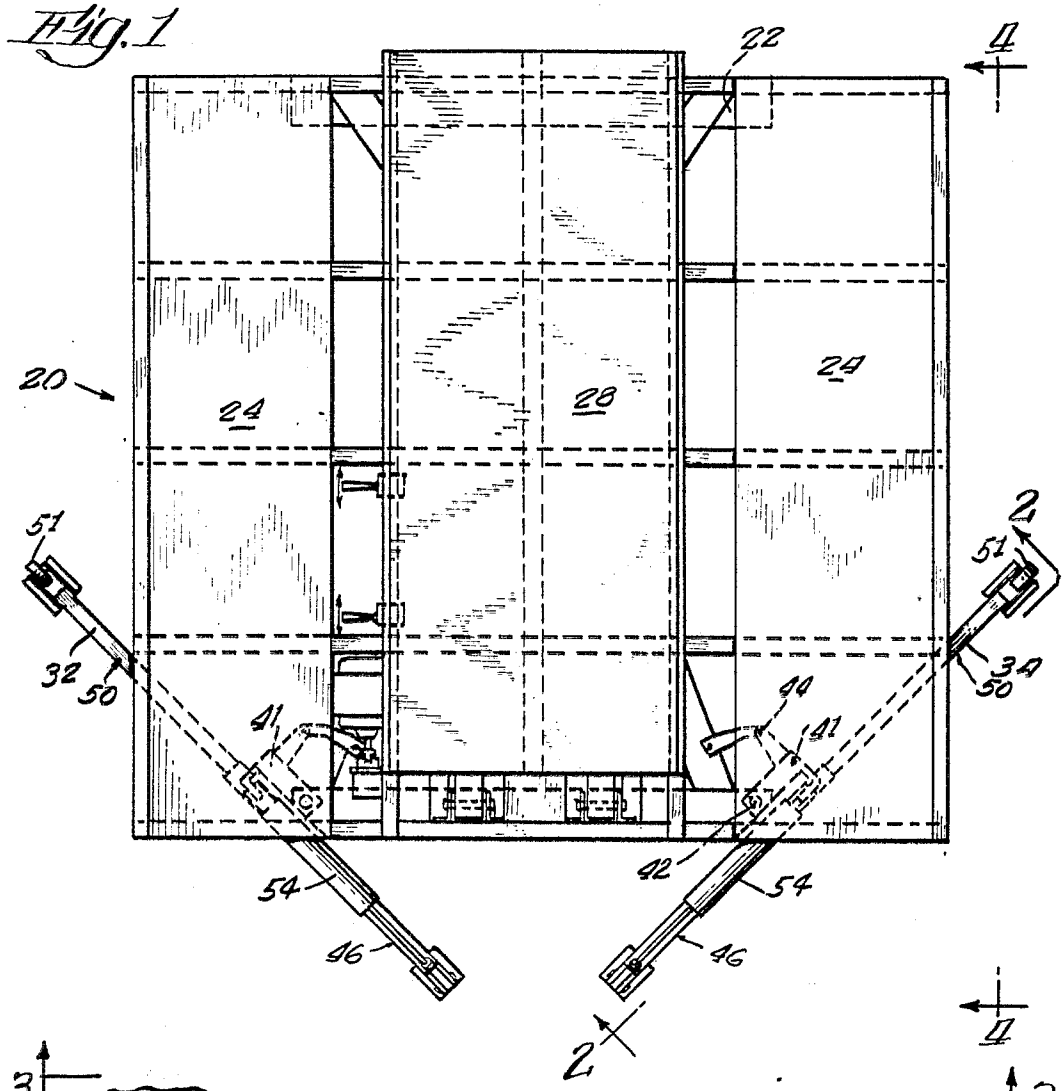
Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 1

Fig. 1



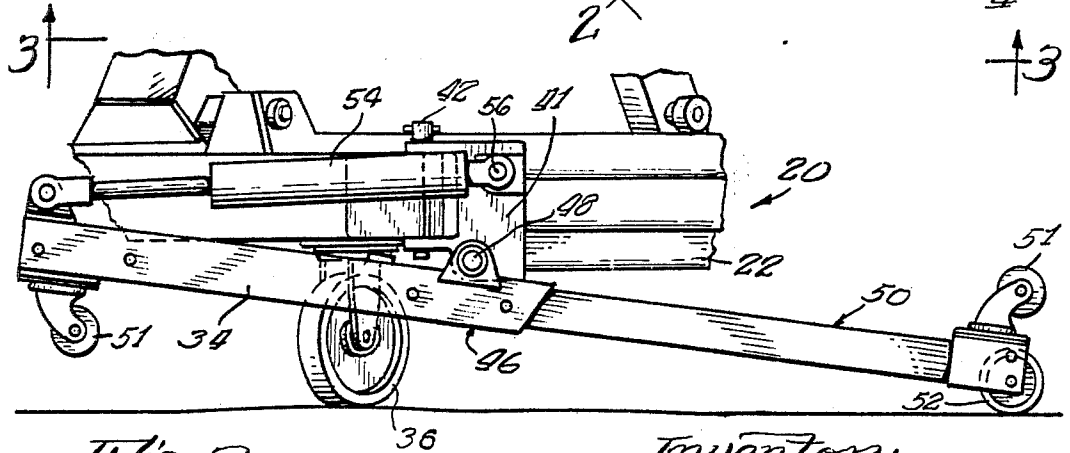


Fig. 2

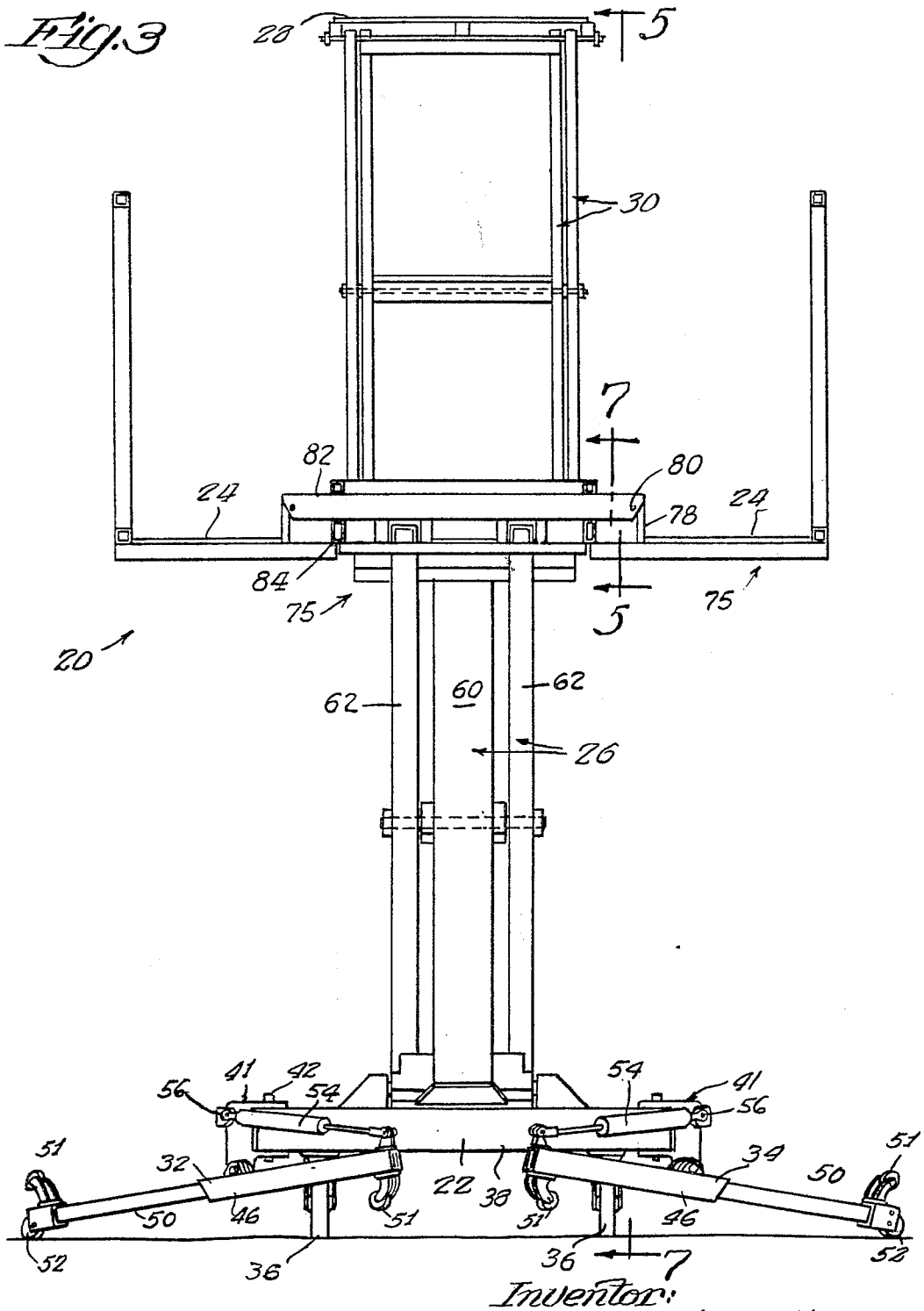
Inventor:
Raymond E. Smith, Jr.
By Hume, Clement, Hume & Lee Attys

Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 2

Fig. 3



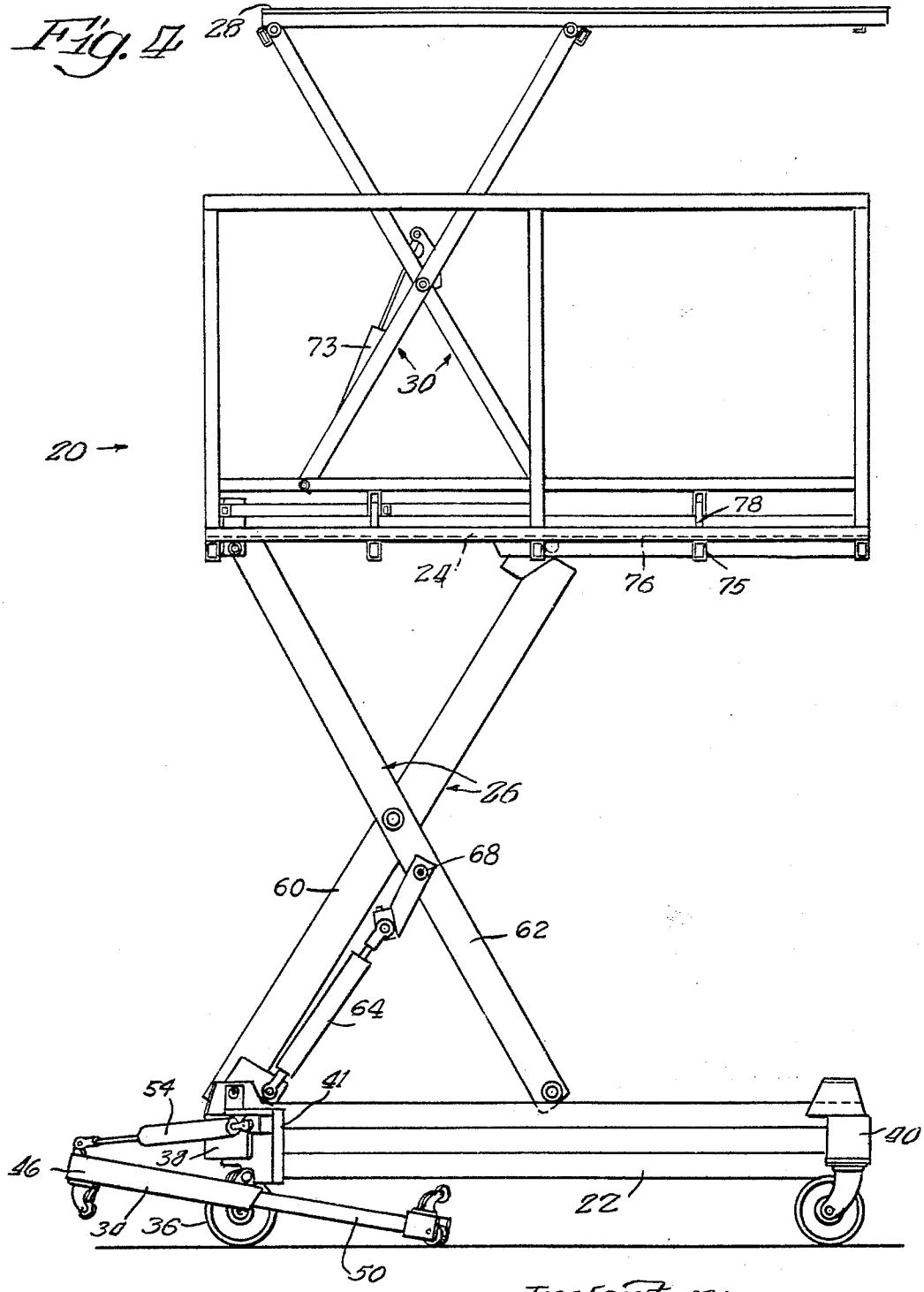
Inventor:
Raymond E. Smith, Jr.
By Hume, Clement, Hume & Lee Attys.

Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 3

Fig. 4



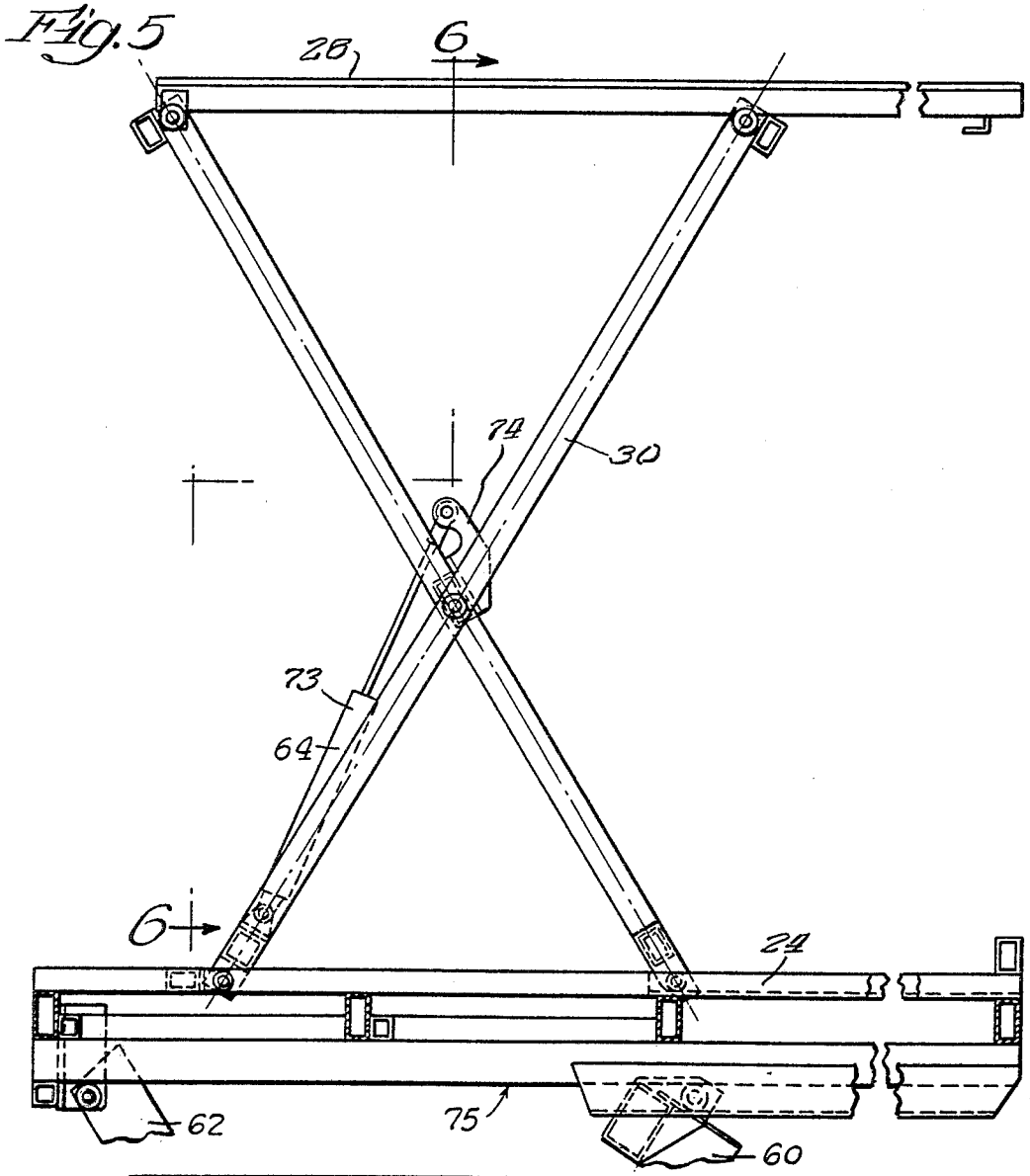
Inventor:
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Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 4

Fig. 5



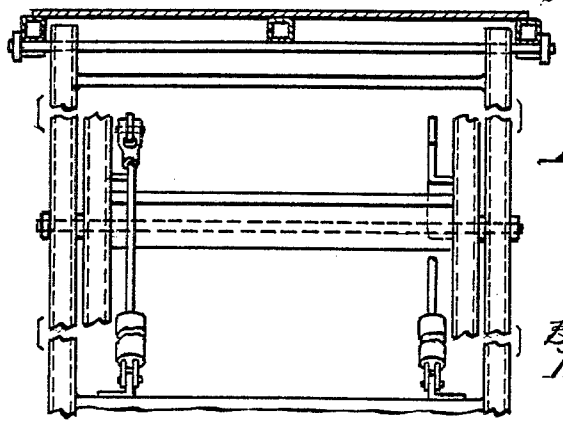


Fig. 6

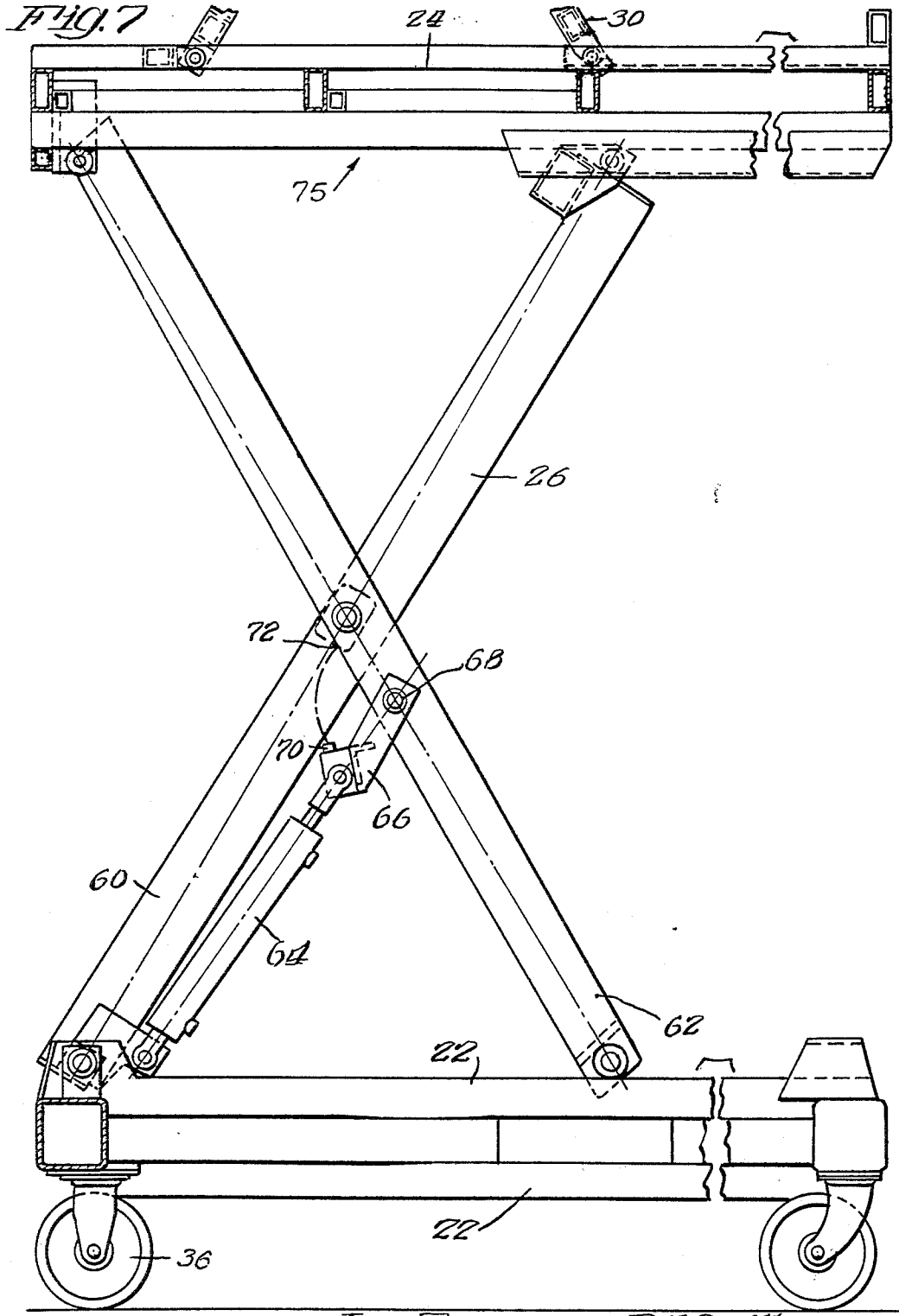
Inventor:
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Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 5

FIG. 7



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Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 6

