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DRAFTING TABLE

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Fig. 1.

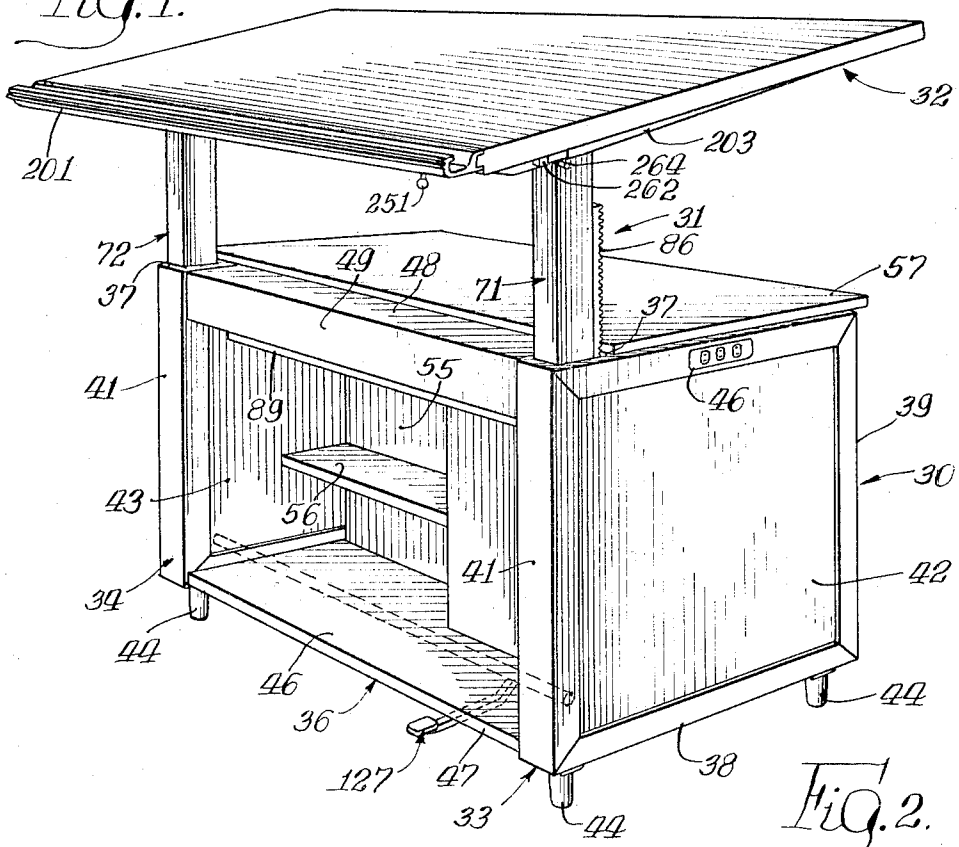


Fig. 2.

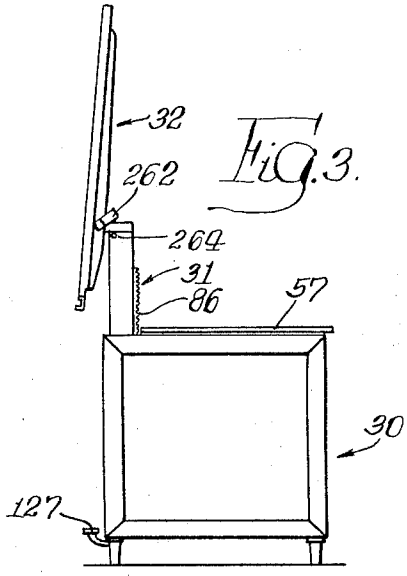
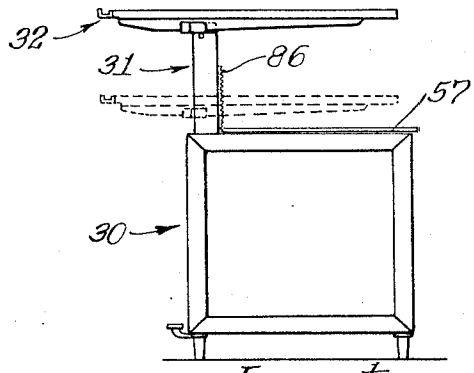


Fig. 3.



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Roy E. Kanitz,
James M. Katzfey,
By Nibben, Moyes & Bicknell Attys.

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DRAFTING TABLE

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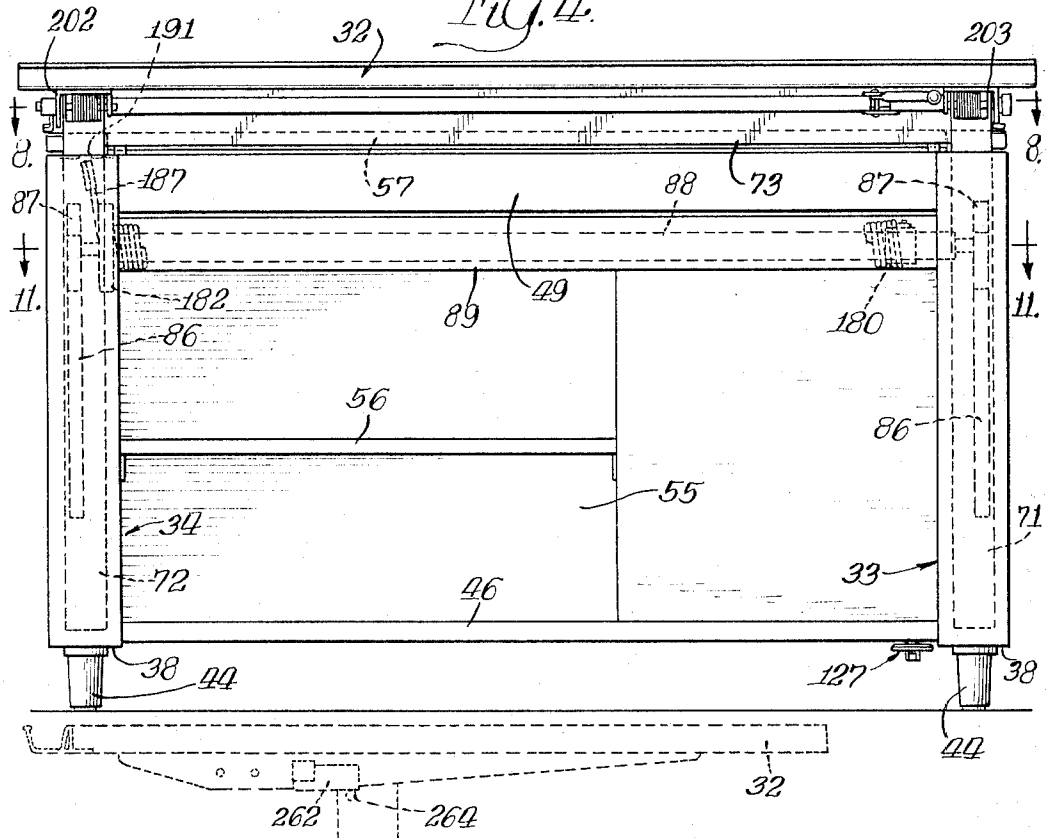
Fig. 4.



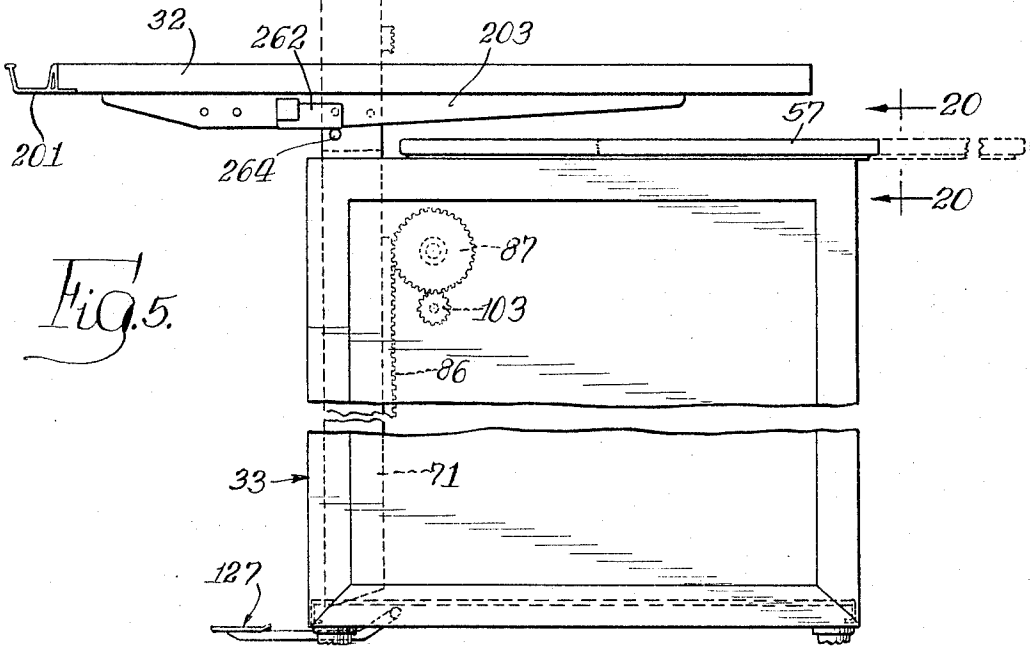


Fig. 5.

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Fig. 6.

