Dec. 21, 1937. L. McDONALD 2,102,636

DRAFTING MACHINE

Filed Aug. 13, 1932 4 Sheets-Sheet 1

FIG. 1

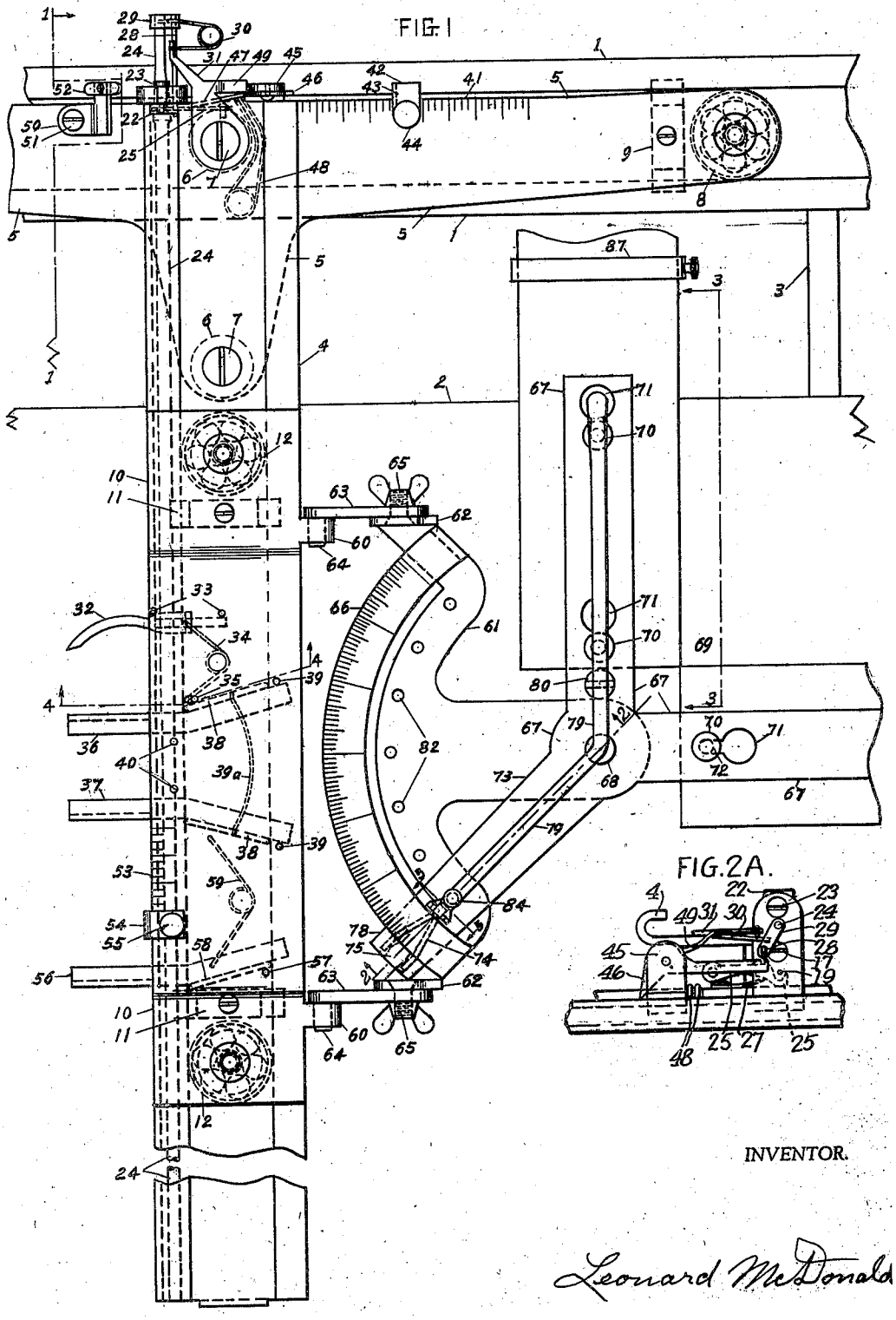


FIG. 2A.

INVENTOR.

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Dec. 21, 1937. L. McDONALD 2,102,636