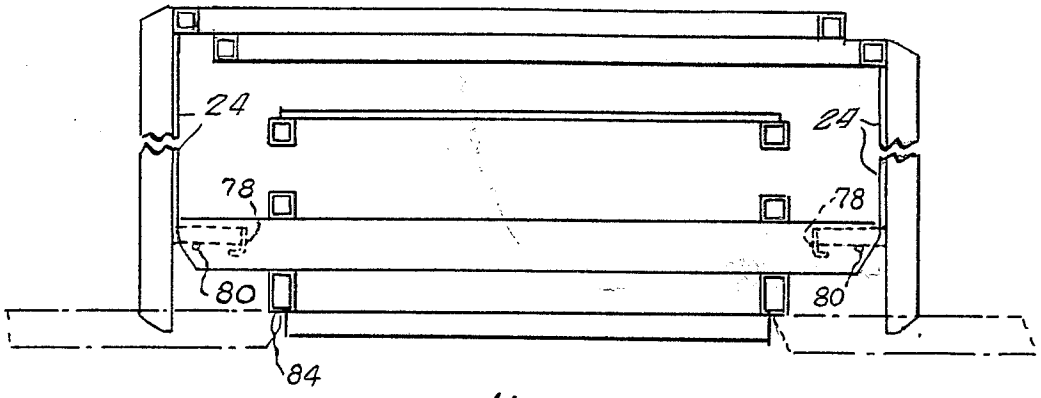


Fig. 13

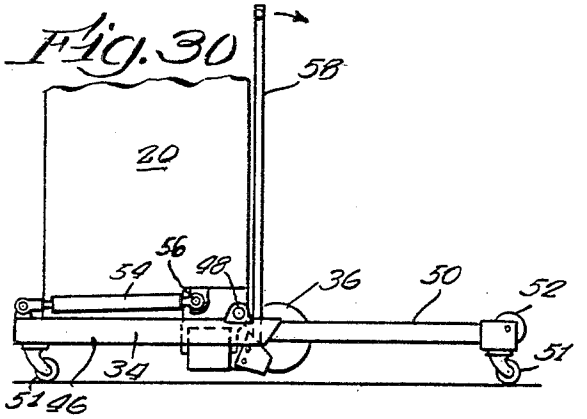


Fig. 30

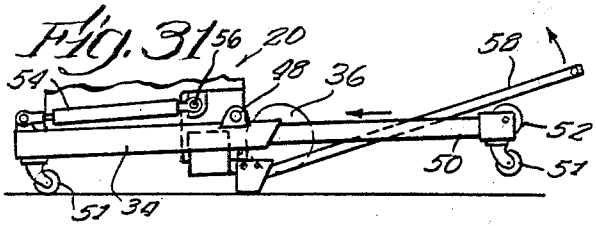


Fig. 31

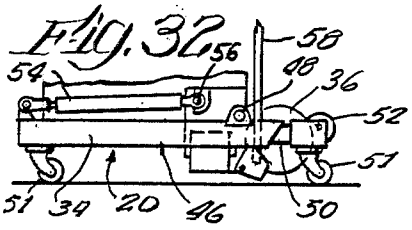


Fig. 32

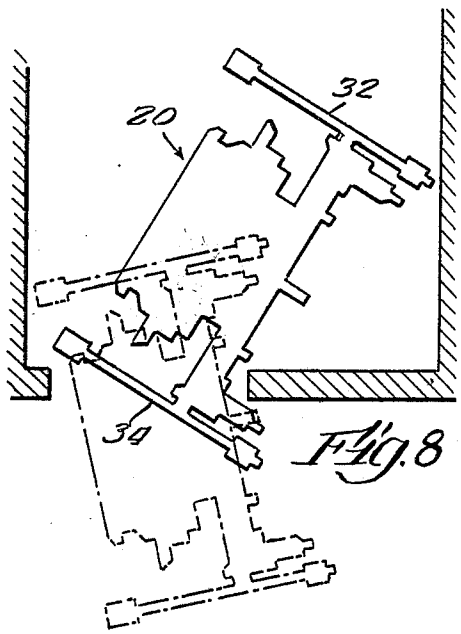


Fig. 8

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Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 7

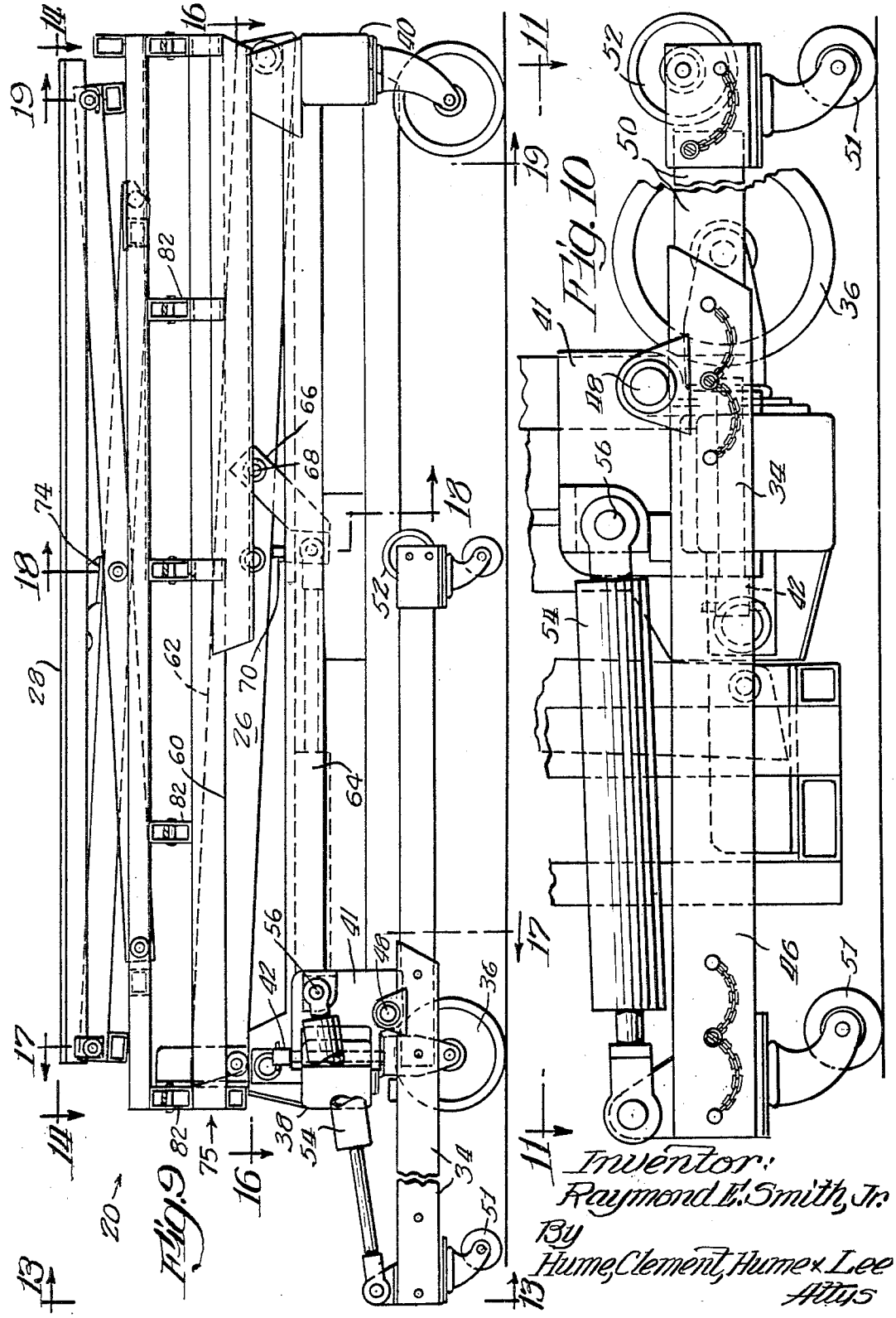


Fig. 9

Fig. 10

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Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 8

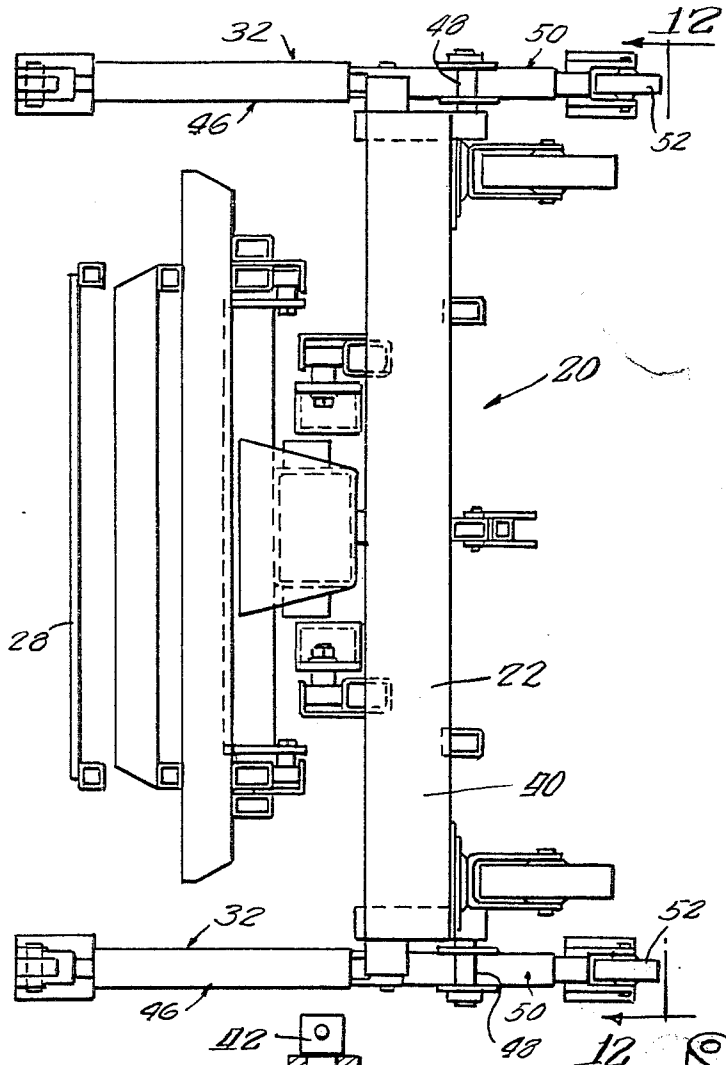


Fig 11

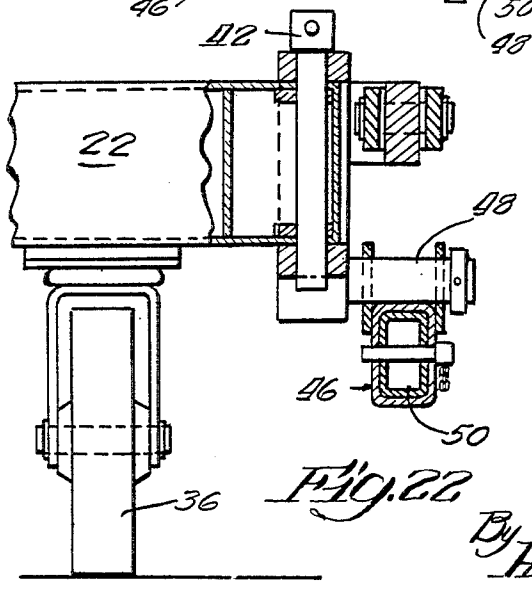


Fig. 22

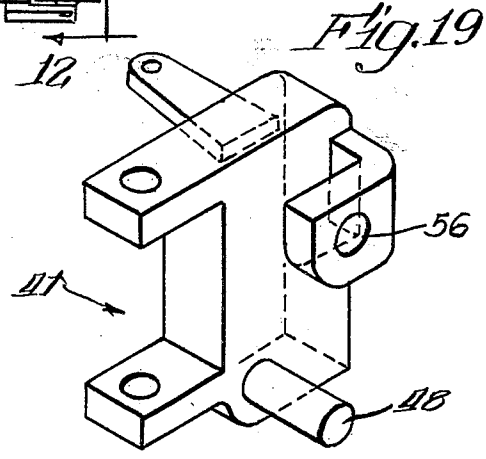


Fig. 19

Inventor:
Raymond E. Smith, Jr.
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Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 9

