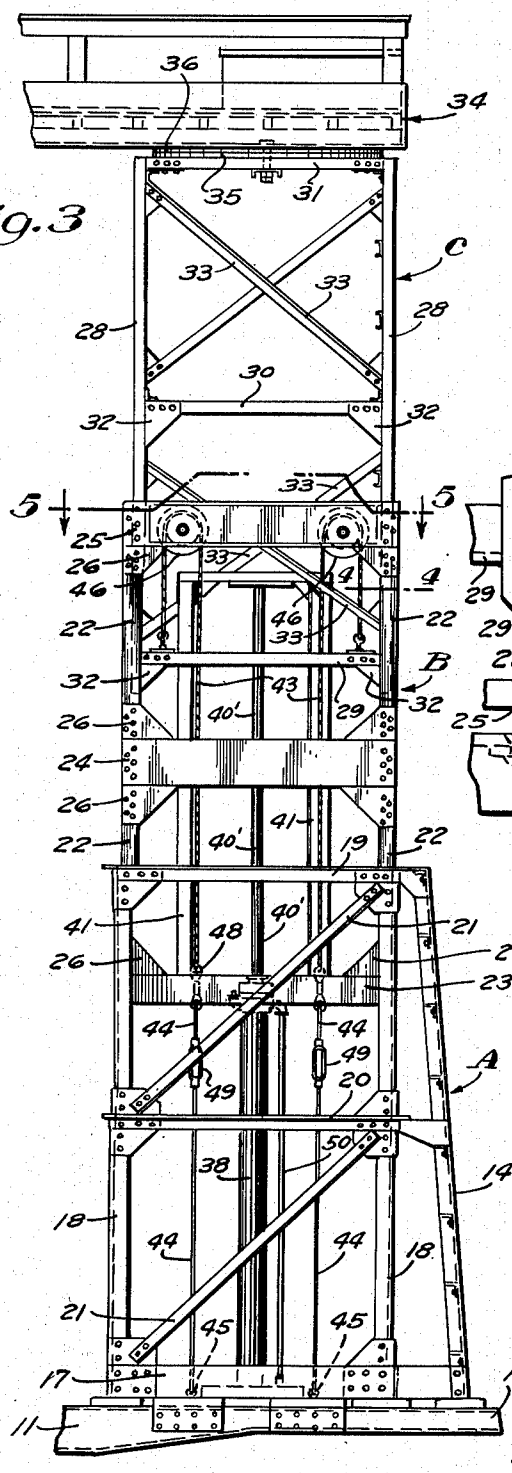
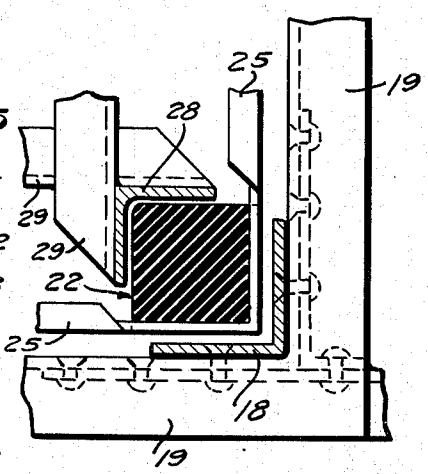


