Aug. 6, 1968 F. A. DAVIDSON, JR., ET AL 3,395,501

HOIST TOWER

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Fig. 1.

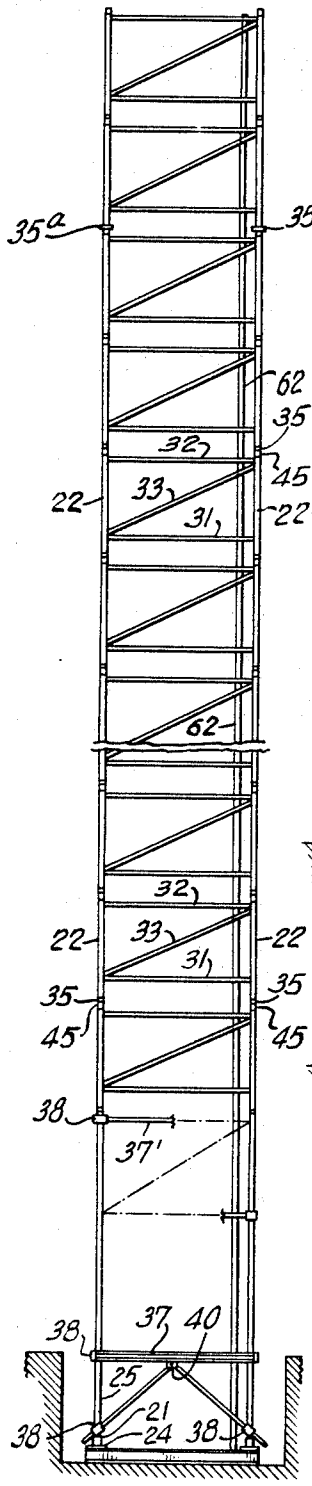


Fig. 2.

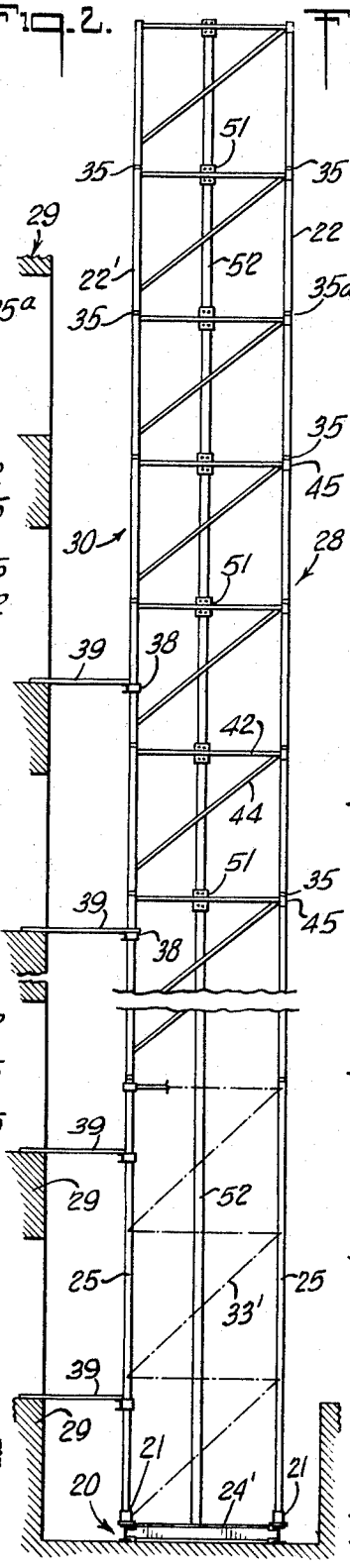
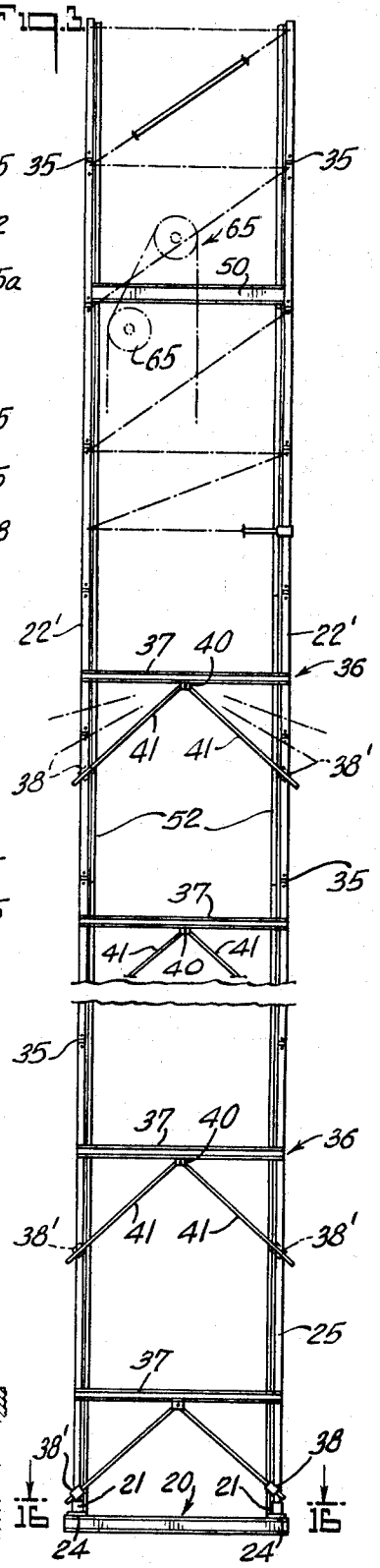


Fig. 3.



