March 19, 1968 A. J. VERINI 3,373,879

ELEVATING AND TILTING FRAME STRUCTURE

Filed March 9, 1966 2 Sheets-Sheet 1

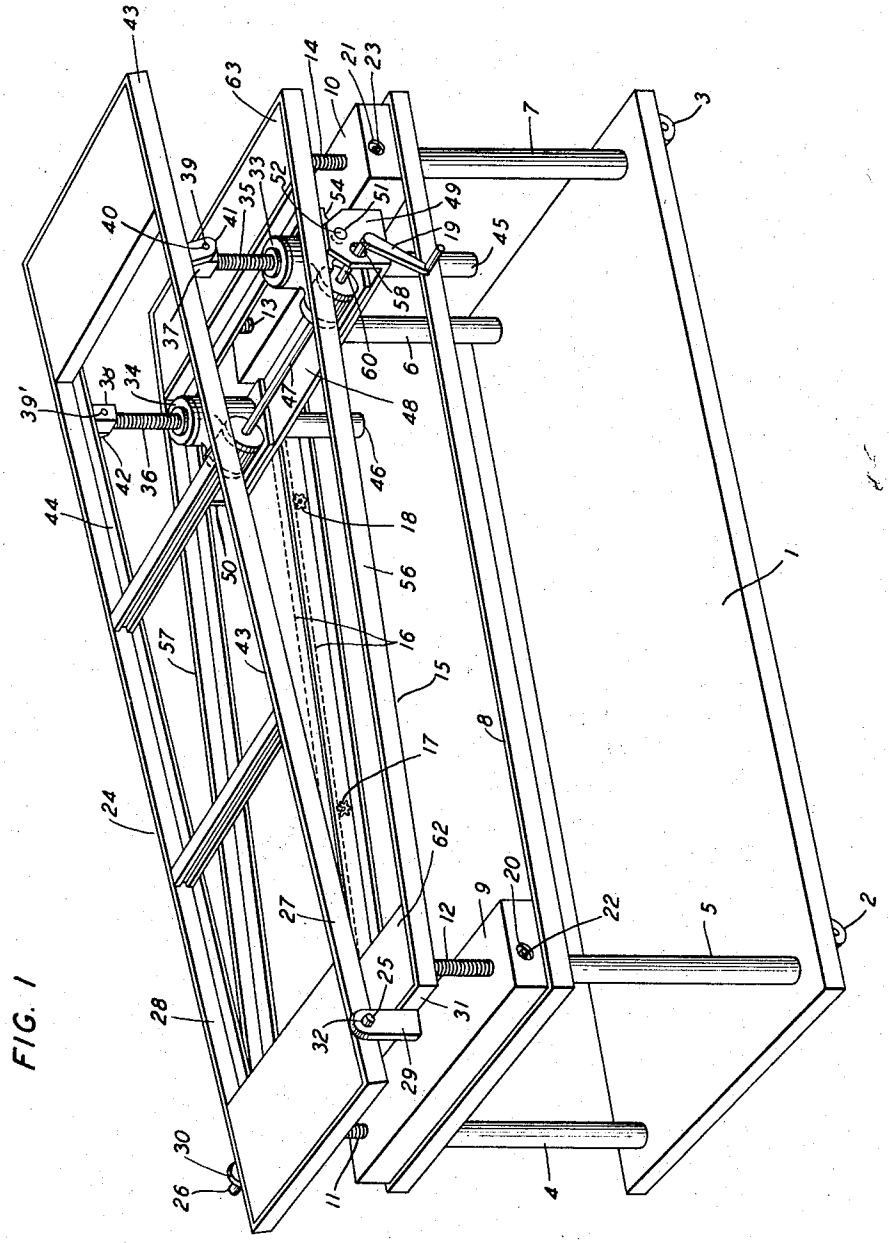


FIG. 1

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Filed March 9, 1966 2 Sheets-Sheet 2