Fig. 4



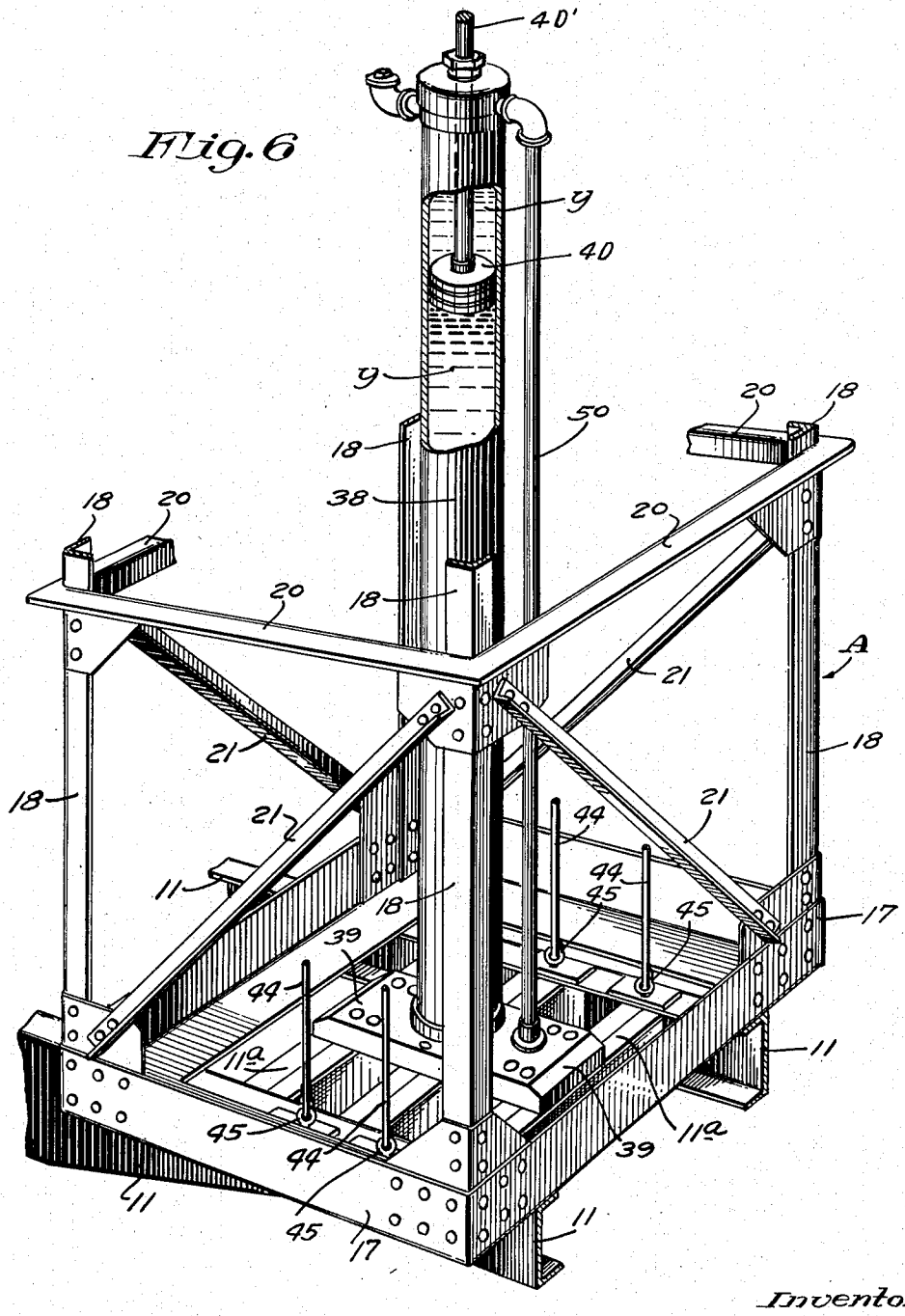
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EXTENSIBLE WORK TOWER