DRAFTING MACHINE

Filed Aug. 13, 1932 4 Sheets-Sheet 2

FIG. 2

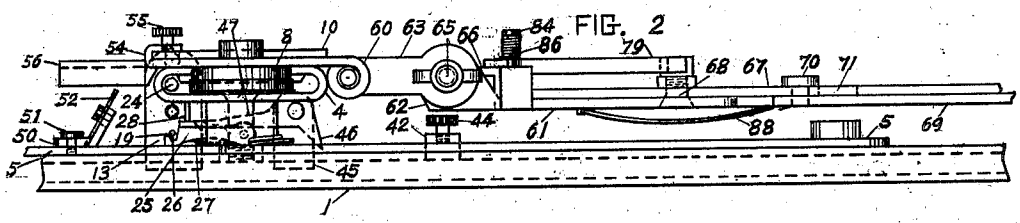


FIG. 3

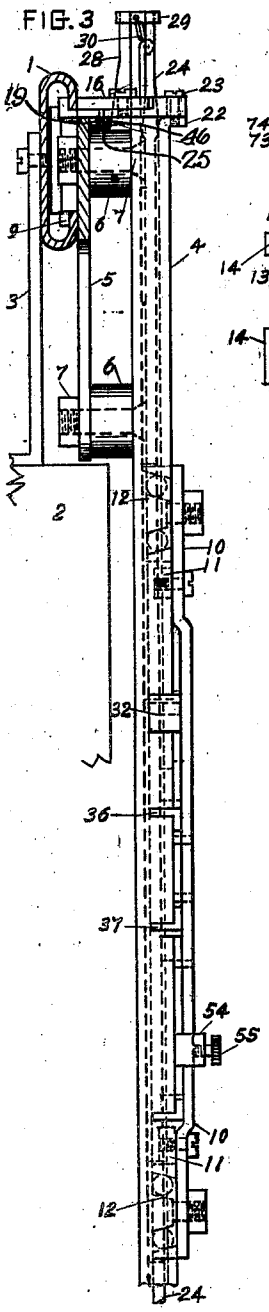


FIG. 5



FIG. 4

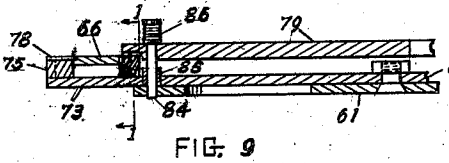


FIG. 6A

FIG. 6



FIG. 7

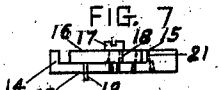


FIG. 8

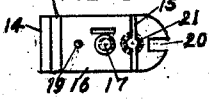


FIG. 9

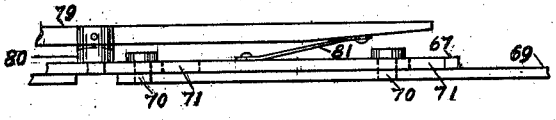


FIG. 11

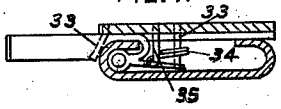


FIG. 10

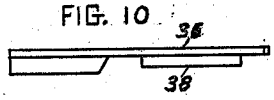


FIG. 12

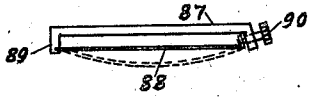
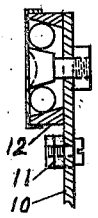


FIG. 13



INVENTOR

Leonard McDonald

Dec. 21, 1937. L. McDONALD 2,102,636

DRAFTING MACHINE

Filed Aug. 13, 1932 4 Sheets-Sheet 3

FIG. 14.

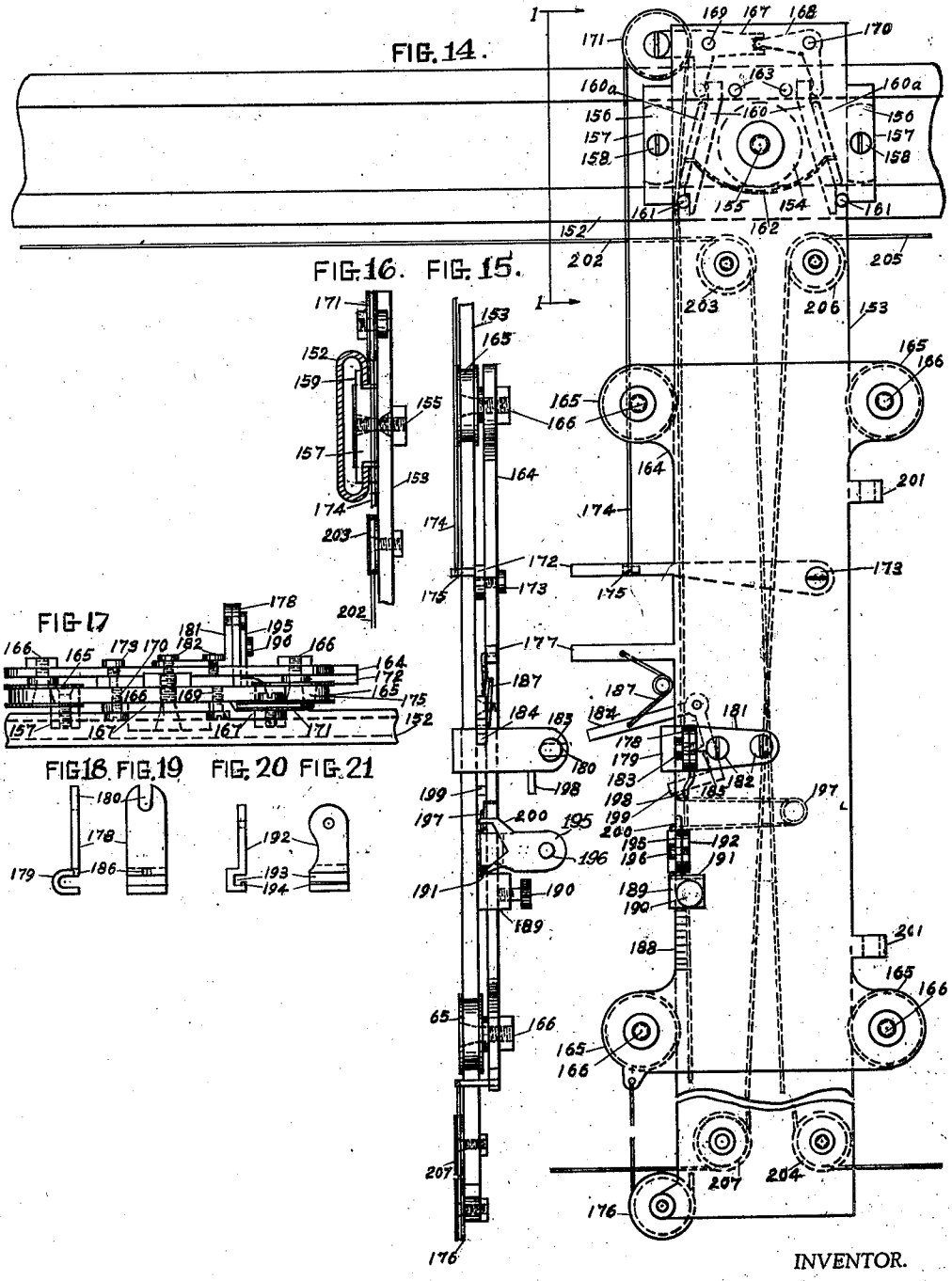


FIG. 16. FIG. 15.

FIG. 17

FIG. 18. FIG. 19 FIG. 20 FIG. 21

INVENTOR.

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Dec. 21, 1937. L. McDONALD 2,102,636

DRAFTING MACHINE

Filed Aug. 13, 1932 4 Sheets-Sheet 4

FIG. 22.

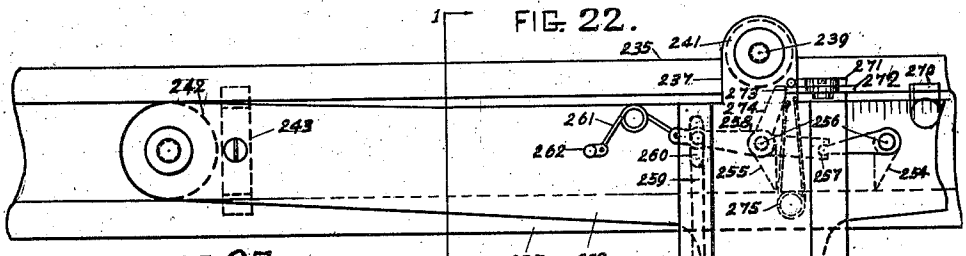


FIG. 23.