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HOIST TOWER

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FIG. 4.

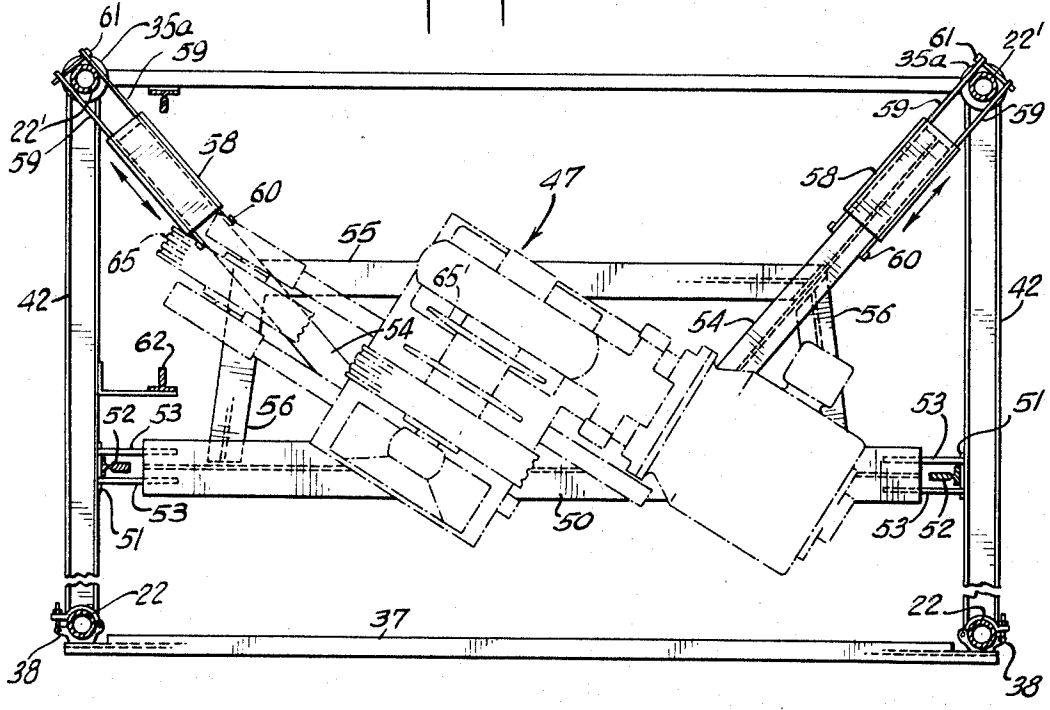


FIG. 7.

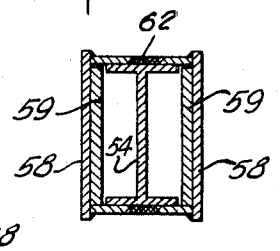


FIG. 6.

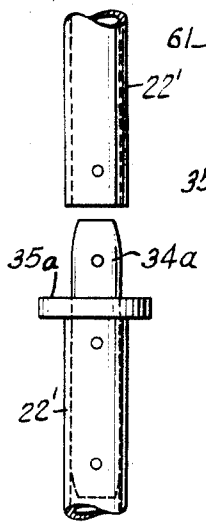
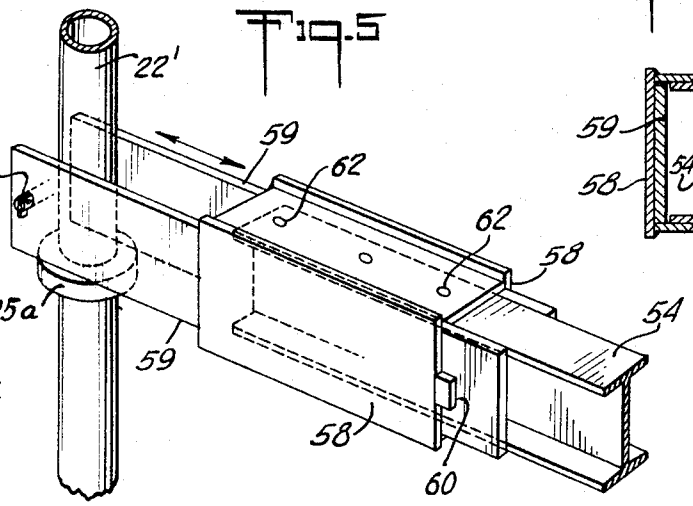


FIG. 5.



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Fig. 8.