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Fig. 6



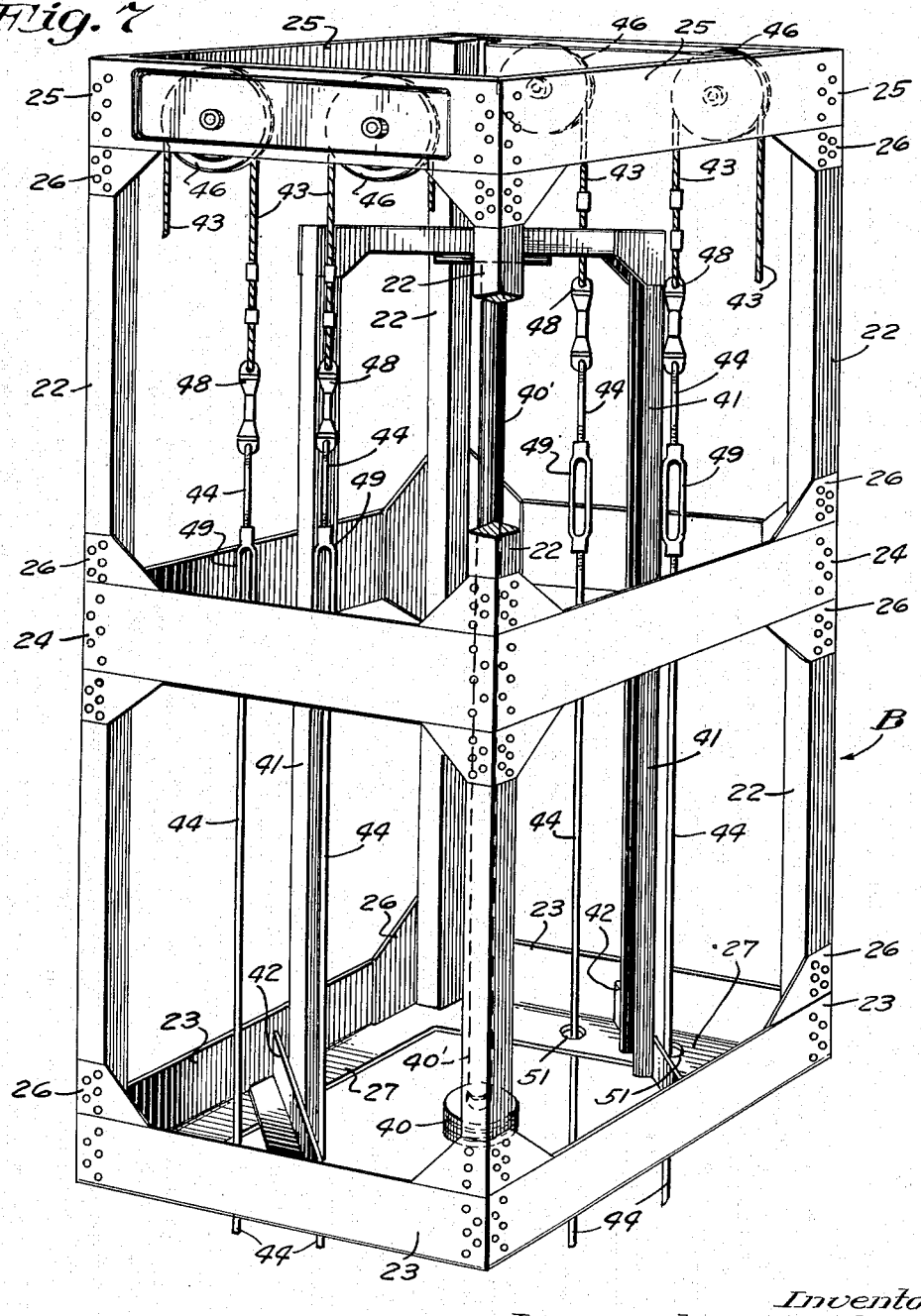
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Fig. 7



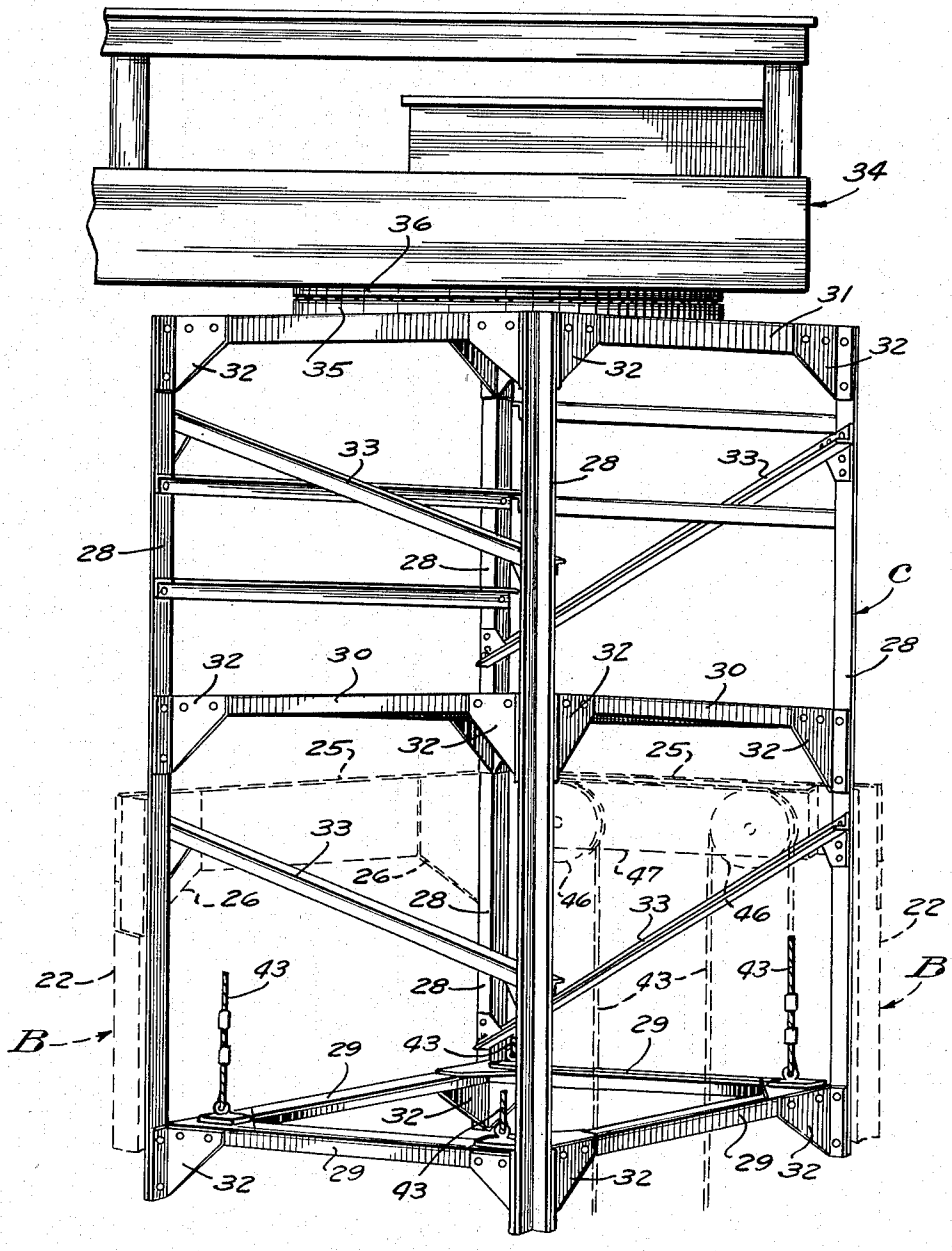
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Fig. 8