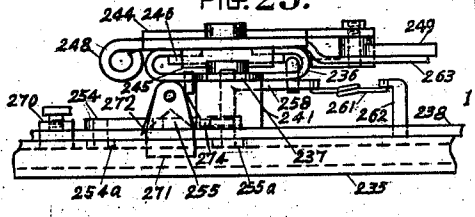


FIG. 24.

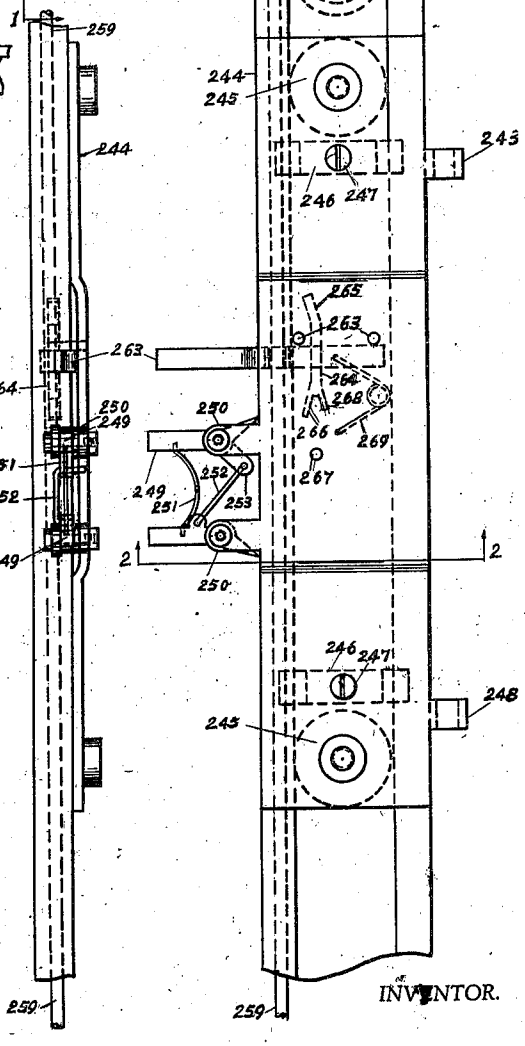


FIG. 25.

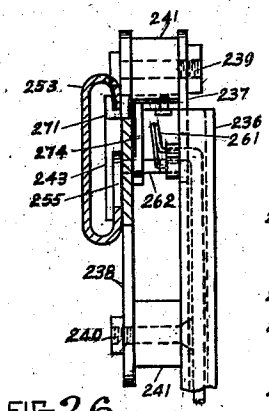
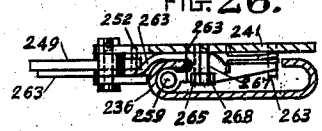


FIG. 26.



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Patented Dec. 21, 1937

2,102,636

UNITED STATES PATENT OFFICE

2,102,636

DRAFTING MACHINE

Leonard McDonald, El Campo, Tex.

Application August 13, 1932, Serial No. 628,622

25 Claims. (Cl. 33—79)

This invention relates to drafting machines; and it has for its objects, the provision of a protractor universally movable over a drawing surface and adapted to be held stationary at any point over the drawing surface by clutches operating to hold the straight-edge stationary, and to hold the protractor, or carriage upon which the protractor is mounted, stationary on the straight-edge, and it has clutches for holding the protractor rules or straight-edges at any angle, all of which are operated from the carriage or protractor in the larger machines. It includes novel clutches conveniently positioned and easily operated, and spacing mechanism which may be conveniently used when numerous parallel equidistant lines or points are to be drawn or located, and other features herein described and claimed.

Fig. 1 is a plan view of the machine in one of its forms. Fig. 2 is a front side elevation of Fig. 1. Fig. 2A is an elevation of a part of the upper end only of Fig. 1. Fig. 3 is a rear elevation partly in section on the line 1—1 of Fig. 1. Fig. 4 is a section on the line 2—2 of Fig. 1. Fig. 5 is a section on the line 1—1 of Fig. 4, and on the line 5—5 of Fig. 1. Figures 6 and 6A are views of the rule-holder clutch detached. Fig. 7 is a side elevation of the straight-edge clutch. Fig. 8 is a plan view of the same. Fig. 9 is a side elevation on the line 3—3 of Fig. 1, of the rule-holder and lever for operating the rule-holder clutch. Fig. 10 is a side elevation of one of the carriage clutches. Fig. 11 is a section on the line 4—4 of Fig. 1. Fig. 12 is a side elevation of means for elevating the protractor straight-edges. Fig. 13 is a sectional elevation of one of the ball bearings of the carriage and of the cross head. Fig. 14 is a plan view of a second species of the machine with the protractor detached. Fig. 15 is a rear elevation of the same. Fig. 16 is a continuation of Fig. 15 on the line 1—1 of Fig. 14. Fig. 17 is an upper end elevation of the same. Figs. 18 and 19 are views of the carriage clutch of the species of Fig. 14. Figs. 20 and 21 are views of the spacing toggle support. Fig. 22 is a third species of the machine. Fig. 23 is an upper end elevation of the same. Fig. 24 is a rear elevation and Fig. 25 is a continuation of the same on the line 1—1 of Fig. 22. Fig. 26 is a section on the line 2—2 of Fig. 22.

Similar numerals refer to similar parts throughout the several views.