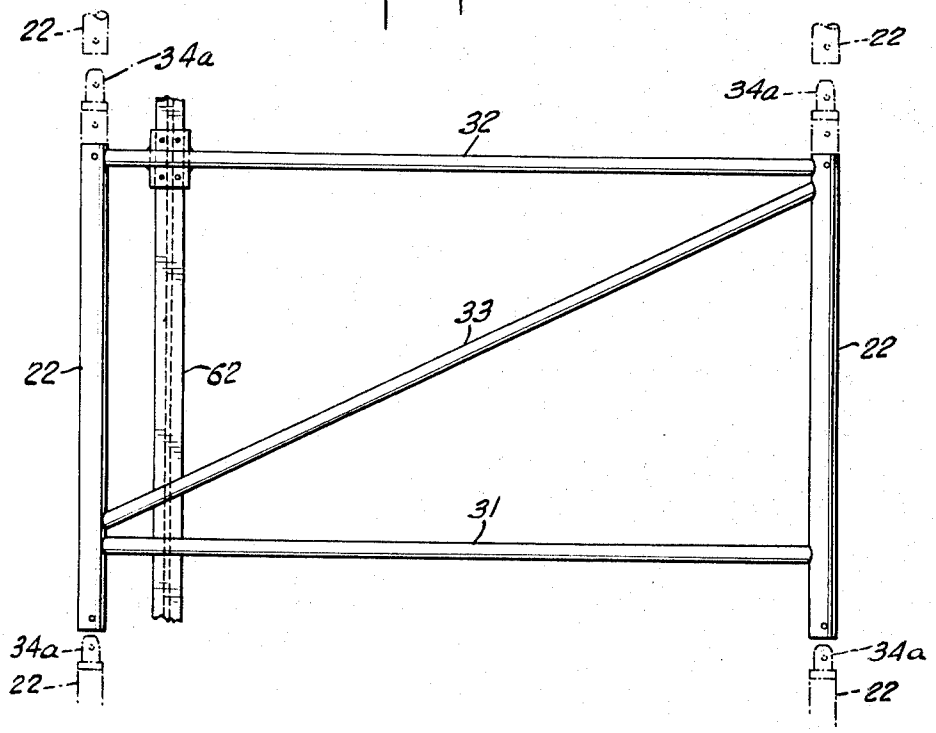


Fig. 9.

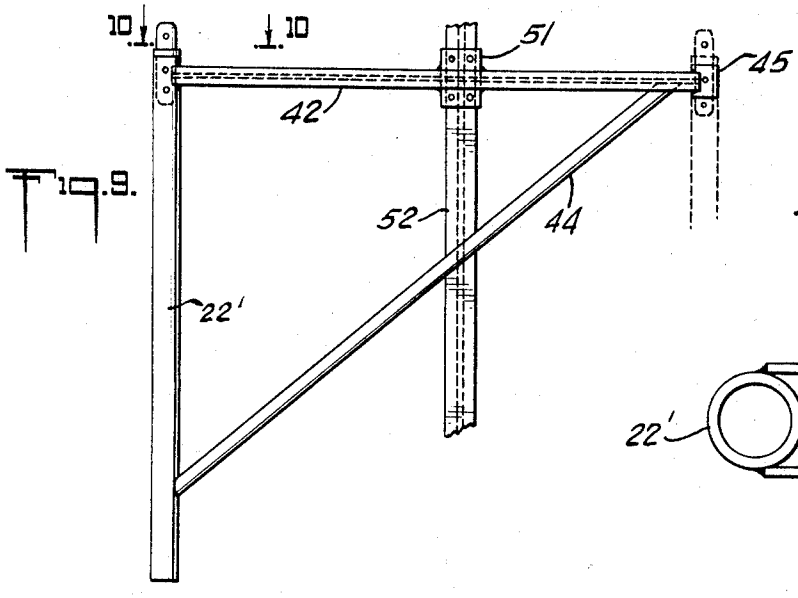
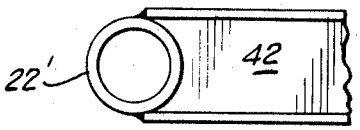


Fig. 10.



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Fig. 11.

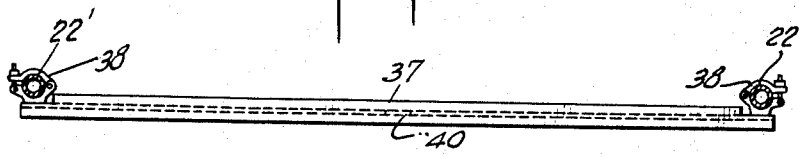


Fig. 12.

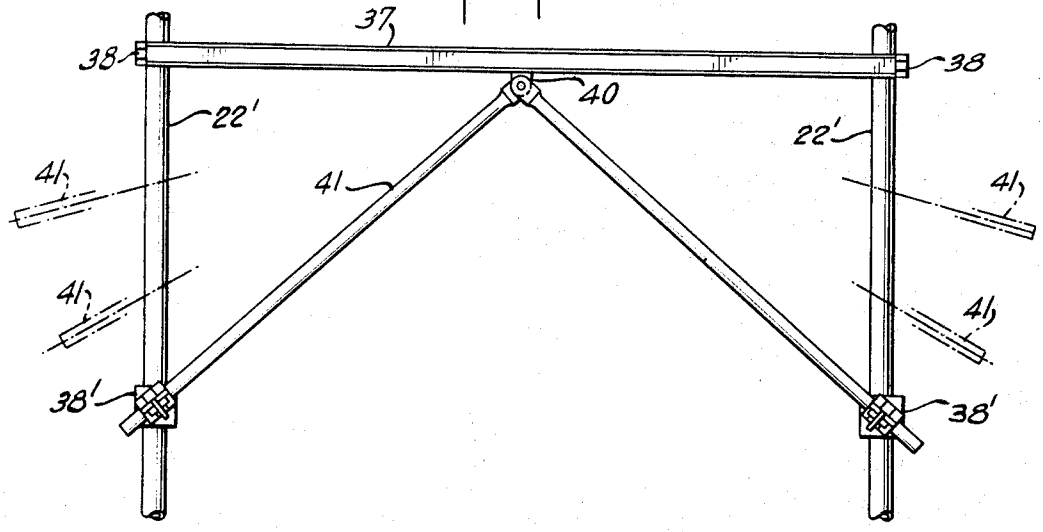


Fig. 13.