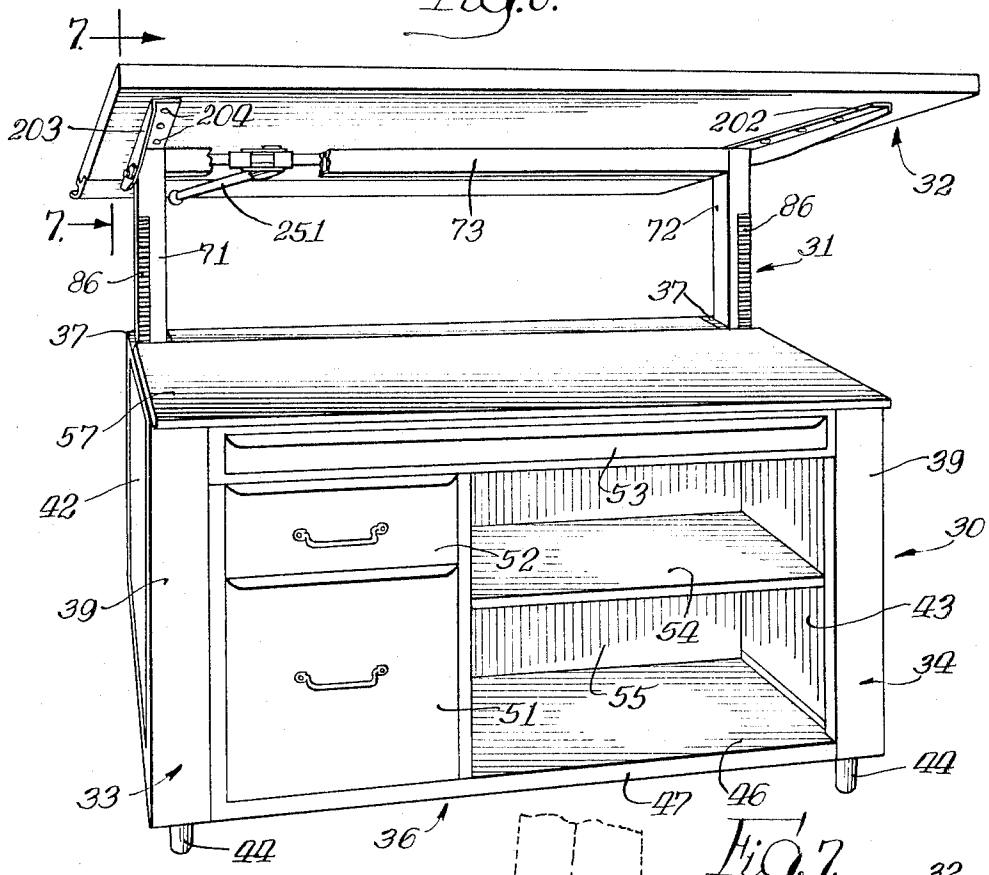
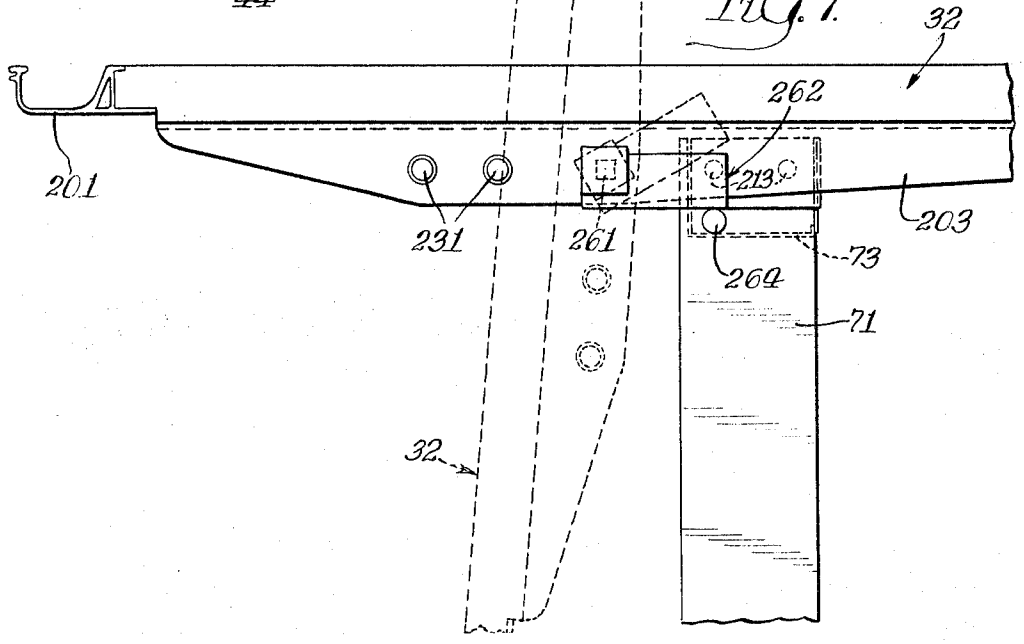


Fig. 7.



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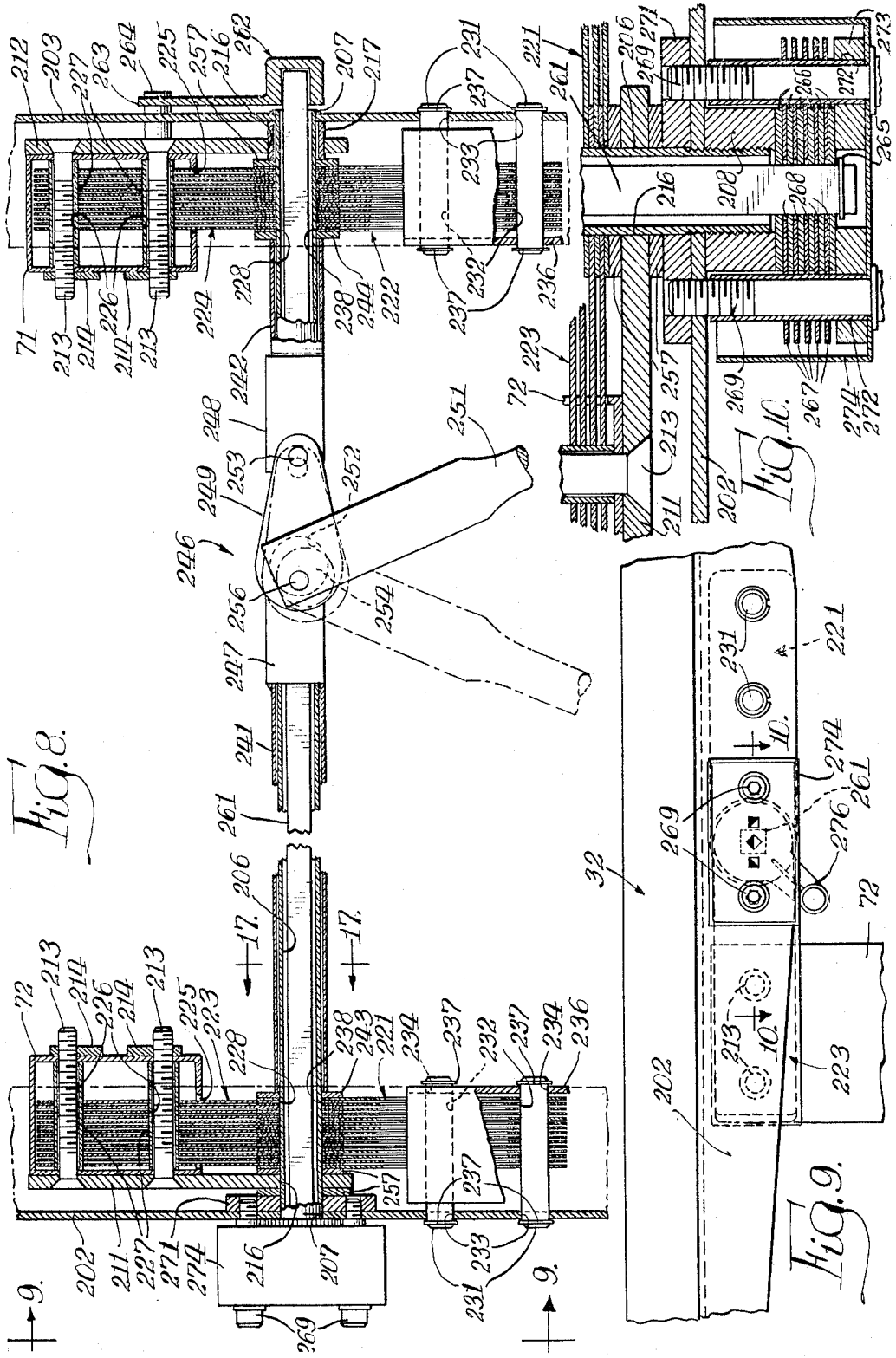

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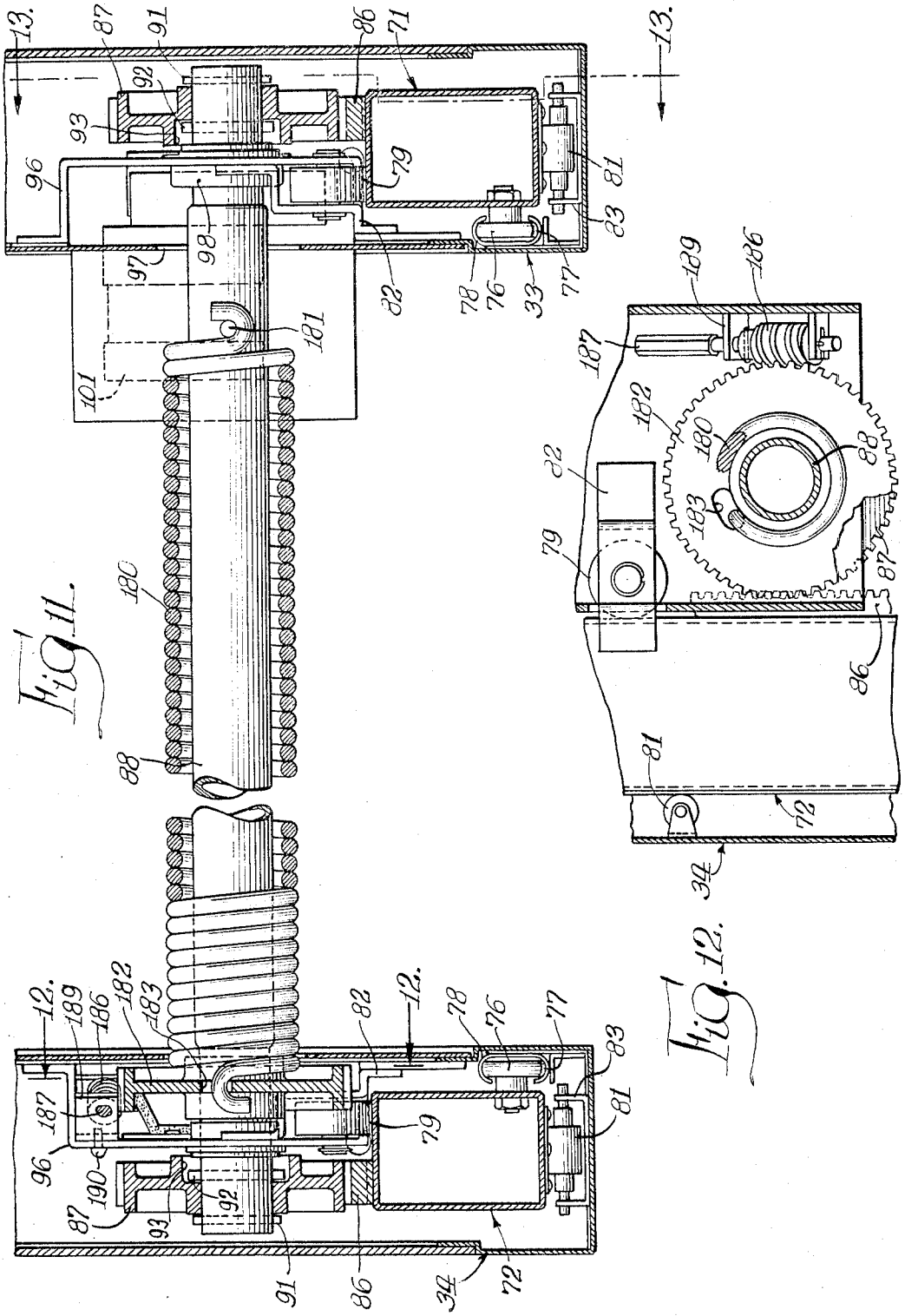