Referring to Figs. 1, 2, and 3, a guide 1 having its edges turned inward forming a straight-edged channel, is attached preferably to the upper edge of a drawing board 2 by supports 3, or to the upper edge of the type of drafting table frame adapted to hold interchangeable drawing boards. A straight guide 4 has its edges turned inward forming a straight-edged channel similar to guide 1, and has a cross bar 5 attached to its upper end by elevating blocks 6 and screws 7. The cross bar has a ball bearing assembly 8 at each end which fits closely between the inturned edges of stationary guide 1. The left extension of the cross bar is shown broken away in Fig. 1. The cross bar is held in place on guide 1 by a bar 9 attached to cross bar 5 near each end, which bars have flat bearing ends sliding on the inner side of the inturned flanges of stationary guide 1. A carriage 10 is held in place on movable guide 4 by similar bars 11 and similar ball bearing assemblies 12 attached to each end, running on and closely fitting between the inturned edges of movable guide 4. A clutch (see Figs. 7 and 8) for holding the movable guide stationary on guide 1, consists of a plate 13 having a flange 14 at one end, its opposite end having a shoulder 15. A block 16 is attached to plate 13 by screw 17 in slot 18, which slot permits the block to be adjusted toward the flange. And it has a pin 19, a slot 20 in one end, and a tapered bearing 21 partially on shoulder 15 and partially on the adjacent edge of the block. The block and flange engage opposite sides of one edge of guide 1. The slotted end of the clutch is pivoted to upturned flange 22 on guide 4 by screw 23. A rod 24 housed in one side of guide 4 extends the length of the guide and has a tapered bearing on its upper end received by bearing 21 for adjusting the block and flange to a close contact with opposite sides of one edge of guide 1. There should be some clearance between the inner side of guide 4 and rod 24 at its tapered end to prevent the rod holding the clutch rigid. The gripping effect of the clutch is not due solely to the wedging effect of the tapered end of the rod in the tapered bearing, which should be slight. Its gripping effect is due to the proportional width of the engaging part of the clutch to the length therefrom to pivotal screw 23, which should be about one to three or less, whereby frictional resistance due to leverage prevents sliding of the clutch, when pressure is applied to its pivoted end only. A bar 25 is pivoted to one of the elevating blocks 6, and it has a notch 26 in its free end which notch, while rod 24 is disengaged from its bearing 21, is held in engagement with pin 19 by spring 27 which spring is connected to bar 25 and to cross bar 5, whereby gripping of the clutch is prevented and displacement of the gripping end of the clutch is prevented while the movable guide

is being moved. A bar 28 is connected rigidly with the upper end of rod 24 by link 29 and it has an inclined lower edge which depresses bar 25 out of engagement with pin 19 while rod 24 is returning to its engaged position. A spring 30 has one end attached to link 29. A member 31 is attached to guide 4 by screw 7 and has an extended end to which the opposite end of spring 30 is attached. The extended end is so positioned that when rod 24 is drawn out sufficiently the spring is moved to the opposite side of its bearing on member 31 which change of position of the spring reverses the direction of its force, thereby holding the rod out. The means for actuating rod 24 for operating the clutch just described, from the carriage, consists of a clutch 32 (see Fig. 11) which has a hole receiving rod 24 loosely, and has an outward extension for manual operation, and an inward extension, and grips opposite sides of rod 24 at points obliquely across the rod from one point of contact to the other by, forward pressure on its outward extension, and by rearward pressure on its inward extension, the degree of the gripping being proportional to the pressure applied to either of its extending ends longitudinally of rod 24. The clutch slides loosely on rod 24 in its straight nongripping position in which position it is held at the rear extremity of its movement against two stop pins 33 on carriage 10 by spring 34 attached to its inwardly extending end between the pins, the other end of spring 34 being attached to the downwardly extended end of pin 35 so as to be more nearly in line with the outwardly extended end of the clutch. When the clutch is pressed into engagement with rod 24 by the finger of the operator, and the clutch and rod are moved forward, the outer end of the clutch contacts first with the outer end of member 36 which is one of the carriage clutch members, a slight further movement brings the inwardly extended end of the clutch into contact with pin 35 while pressure of a finger of the operator on clutch 32 between its contacts with pin 35 and its contact with the outer end of clutch 36, holds the clutch in its nongripping position at the forward extremity of its movement, permitting carriage 10 to be moved longitudinally on its guide. When the clutch is released spring 34 causes the clutch to grip rod 24 and return it. One object of arranging spring 30 to reverse the direction of its force by outward movement of rod 24 whereby the rod is held in its disengaged position, is, that there might be sufficient friction between the clutch and the rod on which the clutch slides while the carriage is being moved, to return the rod to its engaged position, especially in the horizontal position of guide 4, in which case the rod would not be held out by its weight.

The clutch for holding carriage 10 fast on movable guide 4, consists of two clutch members 36 and 37, each having a flange 38 (see Fig. 10) the opposite ends of which flanges form shoulders which are held in engagement with the edges of the channel of guide 4 at points obliquely thereacross from one point of contact of the shoulders to the other, by arched spring 39a connected with holes in flanges 38. They have outwardly extending ends for manual operation. They are held in place between the under side of the carriage and the upper side of the guide, and by two pins 39 on carriage 10 contacting with the outer edges of their inner ends, the clutch members being reversed with respect to each other, whereby one member prevents movement of the carriage in one direction longitudinally of the guide, and the other member prevents movement of the carriage in the opposite direction by their contact with pins 39. Their inner ends may have a slot to receive pins 39, or they may be connected with the carriage by any suitable means that will permit a slight flexibility of the clutch members. Their gripping effect is proportional to the pressure exerted against their inner ends through pins 39 by any attempt to slide the carriage longitudinally on guide 4. They are disengaged from the guide by moving their outer ends toward each other, which movement is limited by their contacting with pins 40 on the carriage. Pins 40 are not entirely essential. The clutch members may also be arranged to be disengaged by moving their outer ends from each other, in which case pins 39 should contact with the inner edges of their inner ends instead of their outer edges.

The carriage clutch and the clutch of the movable guide may be operated independently of each other, or they may be operated simultaneously by moving the extended ends of clutch members 32 and 37 toward each other, by which movement the end of clutch member 32 will contact with member 36, releasing it and permitting the carriage to be moved in any direction over the drawing surface.

Spacing mechanism for the movable guide consists of a graduated edge 41 on cross bar 5, a stop 42 having a slot engaging and sliding on the graduated edge of the cross bar, extending over the adjacent edge of guide 1, and having an inclined surface 43 on its extension, and a screw 44 for holding it at any point along the graduated edge. A support 45 having a slot engaging opposite sides of the adjacent edge of guide 1, and held in place by the edge of cross bar 5, has a pointed toggle 46 pivotally mounted on its upper part. The toggle has an extending arm 47. A spring 48 has one end attached to cross bar 5 and its other end extending downward against the lower edge of support 45 for sliding it to the stop, the point of toggle striking the inclined surface of the stop and turning into contact with guide 1 slightly forward of its pivotal bearing, which prevents further forward movement of the support. When guide 4 is moved forward an extension 49 of member 31 contacts with the upper part of support 45 bringing guide 4 to rest, then if the spacing mechanism is being operated from the carriage, rod 24 is released and in returning the inclined surface of bar 28 depresses arm 47, which disengages the point of the toggle and again allows spring 48 to move the support and toggle forward. With small machines the toggle may be conveniently depressed directly by the finger of the operator without rod 24, and without a clutch for the movable guide, in which case a member 50 for preventing rearward movement of guide 4 while the support is being moved forward, is attached to cross bar 5 by screw 51, and extends over the adjacent edge of guide 1, and has a spring 52 pivoted to the extension, which contacts with the guide at a sufficient angle to cause it to grip against rearward movement of guide 1. The spring may be turned to one side out of operative position.