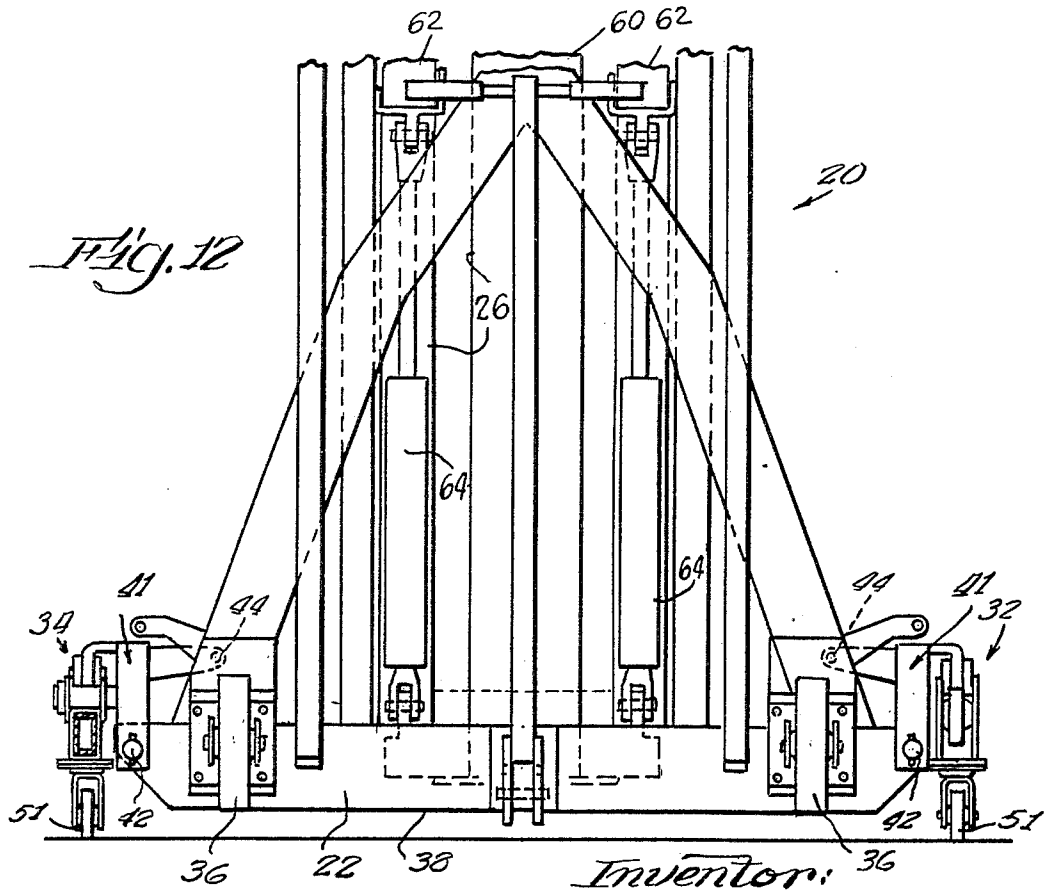


Fig. 12

Inventor:
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Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 10

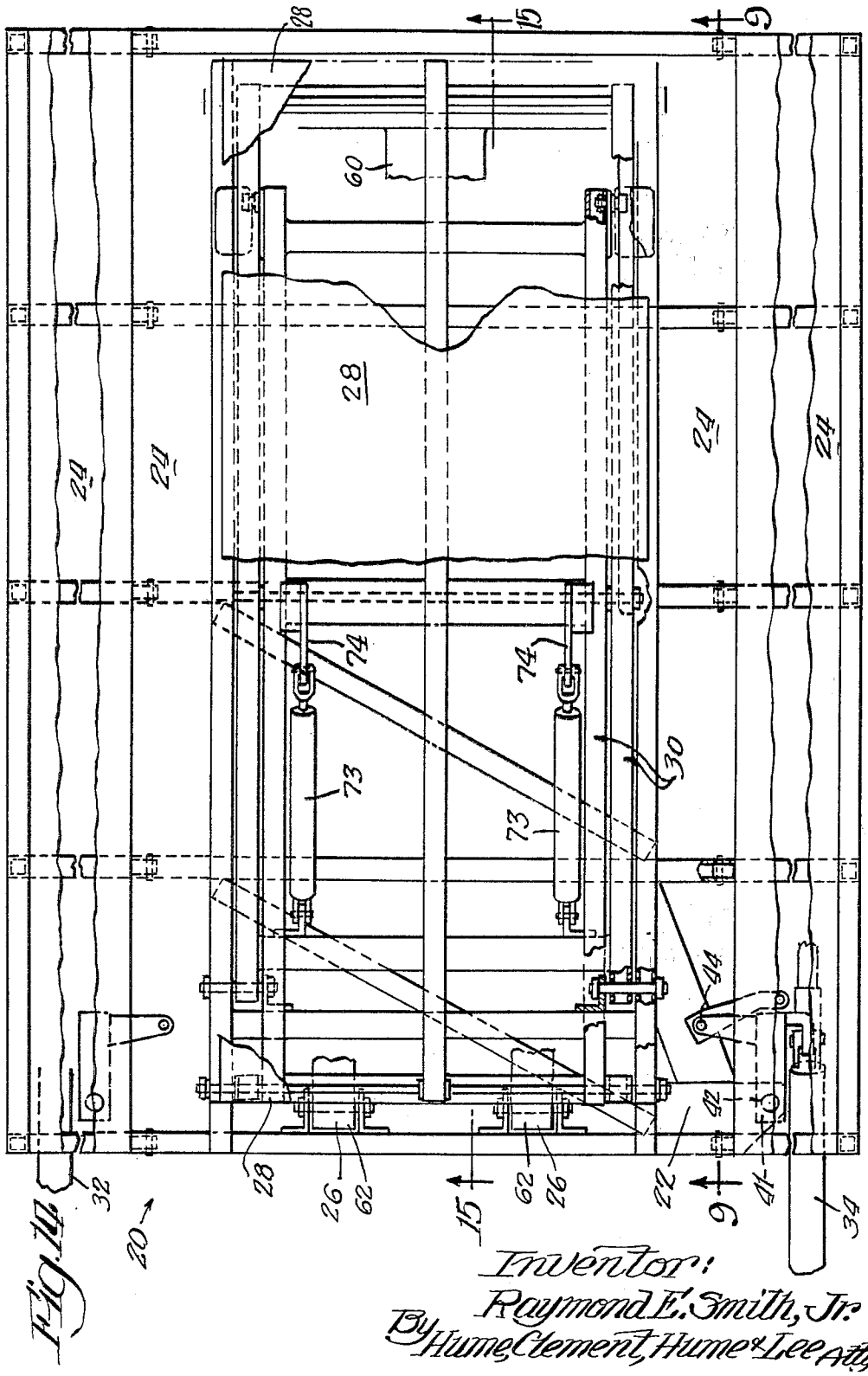


Fig. 11

Inventor:
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Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 11