Fig. 11.

Fig. 12.

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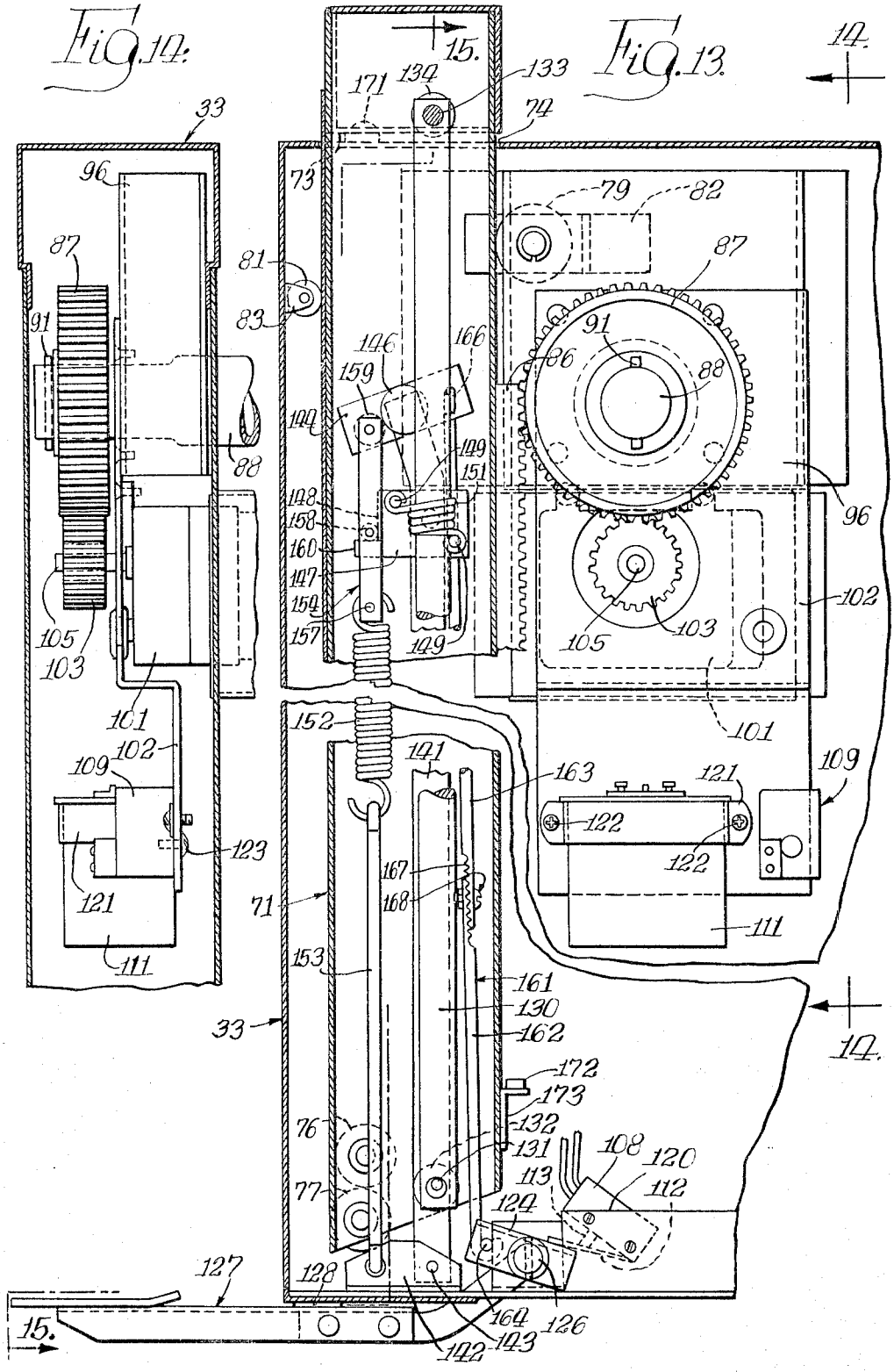
Fig. 14.

Fig. 13.



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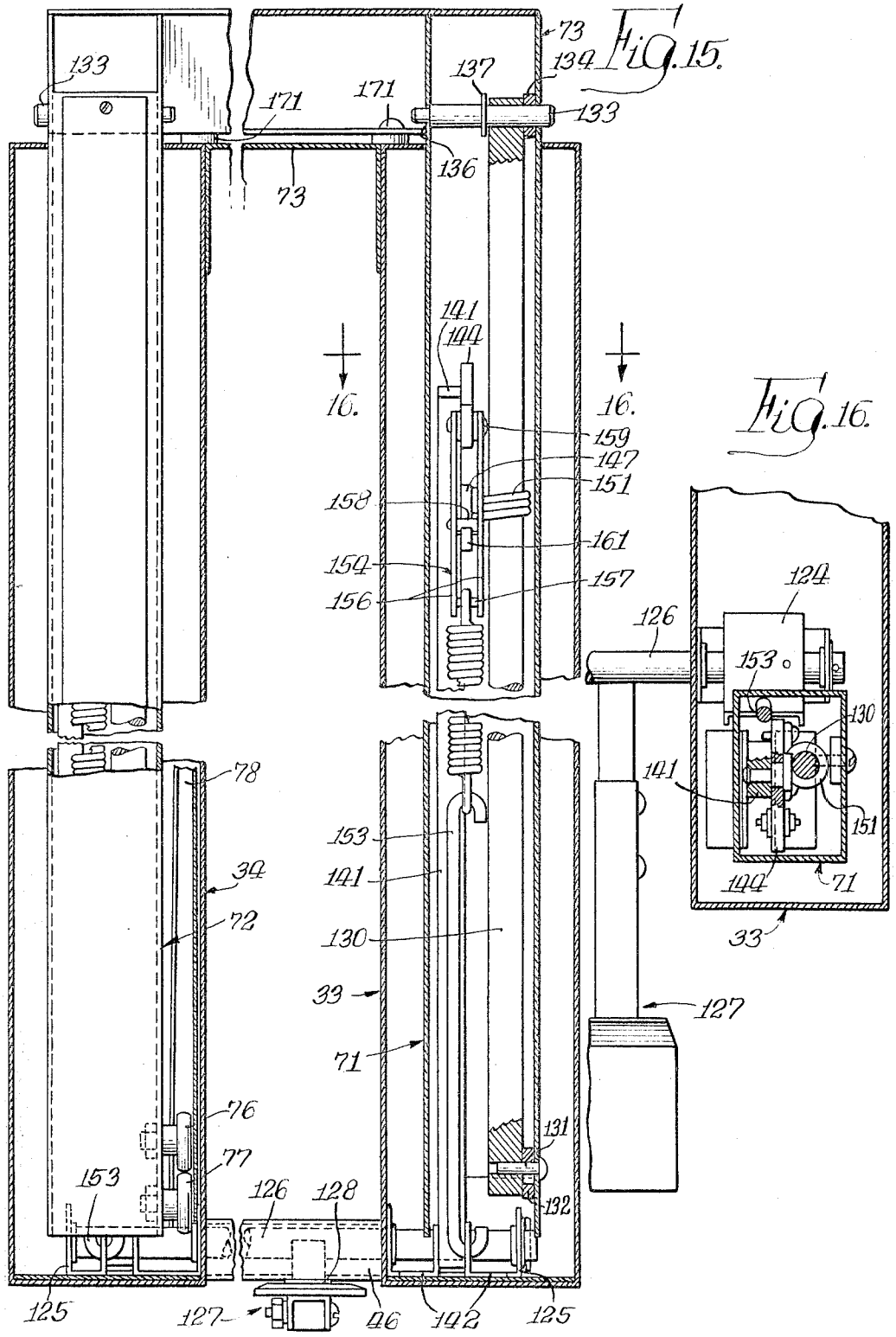

Fig. 15.

Fig. 16.

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FIG. 17.

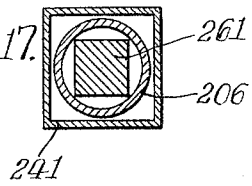


FIG. 18.

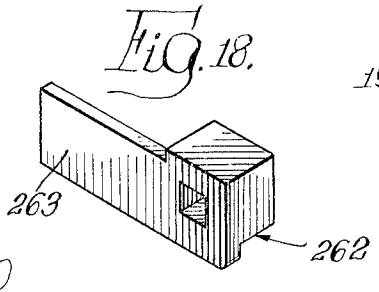


FIG. 19.