Spacing mechanism for the carriage for spacing equidistant points, lines etc., comprises a graduated edge 53 on the carriage and a stop 54 having a slot engaging the graduated edge, and held adjustable along the edge by screw 55, and a spacing clutch 56 held in its disengaged position against pin 57 and bar 11, and having a flange 58 the ends of which form shoulders which

engage the edges of the channel of the guide on which the carriage is mounted, when pressure is applied to the outer end of the clutch, whereby it remains stationary while pressure on clutch member 36 by a finger of the operator advances the carriage until stop 54 contacts with clutch 56, thereby arresting movement of the carriage. Clutch 56 is held in place by the carriage, pin 57, and spring 59 which has one end attached to the carriage and its other end attached to the clutch which it returns to its disengaged position after each movement of the carriage. This clutch grips in the same way as clutches 36 and 37.

Two sockets 60 on the carriage hold the protractor conveniently detachable and interchangeable with lettering devices, or other devices.

The protractor comprises, a support 61 having two flanges 62, two links 63 having shanks 64 engaged by sockets 60, and two screws 65 for clamping the links to flanges 64. A rule-holder 67 is pivoted on support 61 by screw 68, and has two arms supporting two straight-edges 69 at right angles with respect to each other. A graduated arc 66 is fixed to support 61. The rule-holder has an arm 73 extending under arc 66. A V-clutch 74 (see Figs. 1, 4, 5, and 6) is held in place under the arc by the arm of the rule-holder, its diverging ends contact with the sides of stud 75 on the end of arm 73. The clutch has two shoulders 76 near its diverging ends and a shoulder 77 near its opposite end, which shoulders engage opposite edges of arc 66. The clutch should be sufficiently thin to engage the arc with slight resiliency. This clutch will grip the arc by pressure on one of its ends only, due to the relative positions of the contact points of the clutch with the arc, but pressure on its opposite ends at the same time in the same direction will prevent its gripping, whereby it may be slid on the arc, and for this purpose a lever 79 is pivoted on arm 73 of the rule-holder near its pivotal center, or it may be pivoted on a stud screw substituted for screw 68. One end of the lever is extended for sufficient leverage for changing the angle of the rule-holder easily. A spring 81 connected with the rule-holder and the lever exerts upward pressure against the extended end of the lever. The opposite end of the lever is turned downward and has a slot 82 (see Fig. 5) in the down turned end, the slot converging toward its lower end, its narrow lower end engaging the projecting end 74*a* of clutch 74 when the slotted end of the lever is up, the slot and the lower sides of end 74*a* of the clutch being inclined inward for sufficient clearance when the slotted end of the lever is down, as there must then be no connection between the lever and the clutch. Downward movement of the extended end of the lever about one eighth of an inch connects the slotted end of the lever with the extended end of the clutch, then side pressure on the same end of the lever changes the angle of the rule-holder.

For convenient setting to the most frequently used angles which are multiples of 15 degrees, a series of holes in support 1 are spaced 15 degrees apart, and a pin 84 (see Fig. 4) slidable in a hole in 79 and in a bushing 85 in arm 73, is held at its lowest position in its bearings by spring 86 attached to the lever and to the pin. In the highest position of lever 79 the pin cannot enter the holes, but with downward movement of the end of the lever the pin may slide on the surface of support 61 and enter a hole before further downward movement of the lever permits the clutch to become effective.

Means for elevating the protractor and its straight-edges relative to the drawing surface for preventing blotting by contact with freshly inked lines, comprises a bar 87 (see Fig. 12) having its ends turned to a sufficient angle for engaging opposite sides of a straight-edge, a flat spring 88 to be on the under side of the straight-edges, having one of its ends engaged in a slot 89 in one end of the bar, and a screw 90 in the opposite end of the bar having a reduced end engaging a hole in the opposite end of the spring, whereby the spring may be arched for raising the straight-edges. The bars are slidable on the straight-edges. The protractor is raised to correspond with the straight-edges by loosening the thumb nuts on screws 65.

Fig. 14 is a second species of the machine, in which a guide 152 having its edges turned inward forming a straight-edged channel, is attached to a drawing board, or table. A flat straight-edged guide 153 has a roller 154 attached to it near its upper end by bolt 155, the lower end of the bolt forming a tapered bearing for the roller. The roller runs on the edges of the channel of guide 152, and there is a close fit between the same. Two bars 156 attached to the under side of extensions 157 of the movable guide by screws 158, have slots 159 in each end engaging the edges of the channel of stationary guide 152 for holding the movable guide on the stationary guide. The bars 156 elevate guide 153 sufficiently above guide 152 to make room for a clutch, consisting of two clutch members 160 having flanges 160*a* forming shoulders spaced to contact with the opposite edges of the channel of guide 152 obliquely thereacross from one point of contact of the shoulders to the other. Two pins 161 on the movable guide contact with the outer edges of the lower ends of the clutches, and a spring 162 holds their shoulders in engagement with the edges of the channel. They are set reversed with respect to each other to prevent movement of guide 153 in either direction longitudinally of guide 152. Their frictional resistance to pressure applied to their lower ends through pins 161 by pressure against the movable guide, is proportional to the pressure, and is due to the relative positions of their contact points with opposite edges of guide 152, whereby a sort of toggle action is obtained in which the frictional resistance is greater than the pressure applied to the movable guide. They are disengaged from the guide by moving their upper ends towards each other, which movement is limited by their contacting with two pins 163. They may, however, be set to be releasable by moving their upper ends from each other. Pins 163 are desirable but not essential. A carriage 164 is mounted on movable guide 153 by rollers 165 attached to the carriage by screws 166 having tapered lower ends for bearings for the rollers. The upper ends of clutch members 160 may be operated directly with small machines, but are preferably operated from the carriage with all sizes. For this purpose, two bell crank levers 167 and 168 are pivoted on the movable guide by pins 169 and 170, the ends of two of their arms being connected to the outer sides of the upper ends of clutch members 160, their other two arms being connected to each other end to end, whereby a reverse movement of the levers with respect to each other is obtained giving a reverse movement to the clutch members,

moving their free ends toward each other when they are set as shown. A wheel 171 having a grooved periphery is pivoted to the other end of lever 167. A lever 172 is pivoted on the under side of carriage 164 by screw 173, a cord 174 has one of its ends attached to a downward extension 175 of lever 172, and runs over wheel 171 and grooved wheel 176 pivoted on the under side of the lower end of guide 153, and its other end is attached to the carriage. An extension 177 on the carriage is a convenient finger hold when moving lever 172 toward it for disengaging the clutch of the movable guide.