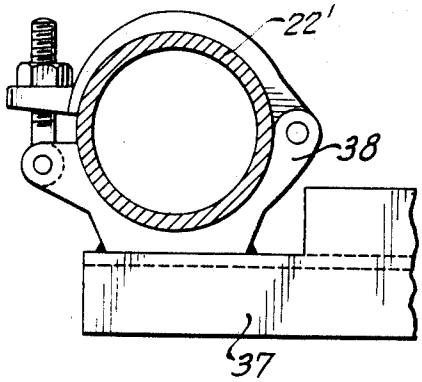


Fig. 14.

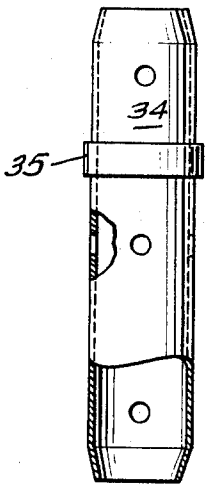
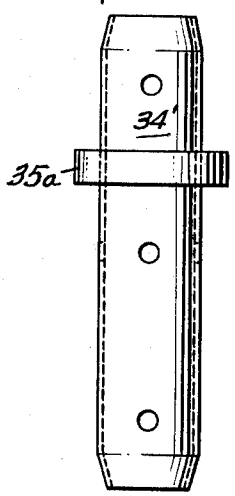


Fig. 15.



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Fig. 16.

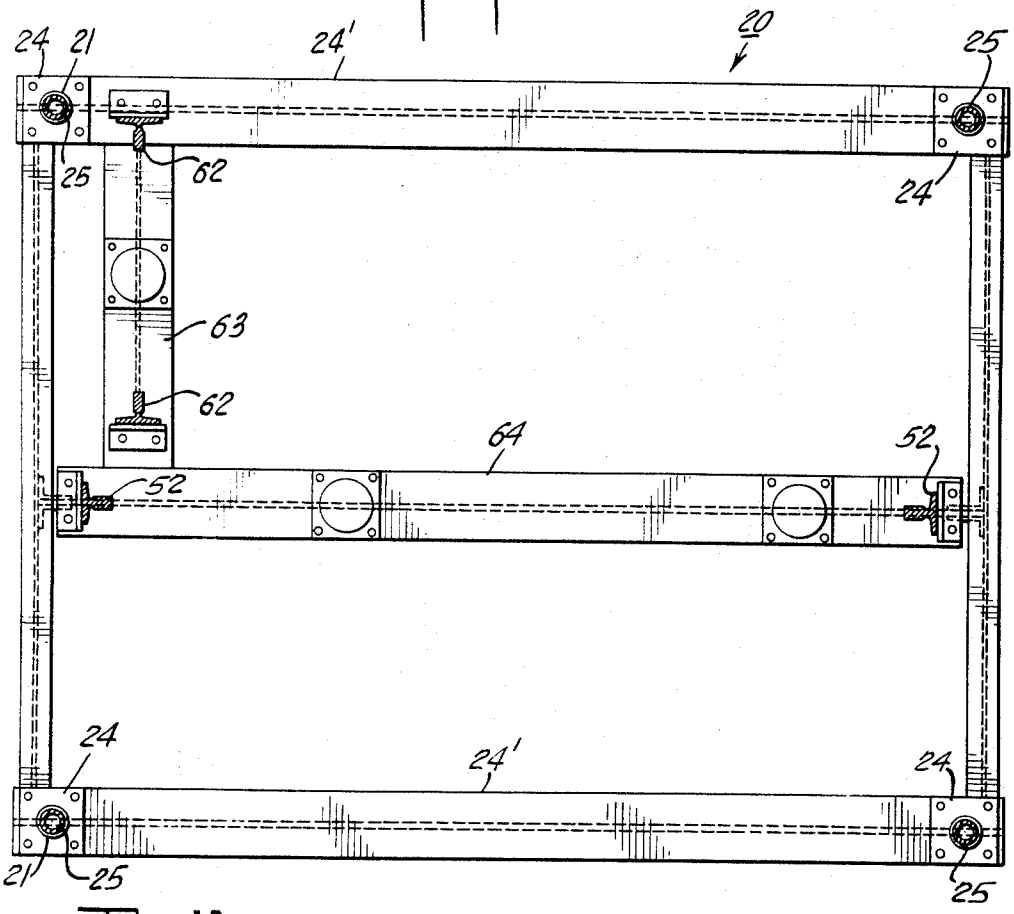


Fig. 18.

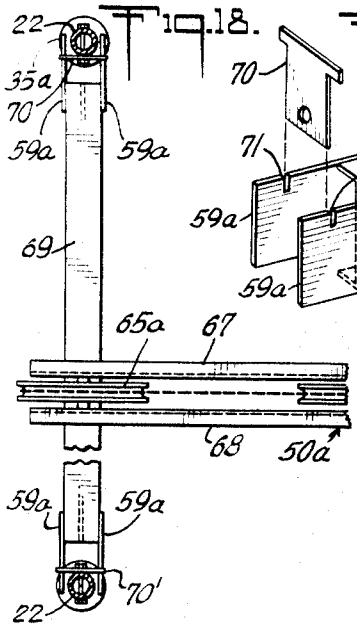
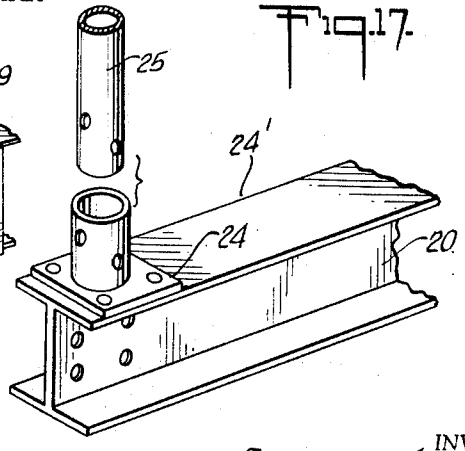


Fig. 19.