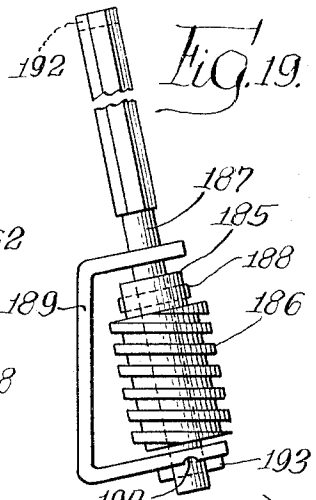


FIG. 20

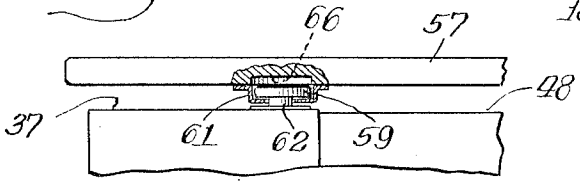


FIG. 21.

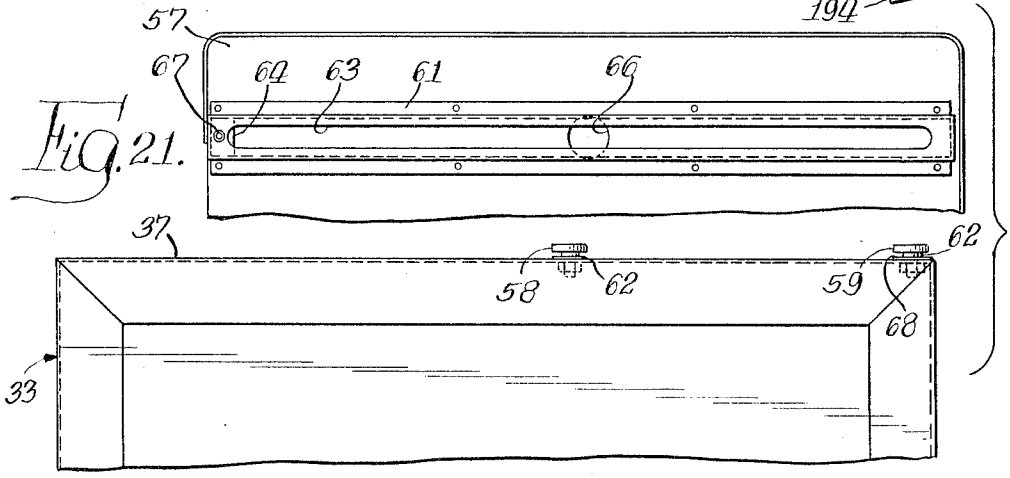
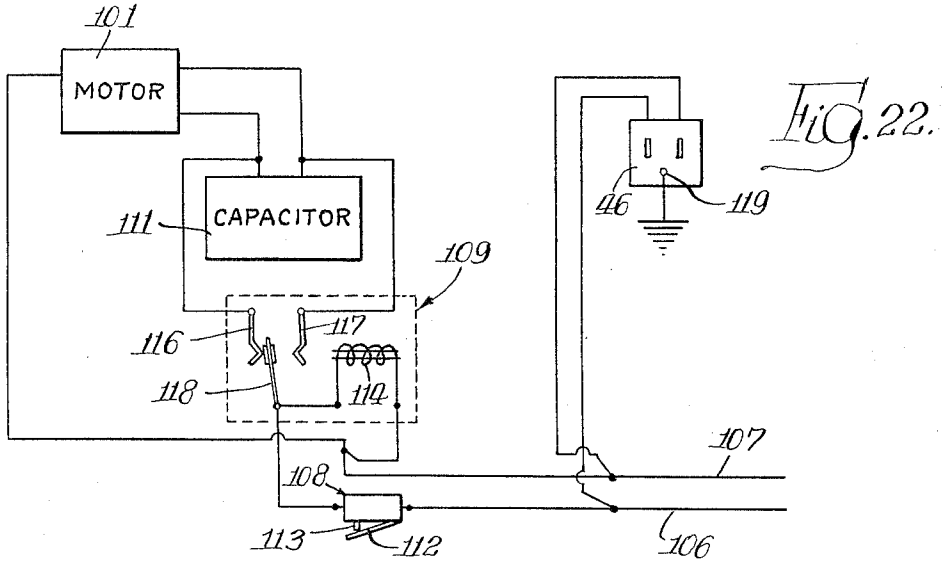


FIG. 22.



United States Patent Office

3,273,517

Patented Sept. 20, 1966

3,273,517

DRAFTING TABLE

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Filed Feb. 12, 1964, Ser. No. 344,303

26 Claims. (Cl. 108—2)

This invention relates to an improved drafting table construction.

It is an object of this invention to provide a novel drafting table having a drafting board which may be easily raised, lowered or tilted.

It is another object to provide a drafting table of the above character, having means for counterbalancing the tilting movement of the drafting board, the counterbalancing means including a novel adjustment mechanism.

It is still another object to provide a drafting table of the above character, having novel adjustable means for counterbalancing the vertical movement of the drafting board.

A further object is to provide a drafting table of the above character, having a motor drive for the vertical movement of the drafting board.

Still a further object is to provide a drafting table of the above character, having novel means for holding the drafting board in any desired position of vertical adjustment.

Other objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying figures of the drawings, in which:

FIG. 1 is a perspective view showing the rear side of a drafting table embodying the invention;

FIG. 2 is a reduced end elevational view of the drafting table;

FIG. 3 is a view similar to FIG. 2 but showing a different position of the drafting table;

FIG. 4 is an enlarged elevational view of the rear side of the drafting table;

FIG. 5 is an enlarged end elevational view of the drafting table;

FIG. 6 is a perspective view similar to FIG. 1 but showing the front side of the drafting table;

FIG. 7 is a fragmentary elevational view taken generally on the line 7—7 of FIG. 6;

FIG. 8 is a fragmentary enlarged sectional view taken generally on the line 8—8 of FIG. 4;

FIG. 9 is a fragmentary elevational view taken on the line 9—9 of FIG. 8;

FIG. 10 is a further enlarged fragmentary sectional view taken on the line 10—10 of FIG. 9;

FIG. 11 is an enlarged fragmentary sectional view taken on the line 11—11 of FIG. 4;

FIG. 12 is a fragmentary sectional view taken on the line 12—12 of FIG. 11;

FIG. 13 is a fragmentary sectional view taken on the line 13—13 of FIG. 11;

FIG. 14 is a fragmentary sectional view taken on the line 14—14 of FIG. 13;

FIG. 15 is a fragmentary sectional view taken on the line 15—15 of FIG. 13;

FIG. 16 is a fragmentary sectional view taken on the line 16—16 of FIG. 15;

FIG. 17 is a fragmentary sectional view taken on the line 17—17 of FIG. 8;

FIG. 18 is a fragmentary view of a portion of the apparatus shown in FIG. 8;

FIG. 19 is an enlarged view of a portion of the apparatus shown in FIG. 12;

FIG. 20 is an enlarged fragmentary elevational view taken on the line 20—20 of FIG. 5;

FIG. 21 is a reduced exploded view of the apparatus shown in FIG. 20; and

FIG. 22 is a schematic diagram of the electrical components of the table.

In general, a drafting table embodying the invention comprises a supporting structure, which may be in the form of a desk or table, a column assembly mounted for vertical movement on the supporting structure, and a drafting board mounted for tilting movement on the column assembly. Means is provided for counterbalancing the weight of the column assembly and the drafting board, and a brake is provided for holding the column assembly and the board at a selected vertical position. Means is also provided for counterbalancing the tilting movement of the drafting board, and another brake is provided for holding the board at a selected tilted position. Both counterbalancing means are adjustable so that different weights on the drafting board may be compensated for. In addition, a motor may be provided for effecting the vertical movement of the column assembly and the drafting board.

With reference to FIGS. 1 to 6, the drafting table comprises a supporting structure indicated by the numeral 30, a column assembly 31 mounted for vertical movement on the supporting structure 30, and a drafting board 32 mounted for tilting movement on the upper portion of the column assembly 31. The supporting structure 30 may be in the form of a desk or table, and comprises a pair of spaced apart end members or pedestals 33 and 34 which are secured together in spaced apart relation by a center drawer and shelf assembly 36. Each pedestal 33 and 34 comprises a top wall 37, a bottom wall 38, front and rear end walls 39 and 41, and outer and inner panels 42 and 43. The outer panels 42 are preferably connected to the remainder of the respective pedestals by snaps so that they may be easily removed when desired. Legs 44 are preferably secured to the underside of each bottom wall 38 at the front and rear of the table, and electrical outlets 46 may be installed in the top wall 37 if desired.

The center drawer and shelf assembly 36 comprises a bottom panel 46 which has a downwardly and inwardly extending flange 47 at its four edges, and is secured to the two pedestals 33 and 34 as by a plurality of screws. The bottom panel 46 secures the two pedestals 33 and 34 together at their lower portions, and, at their upper portions, the two pedestals 33 and 34 are secured together by a tie panel 48. A downwardly and inwardly extending flange 49 is also formed at each edge of the tie panel 48, and the panel 48 is also secured to the two pedestals 33 and 34 as by a plurality of screws. Between the two panels 46 and 48 may be provided, if desired, a plurality of drawers 51, 52 and 53, shown in FIG. 6, a shelf 54 shown in FIG. 6, and another shelf 56 shown in FIG. 1. The shelf 56 may be separated from the shelf 54 by a vertical partition 55. These shelves and drawers may be constructed and installed in a conventional manner. As shown in FIG. 1, the shelf 56 is accessible from the side of the table facing a draftsman (referred to as the rear of the table) while the drawers 51, 52 and 53 and the shelf 54 are accessible from the side of the table away from the draftsman (referred to as the front of the table).