The clutch 178 for holding the carriage fast on guide 153 is shown in Figs. 18 and 19, and is a plate having a deep slot 179 formed in one end across from edge to edge of the plate, for engaging with slight resiliency opposite sides of guide 153 on one edge, and having a short slot 180 through its opposite end. An angle member 181 is attached to the carriage by two screws 182, and has a screw 183 in its upper end pivotally engaging the short slot of the clutch, the axis of the pivoting screw being at right angles to the face of the clutch. The proportional width of the engaging slot of the clutch to the length of the clutch from its engaging slot to the screw in the slot in its opposite end should be about one to three, or less, whereby the frictional resistance of the clutch to pressure applied through the carriage to the pivotally attached end of the clutch, due to leverage, will be greater than the pressure and thereby prevent sliding of the clutch, but means holding the gripping end of the clutch rigid with the carriage will permit the clutch to slide on guide 153 which means consists of a lever 184 pivoted to the under side of the carriage, which lever extends for manual operation and has an arm extending under the carriage, the arm having a V-point 185 adapted to engage notch 186 in clutch 178. A spring 187 normally holds the V-point out of engagement with the notch. The holding means is operated by moving lever 184 toward extension 177. Actuation of said lever 184 will move V-point 185 into engagement with notch 186, whereby pressure on the carriage longitudinally of the guide will move the carriage and slide the clutch on the guide. A close fit of the engaging slot of the clutch on the guide is necessary, but it should not be so close as to prevent easy sliding of the carriage when the clutch is held rigid with the carriage as described.

Spacing mechanism for the carriage, comprises, a graduated edge 188 on the carriage, a stop 189 having a slot engaging the graduated edge of the carriage, held adjustable therealong by screw 190, and having an inclined front edge 191 which extends slightly under the carriage. A support 192 (see Figs. 20 and 21) has a slot 193 across its face at one end, not so deep as the slot of clutch 178, for engaging and sliding on the graduated edge of the carriage, held in place by a rib 194 sliding in a groove on the under side of the edge of the carriage. This support may also be arranged to engage and slide on the adjacent edge of guide 153, as support 45. A toggle 195 is pivoted on the upper end of the support by screw 196. A spring 197 under the carriage having one end attached to the carriage and its other end extending downward against the lower part of the support, slides the support forward, the point of the toggle striking inclined edge 191 and turning into contact with the guide on which the carriage is mounted, which prevents further forward movement of the support while the carriage is being moved forward. When the carriage is moved forward a pin 198 on angle 181 contacts with the upper part of support 192 which brings the carriage to rest, whereat lever 184 is released and extension 199 of the lever strikes an arm 200 of the toggle and raises its point sufficiently for it to go forward again. The carriage has sockets for holding a protractor having shanks like that of Fig. 1, received by the sockets. This spacing mechanism is useful for spacing lines and points, and it is useful for spacing letters when a lettering device having shanks received by the sockets is used interchangeably with the protractor.

The means for maintaining guide 153 at right angles to guide 152 for movement longitudinally on guide 152, consists of a cord 202 extending lengthwise of guide 153 and over wheels 203 and 204 and having its ends attached respectively to the upper left corner and to the lower right corner of a drawing board, and a cord 205 extending lengthwise of guide 153 and over grooved wheels 206 and 207 and having its ends attached respectively to the upper right corner and to the lower left corner of the drawing board.

Any of the usual cord and pulley means attached to a drawing board for maintaining parallelism of the straight-edge, may be used in place of a cross bar having one, or having two rollers on each end cooperating with a guide.

A third species of the machine is shown in Figs. 24, 25, 26, 27 and 28, in which a straight guide 235 having its two edges turned inward forming a straight-edged channel, is attached preferably to the upper edge of a drawing board, or table. A straight guide 236, which is the same as guide 235, has an extension 237 of its bottom part at its upper end. A cross bar 238, shown broken away on the right, is attached to guide 236 by bolt 239 and screw 240, clamping raising blocks 241 between them. The cross bar has a roller 242 at each end fitting closely between and running on the side edges of the channel of the stationary guide, and a bar 243 near each end slides on the inner side of the inturned flanges of guide 235 for holding the cross bar on the guide. A carriage 244 has a roller 245 at each end running on the edges of the channel of the movable guide, and fitting closely between them. Two bars 246 attached to the under side of the carriage by screws 247, hold the carriage on guide 235. The carriage has two sockets for detachably holding a protractor having shanks like the shanks of protractor of Fig. 1.

The clutch for holding the carriage fast on the movable guide, consists of two toggles 249 extending outwardly for manual operation, which are pivoted to two extensions 250 of the carriage so that their points contact with the guide slightly obliquely from their pivotal bearings. A spring 251 holds their points in engagement with the guide, releasable by moving their extended ends toward each other, when mounted as shown, but they may be mounted so as to be releasable by moving their extended ends from each other. A link 252 is connected to an inwardly extending arm 253 of one of the toggles and to a right angled extension of the other toggle, whereby, moving the extended end of either toggle toward the other releases the points of both toggles. The end of link 252 in arm 253 extends upward and contacts with extension 250 when the outer ends of toggles 249 are moved toward each other, which limits their movement toward each other.

The clutch for holding the movable guide fast on the stationary guide, comprises, two toggles

254 and 255 pivoted on cross bar 238 by pivots 256, reversed with respect to each other to prevent movement of guide 236 in either direction longitudinally of the stationary guide. Toggle 255 has an arm having a socket in its end. Toggle 254 has an arm the end of which is engaged by the socket, whereby, the movement of one moves the other in the reverse direction on its bearings. These two toggles may have extended ends for operation directly with small machines, but are preferably operated from the carriage with all sizes, for which toggle 255 has an arm 258 which extends a little beyond rod 259 in one side of the movable guide, the ends of which rod extend at right angles through a slot 260 in the under side of the movable guide and connects with a hole in the arm near its end. A spring 261 has one end engaging a hole in the end of arm 258 and its other end attached to a flange on stud 262 in position for holding the toggles engaged, or for holding them disengaged when the arm is moved sufficiently far out. It is not essential that the points of these toggles be sharp.