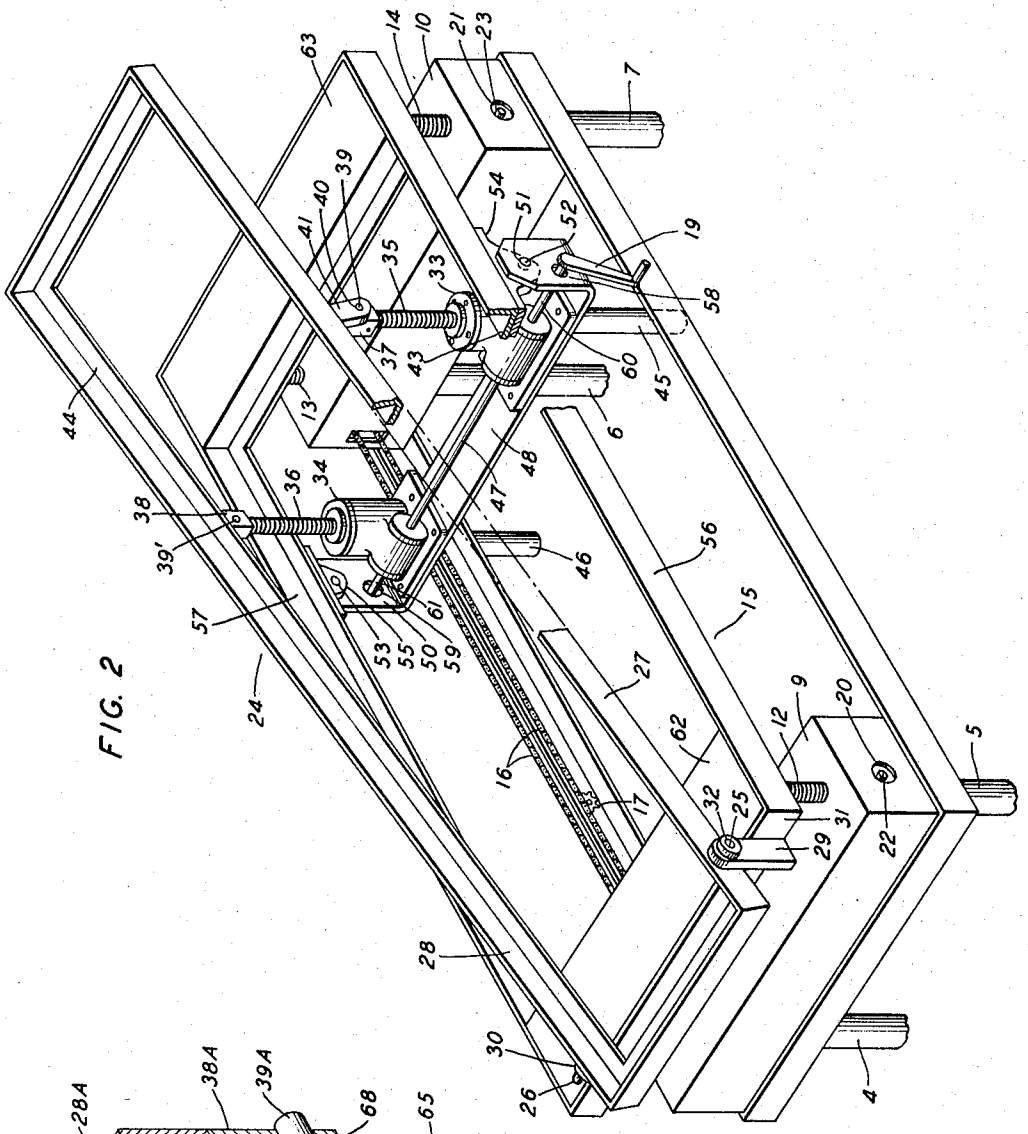


FIG. 2

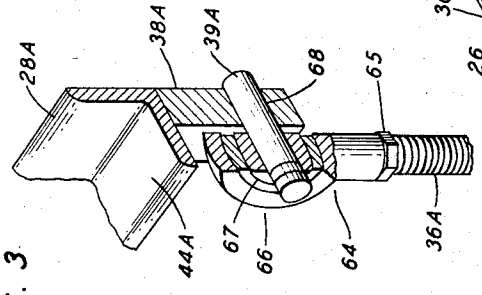


FIG. 3

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# ELEVATING AND TILTING FRAME STRUCTURE

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## ABSTRACT OF THE DISCLOSURE

A vertically adjustable frame structure is disclosed utilizing a pivotally mounted jack-actuated control arrangement for tilting an elevated support platform to desired sloping angles and heights. Control and linking shaft arrangements are used for controlling a pair of jacks mounted on a pivotally secured U-shaped bracket for facilitating the platform tilting action with reduced actuating force by personnel and reduced frictional forces on the jacks.

This invention relates to elevating and tilting structures and particularly to a vertically adjustable frame structure utilizing a pivotally mounted jack-actuated control arrangement for tilting an elevated support platform to desired sloping angles.