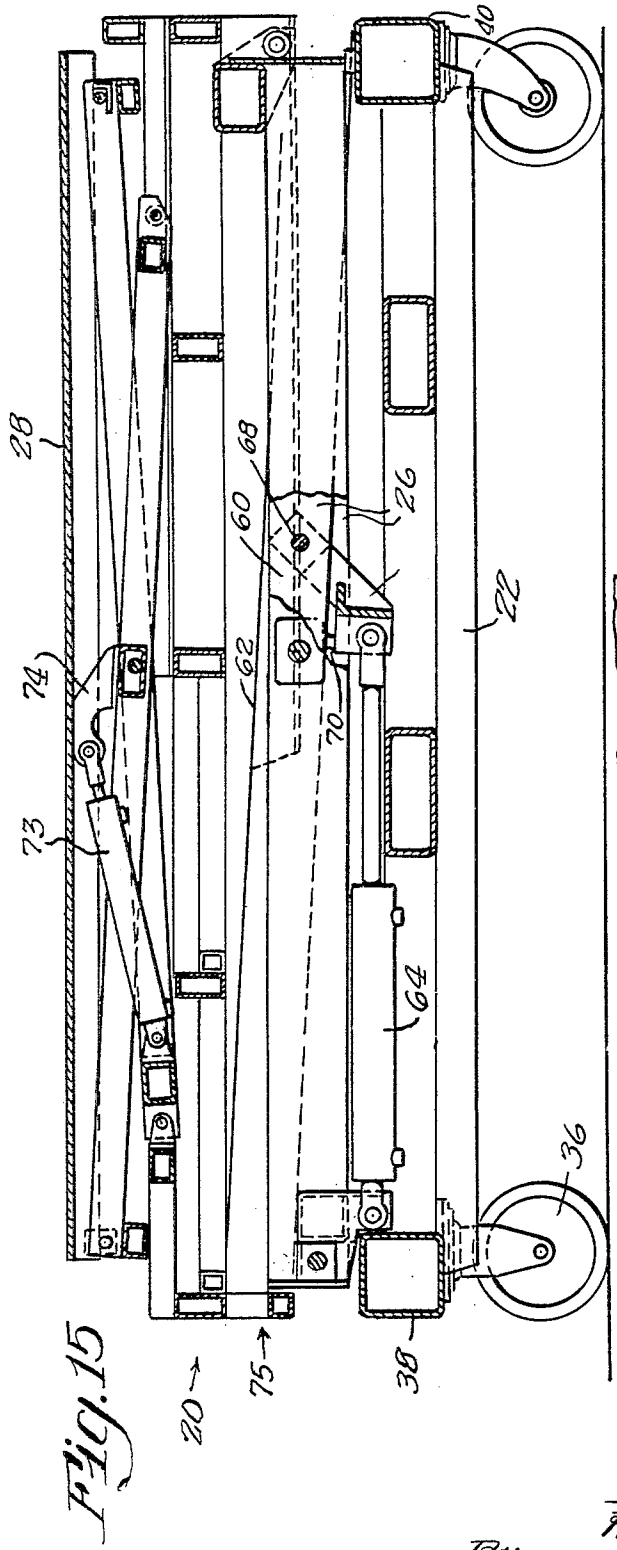


Fig. 15

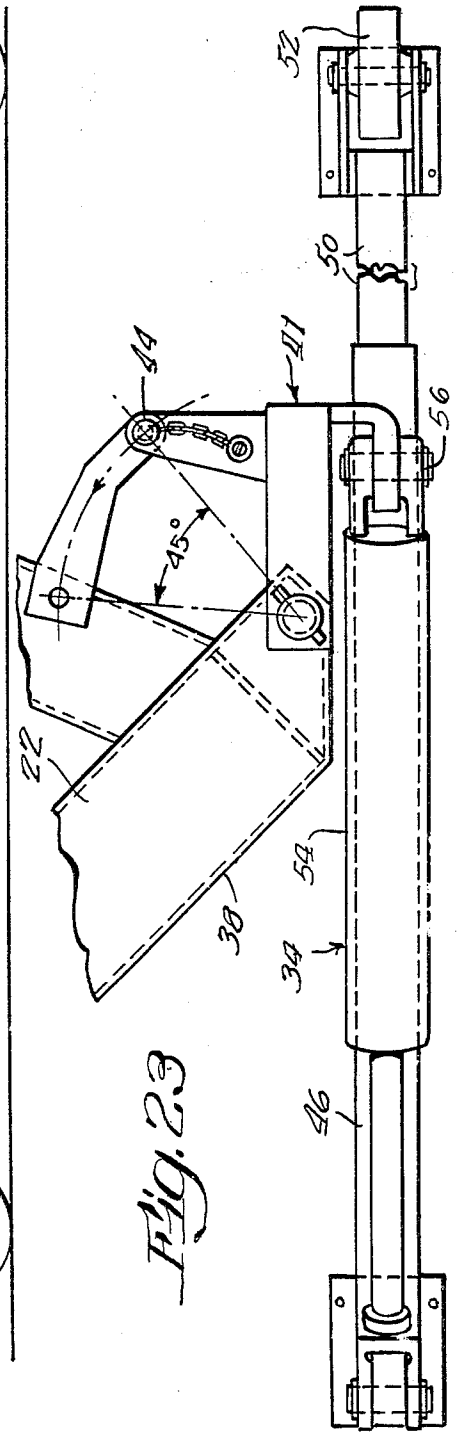


Fig. 23

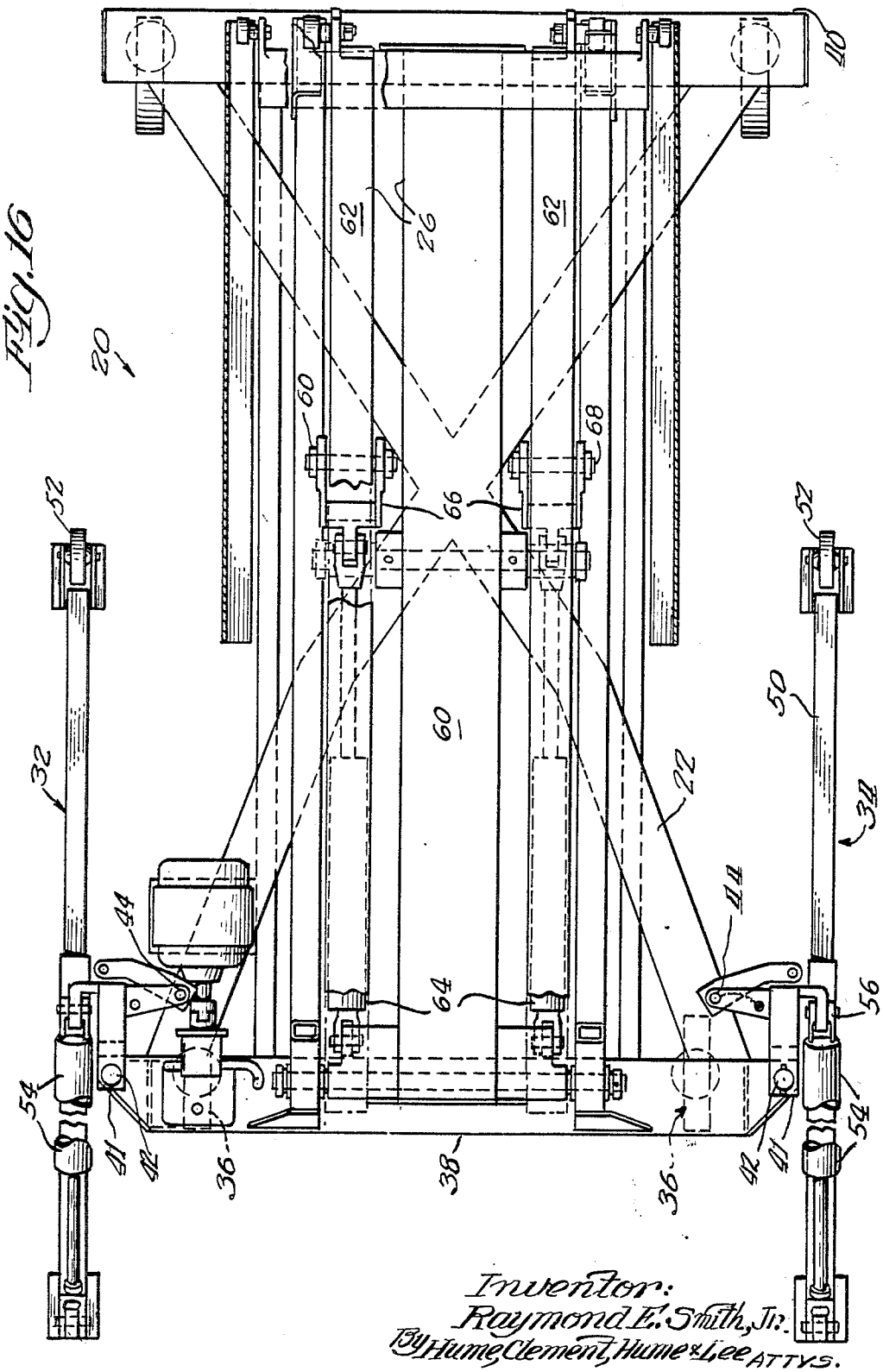
Inventor:
Raymond E. Smith, Jr.
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Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 12

Fig. 16



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Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 13

Fig. 17

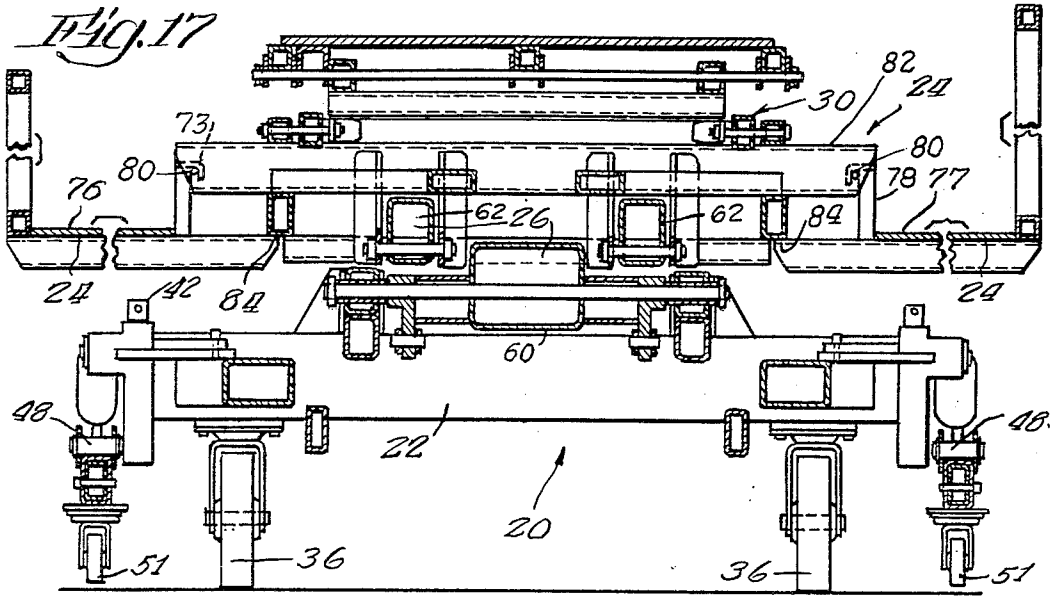


Fig. 18

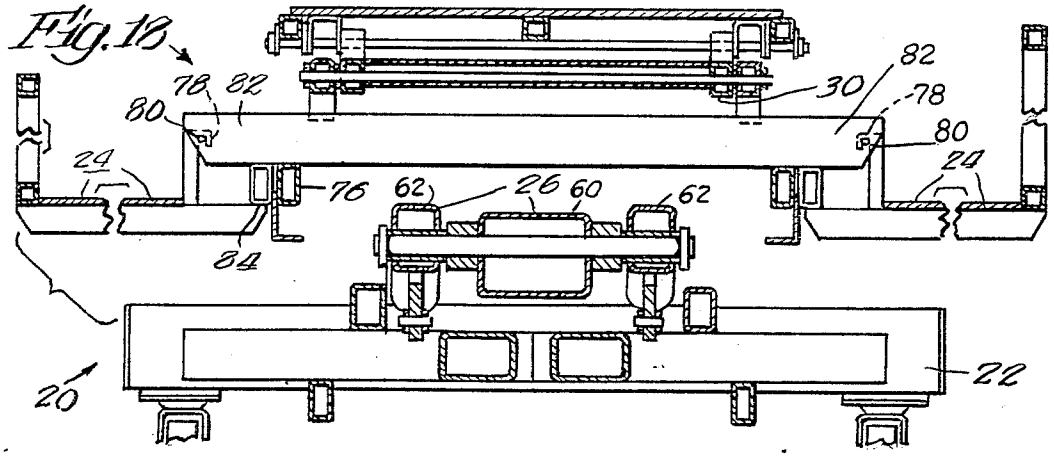


Fig. 19

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Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 14