The means for operating the clutch from the carriage, consists of a clutch 263 (see Fig. 28) having a hole in it receiving rod 259 loosely, and having an outwardly extending part for manual operation, and an inwardly extending part resting against two pins 263*a* when the clutch is in its straight disengaged position, which permits the carriage to be moved longitudinally on the movable guide. A cross bar 264 fixed in a slot in the under side of the clutch, has an inclined surface 265 at its rear end, and an inclined surface 266 at its forward end. When pressure on the outer end of the clutch forces it into engagement with the rod, in a slightly inclined position, and the clutch and rod are moved forward, the inclined surfaces of the cross bar of the clutch contact with one of the pins 263*a* and with pin 267, which causes a slight reverse turn of the clutch to its straight disengaged position. A projection 268 forming a fork brings the clutch to rest against pin 267. The spring 261 holds the rod out while the carriage is moved on the guide. When the clutch is released a spring 269 attached to the carriage and to the inwardly extending part of the clutch, causes the clutch to grip the rod and return it, the clutch being brought to rest against pins 263*a*.

Cross bar 238 has a graduated edge and a stop 270 like that of Fig. 1, and a support 271 having a slot engaging opposite sides of the stationary guide on one of its edges, slidable thereon, held in place by the adjacent edge of cross bar 238, and having a toggle 272 pivoted on it, like the toggle of the spacing mechanism of the carriage of Fig. 14, having a downwardly extended arm 272, and toggle 255 has an upwardly extended arm 274 which contacts with arm 273 while rod 259 is returning to its rearward position, and thereby, disengages the point of the toggle from the guide. Spring 275 having one end attached to cross bar 238 and its other end turned downward against the lower edge of support 271, moves the support forward when the point of the toggle is raised.

The machines herein described have holding means on their carriages for holding lettering devices, or protractors, interchangeable with each other for use of the machines as lettering machines, or as drafting machines. The preferred arrangement of the movable guide with respect to the stationary guide is at right angles. However it is obvious that in the combinations herein claimed that include the stationary guide and the movable guide, the angular position of the movable guide could vary a number of degrees from its preferred right angle position, and the machines would still be useful as drafting machines, or as lettering machines.

I claim:

1. A straight guide adapted to be attached to supporting means having a drawing surface, a straight guide and means adapting it to be guided by said stationary guide, longitudinally thereof, and for maintaining it at right angles thereto, a carriage having means engaging said movable guide for guidance of the carriage longitudinally thereon, a protractor carried by said carriage, having a rule and means supporting the rule for angular adjustment with respect to said movable guide, a clutch carried by said movable guide adapted to engage said stationary guide for holding the movable guide fast thereon, means connected with said clutch extending lengthwise of said movable guide and for disengaging the clutch from the stationary guide, and means on said carriage, the manual operation of which, actuates said lengthwise extending means, permitting the carriage to be moved in any direction over the drawing surface.

2. A straight guide adapted to be attached to supporting means having a drawing surface, a straight guide and means adapting it to be guided by said stationary guide, longitudinally thereof, and for maintaining it at right angles thereto, a carriage having means engaging said movable guide for guidance of the carriage longitudinally thereon, a protractor carried by said carriage, having a rule and means supporting the rule for angular adjustment with respect to said movable guide, a clutch carried by said carriage adapted to engage said movable guide for preventing movement of the carriage longitudinally thereon, a clutch carried by said movable guide adapted to engage said stationary guide for holding the movable guide stationary, means connected with the clutch of the movable guide extending lengthwise of the movable guide, and means carried by said carriage, the manual operation of which, disengages the carriage clutch and actuates said lengthwise extending means for disengaging the clutch of the movable guide practically simultaneously with the disengagement of the carriage clutch, permitting the carriage to be moved in any direction over the drawing surface, and for disengaging said clutches independently of each other for movement of the carriage in two directions at right angles with respect to each other.

3. A straight guide adapted to be attached to supporting means having a drawing surface, a straight guide and means adapting it to be guided by said stationary guide, longitudinally thereof, and for maintaining it at right angles thereto, a carriage having means engaging said movable guide for guidance of the carriage longitudinally thereon, a protractor carried by said carriage, having a rule and means supporting the rule for angular adjustment with respect to said movable guide, a clutch carried by said movable guide for holding the movable guide fast on the stationary guide, means connected with said clutch extending lengthwise of the movable guide, and for operating the clutch, and means on said carriage, the manual operation of which actuates said lengthwise extending means, said operating means permitting the carriage to be moved in any direction over the drawing surface, when the clutch is disengaged.

4. A straight guide adapted to be attached to supporting means having a drawing surface, a straight guide and means adapting it to be guided by said stationary guide, longitudinally thereof, and for maintaining it at right angles thereto, a carriage and means adapting it to be guided by said movable guide longitudinally thereof, a protractor carried by said carriage, having a rule and means for supporting the rule for angular adjustment with respect to said movable guide, a clutch carried by said carriage for holding the carriage fast on the movable guide, spacing mechanism carried by said movable guide cooperating with said stationary guide for horizontal spacing, means connected with said spacing mechanism, extending lengthwise of said movable guide and for operating said spacing mechanism, and means carried by said carriage, the manual operation of which, actuates said lengthwise extending means.

5. In mechanism of the class described, a clutch, comprising, a plate having across its face at one end, a flange extending at right angles to its face, and a shoulder near its opposite end, a block and means attaching it to the face of said plate so as to make it slightly movable toward said flange, the block and flange forming engaging jaws, pivotal attaching means at the opposite end of the plate, the pivotal axis being at right angles to the face of the plate, a tapered bearing partially on said shoulder and partially on the adjacent edge of said block, and a rod having a tapered end received by said tapered bearings for adjusting said block toward said flange.

6. A stationary straight guide, a straight guide and means adapting it to be guided by said stationary guide, longitudinally thereof, and for maintaining it at right angles thereto, a carriage adapted to be guided by said movable guide longitudinally thereon, a clutch carried by said movable guide adapted to engage said stationary guide for holding said movable guide stationary, a rod connected with said clutch for operating it, extending lengthwise of said movable guide, a clutch carried by said carriage, slidable on said rod and having one end extending outwardly for manual operation and its other end extending inwardly beyond the opposite side of said rod, adapted to grip opposite sides of the rod at points obliquely thereacross from one point of contact to the other by forward pressure on its outwardly extended part, or by rearward pressure on its inwardly extended part, and adapted to be disengaged by a slight reverse movement, two stop pins on said carriage, a spring having one end attached to said carriage and its other end attached to said inwardly extended part of the clutch between said stop pins, against which stop pin the rod-engaging clutch is held by said spring in its disengaged position, and to which position it is returned by said spring after each forward movement of the rod, returning the rod also.