It is often desirable to support heavy machines, apparatus or other objects on a platform at prescribed elevations and tilted positions in order to perform certain control operations. Implicit in the design of a structure for performing such elevating and tilting functions is that it be capable of providing precise platform heights and tilt angles without unduly complex control apparatus and substantial amounts of actuating forces by operating personnel.

Accordingly, it is an object of my invention to provide simple and economical control facilities for precisely adjusting the heights and tilt angles of a support platform.

Another object is to provide control apparatus for precisely adjusting the heights and tilt angles of a support platform on a structural frame with minimal actuating force supplied by personnel.

It is another object of my invention to provide elevation and tilting control devices for maintaining precise height and tilt adjustments for a support platform after the adjustments have been made.

The foregoing and other objects are attained in accordance with specific illustrative embodiments of my invention in which efficient, simple and economical facilities are furnished for precisely adjusting a support platform to desired heights and tilt angles under control of a plurality of jack mechanisms. Structurally, the facilities include an elevating frame comprising a horizontally extending rectangular base element and four vertically disposed hollow legs each of which is perpendicularly attached to both the base member nearby an individual corner thereof and to a rectangular horizontally extending upper frame member.

A pair of jacks is mounted at opposite end segments of the upper frame member whereby each of the jacks is located proximate to an individual one of each of the frame corners. Each pair of the jacks comprises a threaded screw which is telescopically cooperative with an individual one of the hollow legs. Moreover, each pair of the jacks at the same frame end is coupled together by a linking shaft for concurrent actuation. The jacks at opposite ends of the upper frame member are also linked together by a chain arrangement which enables a person to interfit a crank handle with a control shaft of any one of the jacks and then to rotate it for uniformly and concurrently raising or lowering the threaded screws of each of the jacks.

Each of the latter screws is rigidly attached on its upper



end to an individual corner section of an intermediate rectangular support device. According to an aspect of my invention, the latter device extends horizontally substantially parallel to the upper frame member and comprises a pillow block element and a swivel pin arrangement on each of its side sections for pivotally mounting a U-shaped bracket. A pair of tilting jacks are rigidly secured to the U bracket and are connectable together for jointly raising or lowering their respective threaded screws when a crank handle is interfitted with the control drive shaft of one of the tilting jacks and is rotated. The upwardly projecting end segments of the threaded screws of the tilting jacks are pivotally connected to first end segments of a top supporting platform which supports a machine or other object. The pivotal connection is made for each such threaded screw by means including a hinge on the platform and a block member on the threaded screw together with a swivel pin inserted through apertures in the hinge and block member. A pair of hinges is rigidly affixed on the supporting device at the end opposite to the tilting jack for pivotally mounting second end segments of the supporting platform. Accordingly, a crank handle interfitted with the control shaft of any one of the tilting jacks may be rotated for moving the support platform and the object secured thereto in an arc about a horizontal plane parallel to that of the support device and with a reference point defined by the swivel arrangement at the aforementioned second end segments of the supporting platform.

During such a tilting movement, the block members secured to the upper ends of the threaded screws of the tilting jacks are pivoted about the associated swivel pins and hinges and the U bracket pivots about the associated swivel pins and pillow blocks. These pivotal arrangements facilitate the tilting action with minimal actuating force by personnel and reduce frictional forces on the tilting jacks.

The foregoing and other objects, features and advantages of my invention will be more clearly understood from a reading of the following description of illustrative embodiments thereof with reference to the drawings in which:

FIG. 1 is a perspective view of an elevating frame structure employing a jack-actuated tilting arrangement in accordanc with a specific illustrative embodiment of my invention;

FIG. 2 is a more detailed sectional view of certain structural elements depicted in FIG. 1; and

FIG. 3 is a sectional view of a swivel mechanism utilized for the tilting arrangement.

Referring to FIG. 1, the exemplary elevating frame structure includes a rectangular, horizontally-extending base element **1** mounted on casters **2** and **3** to facilitate the movement of the frame and tilting arrangement. Four vertically disposed hollow legs **4**, **5**, **6** and **7** are affixed to the base **1** proximate to an individual one of the four corners thereof. Each of the legs **4**, **5**, **6** and **7** projects upwardly and perpendicular from base **1** toward a rectangular frame member **8**.