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UNITED STATES PATENT OFFICE

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EXTENSIBLE WORK TOWER

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Application April 15, 1939, Serial No. 268,082

7 Claims. (Cl. 304—9)

This invention relates broadly to vertically extensible work towers or scaffoldings.

The extensible tower is well adapted for use in connection with a truck, and which arrangement is especially serviceable as a highly efficient work truck for repairing or installing trolley wires or the like.

A truck of this kind when used in connection with trolley lines or other high power electric lines should have highly efficient insulation between the ground and the work top or work platform of the upper section of the tower. The extensible sections of the tower should have great lateral stability and simple, and efficient means should be provided for quickly imparting the extending and contracting movements to the tower.

The above and other important and novel features are accomplished in this invention. Some of the features of the invention especially adapt the tower for use in connection with high power electric lines. Also certain of the features are highly desirable for use in connection with stationary vertically extensible towers or repair scaffolding.

When the extensible tower is used on a truck it is also highly important that no part of the tower extends below the chassis of the truck and that the tower, when contracted, will be brought down to such vertical dimensions that it will readily pass under bridges, through culverts and the like.

From the above it will be understood that the invention is capable of a wide range of uses, to wit; for various services where extensible work devices are required.

The accompanying drawings illustrate a commercial form of the extensible tower applied to a truck such as an automobile or motor propelled truck.

Referring to the drawings wherein like characters indicate like parts throughout the several views:

Fig. 1 is a perspective illustrating the tower applied to an auto truck with the tower contracted to its lowest condition;

Fig. 2 is a side elevation of the parts shown in Fig. 1 but with the tower vertically extended;

Fig. 3 is a side elevation showing the tower extended but removed from the truck, with some parts broken away;

Fig. 4 is an enlarged fragmentary section taken on the line 4—4 of Fig. 3;

Fig. 5 is a horizontal section taken on the line 5—5 of Fig. 3;

Fig. 6 is a perspective with some parts broken away showing the lower section of the tower;

Fig. 7 is a perspective showing the center or second section of the tower; and

Fig. 8 is a perspective showing the third or upper section of the tower with the work deck or platform swiveled thereon, parts of the latter being broken away.

The tower shown is applied to and carried by an auto truck which may take various forms, but is preferably designed to carry various tools or devices useful in performing the work for which the equipment is designed to perform.