A reference top or board 57 is preferably mounted on top of the table over the tie panel 48 and is available for use from the front of a table. With reference to FIGS. 5, 20 and 21, the reference top 57 may be adjusted

between a normal position shown in full lines in FIG. 5 and a withdrawn position shown in dashed lines in FIG. 5. The reference top 57 is mounted by means comprising a rear roller 58 and a front roller 59 (FIGS. 20 and 21) mounted on the top wall 37 of each pedestal 33 and 34. The rollers 58 and 59 are spaced upwardly from the upper surfaces of the top walls 37, and each pair of rollers 58 and 59 extends into two channel shaped members or guides 61 secured to the under surface of the reference top 57. The web or center portion of each guide is spaced downwardly from the reference top 57, and the rollers 58 and 59 are positioned within these spaces. The under surface of the reference top 57 normally rests on the upper faces of the rollers 58 and 59. Each roller 58 and 59 includes a spacer portion 62 which extends downwardly out of the guides 61 through elongated slots 63 formed through the webs of the guides. A resilient bumper 64 is positioned within each guide 61 adjacent the rear edge of the reference top 57, and the bumpers 64 engage the rear rollers 58 when the reference top 57 has been pulled to its furthermost withdrawn position (shown in dashed lines in FIG. 5). To hold the reference top 57 at this position, a circular opening 66 (FIG. 21) is formed in the underside of the reference top 57 at the locations of the front rollers 59 when the reference top is at the furthermost withdrawn position. Thus, when the reference top 57 has been pulled all the way out, it may be released and the front rollers 59 will enter the openings 66 and prevent the reference top 57 from being pushed back to the solid line position shown in FIG. 5 until the front edge of the reference top 57 is lifted sufficiently to permit the front rollers 59 to clear the margin of openings 66. If desired, a glide 67 may be secured to the underside of each guide 61 adjacent its rear edge and a felt washer 68 may be positioned under the front rollers 59 to prevent the guides 61 from marring the finish of the top walls 37 of the two pedestals 33 and 34.

The column assembly 31 is mounted for vertical movement on the supporting structure 30 between a lowered position shown in full lines in FIG. 5 and a raised position shown in dashed lines in FIG. 5. The column assembly 31 comprises a pair of hollow vertically extending columns 71 and 72 which are generally rectangular in cross section (FIG. 11) and are secured together as by welding at their upper ends by a similar hollow cross member 73, (FIGS. 4, 6 and 7). An opening 74 (see FIG. 13) is formed on the top wall 37 of each pedestal 33 and 34 adjacent the rear side of the table, and the two columns 71 and 72 extend through the openings 74. Movement of the lower end of each column 71 and 72 is guided by means comprising a pair of vertically spaced rollers 76 and 77 (FIGS. 11, 13 and 15) rotatably mounted adjacent the lower end of each of the columns, and a U-shaped guide 78 secured to each end pedestal 33 and 34 adjacent the rollers 76 and 77. The guides 78 extend from adjacent the lower ends of the pedestals to the maximum height of movement of the upper rollers 76. As shown in FIG. 13, the roller 76 is off-set toward the front of the table a small amount from the other roller 77, and, as shown in FIG. 11, the roller 76 engages one arm of the associated guide 78 and the other roller 77 engages the other arm of the guide 78. Since each roller does not engage both arms of the guide, free rotation of the rollers 76 and 77 is permitted.

Vertical movement of each column 71 and 72 is guided at the top of the supporting structure 30 by front and back rollers 79 and 81 (FIGS. 11 and 13). The front rollers 79 engage the front sides of the two columns 71 and 72 and are mounted on brackets 82 (FIG. 13) which are secured within the pedestals 33 and 34, and the two back rollers 81 engage the back sides of the two columns 71 and 72 and are rotatably mounted by two U-shaped brackets 83 also secured within the pedestals 33 and 34.

With reference to FIGS. 5, 11 and 13, vertical movement of the column assembly 31 is controlled by means of a rack 86 secured to the front side of each column 71 and 72 and a pinion 87 mounted in each pedestal 33 and 34 adjacent a rack 86 and meshing with the rack. The racks 86 are secured to the two columns 71 and 72 by means such as screws, and the two pinions 87 are mounted on opposite ends of a timing shaft 88 (FIG. 11) which extends laterally of the table from one pedestal to the other. A guard 89 (FIGS. 1 and 4) is preferably positioned adjacent the timing shaft 88 and a torsion spring to be described hereinafter in order to prevent a draftsman using the table from engaging the shaft 88 and the spring.

The two pinions 87 are held in fixed relation to each other and to the timing shaft 88 by means of outer pins 91 (FIG. 11) which extend through openings formed through the timing shaft 88 adjacent its outer ends and which prevent axial movement of the two pinions 87 off the end of the shaft. At the inner sides of the two pinions 87, inner pins 92 extend through openings formed through the timing shaft 88 and prevent inward axial movement of the two pinions 87. The two inner pins 92 also prevent rotative movement of the two pinions 87 relative to the shaft 88 by being positioned in slots 93 formed in the inner sides of the two pinions 87. Due to the connection of the two pinions 87 by the timing shaft 88, simultaneous movement of the two columns 71 and 72 is obtained, which prevents side-wise tilting of the column assembly 31 and a drafting board 32.

To mount the timing shaft 88, on the supporting structure 31, a bracket 96 (FIG. 11) is mounted on the inside of each pedestal 33 and 34 around an opening 97 formed in the inner wall of each pedestal through which the timing shaft 88 extends, and bearings 98, are provided for mounting the timing shaft 88 on the brackets 96. As is shown in FIG. 11, the timing shaft 88 is preferably a tubular member which is swaged to a reduced diameter at each end where the shaft 88 is connected to the two pinions 87.

To effect vertical movement of the column assembly 31, a motor drive unit 101 (FIGS. 11 and 14) is provided, the drive unit 101 being mounted on a bracket 102 which is secured to the mounting bracket 96 within the pedestal 33. The drive unit 101 is preferably an electric motor and includes a drive shaft 105. A drive pinion 103 is mounted on the shaft 105 through a conventional slip clutch arrangement, and the drive pinion 103 meshes with the adjacent pinion 87 mounted on the timing shaft 88. Thus, when the drive unit 101 is energized, the drive pinion 103 causes rotation of the two pinions 87 and the timing shaft 88 and, consequently, either upward or downward movement of the column assembly 31, depending upon the direction of rotation of the shaft 88 and the two pinions 87.

A wiring diagram for the drive motor 101 is shown schematically in FIG. 22, and comprises two power input conductors 106 and 107, a control snap switch 108, a two position relay 109, and a running capacitor 111. The snap switch 108 includes a flexible leaf 112, which has one end secured to the casing of the switch, and a push button 113, and contacts in the switch 108 are closed when the leaf 112 and the push-button 113 are pressed inwardly. The relay 109 includes a coil 114, two stationary contacts 116 and 117, and a movable contact 118 which always engages one or the other of the two stationary contacts 116 and 117. The construction of relay 109 is such that when the coil 114 is first energized by closing the snap switch 108, the movable contact 118 moves to one of the two stationary contacts 116 and 117 and remains at that contact until a subsequent energization of the coil 114, at which time the movable contact 118 moves to the other of the two stationary contacts and remains at that stationary contact until still another subsequent energization of the coil 114. Connection of

the movable contact 118 with one of the two stationary contacts 116 and 117 causes energization of the motor 101 through the capacitor 111 in one direction of rotation, and connection of the movable contact 118 with other of the two stationary contacts causes energization of the motor 101 in the opposite direction. Reversal of the direction of rotation is accomplished by providing the motor 101 with two windings and connecting the capacitor 111 with one or the other of the two windings.

The electrical outlet 46 shown in FIG. 1 may be also connected to the two power input conductors 106 and 107 as shown in FIG. 22. The receptacle 46 is preferably also provided with a ground connection indicated at 119 in FIG. 22.

The snap switch 108, the capacitor 111 and the relay 109 are also shown in FIG. 13. The capacitor 111 is mounted adjacent the lower end of the bracket 102 by means of the strap 121 and screws 122, and the relay 109 is also fastened adjacent the lower end of this same bracket 102 as by means of a screw 123 shown in FIG. 14. The snap switch 108 is mounted in the lower end of the pedestal 33 by a bracket 120. The switch 108 is positioned to be actuated by a channel 124 which has its front end positioned under the flexible leaf 112 of the switch 108 and is pivotally mounted on the supporting structure 30 intermediate its front and rearward ends by a shaft 126 (FIGS. 13 and 15). The shaft 126 extends laterally of the table from one pedestal to the other underneath the bottom panel 46 and is rotatably mounted at its ends by brackets 125 secured to the two pedestals. Intermediate the ends of the shaft 126 is secured a foot engageable pedal 127 which extends from the shaft 126 toward the side of the table occupied by the draftsman and underneath the adjacent flange 47 of the bottom panel 46. A resilient pad 128 (FIGS. 13 and 15) is preferably secured to the underside of the flange 47 of the bottom panel 46 adjacent the pedal 127 to prevent marring of the finish of the flange 47 and to prevent noise from occurring when the pedal 127 engages the flange 47.

When the draftsman wishes to raise the column assembly 31 and the drafting board 32, he simply presses the foot pedal 127 downwardly, causing the channel 124 to rotate counterclockwise about the axis of the shaft 126 and press the leaf 112 upwardly and the push button 113 inwardly of the switch 108. This action closes the contacts in the switch 108 and causes the drive motor 101 to be energized. If the last direction of movement of the column assembly 31 was in the downward direction, the next movement will be in the upward direction. If the operator of the table wishes to raise the table after the previous movement was also in the upward direction, the operator simply presses the foot pedal 127 twice in quick succession.

Means is also provided for holding the column assembly 31 and the drafting board 32 at a selected vertical position this means also being releasable by movement of the pedal 127. A separate brake mechanism is provided within each of the two columns 71 and 72, the brake mechanism mounted in column 71 being illustrated in FIGS. 13, 15 and 16. Generally, each brake comprises a vertically extending rod which is positioned within its associated column and is movable therewith, and means mounted on the pedestal adjacent each rod and adapted to grip and hold the rod until it is released. The rod is cylindrical and indicated by the numeral 130 in the drawings, and, at its lower end, it is secured to the outer wall of the column 71 by means of a screw 131. A spacer 132 is positioned between the lower end of the rod 130 and the column 71 in order to hold the rod 130 away from the column. At its upper end, the rod 130 is secured to the column 71 by means of a pin 133 (FIG. 15) which extends through holes formed in the column 71 and through a hole formed in the upper end of the rod 130. Again, a spacer 134 is provided to hold the upper end of the rod 130 away from the column 71. With reference to FIG. 15, the pin 133 is prevented from movement toward the left by means of a shoulder 136 formed adjacent the left end of the pin 133, the shoulder 135 engaging the inner side of the column 71. Movement of the pin 133 toward the right is prevented by a retaining ring 137, which is secured to the pin 133 closely adjacent the left side of the rod 130.