Fig. 20

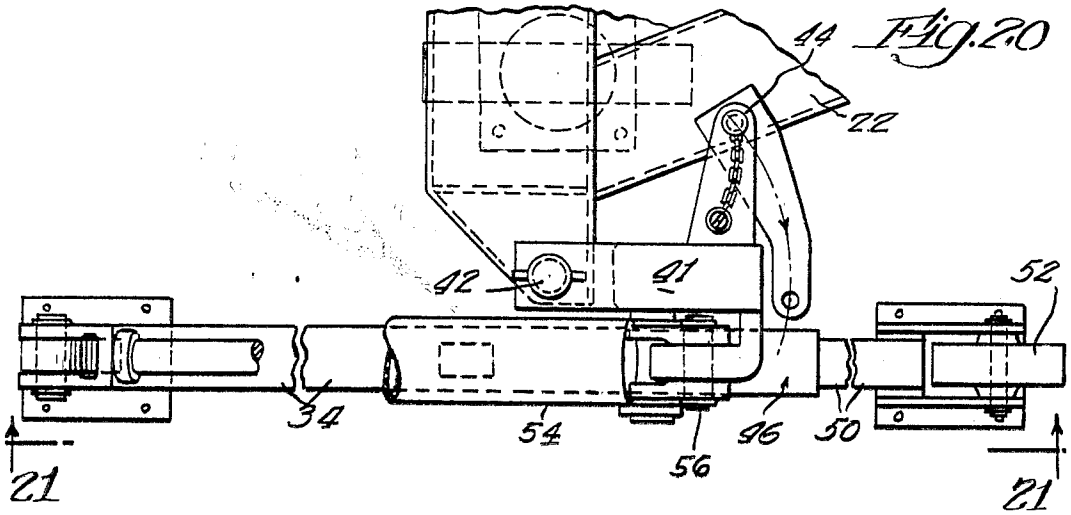
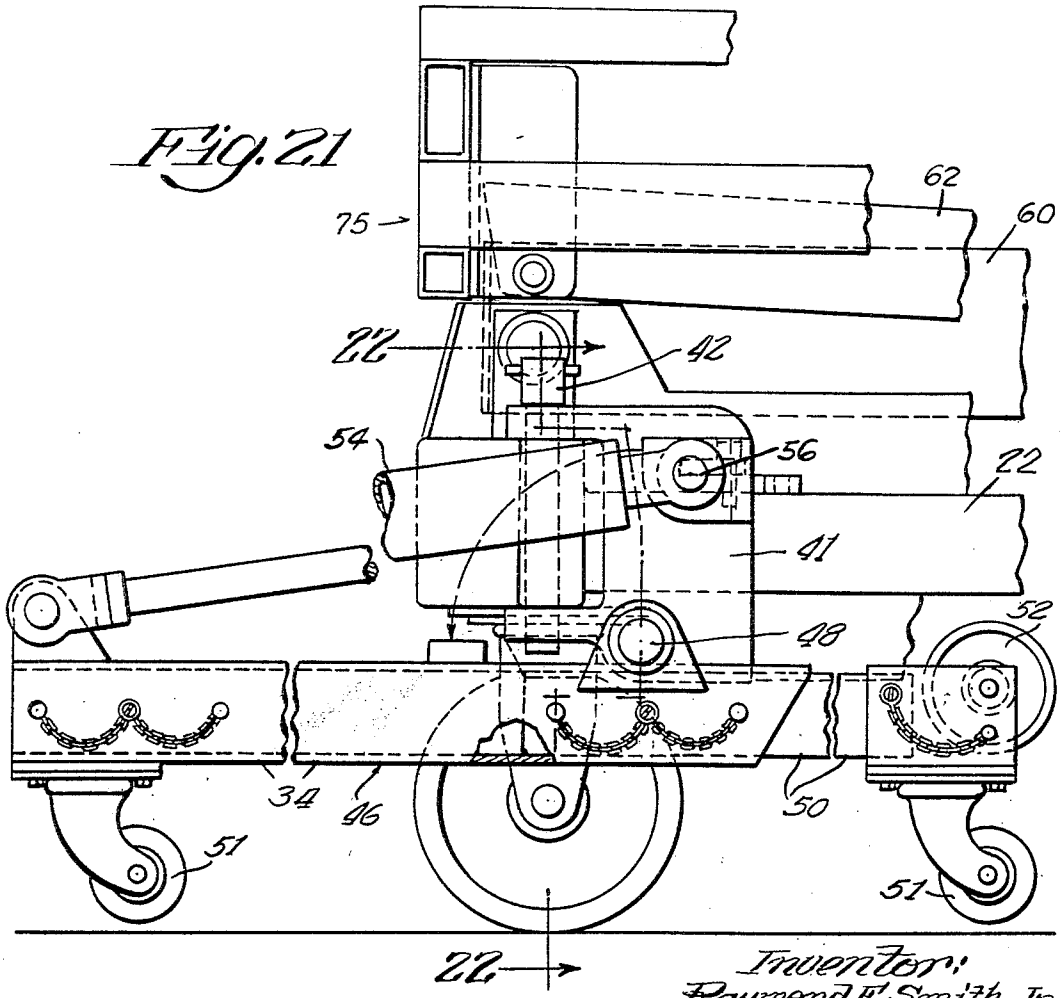


Fig. 21



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Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 15

Fig. 24

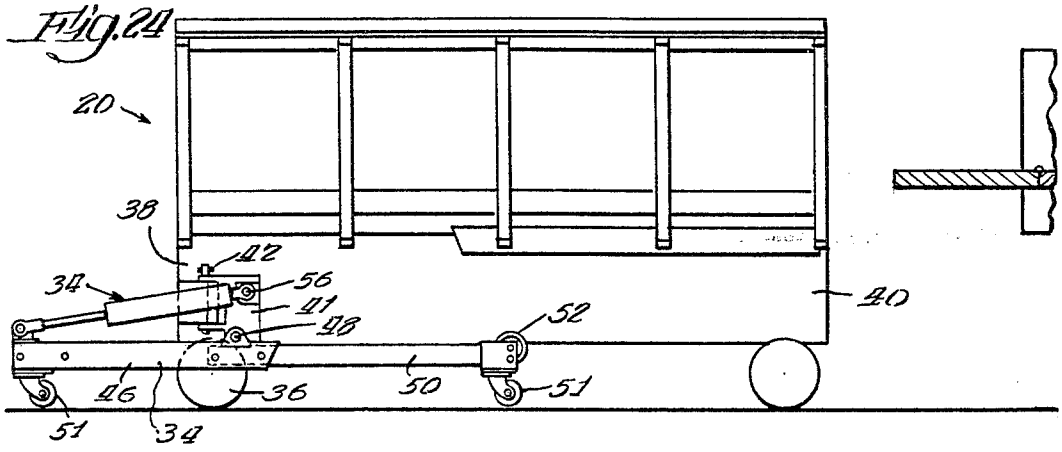


Fig. 25

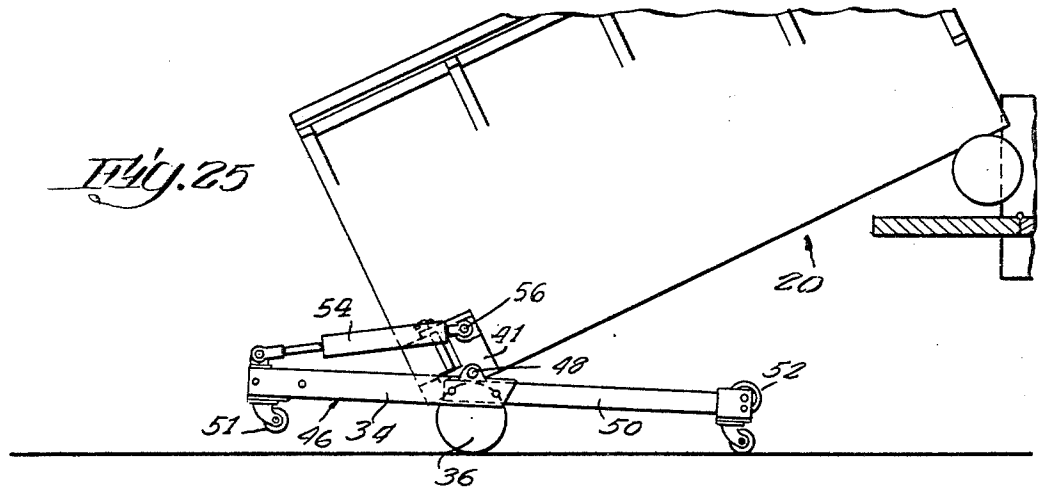
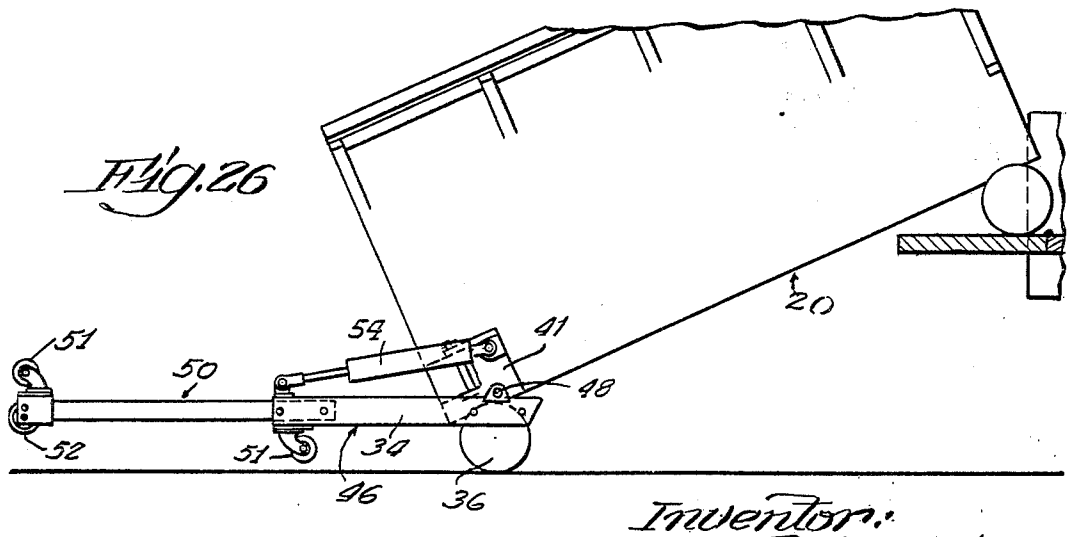


Fig. 26



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Dec. 23, 1969 R. E. SMITH, JR 3,485,321

WORK TOWER

Filed Nov. 20, 1967 16 Sheets-Sheet 16

Fig. 27

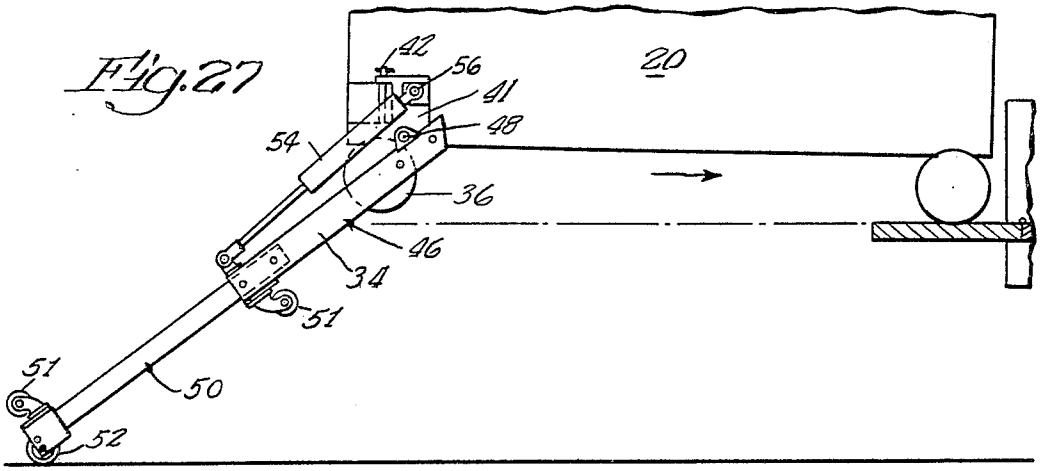
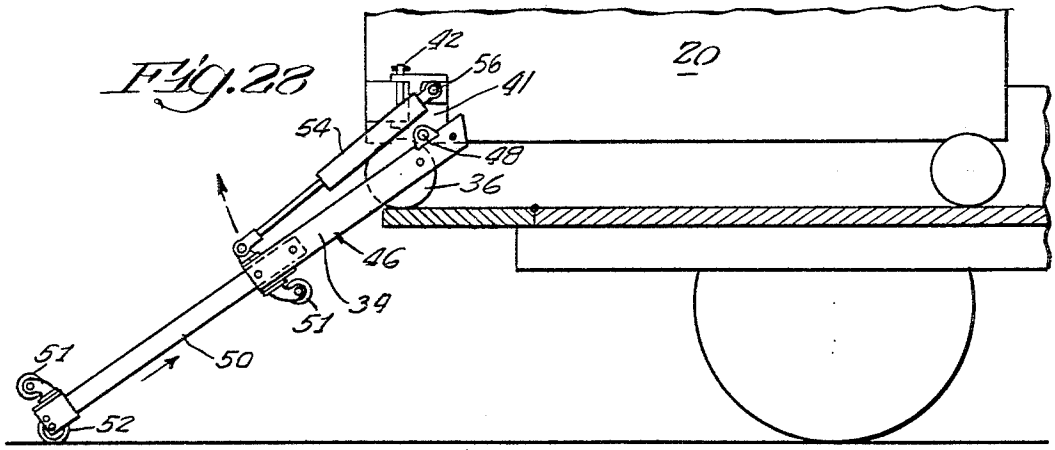