Of the parts of the truck illustrated, it is only desirable for the purpose of this case to briefly note the truck wheels 10, the chassis frame 11 and the truck body 12, which latter is formed on its top with a fixed elevated deck 13. Incidentally, it will be further noted that the truck at its rear is shown as provided with a fixed upright ladder 14 that extends from a lower rear platform 15 to a point above the rear of the upper deck 13. The numeral 16 indicates portable ladders shown as carried by the truck, but which form no part of the present invention.

Directing attention particularly to Figs. 3 and 6, it will be noted that the lower section A of the tower is rigidly secured to and carried directly on the rear ends of the chassis beams 11. This lower section A is a rectangular steel structure made up as shown of rectangular angle iron or steel beams 17 that are directly secured upon the chassis beams 11 and cross frame members 11a that span the beams 11. Angle iron corner posts 18 are rigidly secured to and rise from the corner base frame 17. At their extreme upper ends the corner posts 18 are tied together by a rectangular steel frame 19 and at their intermediate portions they are tied together by a similar rectangular steel frame 20. The frame work of this lower section A is shown as further reenforced by oblique angle bars 21.

The second or intermediate section B of the tower is a rectangular skeleton member, the corner posts of which are arranged to slide in the channels of and be guided by the corner posts 18. This intermediate section B has corner posts 22 which for an important purpose already indicated and hereinafter more fully discussed, are of material that is a good electrical insulator. In practice, and preferably, these posts 22 are made of wood such as oak. At their lower ends these posts 22 are rigidly secured to metal tie plates 23; at their intermediate por-

tions are rigidly secured to and tied together by metal tie plates 24; and at their upper ends are rigidly secured to and tied together by tie plates 25. The said tie plates 23, 24 and 25 are in rectangular arrangement and are applied to and secured to the outer faces of the posts 22 by rivets, bolts or the like and advisably also by gussets 26, which latter are bolted to said posts and electrically welded to the respective tie plates. The lower tie plates 23 are further reinforced by and either formed integral with or spot welded to horizontally disposed inwardly projecting metal tie plates 27.

The third or upper section C is also a rectangular skeleton structure having four corner posts 28, see particularly Figs. 3, 4 and 8, that are tied together at their lower ends by metal tie bars 29; are tied together at their intermediate portions by similar metal tie bars 30; and at their upper ends are tied together by similar metal tie bars 31. The said tie bars 29, 30 and 31 are very rigidly secured to the corner posts 28, by spot welding, and preferably also by gussets 32 riveted, bolted, or attached by spot welding. Also, the rectangular skeleton of the upper section C is further reinforced by oblique metal bars 33.

It is now important to note, see particularly Fig. 4, that the metal corner posts 28 are steel or metal angle bars having outwardly exposed channels that engage the inwardly projecting corner and face portions of the wooden posts 22 of the intermediate or second section B, thereby very effectually insulating the upper metallic section C from all grounded connection with the lower portion of the tower, the truck and the ground.

Of course, there may be more than the illustrated three sections in the tower. However, the uppermost section which, in the present instance is section C, carries a horizontally rotatable working platform. In the drawings this working platform is indicated as an entirety by the numeral 34 and it has such length that it will project a very considerable distance from the tower. To stably support the working platform 34 from the tower, a turntable structure is employed. As shown, this turntable involves a lower annular bearing plate 35 rigidly secured on the top of the section C, and an upper annular bearing plate 36 rigidly secured to the bottom of the working platform 34 near one end thereof.

When the working platform 34 is elevated, it is adapted to be turned to any desired position, but when the tower is lowered, the projecting portion of this platform will fall between laterally spaced stop brackets 37 rigidly secured on the deck and will then be held against lateral pivotal movements and in direct line with the truck body so that it will not accidentally move during transportation.

The power actuating lifting means for the movable sections of the tower is highly important and considered novel. The primary lifting element is an upright hydraulic cylinder 38 which, for an important purpose, is located at the axis or center of the tower and at its lower end is directly anchored to a base 39, see particularly Figs. 3, 6 and 7. Working in the cylinder 38 is a piston 40, the stem 40' of which works upward through the head of the piston. The cylinder 38, in vertical extent, is somewhat less than the height of the lower section A and also somewhat less than the height of either of the movable tower sections B and C and this feature, as will hereinafter appear, is important.