Member **8** extends horizontally in a plane substantially parallel to the base **1** and supports a pair of jack assemblies **9** and **10** each of which is rigidly mounted at an opposite end of member **8** in a cooperating relationship with a pair of legs **4** and **5** or **6** and **7**. Each of the assemblies **9** and **10** comprises a pair of jack mechanisms (not shown in detail) each of which has a threaded screw element **11**, **12**, **13** or **14** telescopically cooperative with an individual one of the legs **4**, **5**, **6** or **7**, respectively, and affixed to a lower surface of a rectangular, horizontally-extending support device **15**.

A drive mechanism including a linking chain **16** and

tensioning sprockets 17 and 18 is utilized in the elevating frame structure to drive concurrently all of the threaded screws 11, 12, 13 and 14 for raising and lowering the supporting device 15. The drive mechanism, as explained hereinafter, links all four of the jacks of the assemblies 9 and 10 and is operated under control of a crank handle 19. The latter is adapted to be inserted through one of the assembly apertures 20 or 21 for interfitting with a control shaft 22 or 23 of an associated one of the jacks of assemblies 9 or 10. Control shafts (not shown) of each of the jacks of assemblies 9 and 10 associated with the threaded screws 11 and 13 may be selectively engaged, or interfitted, with the crank handle 19 via apertures (not shown) in the assemblies 9 and 10 at the opposite ends thereof with respect to apertures 20 and 21. Accordingly, my arrangement advantageously enables the supporting device 15 to be vertically raised or lowered by the concurrent driving of the screws 11, 12, 13 and 14 under control of the rotation of the crank handle interfitted at any one of the four corners of the elevating frame structure with an associated one of the jacks of assemblies 9 and 10.

A rectangular platform device 24 having an L shaped cross-section is pivotally mounted near one of its ends to the supporting device 15 by a pivot means including a pair of pivot pins 25 and 26 secured to side segments 27 and 28 of platform 24, and a pair of hinge members 29 and 30 rigidly affixed at prescribed locations on end segment 31 of device 15. Each of the hinge members 29 and 30 includes an aperture, such as aperture 32, to cooperate with an individual one of the pivot pins 25 or 26 for the pivotal movement of platform 24.

In accordance with an aspect of my invention, the illustrative platform 24 is tiltable, or movable, in an arc from a horizontal plane parallel to that of the supporting device 15 under the control of a pair of jacks 33 and 34. As is best depicted in FIG. 2, the jacks 33 and 34 comprise threaded screw members 35 and 36 having upper swivel block elements 37 and 38, respectively. Each of the blocks 37 and 38 includes a pivot pin, such as pin 39, for cooperating with a member having an aperture, such as aperture 40, in an individual one of a pair of hinge elements 41 and 42 affixed to the underside members 43 and 44, respectively, of platform 24. Jacks 33 and 34 each include a hollow sleeve member 45 or 46 for telescopically cooperating with the associated threaded screw 35 or 36, respectively. Advantageously, the illustrative embodiment of my invention depicts the jacks 33 and 34 as coupled together by a linking shaft 47 for the simultaneous actuation of screws 35 and 36.

Each of the jacks 33 and 34 is affixed to a U shaped bracket 48 with the sleeve members 45 and 46 extending through individual apertures (not shown) in bracket 48. According to another aspect of my invention, the bracket 48 comprises end members 49 and 50 each of which includes an aperture, such as aperture 51, for the pivotal mounting of bracket 48 onto pivot pins 52 and 53 on the pillow block members 54 and 55 rigidly secured to the under-surface of the side members 56 and 57, respectively, of the supporting device 15 facing the base element 1 of FIG. 1. Bracket 48 further comprises the apertures 58 and 59 in the members 49 and 50, respectively. Each of the latter apertures is aligned for enabling the crank handle 19 to be inserted therethrough for interfitting with the associated control shaft 60 or 61 whereby the jacks 33 and 34 are concurrently actuatable under control of the rotation of handle 19 to effect the tilting movement of platform 24.

According to my invention, the crank handle 19 when interfitted with the control shaft 60 as shown in FIG. 2, is rotatable clockwise and counterclockwise for actuating the jacks 33 and 34 whereby the threaded screws 35 and 36 are raised or lowered for tilting the platform 24 about an arc from a horizontal plane parallel to that of the supporting device 15. Advantageously, the exemplary embodiment of my invention provides two pivotal facilities for each of the jacks 33 and 34 whereby, when the jacks are actuated, swivel actions occur about pins 39 and 39' as the threaded screws 35 and 36 are driven upward or downward by the actuated jacks 33 and 34. The concurrent raising or lowering of screws 35 and 36 also cause the U shaped bracket 48 to pivot about the swivel pins 52 and 53 in an arc from a perpendicular plane to that of supporting device 15 and toward the direction of the legs 6 and 7.