The means for holding the rod 130 and the column 71 at a selected vertical position comprises a vertically extending brake support bar 141. The lower end of the bar 141 is positioned between a pair of angle shaped brackets 142 and connected thereto by a pin 143, and the upper end of the bar 141 pivotally supports a pivot plate 144 by a pin 146. Also mounted on the bar 141 at a location spaced downwardly from the pivot plate 144 is a mounting plate 147 which is pivotally connected to the bar 141 by a pin 148. The plate 147 supports a coiled brake spring 151 which is wound around the circular rod 130 and is connected at its two ends by screws 149 to the plate 147. As shown in FIG. 13, the two ends of the spring 151 extend in opposite directions from a center of the rod 130, and the axis of the rod 130 is intermediate the two screws 149. Also, the axis of the pin 148 substantially coincides with the axis of the rod 130.

When the brake spring 151 is in the position shown in FIG. 13, the spring 151 tightly grips and holds the rod 130 and prevents it from moving. To hold the mounting plate 147 and the spring 151 in the engaged position where it grips the rod 130, a coiled tension spring 152 is connected at its lower end to one of the angle shaped brackets 142 by means of a link 153 and at its upper end to the mounting plate 147 by means of a pivot link 154. As shown in FIGS. 13 and 15, the pivot link 154 comprises two spaced apart strips 156 which are held together by three rivets 157, 158 and 159. The rivet 157 is adjacent the lower end of the pivot link 154 and connects the link 154 to the upper end of the coiled tension spring 152. The rivet 158 is located substantially midway between the ends of the pivot link 154 and extends above an outwardly extending ledge 160 formed on the mounting plate 147. The third rivet 159 is adjacent the upper end of the pivot link 154 and pivotally connects the pivot link 154 to the pivot plate 144. The force of the tension spring 152 urges the pivot link 154 downwardly and the pivot plate 144 in the counterclockwise direction, and the rivet 158 normally engages the ledge 160 and holds the mounting plate 147 in the engaged position where the spring 151 grips the rod 130.

To cause the brake spring 151 to release the rod 130 when vertical adjustment of the column assembly 31 and the drafting board 32 is desired, a brake release rod 161 is provided which comprises a lower half 162 and an upper half 163. The brake release rod 161 extends generally in the vertical direction, and the lower end of the lower half 162 is connected to the rear portion of the channel 124 by means of a pin 164. It will be recalled that the channel 124 is mounted on the shaft 126 and also serves to actuate the snap switch 108. The upper end of the upper half 163 of the brake release rod is bent over to form a hook which is positioned through a hole 166 formed in the pivot plate 144 at the end of the plate 144 opposite the end which is connected to the pivot link 154. The adjacent ends of the two halves 162 and 163 have a plurality of teeth or ridges 167 formed on one side thereof, and a screw nut combination 168 secures the adjacent ends of the two halves 162 and 163 together with the teeth 167 of the two halves engaging each other.

Assuming that a vertical adjustment of the column assembly 31 and the drafting board 32 is desired, the draftsman presses the foot pedal 127 downwardly, or in the counterclockwise direction as seen in FIG. 13, which action first causes the brake mechanisms to release. Very slight additional movement of the brake pedal 127 in the downward direction 108 causes energization of the drive

unit 101. The pivot plate 144 pivots in the clockwise direction due to the connection of the pivot plate 144 with the channel 124 through the brake release rod, and the rivet 158 rises upwardly of the ledge 160. The construction of the mounting plate 147 including the brake spring 151 is such that, without an external force applied to it by the rivet 158, it automatically rotates to the position where the brake spring 151 releases the rod 130. As soon as the spring 151 releases the rod 130, the motor drive unit 101 is free to move the column assembly 31 and the drafting board 32. After this position has been attained, pressure on the pedal 127 is released, which permits the tension spring 152 to rotate the pivot plate 144 and the mounting plate 147 in the counterclockwise direction as seen in FIG. 13 and again cause the brake spring 151 to tightly grip and hold the rod 130. The spring 152 also raises the foot pedal 127 to its normal position shown in FIG. 13 by rotating the shaft 126. Shortly before the brake mechanisms are again engaged, pivotal movement of the brake pedal 127 and the shaft 126 permits the switch 108 to open and deenergize the drive motor 101. In the event the overall length of the brake release rod 161 is so long that the brake spring 151 will not release the rod 130 or is so short that the spring 151 will not grip the rod 130, the overall length of the release rod may be adjusted by loosening the screw and nut combination 168 and either moving the two portions 162 and 163 longitudinally relative to each other. The teeth 167 of the two portions 162 and 163 insure a positive lock between these two portions when the screw and nut combination 168 is tightened.

A plurality of resilient bumpers 171 (FIGS. 13 and 15) are preferably secured to the underside of the center portion 73 of the column assembly 31 in position to engage the upper surface of the supporting structure 30 when the column assembly 31 is all the way down. Further, a resilient bumper 172 is preferably secured as by a bracket 173 (FIG. 13) to the front side of each column 71 and 72 in position to engage bracket 102 when the column assembly 31 has been moved to its uppermost position. In the event power is still applied to the power unit 101 after the column assembly 31 has reached either its uppermost or its lowermost position, damage cannot result to the power unit 101 due to the slip-clutch connection of the shaft 105 with the pinion 103, which acts as an overload protector for the power unit 101.

To counterbalance the weight of the column assembly 31 and the drafting board 32, counterbalancing means in the form of a torsion spring 180 (FIGS. 4, 11, and 12) is provided. The torsion spring 180 is wound around the timing shaft 88, and one end of the torsion spring 180 is secured to the shaft 88 by means of a pin 181 which extends through the timing shaft 88 and connects with a hook-shaped portion at this end of the torsion spring 180. The other end of the torsion spring 180 is normally held stationary relative to the supporting structure 30 by means comprising an adjusting gear 182 which is mounted for rotation on the timing shaft 88. An opening 183 (FIGS. 11 and 12) is formed in the web of the gear 182, and this end of the torsion spring 180 is shaped as a hook and positioned in this opening 183. By this construction, when the column assembly 31 and the board 32 are moved in the downward direction, the timing shaft 88 rotates and causes the spring 180 to wind up, and the force required to wind the spring 180 counterbalances the weight of the assembly 31 and the board 32. The torsion spring 180 tends to turn the timing shaft 88 in the direction to raise the column assembly 31 and the board 32, with the result that the power unit 101 may be of a very small fractional horsepower rating. In fact, the power unit 101 may be eliminated if desired. To compensate for different loads placed on the drafting board 32, the amount of force exerted by the torsion spring 180 is made adjustable. When the gear 182 is turned in the clockwise direction, for example, as seen in FIG. 12, the torsion spring 180 is wound up which causes it to exert a greater force than would otherwise be the case. The means for turning the gear 182 comprises a worm gear 186 (FIGS. 11, 12 and 19) which is mounted in the pedestal 34 and meshes with the gear 182. The worm gear 186 is secured to a shaft 187 by means of a pin 188, which extends through the shaft 187 and a reduced diameter portion 185 of the worm gear 186, and the shaft 187 is rotatably mounted on a generally U-shaped bracket 189. Holes are formed through the two arms of the bracket 189 and the shaft 187 extends through these two holes. The center portion of the bracket 189 is secured to the bracket 96 within the pedestal 34 by means of screws 190 (FIG. 11). From the gear 182, the shaft 187 angles upwardly and toward the outer panel 42 of the pedestal 34. An opening 191 (FIG. 4) is formed on the top wall 37 adjacent the upper end of the shaft 187, and the upper end of the shaft 187 is slotted as at 192 for engagement by a screwdriver. To adjust the counterbalancing force exerted by the torsion spring 180, the reference top 57 is moved to its withdrawn or forward position which makes the opening 191 accesible, and a screwdriver inserted through the opening 191 and the shaft 187 is turned to wind or unwind the torsion spring 180 the desired amount.

In the event the force of the torsion spring 180 is sufficient to cause the gear 182 and the worm gear 186 to back-off by itself and permit the spring 180 to unwind, a simple locking device may be provided to hold the shaft 187 in a desired position. The locking device shown in FIG. 19 comprises a pin 193 which extends through a hole formed in the shaft 187 and is secured thereto, and a detent in the form of a groove 194 formed in the other surface of the bracket 189 adjacent the pin 193 and radially of the shaft 187. The force exerted by the spring 180 urges the worm gear 186 upwardly as seen in FIG. 19 and holds the pin 193 in the groove 194 once it has been positioned therein. When an adjustment of the counterbalancing force of the spring 180 is desired the screwdriver is positioned in the slot 192 and a downward force is applied on the shaft 187 in addition to a turning force, and this downward force moves the pin 193 out of the groove 194 and permits rotation of the shaft 187.

Other means may be provided for holding the worm gear 186 at a desired position. For example, the pin 193 and the detent 194 may be eliminated and a piece of brake lining material may be positioned around the shaft 187 between the upper end of the worm gear 186 and the upper arm of the bracket 189. The upward force exerted on the worm gear 186 by the torsion spring 180 is sufficient to squeeze the brake lining material between the upper arm of the bracket 189 and the worm gear 186 and restrain rotative movement of the worm gear 186. The worm gear shown in FIG. 19 is provided with double threads, but rotation of the worm gear 186 may be prevented if a single thread is formed on the worm gear instead of the double threads shown.

The drafting board 32 has a generally rectangular configuration and has a smooth drawing surface on its upperside. A pencil trough 201 (FIGS. 1, 5 and 7) may be secured to the edge of the drafting board 32 occupied by a draftsman if desired. The drafting board 32 is supported on the column assembly 31 by a pair of angle shaped top supports 202 and 203 which are secured to the under side of the drafting board 32 by screws 204, and the supports 202 and 203 are pivotally connected to the upper end portion of the column assembly 31.

The drafting board 32 is mounted for pivotal movement about a horizontal axis parallel to the side of the board occupied by the draftsman that is, the side of the board at which the pencil trough 201 is located, so that a draftsman may place the board at any angle convenient to him. In fact, the board 32 may be positioned at any angle between a horizontal position, shown in FIG. 2, and a substantially vertical position shown in FIG. 3.