The piston 40 acts primarily to raise the second section B, and to accomplish this, with the cylinder 38 located within the lower section A and above the chassis of the truck, the upper end of the piston is connected to the bottom of the section B by a strong, centrally located, inverted U-shaped hanger frame 41. This hanger frame is a strong metal structure preferably made up of channel bars rigidly connected at their upper ends by a transverse portion. The lower ends of the bars of the hanger frame 41 are rigidly anchored to the bottom of section B preferably and, as shown, by oblique anchor bars 42, the ends of which are welded or otherwise rigidly attached to the bottom tie members 23 and 27 of said section B, as best shown in Figs. 5 and 7.

To cause the section C to be elevated not only with the section B but to move in respect to the latter, a multiplying motion transmitting mechanism is provided. This mechanism, as best shown in Figs. 3, 4 and 6, involves cables anchored to or in respect to the bottom of section A, passed over shims or guide devices on the top of the section B and having depending ends anchored to the bottom of the section C. These so-called cables, as herein illustrated, involve chains or flexible sections 43 and rod or non-flexible sections 44. In this arrangement it is the lower ends of the rod portions 44 that are anchored at 45 to the bottom of the tower section A, see particularly Fig. 6. The flexible sections 43 are passed over guide sheaves 46, shown as journalled to the upper tie plates or bars 25 of the intermediate section B and to supplemental bearing plates 47, see particularly Figs. 5 and 7, which latter are rigidly secured to the inner faces of said tie plates 25.

In this arrangement there are four guide sheaves 46 and four cables, and it is highly important to note that the depending portions of the flexible cable sections 43 are attached to the four corners of the bottom of the section C at the four corners of the said section C, so that the lifting or supporting action of the section C is equally distributed at the four corners thereof. The long depending and more or less rigid portions of the lifting cables are shown as provided with insulators 48 and turnbuckles 49.

The motive power here preferably employed is a fluid such as oil, indicated by the character Y, which will be circulated from the one end to the other of the cylinder 38 under the action of suitable means such as a pump, not shown, but which would operate through a conducting pipe 50 shown in Fig. 6.

It may be noted that the lower portions 44 of the lifting cables are passed through clearance holes 51 in the frame bottom plates 27.

Summary of operation

Fig. 1 shows the tower contracted or lowered and the truck in condition for traveling to the place where it is to be used. Figs. 2 and 3 show the tower elevated. The primary power from the cylinder and piston motor, under the action of hydraulic pressure, applies the power to primarily lift the second tower section B, with the force applied at the center or axis of the latter, so that the lifting strain is distributed evenly at the four corners of the said section B. The four pulleys 46, of course, are raised to the same extent as the section B, but the cable being an-

chored at one end and attached to the third or upper section C at the lower portion of the latter, will cause the said section C to be elevated twice as far as the section B, or in other words, the section C will be given, in respect to section B, the same amount of vertical movement that is given to the section B, in respect to the fixed section A. These four cables attached at the four corners of the section C evenly lift the said section C and prevent binding of the section C in respect to the guides afforded by the section B.

The insulated or insulating posts 22 afford small guiding surfaces for the angle iron posts 28 of upper section C, and all of the adjustments of the sections of the tower afford a high grade electrical insulation between the upper tower section and the section B. Of course, this insulation completely insulates the working platform 34 from the truck and from the ground and thus prevents those working on the platform 34 from being electrically grounded from high tension wires or the like.

As already indicated, the maximum movement of the piston 40 within the cylinder 38 is considerably less than the otherwise possible movement of the section B, in respect to section A, and section C in respect to section B. For example, Fig. 3 illustrates about the maximum possible vertical extension of the tower under the movement of the piston in respect to the cylinder. This always maintains sufficient telescoping contact between the sections to maintain the desired lateral stability of the tower and to prevent undue strains on the tower sections caused by weight that may be on the extended portion of the working platform 34.

Of course, the movement of the piston in respect to the cylinder, and hence the extension of the tower, may be limited to any desired extent, by control of the oil or liquid to and from the opposite ends of the cylinder. Valve mechanism and co-operating connections for causing reciprocations of pistons within cylinders are well known, and as far as this invention is concerned, may take any of the well known and suitable forms.

Again it is also important to note that the tower extends through the deck 13, so that workmen reaching this deck 13 from the conveniently located ladder 14, or otherwise, may very easily mount the working platform 34, when the tower is contracted or lowered, as shown in Fig. 1. The inverted lifting frame applies the lifting force to the bottom or lower portion of the second section B.

Also, from the foregoing, it will be understood that the preferred and at present commercial form of the device is capable of modifications within the scope of the invention herein disclosed and desired to be broadly claimed.