Fig. 17.



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3,395,501

HOIST TOWER

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Filed Jan. 3, 1966, Ser. No. 518,052
2 Claims. (Cl. 52—30)

ABSTRACT OF THE DISCLOSURE

A hoist tower is built up of disconnectable frame units fitted together so as to form a substantially rigid structure; the units respectively comprising:

(1) triangular units having
  (a) legs tubular at opposite ends for reception of connecting sprockets,
  (b) rings with their axes parallel to the axes of said legs and spaced therefrom,
  (c) arms projecting to one side from said legs, the ends of said arms and said rings being joined together at the remote apices of the triangles, said rings being adapted to be aligned respectively with the tubular openings in the legs of adjacent units for insertion therethrough of
(2) sprockets to connect the vertical legs of the units respectively with the vertex rings of adjoining units
(3) side panels respectively comprising
  (a) vertical legs spaced apart,
  (b) horizontal girts connecting the legs into a frame and
  (c) diagonal braces secured between said girts and legs to give greater rigidity to the structure and
  (d) said legs being hollow at their ends for receiving sprockets by which they are connected to adjoining units.

The present invention relates to hoisting towers more particularly of the type which is assembled or erected on the job for temporary use and thereafter dismantled and removed for use at another location.

Known forms of such towers have included various expedients intended to facilitate fabrication or to provide for different uses. Thus, there are towers more particularly suited for hoisting supplies or materials and others for carrying personnel. In some instances, hoisting towers are erected with two or more shafts at least one of which is fitted to accommodate personnel and another to handle materials. Known types of such towers involve extensive use of separable girts, braces, posts, rails, etc., with nuts and bolts for holding these component parts together. All these require use of judgment as to selection of component parts and skill in their assembly.

In general, material-hoisting towers employ a "cathead" or other carrier at or near the top of the tower for cable sheaves to guide and support the hoisting cables. Said sheave carriers are in turn ordinarily supported on beams mounted on the tower. Such beams have been so heavy as to make for difficulty in erecting and moving the tower, and at best involve costly time and labor in erection and dismantling.

In such hoisting towers, the actuating machine for lifting the elevator car, or cage, usually includes an electric motor, which may be at the base of the tower or mounted on a frame in the tower. If the latter, the weight of this machine plus the elevator cars and loads is borne by the tower structure.

Among the objects of the present invention are to provide a tower construction wherein:

The structural skeletal parts are, in major degree, prefabricated into integral units, flat, i.e., substantially two-

dimensional for compact storage, readily handled and of moderate weight, which can be quickly assembled on the job in vertical array and releasably secured together quickly and easily, substantially without the use of nuts and bolts.

Separate diagonal and horizontal framing elements, such as braces, girts, and the like, can now be substantially eliminated.

Our invention may be embodied in a single or multiple shaft hoisting tower comprising a vertical array of substantially similar superimposed sections made up of prefabricated two-dimensional units or "panels" including tubular posts and diagonal braces and horizontal girts, each section including opposed spaced unitary side panels, a unitary end panel at the outer, or street, end of the section, and ordinarily also a landing panel at the inner or building end thereof, said landing panel including a spacer supported at its ends on, and fixing the space of, opposed posts, and angularly adjustable braces pivotally mounted on said spacer and having end portions releasably engaging said posts at a distance from said spacer along the posts.

Said panels are generally integral units of triangular plan defined by a horizontal girt, an upright tubular post secured at its upper end to one end of said horizontal girt, a sleeve at the opposite end thereof and a diagonal brace with one end secured near the sleeve end of the horizontal girt and its other end secured to said upright post between the bottom end and a mid portion thereof. Opposite side panels are assembled on the job with an end panel, connecting the sleeves at the outer ends thereof with the posts at each side of the end panel to form the sections of the tower. These sections are connected at the section corners to panels of vertically adjacent sections by adapters, generally what is known to the trade as "sprockets," i.e., substantial pins, each of which includes an elongated shank or stem and has in its midsection, means to limit its insertion so that one end will extend into the top of the post sufficiently for a strong connection and the other end will be left projecting for insertion into the next adjacent section. Advantageously this means is a peripheral flange or other projection midway between its ends to position the sprocket on the top end of a post or a sleeve of a lower unit, where it may be releasably locked by a pin extending through it and such post or sleeve, into which it is telescoped snugly.

The hoisting tower of our invention, whether a single or multiple shaft tower, is designed with vertical guide rails and a carrier removably mountable at the top of any desired section for supporting hoisting machinery in position to raise and lower an elevator car slidably engaged with the guide rails below the carrier; said carrier may include a deck frame comprising a transverse beam having its ends securely engaged with said guide rails and also having diagonally disposed beams with extensible portions, the outer ends of which are arranged and adapted to rest on the flanges of the sprocket below, being held in accurate position by sprockets with peripheral flanges which engage the tops of the posts in the next lower section. The hollow posts and holes in said beams respectively embrace the portions of the shanks of said sprockets which extend below said flanges.

Said machine carrier has a buffer and connecting device which cooperate with cushioning means arranged at the top of said elevator whereby, if the elevator car rises to a predetermined position beneath said carrier, it bumps against said buffer cushions. Said buffer and connecting parts are provided with means for releasably locking them together, thereby releasably to lock the elevator to the carrier for moving said parts, as a unit vertically in the shaft.