Fig. 28



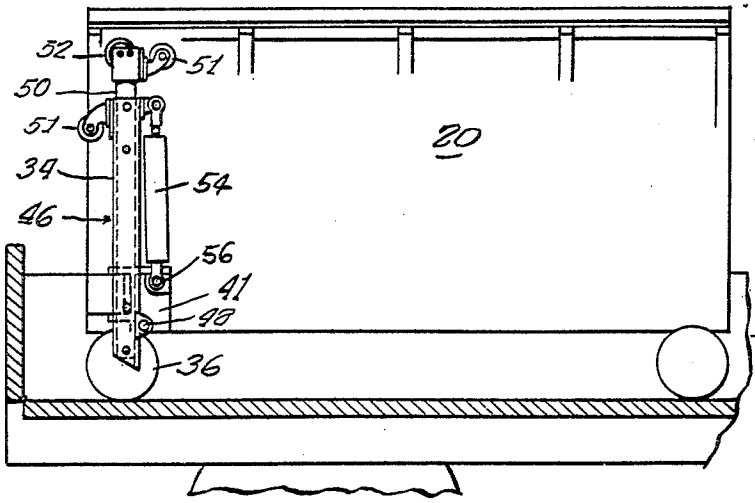


Fig. 29

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United States Patent Office 3,485,321 Patented Dec. 23, 1969

3,485,321

WORK TOWER

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Filed Nov. 20, 1967, Ser. No. 691,668
Int. Cl. E04g 1/00; E06c 5/04; F16g 11/12
U.S. Cl. 182—131 14 Claims

ABSTRACT OF THE DISCLOSURE

A work tower with a hydraulically positionable personnel platform and work platform and hydraulically powered outriggers which are vertically and horizontally positionable to tilt and support the work tower at a vertical angle.

Introduction

The present invention relates to work towers and more specifically to a fully portable work tower which provides flexible operation with integral powered loading, unloading and erection in a highly compact structure adapted for maneuverability in limited space.

The invention basically comprises a movable base supporting a personnel-supporting platform, means for raising and lowering the platform, and outrigger means pivotally connected to the base. The outrigger means are extendable and are adapted to selectively vertically tilt the work tower for transportation.

Further objects, features and advantages of the invention pertain to the particular arrangement and structure whereby the above mentioned aspects of the invention are attained. The invention will be better understood by reference to the following description and to the drawings forming a part thereof, which are substantially to scale, wherein:

FIGURE 1 is a top plan elevation of an exemplary work tower in accordance with the present invention with outriggers extended;

FIGURE 2 is a sectional view taken along the line 2—2 of FIGURE 1;

FIGURE 3 is a front elevation taken along the line 3—3 of FIGURE 1;

FIGURE 4 is a side elevation taken along the line 4—4 of FIGURE 1;

FIGURE 5 is an enlarged view taken along the line 5—5 of FIGURE 3;

FIGURE 6 is a sectional view taken along the line 6—6 of FIGURE 5;

FIGURE 7 is an enlarged view taken along the line 7—7 of FIGURE 3;

FIGURE 8 is a plan view showing the work tower moving on end through a narrow doorway;

FIGURE 9 is a side elevation of the work tower in its collapsed position taken along the line 9—9 of FIGURE 3;

FIGURE 10 is a enlarged side elevation of the lower position of FIGURE 9 with the work tower rotated 90° to a vertical position;

FIGURE 11 is a top plan view of the work tower in a vertical position looking in the direction of the line 11—11 of FIGURE 10;

FIGURE 12 is a bottom elevation of the lower portion of the work tower taken along the line 12—12 of FIGURE 11;

FIGURE 13 is a front elevation of the work tower taken along the line 13—13 of FIGURE 9;

FIGURE 14 is a plan elevation taken along the line 14—14 of FIGURE 9;

FIGURE 15 is a sectional view taken along the line 15—15 of FIGURE 14;

FIGURE 16 is a sectional view taken along the line 16—16 of FIGURE 9;

FIGURE 17 is a sectional view taken along the line 17—17 of FIGURE 9;

FIGURE 18 is a sectional view taken along the line 18—18 of FIGURE 9;

FIGURE 19 is a perspective view of the frame of an outrigger of the work tower;

FIGURE 20 is an enlarged fragmentary view taken along the line 20—20 of FIGURE 13;

FIGURE 21 is a sectional view taken along the line 21—21 of FIGURE 20;

FIGURE 22 is a fragmentary sectional view taken along the line 22—22 of FIGURE 21;

FIGURE 23 is a view similar to FIGURE 20 but with the outrigger rotated 45°;

FIGURES 24 through 29 are schematic side elevations successively illustrating the loading of the work tower of FIGURES 1 through 23 onto a transport vehicle;

And FIGURES 30 through 32 are side elevations of the work tower of FIGURES 1 through 29 in a vertical position.

Description of the exemplary embodiment

Referring to the FIGURES 1 through 32, there is shown an exemplary work tower **20** in accordance with the present invention. The work tower **20** is a self-contained portable unit including a wheeled base **22** and a personnel-supporting platform **24** raised and lowered from the base **22** by a first hydraulically powered scissors linkage **26**. The personnel platform **24** mounts a separate work supporting platform **28** independently raised and lowered by a second hydraulically powered scissors linkage **30**. Pivotally connected to the base **22** at opposite sides are outriggers **32** and **34** adapted to extend from the base. The outriggers **32** and **34** are vertically pivotable by integral hydraulic cylinders with respect to the base **22** to selectively vertically tilt the entire work tower **20** to any desired angle including a fully vertical position.

The entire work tower **20** is preferably actuated by hydraulic cylinders powered by a hydraulic system on the base **22**. Commercially available hydraulic system components may be employed. Line current or self-contained batteries may be employed to drive the hydraulic pump.

Considering the base **22**, it provides the basic connection point and support for the work tower **20**. Preferably, it has two large fixed axis wheels **36** at a first end **38** and two large pivotable (castered) wheels at the opposite or second end **40**.

Each of the two outriggers **32** or **34** is adapted to act as an arm for hydraulically manuevering the entire work tower **20**. The entire outrigger unit is pivotally connected by its frame **41**, shown in FIGURE 19, to the base **22** by a vertical pin **42**. The outrigger is normally restrained from horizontal rotation by a securing pin **44** connecting an ear of the outrigger frame **41** with the base **22**. As shown in FIGURE 23, two different apertures for the pin **44** may be provided. Thus, the outrigger may be held parallel the side of the base **22** or horizontally pivoted to a 45° angle to the base **22** to provide lateral stability for the work tower as shown in FIGURE 1. In either position, with the pin **44** in place the outrigger is secured to the base **22**.

The outriggers each include an elongate outrigger arm **46** pivotally secured thereto for horizontal rotation about a pin **48** in the frame **41** adjacent the inner end of the outrigger arm **46**. The arm **46** is a rectangular tubular member and is adapted to slidably receive therein an extension arm **50**. The extension arm **50** slides into either the inner or outer ends of the outrigger arm **46**, co-

linearly extending the outrigger beyond the end of the work tower in the first case and past the midpoint or center of gravity of the work tower in the other case. The extension arm **50** can also telescope almost entirely inside the outrigger arm **46** for minimum extension as shown in FIGURES 30 through 32.

The outrigger contains its own wheel system comprising a small caster wheel at the outer end of the outrigger arm **46** and a small caster wheel **51** at the outer end of the extension arm. The extension arm **50** also has a pin lockable fixed axis wheel **52** opposite its caster wheel **51**. By inserting the extension arm **50** in the outrigger arm upside down, the wheel **52** is presented toward the floor rather than the caster wheel **51**. It will be noted that, with the outrigger arm in a horizontal position and the work tower in its normal position, as in FIGURE 24, only the wheels on the base **22** contact the floor. The wheels on the base **22** extend below the wheels on the outrigger arms and the extension arm, thereby providing clearance for positioning the outriggers.

The outrigger may be tilted vertically, i.e. about a horizontal axis, or the base may be tilted vertically depending upon the position of the extension arm **50**. This vertical movement may be either above or below the horizontal and is accomplished by the piston movement of a hydraulic cylinder **54**. The selectable operation of the cylinder **54** provides in effect a variable length arm connecting the outer end of the outrigger arm **46** with a pivot point **56** on the outrigger frame **41** spaced above the piston **48**. Thus expansion or contraction of the cylinder **54** respectively lowers or raises the outer end of the outrigger arm **46**, thereby pivoting both the outrigger arm and the extension arm vertically about the pin **48**.

When the work tower **20** is tilted into its vertical or "on end" position by the outriggers **32** and **34**, as in FIGURES 8 and 10 through 12, the work tower is supported and movable on the outrigger wheels alone. The wheels on the base **22** are pivoted off the floor. Accordingly, referring to FIGURES 30 through 32, to allow the retraction of the extension arm **50**, an elongated lever **58** is provided to lift both the first end **38** of the base and the outriggers slightly above the floor. The lever **58** has its fulcrum point on the base **22** closely spaced above the floor to provide a high leverage ratio. The short arm of the lever below the fulcrum is adapted to engage the floor and to tilt up and hold the work tower and the outriggers when the lever **58** is rotated from a generally vertical to a generally horizontal position.

The personnel-supporting platform **24** may be automatically from a compact folded position to any selected working height with the personnel remaining on the work tower. Referring particulary to FIGURES 4 and 7, an effective yet simple hydraulically powered scissors linkage **26** raises and lowers the platform **24** from the base **22** while maintaining the horizontal level of the platform. The scissors linkage **26** includes at both sides of the work tower **20** two elongate legs **60** and **62** centrally pivotally connected. The lower end of the leg **60** is pin connected to the first end **38** of the base **22**. The corresponding overlying end of the platform **24** is pin connected to the upper end of the leg **62**. The upper end of the leg **60** has a roller which engages and rolls horizontally along the underside of the platform **24**. Correspondingly, a roller on the lower end of the leg **62** rollably engages the base **22**.

The lifting of the platform **24** is provided here by a hydraulic cylinder **64**. Because of the large forces and varying positions involved, a special lever link **66** connection is preferably provided between the hydraulic cylinder **64** and the scissors linkage **26**. The cylinder **64** is pivotally secured at one end to the lower end of the leg **60**. The piston end of the cylinder **64** is pivotally secured to the outer end of the link **66**. The link **66** is an elongate integral member and is pivotally secured to the lower portion of the leg **62** at a pivot point **68**. Due

to the pivotal connections, the cylinder **64** and the link **66** are normally pulled colinearly by the cylinder **64**, and the lifting force exerted by the cylinder **64** normally acts through the pivot point **68**.