It is within the scope of my invention to provide for the tilting of the platform 24 in four separate upward and downward directions about a horizontal plane of device 15. The structure utilizable for this feature comprises the elimination of the linking shaft 47 between the jacks 33 and 34 and the provision of a supplemental pair of such jacks mounted on an additional U shaped bracket corresponding to bracket 48. The supplemental jacks are not coupled together by a linking shaft such as one corresponding to shaft 47. The additional bracket advantageously is pivotally mountable to an additional pair of pivot pins each of which corresponds to a pin 52 or 53 and is associable with an individual one of another pair of pillow block members corresponding to members 54 and 55 and secured to the undersurface of the side members 56 and 57, respectively, nearby to the support element 62. Accordingly, the pivot pins 25 and 26 are to be removed from hinges 29 and 30, respectively. Moreover, each of the block members at the upper ends of the threaded screws of the supplemental pair of jacks is pivotally connectable about an individual one of another pair of pins associated with another pair of hinges corresponding to hinges 41 and 42 and which is secured to the platform 24 above the additional U shaped bracket. Consequently, each of the jacks 33 and 34 as well as the supplemental pair of jacks is actuatable individually under control of the crank handle interfitted with the control shaft, such as shaft 60, to raise or lower only the threaded screw associated with the engaged jack and thus the associated corner of platform 24.

FIG. 3 depicts a swivel arrangement for pivotally connecting a threaded screw 36A about a swivel pin 39A. A swivel fastener 64 is depicted partially in a sectional view and it comprises a contiguous threaded nut 65 for interfitting with a threaded screw 36A in a fastening relationship. Swivel fastener 64 further comprises a circular head part 66 having a slotted section member 67 complementing and axially cooperating with the pin 39A which is fastened within a cavity 68 of a block member 38A. The latter is rigidly affixed to an underside member 44A of an L shaped frame element. Advantageously, the structural arrangement of FIG. 3 may be utilized in the equipment of FIG. 2 for pivotally connecting a threaded screw, such as screw 35 or 36, with a swivel pin, such as pin 39, in a swivel block member, such as member 37 or 38, affixed to the underside member 43 or 44 of platform 24.

The pair of jacks in each of the assemblies 9 and 10 may advantageously comprise essentially the same mechanical structure as for the jacks 33 and 34. To elaborate, the assembly jacks may be coupled together by a linking shaft similar to the shaft 47 and may further comprise control shafts, such as shafts 22 and 23, for controlling in conjunction with crank handle 19 the raising and lowering of the respective threaded screws 11, 12, 13 and 14. In addition, each of the control shafts of the assembly jacks may have mounted thereon a driving sprocket cooperating with a chain, such as chain 16, and a drive sprocket on the control shaft of the jack at the opposite end of the support device 15 for controlling with the handle 19 the concurrent raising and lowering of the screws 11, 12, 13 and 14. Thus, the apparatus in assemblies 9 and 10 including the jack linking shafts, sprockets and chain arrangements may advantageously comprise the aforementioned driving mechanism. Furthermore, the upper block element (not shown) of each of the screws 11, 12, 13 and 14 is rigidly

affixed to the associated one of the support elements **62** and **63** of device **15**.

Jacks **33** and **34** as well as the jacks of assemblies **9** and **10** may advantageously comprise commercially available JACTUATOR devices marketed by the Duff-Norton Company of Charlotte, North Carolina.

In the illustrative embodiment of my invention disclosed in FIG. 1, the platform **24** comprises L shaped angle sections including the side segments **27** and **28** for supporting the plate elements **69** and **70** as well as the bar members **71** and **72**. The latter elements and members are utilized for supporting a load structure on the platform **24**. Alternatively, a continuous surface top member may be supported by the L shaped angle sections to form a top of a tiltable table.