Said transverse beam of the sheave carrier is advanta-

geously provided at its ends with longitudinally adjustable bolts movable outwardly to a position with their ends supported on said guide rails thereby taking part in providing support for the carrier and the machine, said bolts being retractable to disengage from said guide rails when the carrier is to be moved vertically in the shaft. Such bolts may be plates, channels, angle irons, bars, tubes, etc.

Other objects and distinctive features of our invention will appear in the following description and claims and in the accompanying drawings, wherein we have shown a preferred embodiment of our invention.

In the accompanying drawings and this specification we have shown and described a preferred embodiment of the invention and suggested various alternatives. These are given to illustrate the invention and to aid others in understanding its principles so that they can practice it in various forms and modifications, each as may be best suited to the conditions of a particular use, and are not intended to be exhaustive.

FIGURE 1 is a view in elevation of an elevator tower erected at the side of a building under construction.

FIGURE 2 is a side elevation of the same.

FIGURE 3 is a view in elevation showing the front of the tower adjacent to the building.

FIGURE 4 is a plan view of a platform structure for carrying elevator operating machinery, etc.

FIGURE 5 is a detail view showing, in perspective, the construction at the upper left-hand corner of FIGURE 4.

FIGURE 6 is a detail elevation of a sprocket connection of FIGURE 5.

FIGURE 7 is a detail cross-section of a telescopic box structure of FIGURE 5.

FIGURE 8 is a view in elevation of one of the panels which compose the back of the tower, as shown in FIGURE 1.

FIGURE 9 is a view in elevation of one of the side panels which compose the sides of the tower, as illustrated in FIGURE 2.

FIGURE 10 is a detail taken on line **10—10** of FIGURE 9, showing in plan the construction at the vertex end of the triangular side panel.

FIGURE 11 is a view in plan section of a landing panel structure.

FIGURE 12 is a view in elevation of a landing panel structure.

FIGURE 13 is a view partly in elevation and partly in horizontal section of FIGURE 11, showing the post and adjoining end of the landing panel structure of FIGURE 11 on enlarged scale.

FIGURE 14 shows in elevation a sprocket adapted for use in joining the main posts of the sectional tower.

FIGURE 15 is a similar view of a sprocket used near the top of the tower for mounting the machine support platform, as indicated in FIGURES 5 and 6.

FIGURE 16 is a plan view of the base for the tower taken on line **16—16** of FIGURE 3;

FIGURE 17 is a detail perspective view of the corner structure of the base **20**;

FIGURE 18 is a fragmentary plan view showing a cathead support beam and a portion of the cathead which may be used at the top of a tower in conjunction with a hoisting machine at the base of the tower in lieu of the hoisting machine and platform at the top of the tower as shown in FIGURE 4; and

FIGURE 19 is a detail showing on an enlarged scale and in perspective, of the end of a cathead support beam shown in plan in FIGURE 18.

Guys to the ground or to the adjoining building to hold the tower erect, elevator cars, cables, motors, sheaves, catheads, and other accessories and special equipment may be mounted on the tower as with towers heretofore known in the art.

Referring first to FIGURES 1–3 inclusive, the tower shown is made up of a base structure **20** shown in this case as consisting, as illustrated in FIGURES 16 and 17, of broad flange beams on which are mounted post footing

socket members **21**. These are formed, for example, by bottom plates or sleepers **24** to which are affixed short (e.g., 6″) lengths of pipe with inside diameter fitted to the outside of the main support posts **22** of the tower. The socket structure **21** on the structure **20** may be riveted or otherwise secured to I-beam sleepers **24′** which form a sill and bearing for the tower.

The tower shown in FIGURES 1–3 uses heavier and longer posts as "starter columns" **25** below the first assembled tower panels. Thus, the elevator tower may be left open on all sides to give full access for loading and unloading at ground level. Because these starter columns may be left unbraced for maximum accessibility, it is advantageous that they be substantially stronger than the posts used in the remainder of the tower, above. In many cases, however, additional bracing may be supplied, as indicated by the broken lines.

In practice, these starter posts are generally about 20 ft. long, which allows sufficient elevation for the first cross bar or other obstruction.

When normal loading and unloading are not interfered with by the size of the opening between the side panels **30**, the starter posts **25** may be omitted and the sectional construction started immediately on the base **20**. In such case it may be more convenient, however, to have an access at the ground level on the opposite side of the tower instead of facing the building. This may be done and the next section above assembled with its end panel over the opening.

Each end panel **28** is constructed with main support posts **22** at opposite sides, horizontal girts **31** and **32** near the top and bottom, and a diagonal brace **33** extending across the rectangular opening defined by the posts and the girts. These elements are assembled on a flat surface to assure planar relation and are welded together into an integral rigid unit. Into the top and bottom of each post **22**, as shown in FIG. 6, a sprocket **34** is fitted, e.g., of the type shown in FIGURE 14 or 15, which is a steel tube with the ends tapered for easy insertion into the hollow posts and with a bearing ring **35** welded on at a mid point. The ring **35** may be cut from the same tubing as is used for the posts **22**, and both its end edges and the ends of the posts are substantially square and bear on one another. Less advantageously, the "sprocket" may be an external short pipe with an internal ring or other stop secured in place to abut the ends of posts which are received in its bore.