However, for the initial lifting movement of the work platform, i.e. when the scissors **26** are closed, a desired different lifting leverage is provided. This is provided by a fulcrum projection **70** on the link **66**. The projection **70** extends at right angles to the link **66** substantially spaced from the pivot point **68**. When the scissors **26** are substantially closed, as in FIGURES 9 and 15, the projection **70** operatively engages a point of contact **72** on the leg **62** spaced substantially above the pivot point **68**. It may be seen that in this position, the link **66** is not colinear the cylinder **64**. Lower pressure is needed in the cylinder **64** for the initial lifting of the platform **24** than would be required without this arrangement.

The work supporting platform **28** may be independently raised and lowered above the personnel-supporting platform **24** to place the work materials at any desired height convenient to the workmen and the ceiling or work height, thus greatly improving working efficiency in many applications. The work platform **28** is positioned and supported by a separate hydraulic powered scissors linkage **30** connected to and overlying the personnel platform **24** as shown in FIGURES 4 through 6. It differs somewhat from the personnel platform **24** system in that its hydraulic cylinder **73** operates against a lever arm **74** which is rigidly secured to a leg of the scissors.

The personnel-supporting platform **24** preferably includes a central framework **75** and foldable and removeble walkways **76** and **77** along each side as shown in FIGURES 1, 3, 13 and 18 for example. Each walkway is preferably an integral unit providing horizontal flooring and vertical outside safety railing. Each walkway is retained by a plurality of hooks **78** which fit over horizontal pins **80**. The pins **80** are inside the open ends of tubular members **82** of the framework **75**, thus providing lateral restraint for the hooks **78**. Rotation of the walkways about the pins **80** below the horizontal is prevented by the abutment of the inside edge of the walkway with the underside of the platform framework **75** at contact areas **84**.

Each walkway **76** and **77** may be removed by lifting the hooks **78** off the pins **80**. Further, the walkways can be pivoted upwardly 90° to compactly fold over each other and the work tower when both of the tower platforms are in their lowered positions.

The walkways **76** and **77** may be constructed primarily of wood if desired. However, they may also be of metal construction. The entire work tower **20** is preferably constructed with high strength yet relatively light weight materials for portability. Suitable tubular metal construction is shown in the drawings.

The work tower **20** provides both flexible operation and compact portability without requiring either manual exertion or auxiliary equipment. Both the operation and transportation can be accomplished by a single person operating the appropriate hydraulic valves, outrigger components and the lever **58** without requiring a dock, crane or other equipment even though the work tower may be of a weight which would normally preclude manual movement. The work tower **20** is particularly suitable for the needs of building contractors who must make installations above the floor level. It may be constructed small eenough to be transported to any job site in a pickup truck. At the job site, it can be unloaded without assistance by manipulation of its own hydraulic outriggers. The work tower can then be easily moved and positioned on its integral wheels. When in position, it may be stabilized by its own outriggers. The work tower can also turn itself completely on end so that it may move through narrow door openings. Both the equipment to be installed and the workers can be vertically positioned where desired by the raising of the tower platforms to the respective desired

working heights. The personnel can work on both sides of the load on the walkways or one walkway may be removed for clearance if desired.

For stabilizing the work tower **20**, the outriggers may be arranged and positioned as shown in FIGURES 1 and 2. The outriggers are pivoted horizontally as previously described, and the extension arm **50** is positioned in the outrigger arm **46** so that the pin lockable wheel **52** can be locked and forcibly brought to bear against the floor by the operation of the hydraulic cylinder **54**.

FIGURES 24 through 29 illustrates the steps of self-loading the work tower **20** onto a vehicle. During unloading, the same steps are reversed.

In FIGURE 24, it may be seen that the outrigger arms **46** and the extension arms **50** extend parallel the sides of the work tower. The extension arms **50** extend from the inner end of the outrigger arms **46** with the caster wheel **51** down. Then, as shown in FIGURE 25, the hydraulic cylinder **54** is actuated and the second end **40** of the work tower is lifted above the vehicle floor level. At this point, the work tower is supported and movable on the wheels **36** at the first end **38** of the work tower and the caster wheels **51** on the extension arm. Thus, the work tower may be pushed forward until the second end **40** is over the vehicle floor. Then the hydraulic cylinder **54** may be actuated to lower the wheels on the second end **40**. Continued operation of the hydraulic cylinder **54** can then lift the extension arm **50** sufficiently for it to be removed, turned over and inserted in the outer end of the outrigger arm **46** as shown in FIGURE 26. Further operation of the cylinder **54** then results in lifting the front end **38** above the vehicle floor level so that it may be rolled into the truck on the wheels **52** and the wheels on the second end **40** as shown in FIGURES 27 and 28. The cylinder **54** may then be actuated again to lift the outriggers into a vertical position as shown in FIGURE 29.

It may be seen that there has been described herein a work tower which is extremely versatile and transportable. The apparatus described herein is presently considered to be preferred; however, it is contemplated that further variations and modifications within the purview of those skilled in the art can be made herein. The following claims are intended to cover all such variations and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A movable work tower adapted for compact storage and movement through a narrow opening comprising:
- a horizontally disposed base having predetermined lateral dimensions and adapted to support said work tower on a generally horizontal first surface;
- a personnel-supporting platform connected to said base;
- means for raising and lowering said personnel-supporting platform above the first surface, said personnel supporting platform in its lowered position and said base being of a combined thickness less than either of said predetermined lateral dimensions;
- and outrigger means pivotally connected to said base at a point to one side of the center thereof;
- said outrigger means being extendable from said base and having roller means for engaging the first surface;
- said outrigger means being adapted to tilt said base on end so said base is oriented vertically relative to said generally horizontal first surface with said roller means serving to rollably support said work tower for movement through said confined opening and said outrigger means being further adapted to provide lateral stabilizers for said work tower when said base is in its horizontal postion.

2. The work tower of claim **1** further including a work support platform on said personnel-supporting platform and means for independently raising and lowering said work support platform relative said first surface and said personnel-supporting platform.

3. A movable work tower comprising:
- a base having first and second ends and wheels movably supporting said base on a horizontal first surface,
- a personnel-supporting platform connected to said base,
- means for raising and lowering said personnel-supporting platform above said first surface,
- an elongate outrigger arm having inner and outer ends,
- each said outrigger arm being pivotally connected for vertical and horizontal rotation about its inner end at opposite sides of said first end of said base,
- an extension arm colinearly projecting from each said outrigger arm,
- said extension arm having lockable means for rollably engaging said first surface at its outer end,
- both said inner and outer ends of said outrigger arm being adapted to selectively connect with said extension arm,
- wheel means on said outer end of said outrigger arm adapted to engage said first surface,
- hydraulic means connecting between said outrigger arm and said base for vertically pivoting said base relative to said outrigger about said first end of said base,
- and lever means, pivotally connected to said base adjacent said outrigger means, for lifting said base and said outrigger means from said first surface for movement of said extension arm.

4. The work tower of claim **3** further including a work support platform on said personnel-supporting platform and means for independently raising and lowering said work support platform relative said first surface and said personnel-supporting platform.

5. A movable work tower comprising:
- a base having first and second ends and adapted to support said work tower on a generally horizontal first surface,
- a personnel-supporting platform connected to said base,
- means for raising and lowering said personnel-supporting platform above the first surface,
- and outrigger means pivotally connected to said base,
- said outrigger means being extendable from said base and having means for engaging the first surface,
- said outrigger means being adapted to selectively vertically tilt said first and second ends of said base above the first surface and to provide lateral stabilizers for said work tower,
- and lever means, pivotally connected to said base adjacent said outrigger means, for lifting said base and said outrigger means from said first surface for extension and retraction of said outrigger means,

6. The work tower of claim **5** further including a work support platform on said personnel-supporting platform and means for independently raising and lowering said work support platform relative said first surface and said personnel-supporting platform.

7. The work tower of claim **5** wherein said means for raising and lowering said personnel-supporting platform includes,
- a scissors connector therebetween with at least two pivotally connected legs and lifting means moving said scissors connector between opening and closing positions,
- said lifting means including a hydraulic cylinder and a lever linkage pivotally connecting with said hydraulic cylinder and pivotally connecting with a first point on said scissors connector,
- said lever linkage providing a lifting connection of said hydraulic cylinder with a second point on said scissors connector substantially spaced from said first point in said closing position of said scissors connector,
- and said lever linkage providing a lifting connection of

said hydraulic cylinder with said scissors connector only at said first point during the remainder of the movement of said scissors connector.

8. The movable work tower of claim **7** wherein said lever linkage is an elongate integral member having a fulcrum portion projecting at right angles thereto, said fulcrum portion engaging said second point of connection only in said closing position of said scissors connector.

9. In a portable work tower having an ambulatory base and a lift platform supported thereon, self-loading means adapted for lifting said work tower between generally horizontal first and second surfaces at vertically spaced levels comprising:

first lever means supported on the underside of said base adjacent one end thereof and adapted for pivotal movement about a generally horizontal axis;

second lever means comprising an elongated lever arm adapted for selective locking engagement with said first lever means in each of a first and a second position in which said second lever arm extends along a line generally parallel to the longitudinal axis of said work tower in respective opposite directions from said first lever means;

and power operated actuator means coupled between said first lever means and said base for pivoting said first lever means to displace, through coaction of said elongated lever arm and one of said first and second surfaces, one end of said work tower between said first and second surfaces when said elongated lever arm is in said first position and for displacing the other end of said work tower between said first and second surfaces when said elongated lever arm is in said second position.

10. The self-loading means of claim **9** in which said first lever means and said elongated lever arm of said second lever means are each comprised of a hollow channel member with said hollow channel of said first lever means being of internal dimensions for snugly receiving one end portion of said elongated lever arm therewithin and in which said first lever means and said elongated lever arm are selectively maintained in locking engagement by a bolt extending through aligned apertures in said hollow channel members.

11. The self-loading means of claim **10** in which said power operated actuator means comprises a hydraulically operated piston and cylinder arrangement with said piston and said cylinder being each pivotally mounted to a respective one of said first lever means and said base.

12. The self-loading means of claim **11** and including wheel means at each end of said elongated lever arm of said second lever means for rollably engaging said first and second surfaces.

13. A portable work tower for raising objects to a predetermined substantial height and for folding into a compactly stored unit comprising:

base means including a generally rectangular bed having wheels thereon supporting said base for rollable movement;

first platform means having a support deck and further having power actuated lifting apparatus for displacing said support deck between a lowered position substantially contiguous said bed of said base means and a raised position a predetermined distance above said bed;

second platform means, mounted on said support deck of said first platform means, having an associated support deck and further having power actuated lifting apparatus for displacing said associated support deck between a closed position substantially contiguous said support deck of said first platform means and a raised position a predetermined distance above said support deck of said first platform means;

and a pair of personnel carrying platform means hingedly mounted to opposed sides of said support deck of said second platform means and pivotable inwardly from normal work positions lateral of said second platform means toward one another to lie in overlapping relation on said lowered support deck of said second platform means to effect a compact storage of said personnel carrying platform means.

14. The work tower of claim **13** in which said pair of personnel carrying platform means each comprise a personnel supporting deck and a guard rail mounted about the outer periphery about said deck.

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