The mounting for the board 32 also includes a brake for holding the board at any selected position, and counterbalancing means to permit the drafsman to adjust the board 32 with a minimum of effort. Since a draftsman frequently places objects of substantial weight, such as a drafting machine or a lamp, on the board, the amount of force exerted by the counterbalancing means is made adjustable in order to compensate for changes in weight.

The board 32 is pivotally supported on the column assembly 31 by a tubular tension member 206 (FIGS. 8, 10 and 17) which extends laterally of the table and through holes 207 formed in the vertical arms of the top supports 202 and 203. One end of the tension member 206 is secured to the top support 203 as by welding, and the other end of the member 206 is threaded and receives a knurled nut 208 (FIG. 10). Thus, the tension member 206 is rigidly connected to the top supports 202 and 203 and pivots with the drafting board 32.

The tension member 206 is pivotally mounted on the columns 71 and 72 by two bearing plates 211 and 212. The plates 211 and 212 are generally rectangular and are positioned against the upper ends of the outer sides of the columns 71 and 72 and are rigidly secured thereto by bolts 213. The bolts 213 extend through countersunk holes formed in the plates 211 and 212 and through holes formed through the columns 71 and 72, and are threaded into nuts 214 which are welded to the inner sides of the columns. The bearing plates 211 and 212 extend rearwardly, or toward the draftsman's side of the table, from the columns 71 and 72, and have holes 216 formed therethrough which receive the tubular tension member 206. A bushing 217 is preferably positioned between the tension member 206 and the bearing plate 212. The bearing plates 211 and 212 thus pivotally support the tension member 206 and the drafting board 32 on the columns 71 and 72.

To hold the board 32 at a selected tilted position, a brake is provided comprising two sets of board brake leaves 221 and 222 (FIG. 8) and two sets of column brake leaves 223 and 224, the sets 221 and 223 being interleaved and the sets 222 and 224 being interleaved. All of the leaves 221 to 224 may be generally rectangular and have rounded corners as shown in FIG. 9. The column brake leaves 223 and 224 are connected to the columns therein by the bolts 213, which extend through holes 226 formed in the leaves. A sleeve 227 is positioned around each of the bolts 213, and the leaves 223 and 224 are slidable on the sleeves 227. From the columns 71 and 72, the column brake leaves 223 and 224 extend out of the columns through openings 225 and toward the drafting side of the table and have holes 228 formed therethrough which loosely receive the tension member 206.

The board brake leaves 221 and 222 are fastened to the top supports 202 and 203 by pins 231 which extend through the leaves 221 and 222. The pins 231 also extend through holes 233 formed in the vertical arms of the top supports 202 and 203, and through holes 234 formed in an arm of an angle 236 which is secured as by welding to the underside of each top support 202 and 203, and a plurality of retainer rings 237 at both ends of the pins 231 hold the pins 231 in place. From the pins 231, the leaves 221 and 222 extend forwardly away from the drafting side of the table, and holes 238 formed in the leaves 221 and 222 loosely receive the tension member 206.

The drafting board 32 is held at a selected angle of inclination by pressing the leaves together, which is accomplished by means comprising a pair of compression members 241 and 242 which are positioned around the tension member 206 between the sets of leaves, and cooperate with the tension member 206 to apply a compressive force on the leaves. At their outer ends, the compression members 241 and 242 engage pressure pads 243 and 244, respectively, which are positioned between the compression members 241 and 242 and the innermost leaves of the sets 221 and 222. The inner or adjacent ends of the compression members 241 and 242 are secured as by welding to a toggle assembly 246 which may be of the general type described in Grow et al. patent application Serial No. 128,140, filed July 31, 1961, and entitled "Drafting Table." The toggle assembly 246 is carried on the tension member 206, and comprises two toggle brackets 247 and 248, a pair of toggle links 249 and a toggle handle assembly 251. The toggle brackets 247 and 248 are secured as by welding to the compression members 241 and 242. Each of the toggle links 249 is formed with a widened portion at one end, this portion having a circular hole 252 formed therethrough. The other or narrowed end of each toggle link 249 is pivotally connected to the toggle bracket 248 by pins 253. The portion of the handle assembly 251 adjacent the links 249 is U-shaped, the arms of the U being sufficiently spaced to fit over the outer surfaces of the toggle links 249. On the inner surfaces of the U-shaped portion of the handle assembly 251 are provided generally circular portions 254 which extend into the openings 252 in the toggle links 249, and are pivotally connected to the arms of the toggle bracket 247 by pins 256. The pins 256 are positioned eccentrically of the circular portions 254 of the handle assembly 251. Thus, on swinging movement of the handle to the dashed line position shown in FIG. 8, the brackets 247 and 248 are caused to move toward each other and pull the compression members 241 and 242 inwardly away from the pressure pads 243 and 244 to free the leaves 221 to 224 from pressure against each other. When the handle is moved to the solid line position shown in FIG. 8, the toggle brackets 247 and 248 and the compression members 241 and 242 are forced outwardly which causes outward pressure to be applied to the pressure pads 243 and 244 and the leaves 221 to 224.

Since the outermost leaves are held against movement in the axial direction by the tension member 206, movement of the toggle assembly 246 to the solid line position shown in FIG. 8 causes a compressive load to be applied to the leaves, and the frictional forces between adjacent leaves is easily sufficient to hold the board at a selected angle of inclination. As shown in FIGS. 8 and 10, a plurality of washers 257 may be provided between members of the brake mechanism.

Counterbalancing of the weight of the drafting board and the objects mounted thereon is provided by a torsion bar 261 (FIGS. 8, 10 and 17) which preferably has an out-of-round cross section such as a square, and which extends through the tension member 206 and beyond both ends of the tension member 206. At one end of the torsion bar 261, an anchor member 262 is secured to the bar 261 and anchors this end of the bar to the column assembly 31. The anchor member 262 (FIG. 18) includes a plate portion 263 which engages a pin 264 fastened to the column assembly 31, as will be described hereinafter.

The other end of the torsion bar 261 extends outwardly beyond the outer surface of the nut 208, and a plurality of discs 266 (FIGS. 10) are positioned over this end of the torsion bar 261. The discs 266 have openings formed therethrough which correspond to the configuration of the torsion bar 261 so that the disks 266 cannot rotate relative to the torsion bar 261. Interleaved with the discs 266 are a plurality of brake plates 267 which have openings 268 formed therethrough sufficiently large to permit free rotation of the torsion bar 261 relative thereto. The discs 266 and the plates 267 are prevented from moving off the end of the torsion bar 261 by a retaining ring 265. The brake plates 267 are prevented from rotating relative to the top support 202 by two screws 269 which extend through holes formed in the brake plates 267 near their outer end, through holes in the top support 202, and are threaded into a pressure pad 271. Bushings 272 may

be positioned around the screws 269, and another pressure pad 273 is preferably positioned between the heads of the screws 269 and the outermost disc 266 in order to evenly distribute pressure over the discs 266 and plates 267. Further, a cover 274 may be carried by the screws 269 and cover the discs and plates. The innermost of the discs 266 engages the outer surfaces of the nut 208, and the outermost of the discs 266 engage the pressure pad 273. It will be apparent that, when the two screws 269 are tightened into the pressure pad 271, the stack of discs 266 and brake plates 267 will be tightly compressed. The frictional force between the discs 266 and the brake plates 267 is sufficient to prevent the discs 266 from rotating relative to the brake plates 267 and the top support 202. Since the torsion bar 261 cannot rotate relative to the discs 266, this end of the torsion bar 261 is also prevented from rotating relative to the top support 202 and the drafting board 32.

The angular position of this end of the torsion bar 261 may be varied relative to the top support 202 and the drafting board 32 by loosening the two screws 269 sufficiently to permit rotation of the discs 266 relative to the brake plates 267. The innermost of the discs 266 has a downwardly extending handle 276 (FIG. 9) formed thereon which extends out of the cover 274. The handle 276 may be manually pivoted through an angle of approximately 90°, such movement also causing the other discs 266 and this end of the torsion bar 261 to rotate. After this end of the torsion bar has been placed at a desired position, the screws 269 are again tightened into the pressure pad 271, which causes this end of the torsion bar 261 to be held stationary relative to the top support 202 and the drafting board 32.

Assume that the drafting board 32 is initially in a substantially vertical position as shown in full lines in FIG. 3 and dashed lines in FIG. 7. Assume also that the end of the torsion bar 261 connected to the discs 266 and plates 267 is prevented from rotating relative to the drafting board 32 (which is accomplished by tightening the screws 269) and that the handle 276 has previously been adjusted to a position where the plate portion 263 of the anchor 262 is inclined upwardly from the torsion bar 261 at an angle of approximately 30° (shown in dashed lines in FIG. 7) when the drafting board is substantially vertical. Since the end of the torsion bar 261 having the anchor 262 is permitted to rotate freely in this position of the board (because the anchor 262 is out of engagement with the pin 264), there is no twist or tension on the torsion bar 261 and a counterbalancing force is not exerted. However, when the handle assembly 251 is turned to release the brake and the drafting board 32 is rotated clockwise (as seen in FIG. 3) through an angle of approximately 30° from the vertical position, the anchor 262 engages the anchor pin 264 and prevents further rotation of this end of the bar 261. Continued clockwise movement of the drafting board 32 thereafter causes the torsion bar 261 to twist and exert a force on the drafting board 32 tending to return the drafting board toward the vertical position. When the drafting board 32 has been placed at the desired angle of inclination, the handle assembly 251 of toggle mechanism 246 is shifted to cause the brake mechanism to engage and to hold the board in that position. The force exerted by the torsion bar 261 continues however and counterbalances the weight of the board and of any objects mounted on the drafting board, making it relatively easy to later increase the angle of inclination of the drafting board 32 if desired. Should it be desired to increase the counterbalancing force exerted by the torsion bar 261, which may occur when an additional object is placed on the board 32, the drafting board 32 may again be pivoted toward the vertical position (after the brake mechanism has been released) sufficiently far to bring the anchor 262 out of engagement with the anchor pin 264. The screws 269 at the other end of the drafting board 32 may then be loosened and the handle 276 turned to rotate the torsion bar 261 and the anchor 262 in the clockwise direction as seen in FIG. 7. The screws 269 are again tightened, and the drafting board 32 is pivoted toward the horizontal position. The anchor 262 engages the anchor pin 264 sooner than previously occurred which causes the torsion bar 261 to be twisted through a greater angle than was previously the case, thereby causing a greater counterbalancing force to be exerted.