As shown in FIGURES 9, 14 and 15, the sprockets may be provided with holes at suitable intervals and of size adapted to receive pins; and corresponding holes may be provided in the posts **22**, **25**, etc., and in the sockets **21**, etc., aligned with these holes so that pins can be fitted in to hold the parts secured together. Holes may be similarly provided in the footing socket members **21** to align with such holes in posts **22**, **25**, etc., and be pinned thereto. Ordinarily such pins are not necessary, but where a tower is to be disassembled and re-erected, it may be desirable to hold sprockets in the various panels, or to handle several panels together, and this can be accomplished by pinning them in the manner indicated above.

The front of the tower, as will be noticed, is formed primarily by the posts of the side panels **30**. Thus, the side facing the building **29** is initially unobstructed so that landings can be provided at whatever height is convenient, according to the structure of the building being erected. At each level where there is to be a landing, a landing panel **36** is provided on and between the posts **22′** of the side panels **30**.

Several such landing panels are shown in FIGURE 3, and on a larger scale in FIGURE 11. In this example, an I-beam **37**, or a pair of channel beams secured back to back, extends across the opening, the flanges, or one of said channels, on the inside of the I-beam being cut back from the ends to give clearance for the posts **22′** of the

side panels 30, whereas the longer channel, or the web and the outer flanges of the I-beam, extend beyond the posts as shown in FIGURES 3, 11, 12, and 13.

A clamp 38 (FIGURES 11 and 13) on each end of the beam 37 is adapted to secure the beam 37 on the posts 22' so that it serves as a frame or sill for a landing platform 39 and also to hold the posts 22' of the side panels securely in their properly spaced positions.

Secured on the beam 37 at its center is a projecting pivot block 40; and pivoted on this are two braces 41, each with a clamp 38' at its end adapted to be clamped on the posts 22', respectively, in the same manner and for the same purpose as the clamps at the ends of the beam 37. In order to provide for engagement at different heights, the clamps 38' are pivotally secured to the ends of beam 37, e.g., as shown, by having two clamps pivotally connected, one engaging the post and the other engaging the brace. Where adjustability as to height is not important, a single clamp can be rigidly welded or bolted to the end of each brace 41, substantially like the clamps 38 on beam 37.

These braces give greater rigidity to the tower and yet allow adequate height for personnel and various equipment and materials to be moved into and out of the tower at their respective levels.

The braces 41 may be provided with several holes spaced apart near their ends. This allows easy attachment of braces, etc., by bolting at different heights and angles, as required. This is less costly than using clamps 38' as described above.

The side panels 30, as shown in FIGURES 2 and 9, are each provided with a horizontal girt 42 welded to its post 22' and a brace 44 welded at opposite ends respectively to the post 22' and the girt 42, thus making a triangular panel. At the outer end or vertex, just beyond the junction of the brace and the girt, a short length of pipe or sleeve 45 is secured. This is of the same diameter, outside and inside, as the posts 22 of the end panels 28 and is secured thereto by sprockets 34 (shown in broken lines on FIGURE 8), the ring 35 in each case resting on the sleeve 45, and the longer end of the sprocket extending down through the sleeve 45 into the post 22 of the next lower end panel 28.

The braces 44 and the girts 42 advantageously are welded at their ends to the post 22' or to each other, as shown. In the preferred embodiment as shown in FIGURE 9, girt 42 is an I-beam or a channel, with its flanges vertical and spaced the same distance as the diameter of the pipe used for the brace 44. The web of this beam is cut out on an arc fitted to the exterior of the post and each flange fits against the post 22 as shown in FIGURE 10; and, if desired, the flanges and the arcuate ends of the web are welded to the post 22' and the sleeve 45. In many cases, however, a pipe girt will be used with like result.

The posts 22' on the vertical sides of the triangles are substantially the full height of each section and thus may rest on one another from section to section, each having a sprocket inserted into the top of the lower panel and fitting into the bottom of the post 22' of the next panel above with the flange or ring 35 engaged between the superposed sections of the posts 22'.

The operating mechanism 47 and appurtenant structures may be conventional and may be located at the top or beside the bottom of the tower, as heretofore used. An especially advantageous arrangement is shown in the drawing. At or near the top of the tower, a cathead or machine support (shown more clearly in FIGURE 4) comprises a frame or horizontal truss assembly of beams operatively engaging the posts and rails, respectively, and a floor plate (not shown) provided with appropriately arranged bolt holes to receive machine anchoring bolts. Said frame, as seen in FIGURE 4, comprises a main I-beam 50 extending across the interior of the tower between plate rests 51, with its opposite ends adapted to engage the plate rests 51 anchored to rails 52 which also serve for guiding the movement of the elevator car, etc. The rails 52 are secured to plate rests 51 on the girts 42 which are wider than the rails, so that shoulders project beyond plate rests 51, on which the extensible bolts 53 slidably secured to opposite ends of the I-beams 50 are supported.

The slidable support bolts 53 in this instance are plates or channels, adjustably clamped, at opposite ends, to the main beam 50 so as to be extended over and rest upon the plates 51 which are secured to the guide rails and to the side panels. The plates 51 have shoulders which extend beyond the rails and form seats for bolts 53.

A horizontal truss structure is formed by I-beams 54, 55, and 56 secured to the main beam 50, as shown.

At the outer end of beam 54 is a telescopic extension comprising the portion 58 made of a box beam, or two channel beams face to face welded at their contacting edges, and dimensioned to receive the end of beam 54 with just enough space at each side for the extension bolts 59 in the form of steel plates fitted to slide between the edges of the beam flanges and the inside corners of the beam box 58. These spaced plates 51 fit on opposite sides of the post 22' at the corresponding corner of the tower, and rest on the extended flange 35*a*. The bolts 59 may be pinned with locking pins 61 to close them around the post 22'. A stop 60 on the back end of each plate 51 limits telescopic sliding of the plate to hold it in the box 58. The box 58 is welded or otherwise secured at 62 to the end of beam 54. Pins 61 lock the extension bolts 59 on the post 22'.