What we claim is:

1. In a tower of the kind described, a relatively fixed lower section, a second or vertically movable section telescoped for sliding movement in said lower section, an inverted lifting frame located within said movable section with its lower portion fixed to the lower portion of said movable frame, and a power actuated lifting motor located centrally of said frames, anchored at the base of said lower frame and operative on the upper portion of said inverted lifting frame, to elevate the latter and said movable frame, in further combination with a third frame telescopically removable within said second frame, four cable guides on the upper portion of said second frame, four cables anchored at their lower ends to the base of said relatively fixed lower frame, passed over said cable guides and having their upper ends attached to the base of said third frame at the four corners thereof, whereby the lifting power is applied evenly at the four corners of said third frame.

2. In a tower of the kind described, a substantially rectangular relatively fixed lower frame, a substantially rectangular second frame telescopically slidable within said relatively fixed lower frame, a substantially rectangular third frame telescopically slidable within said second frame, a hydraulic power device including a cylinder and piston, said cylinder being located within said relatively fixed lower frame and anchored at the base thereof, said piston being connected to and operative on said second frame to lift the same, and a motion multiplying connection operative under vertical movements of said second frame, to impart additional upward movement to said third frame, and in which one of said frames has corner posts with guide surfaces of electrical insulating material, and a co-operating frame has metallic corner posts engaging said insulating guide surfaces.

3. In a tower of the kind described, a substantially rectangular relatively fixed lower frame, a substantially rectangular second frame telescopically slidable within said relatively fixed lower frame, a substantially rectangular third frame telescopically slidable within said second frame, a hydraulic power device including a cylinder and piston, said cylinder being located within said relatively fixed lower frame and anchored at the base thereof, said piston being connected to and operative on said second frame to lift the same, cable guides on the upper portion of said second frame, and cables passed over said cable guides, with their lower ends anchored to the base of said fixed lower frame, and having their upper ends anchored to the base of said third frame, and in which said second frame has corner posts of electrical insulating material affording guide surfaces for said third section.

4. In a tower of the kind described, a relatively fixed lower section, a second or vertically movable section telescoped for sliding movement in said lower section, an inverted lifting frame located within said movable section with its lower portion fixed to the lower portion of said movable frame, and a power actuated lifting motor located centrally of said frames, anchored at the base of said lower frame and operative on the upper portion of said inverted lifting frame, to elevate the latter and said movable frame, and in further combination with a third frame telescopically removable within said second frame, cable guides on the upper portion of said second frame, and cables passed over said cable guides anchored at their lower ends to the base of said relatively fixed lower frame and at their upper ends anchored to the base of said third frame, one of said frames having corner posts that afford guide surfaces and are insulated against electric current, and the co-operating section has metallic corner posts slidably engageable with said insulating surfaces.

5. In a tower of the kind described, a relatively fixed lower section, a second or vertically movable section telescoped for sliding movement in said lower section, an inverted lifting frame located within said movable section with its lower portion fixed to the lower portion of said movable frame, and a power actuated lifting motor located centrally of said frames, anchored at the base of said lower frame and operative on the

upper portion of said inverted lifting frame, to elevate the latter and said movable frame, and in further combination with a truck on the chassis of which said first or lower frame is anchored, said truck having a raised deck through which said first or lower frame is extended.

6. In a tower of the kind described, a relatively fixed lower section, a second or vertically movable section telescoped for sliding movement in said lower section, an inverted lifting frame located within said movable section with its lower portion fixed to the lower portion of said movable frame, and a power actuated lifting motor located centrally of said frames, anchored at the base of said lower frame and operative on the upper portion of said inverted lifting frame, to elevate the latter and said movable frame, and in further combination with a truck on the chassis of which said first or lower frame is anchored, said truck having a raised deck through which said first or lower frame is extended, and a ladder structure mounted on the rear portion of said truck, extended to said deck and to the upper portion of said lower frame.

7. In a tower of the kind described, a fixed lower frame having metallic posts, a second frame having wooden posts directly engageable with and slidable vertically in respect to the metallic posts of said lower frame, and a third or upper frame having metallic posts directly engageable with and slidable vertically in respect to the wooden corner posts of said second frame, and thereby insulated from said lower frame and from the ground, and means for vertically moving the said second and third frames in respect to said lower frame and said third frame in respect to said second frame.

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