From the foregoing description it will be apparent that a novel and useful drafting table has been provided. Because the cross member 73 connects the upper ends of the two columns 71 and 72 and the column assembly 31 is rigid, and because the columns 71 and 72 are always moved equally, rollers or similar devices do not have to be provided to prevent sidewise tilting of the column assembly 31. Both the counterbalance for the vertical movement of the column assembly 31 and the tilting movement of the board 32 have a novel adjusting mechanism. The brake for holding the column assembly at a selected vertical position is sturdy and will not wear out even after long use. The drafting table has additional novel features including a motor drive for adjusting the vertical position of the column assembly, and the mounting balance of the reference top 57.

We claim:

1. A drafting table comprising a supporting structure, a column assembly mounted for vertical movement on said supporting structure comprising two laterally spaced vertically extending columns and a horizontally extending center member rigidly connecting the upper ends of said columns together, means for guiding the vertical movement of said column assembly on said supporting structure, means for vertically moving said columns equally, a drafting board on said column assembly, said means for guiding the vertical movement of said column assembly preventing forward and rearward tilting movement of said assembly, the rigid connection of said center member with said columns and said equal moving means preventing lateral tilting of said column assembly.

2. A drafting table as in claim 1, wherein said means for guiding the vertical movement of said column structure comprises a first and second rollers mounted on said supporting structure adjacent the top thereof and engaging the forward and rearward side respectively of each of said columns, third and fourth rollers mounted on each of said columns adjacent the bottom thereof, said third and fourth rollers being vertically spaced and one of said third and fourth rollers being offset forwardly from the other, and a generally U-shaped guide mounted on said supporting structure adjacent each of columns, said third and fourth rollers being positioned between the two arms of its associated guide with one of said third and fourth rollers engaging one of said arms of said guide and the other of said third and fourth rollers engaging the other of said arms of said guide.

3. A drafting table comprising a supporting structure, a column assembly mounted for vertical movement on said supporting structure, said column assembly including a pair of vertically extending laterally spaced columns, and means for controlling the position of said column assembly comprising a rack gear secured to each of said columns, a pinion gear meshing with each of said rack gears, a shaft rotatably mounted on said supporting structure and secured to said pinion gears, and a drive unit mounted on said supporting structure for causing rotative movement of said shaft and said pinion gears, such rotative movement causing vertical movement of said rack gears and said column assembly.

4. A drafting table as in claim 3, wherein said drive unit comprises a motor having a drive shaft, a drive pinion meshing with one of said pinion gears, and slip clutch means connecting said drive pinion to said drive shaft.

5. A drafting table as in claim 3, and further including means for counterbalancing said vertical movement comprising a torsion spring mounted on said shaft, one end of said spring being secured to said shaft and the other end of said spring being anchored to said supporting structure.

6. A drafting table as in claim 3, and further including a brake for holding said column assembly at a selected vertical position, said brake comprising a vertically extending rod secured to at least one of said columns and movable therewith, and gripping means embracing said rod and tightly gripping said rod when in one position and permitting movement of said rod when in another position, brake release means for moving said gripping means to said other position, biasing means for urging said gripping means to said one position, and manually operable means for controlling said brake release means, said manually operable means also controlling energization of said drive unit.

7. A drafting table as in claim 3, wherein said power unit includes an electric motor, said drafting table further including a control circuit for said electric motor, said circuit including a two position relay connected to cause one direction of rotation of said motor when in one position and the other direction of rotation of said motor when in the other position, said relay changing its position each time it is energized, and a switch connected to control energization of said relay.

8. A drafting table as in claim 7 and further including a foot pedal for actuating said switch.

9. A drafting table as in claim 8, wherein said drafting table further includes a brake for holding said column assembly at a selected vertical position, a shaft for pivotally supporting said foot pedal, a member mounted for rotation with said shaft and extending from opposite sides of said shaft, one end of said member being arranged to actuate said switch, and the other end of said member being connected to release said brake.

10. A drafting table as in claim 9, in which a leaf spring is interposed between said switch and said one end of said member.

11. A drafting table comprising a supporting structure, a column assembly mounted for vertical movement on said supporting structure, and brake means for holding said column assembly at a selected vertical position, said brake means comprising a vertically extending rod secured to said column assembly and movable therewith, and gripping means mounted on said supporting structure adjacent said rod and encircling said rod, said gripping means being adapted to tightly grip and hold said rod when in one position and being adapted to permit vertical movement of said rod when in another position.

12. A drafting table as in claim 11, wherein said gripping means comprises a spring which is wound around said rod.

13. A drafting table as in claim 11, and further including a mounting plate pivotally connected to said supporting structure, said gripping means being secured to said mounting plate, biasing means normally engaging said mounting plate and tending to pivot said mounting plate such as to move said gripping means to said one position, and release means for moving said biasing means out of engagement with said mounting plate to permit said gripping means to move to said other position.

14. A drafting table as in claim 13, wherein said biasing means comprises a pivot link and a tension spring, said pivot link having a portion overlying a portion of said mounting plate, and said tension spring being connected between said pivot link and said supporting structure and urging said pivot link downwardly, and said release means comprises a pivot plate pivotally mounted intermediate its end on said supporting structure, one end of said pivot plate being connected to said pivot link and adapted to move said portion of said pivot link out of engagement with said mounting plate upon pivotal movement of said pivot plate, and a release rod connected to the other end of said pivot plate for effecting pivotal movement of said pivot plate.

15. A drafting table as in claim 14, wherein said release rod is also connected to a manually operable pedal, and the over-all length of said release rod is adjustable.

16. A drafting table as in claim 14, and further including a brake support bar mounted on said supporting structure, and extending upwardly into said column assembly said mounting plate and said pivot plate being pivotally secured to said support bar adjacent its upper end.

17. A drafting table comprising a supporting structure, a column assembly mounted for vertical movement on said supporting structure, said assembly including a pair of laterally spaced vertically extending columns, a rack gear secured to each of said columns, a pinion gear meshing with each of said rack gears, a laterally extending timing shaft rotatably mounted on said supporting structure and secured to each of said pinion gears, a coiled torsion spring positioned around said timing shaft between said pinion gears, one end of said torsion spring being secured to said timing shaft, and means for anchoring the other end of said torsion spring to said supporting structure.

18. A drafting table as in claim 17, wherein said anchoring means comprises an adjusting gear rotatably mounted on said timing shaft and secured to said other end of said torsion spring, and a worm gear mounted on said supporting structure and meshing with said adjusting gear, said worm gear being manually rotatable and being adapted to remain at a given position until it is manually rotated.

19. A drafting table as in claim 18, wherein said worm gear is held at a given position by a pin which is connected to and rotatable with said worm gear, and said supporting structure has a detent adjacent said pin, the force of said torsion spring through said adjusting and worm gears normally urging said pin into engagement with said detent, said pin and detent thereby restraining rotative movement of said worm and counterbalance gears.

20. A drafting table comprising a supporting structure, a column assembly mounted for vertical movement on said supporting structure, a drafting board mounted on said column assembly, and a horizontal reference top means mounting said top on said supporting structure and permitting said top to be adjusted between first and second positions, said top overlying substantially all of said supporting structure when in said first position and extending forwardly of said supporting structure when in said second position, said means comprising two laterally spaced pairs of roller means and two guides, each pair of roller means being mounted on said supporting structure and one roller means of each pair being spaced forwardly of the other roller means of each pair, said guides being secured to the undersurface of said top, and each of said guides being slidably connected to one of said two pairs of roller means.

21. A drafting table as in claim 20, wherein said guides are generally U-shaped in cross section and an elongated slot is formed through the center portion of each of said guides, said roller means extending through said slots and engaging the undersurface of said top.

22. A drafting table as in claim 21, wherein recesses are formed in the undersurface of said top at the locations of said forwardly spaced roller means when said top is in said second position, said forwardly spaced roller means being adapted to enter said recesses and prevent movement of said top until said top is lifted.

23. A drafting table comprising drafting board supporting assembly, a drafting board assembly, means mounting said drafting board on said board supporting means for tilting movement about a laterally extending horizontal axis, and means for counterbalancing said tilting movement comprising a torsion bar mounted substantially on

said axis, adjustable means securing one end of said bar to one of said assemblies and means anchoring the other end of said bar to the other of said assemblies, said adjustable means comprising a plurality of first leaves connected to one end of said bar and rotatable therewith, a plurality of second leaves interleaved with said first leaves and connected to said one assembly and means for pressing said first and second leaves tightly together to prevent rotation of said first leave relative to said second leaves.

24. A drafting table as in claim 23, wherein one of said first leaves has a handle portion for adjustment of said one end of said bar and said first leaves relative to said second leaves when said pressing means is inoperative to press said first and second leaves together.

25. A drafting table as in claim 23, wherein said anchor means comprises a member connected to said other end of said bar for rotation therewith and having a portion extending radially outwardly from said other end, said portion being adapted to engage said other of said assemblies upon rotation of said bar in a first direction, such engagement thereafter preventing further rotation of said member and said other end of said bar in said first direction.

26. A drafting table as in claim 23, wherein said one end of said bar is secured to said drafting board assembly and said other end of said bar is anchored to said board supporting assembly, said pressing means comprising at least one bolt which extends through holes in said second leaves and is threaded into said drafting board assembly, said bolt pressing said leaves together when it is tightened, one of said first leaves having a handle formed thereon for adjustment of the angular position of said one end of said bar and said first leaves when said bolt is loosened, and said anchor means comprising a member connected to said other end of said bar for rotation therewith and having a plate portion extending radially outwardly from said other end, and a pin secured to said board supporting assembly and positioned to be engaged by said plate portion upon rotation in a first direction of said drafting board and said bar, such engagement thereafter preventing further rotation of said member and said other end of said bar in said first direction.

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