This telescopic extension permits accommodation of irregularities in the geometry of the tower, still allowing for engagement of the ends of extension bolts 59 on the posts 22' and on the flanges 35*a* of the sprocket 34*a*. This modified sprocket is similar to the sprocket 34 excepting that, instead of the ring 35 of the same radial thickness as the posts 22, flanges 35*a* extend radially and form seats for bolts 59, extended from the sides of box 58.

A deck plate or a plurality of spaced plates may be secured to the framework just described for carrying the various machine elements as required for operation of the elevator.

Instead of the machine support 47, with the elevator mechanism as shown in FIGURE 4, one may have a simple cathead 50*a*, as shown in FIGURE 18, carrying sheaves 65*a* over which the hoisting cable runs to hoisting machinery at the base of the tower.

As seen in FIGURE 4, the rails 52 at opposite sides of the elevator shaft guide the movement of the elevator car. The elevators for personnel shown in FIGURE 4, have, at the left-hand end of the shaft, another pair of rails 62 secured on the framework of the tower to guide a counterweight for the elevator car and to hold the excess cable vertical in the elevator shaft when the car moves up into the top of the shaft. Material hoists ordinarily do not have such counterweight and, therefore, would not have the rails 62 and the sills 63, 64 (FIGURE 16).

When in the course of construction the building has reached the height served by the elevator and it becomes necessary to extend the elevator upward for further use in the erection of the building, the tower is extended by addition of more sections as described above, and the deck frame is moved to the top of the shaft and is secured to the rails 52 by extending bolts 53 over the shoulders of plates 51 and is secured to the post 22' by extending bolts 59 over flanges 35*a*.

As will have been seen, the hoisting load is transmitted by the elevator cable to the hoisting machine 47, and thence to the machine deck frame 50–56, which, in turn, bears on the corner posts 22' (through flanges 35*a*) and on the guide rails 52 (through bolts 53 and plates 51) thence on the girts 46 and the tower frame in general.

The invention, as will be seen from FIGURE 18, lends itself to mounting of other loads in the tower. FIGURES 18 and 19 show a cathead beam such as is used on material hoists, where the hoisting machine is generally located at the base of the elevator tower and the cable runs up one side of the tower over sheaves on the cathead and down into the shaft to the hoisting bucket or car. In such case, the deck structure shown in FIGURE 4 is not required, but a simple cathead **50***a* may be used advantageously consisting of two channel beams **67** and **68** and sheaves **65***a* rotatably mounted between them. Such cathead is advantageously mounted on a cathead support beam **69** which is provided with extended or extensible bolts **59***a* which embrace the post **22** and rest on the sprocket flanges **35***a*.

The cathead support beam **69** has the extensible bolts **59***a* extended far enough beyond the end of the I-beam as shown so that the latter can be pushed out against the post **22** far enough so that at least one of the bolts **59***a* at its opposite end can clear the opposite post **22** when the beam is swung around in a horizontal plane. Once the post **22** is aligned with the space between the bolts **59***a*, the beam is pushed out until the plate **70** at the outer end abuts the post **22**, whereupon the slots **71** at the other end are found to align just beyond the opposite post **22**. Thereupon, the plate **70'** is dropped into said slots **71**, and the beam is thus locked in position.

By this device, as shown on the drawings, we have eliminated the clamping devices heretofore required. Thus we have reduced by 80% the labor from what is needed to install the previously available devices and, in addition, have eliminated many individual pieces such as clamps and bolts. And, of course, a very important feature is the elimination of the eccentric load induced by the present devices. In our disclosed device, we have concentric loading on the posts, which increases the load carrying capacity when compared to the known equipment.

We claim:

1. A sectional tower having its several sections superimposed in vertical array, each section comprising a prefabricated back panel and prefabricated side panels, the back panel comprising spaced upright tubular posts, spacers and braces, said parts being rigidly connected and positioned relative to one another by the spacers and braces, and all being secured in substantially planar relation to the posts, the side panels comprising, respectively, upright tubular posts at their front ends and short sleeves at their back ends integrally joined by horizontal spacers and diagonal bracing members, said sleeves being adapted to fit end to end with posts of the back panels, said spacers and bracing members and sleeves being triangularly arranged with and integrally secured to said front posts and holding the posts and sleeves spaced and parallel each in substantially planar relation with a post; and connector sprockets fitted into adjacent ends of said tubular posts, whereby to align said posts into load bearing columns of the tower; sprockets in the back panel having a relatively long stud portion extending through said sleeve and into an adjacent post of the back panel and a shorter stud portion extending oppositely into the adjacent post of the next section, and in which tower, the back panels and side panels are respectively aligned vertically over back panels and side panels respectively of lower sections, the support columns formed by the posts of the side panels being spaced apart to provide openings for access from and into a building structure and said tower; and said columns are secured in desired spaced relation by landing beams at several landing levels extending across said opening, and clamping means on said beams securing said beams to said columns and holding the columns in fixed spaced relation, and vertically adjustable thereon, whereby the effective height of the access openings in the tower may be varied by adjustment of the beams along said columns.

2. A sectional tower as defined in claim **1**, in which braces are positioned above the openings each pivoted at a central position on a beam and secured diagonally below on one of said posts, whereby to form with said posts and beams arches around said openings, whereby an access opening left beneath said braces has substantially increased height near the center to eliminate the need for installing individual girts and braces.

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