It is to be understood that the hereinbefore described arrangements are illustrative of the application of the principles of my invention. In light of my teaching, it is apparent that numerous other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

**1.** In combination,
a frame structure including a horizontally extending support device,
a bracket means,
first swivel means pivotally mounting said bracket means on said frame,
a platform member,
second swivel means pivotally mounting said platform member on said supporting device,
tilting jack means rigidly secured to said bracket means and including elevating means and apparatus for pivotally connecting said elevating means to said platform member,
said jack means being operative to actuate said elevating means for tilting said platform member with respect to said supporting device,
and said first and second swivel means being responsive to the actuation of said elevating means for pivoting said bracket means and said platform member on said supporting device,
wherein said tilting jack means comprises a pair of jack mechanisms secured to said bracket means,
said elevating means includes an individual threaded screw arrangement of each of said mechanisms,
said apparatus includes an individual swivel means for each of mechanisms and comprising a coupling member affixed to an upper end segment of said threaded screw of said mechanism, a hinge means secured to said platform member and a pin member element interfitted with said coupling member and said hinge means for pivotal movement of said coupling member on said pin element in response to the actuation of said threaded screw elevating means of the same mechanism,
further comprising a shaft linking said pair of jack mechanisms,
and wherein each of said jack mechanisms includes a contral shaft rotatable for operating its jack mechanism and said linking shaft,
said bracket means comprises members each having apertures associated with an individual one of said control shafts,
and further comprising means projectable through any one of said apertures to interfit with said associated control shaft for the rotation of said last-mentioned shaft whereby said jack mechanisms are concurrently operative under control of said linking shaft for actuating each of said screw elevating means to tilt said platform member.

**2.** The combination in accordance with claim **1**
wherein said frame structure further includes a horizontally extending frame member,
a plurality of elevating jack mechanisms mounted at opposite end segments of said frame member and each having a threaded screw affixed to said supporting device and a control shaft rotatable for actuating the elevating jack mechanism for selectively raising and lowering said threaded screw thereof and in turn said affixed supporting device.

**3.** The combination in accordance with claim **2**
wherein said plurality of elevating jack mechanisms comprises a pair of elevating jack mechanisms mounted at each opposite end segment of said frame member,
and further comprising a plurality of coupling shafts and each of said last-mentioned shafts coupling together said pair of said elevating mechanisms at the same end segment of said frame, and a chain drive arrangement cooperating with the control shafts of each of said elevating mechanisms for linking each of said last-mentioned mechanisms together and being responsive to the rotation of the control shaft of any of said elevating jack mechanisms for cooperating with said coupling shafts concurrently to operate each of said elevating jack mechanisms whereby said threaded screws thereof simultaneously are selectively raised and lowered.

**4.** The combination in accordance with claim **3**
wherein said frame structure further includes a horizontally extending base element,
a plurality of vertically disposed hollow legs each projecting upwardly from said base element to said frame member and being attached to said base element and said frame member,
and each of said threaded screws of said elevating jack mechanisms being aligned for telescopically cooperating with an individual one of said legs.

**5.** An elevating and tilting structure comprising
a horizontally extending base element,
a horizontally extending upper frame member,
a plurality of vertically disposed hollow leg devices each projecting upwardly from said base element to said frame member and being attached to said base element and frame member,
a pair of jacks mounted at each of the opposite end segments of said frame member and each of said jacks having a threaded screw telescopically cooperative with an individual one of said leg devices,
a plurality of linking shafts, each of said shafts linking an individual pair of said jacks at the same end segment of said frame member,
a chain drive arrangement linking each of said jacks together for concurrent actuation of said jacks,
each of said jacks further having a control shaft being rotatable for actuating the associated jack to drive said linking shafts and chain arrangement and thereby concurrently to actuate each of said jacks for simultaneously raising and lowering each of said threaded screws,
an intermediate support device extending horizontally substantially parallel to said upper frame member and being attached to upper end segments of said threaded screws for elevation movement under control of the raising and lowering of said screws,
said support device having side elements each of which includes a pillow block member and pivot pin arrangement,
a U-shaped bracket device pivotally associated with each of said pivot pin arrangements,
hinge means secured to an end section of said intermediate support device,
a top support platform including pin means cooperating said said hinge means for pivotal movement of said platform and
a pair of swivel hinge devices,
a pair of tilting jacks rigidly secured to said bracket device and each of said tilting jacks including a threaded screw having an upper block member and

a swivel pin arrangement pivotally cooperative with one of said pair of swivel hinge devices,

a shaft coupling said tilting jacks together for concurrent actuation thereof,

and each of said tilting jacks further including a control shaft being rotatable for actuating the associated jack to drive said coupling shaft and thereby concurrently to actuate each of said tilting jacks for simultaneously raising and lowering each of said screws of said tilting jacks whereby said block member and swivel pin arrangements pivotally cooperate with said hinge devices and said bracket device pivotally cooperates with said pillow block member and pivot pin arrangements thus to move said platform in an arc from the horizontal plane of said support device about said pivotally cooperating pivot hinge means and said pin means.



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