7. In mechanism as in claim 6, an outwardly extending member carried by said carriage in position to contact with the outwardly extended end of said rod-engaging clutch, and a pin carried by said carriage in position to contact with the inwardly extended end of the rod-engaging clutch on forward movement of the clutch, whereby the clutch is forced to its disengaged position against said pin and member at the forward extremity of its movement by a finger of the operator pressing on the clutch at a point between its points of contact with said pin and member.

8. A stationary straight guide, a straight guide and means adapting it to be guided by said stationary guide, longitudinally thereof, and for maintaining it at right angles thereto, a carriage adapted to be guided by said movable guide longitudinally thereof, spacing mechanism carried by said movable guide cooperating with said stationary guide for horizontal spacing, when the movable guide is arranged in the vertical position, a rod connected with said spacing mechanism for operating it, extending lengthwise of said movable guide, a clutch carried by said carriage slidable on said rod, having one end extending outward for manual operation, and its other end extending inwardly beyond the opposite side of said rod, adapted to grip opposite sides of the rod at points obliquely across the rod from one point of contact to the other by forward pressure on its outwardly extended end, or by rearward pressure on its inwardly extended end, and adapted to be disengaged by a slight reverse movement, two stop pins on said carriage, a spring having one end attached to said carriage, and its other end attached to said inwardly extended part of the clutch at a point between said stop pins, against which stop pins the clutch is held by said spring in its disengaged position at the rear extremity of its movement, and to which position it is returned by said spring after each movement of the rod, returning the rod also.

9. A stationary straight guide, a straight guide and means adapting it to be guided by said stationary guide, longitudinally thereof, and for maintaining it at right angles thereto, a carriage adapted to be guided by said movable guide longitudinally thereon, a clutch carried by said movable guide for holding the movable guide fast on the stationary guide, a rod connected with said clutch extending lengthwise of the movable guide and for operating the clutch, a clutch carried by said carriage slidable on said rod, having one end extending outwardly for manual operation, and its other end extending inwardly, adapted to grip opposite sides of said rod at points obliquely across the rod from one point of contact to the other by forward pressure on its outwardly extended end, or by rearward pressure on its inwardly extended end, and to be disengaged by turning it slightly the reverse, two stop pins on said carriage, a spring having one end attached to said carriage and its other end attached to said inwardly extended part of the rod-engaging clutch between said stop pins, against which stop pins the rod-engaging clutch is held by said spring in its disengaged position at the rear extremity of its movement, a bar fixed to the rod-engaging clutch extending parallel with the rod and having an inclined surface at each end, and two pins, including one of the first mentioned pins, on said carriage spaced to contact with said inclined surfaces by forward movement of the clutch and rod, thereby giving the clutch a slight reverse turn, releasing its grip on said rod at the forward extremity of its movement.

10. A straight guide, a member adapted to be guided by said guide, longitudinally thereof, spacing mechanism for said guided member, comprising, a graduated edge on said guided member, a stop having means holding it adjustable long said graduated edge, the stop extending over the adjacent edge of said guide, and having an inclined surface on said extension, a support and means holding it slidable on the adjacent sides of said guide, a pointed toggle pivoted on the upper part of said support, a spring

having one end attached to said guided member and its other end engaging the lower part of said support, sliding it to said stop, the point of the toggle striking the inclined surface of said stop and turning into contact with said guide a short distance forward of the pivotal bearing of the toggle, thereby holding the support stationary, an extension on said guided member, which when the guided member is moved forward contacts with the upper part of said support, bringing the guided member to rest, means for disengaging the point of said toggle, whereby the support is again moved forward by said spring, and means for preventing rearward movement of said guided member while said support is being moved forward.

11. A straight guide, a member adapted to be guided by said guide, longitudinally thereof, spacing mechanism carried by said guided member, comprising, a graduated edge on the guided member, a stop having means holding it adjustable along said graduated edge, and having an inclined edge extending over the adjacent edge of said guide, a support having a slot engaging opposite sides of said guided member on its graduated edge, slidable thereon, a pointed toggle pivoted on the upper part of said support, the pawl having an extended arm, a spring having one of its ends attached to said guided member and its other end engaging the lower part of said support, for sliding the support to said stop, the point of the toggle striking said inclined surface of the stop and turning into contact with said guide a short distance forward of the pivotal bearing of the toggle, thereby holding the support stationary, a projection on said guided member, which when the guided member is moved forward contacts with the upper part of said support, arresting the movement of the guided member, a clutch carried by said guided member for holding it fast on said guide, means for disengaging said clutch, and means operated by said disengaging means while it is returning to its normal position, for raising the point of the toggle out of contact with said guide, whereby the support is moved forward by said spring.

12. A straight guide, a member adapted to be guided by said guide longitudinally thereof, spacing mechanism carried by said guided member, comprising, a graduated edge on the guided member, a stop having means holding it adjustable along said graduated edge, and having an inclined edge extending over the adjacent edge of said guide, a support having a slot engaging opposite sides of said guided member on its graduated edge, a pointed toggle pivoted on the upper part of said support, a spring having one of its ends attached to said guided member, and its other end engaging the lower part of said support, for sliding the support to said stop, the point of the toggle striking said inclined surface of the stop and turning into contact with said guide a short distance forward of the pivotal bearing of the toggle, thereby holding the support stationary, a projection on said guided member, which when the guided member is moved forward contacts with the upper part of said support, arresting the movement of the guided member, means for disengaging the point of said toggle, whereby the support is again moved forward by said spring, and means for preventing rearward movement of said guided member while the support is being moved forward by said spring.

13. A channeled guide, a carriage having means mounting it for movement longitudinally on said guide, a clutch carried by said carriage for holding it fast on said guide, and means for disengaging the clutch, spacing mechanism carried by said carriage, comprising, a graduated edge on said carriage, a stop having means holding it adjustable along said graduated edge, a spacing clutch having two shoulders spaced to contact with the opposite side edges of the channel of said guide at points obliquely across the channel from one point of contact of said shoulders to the other, a spring having one of its ends attached to said carriage and its other end attached to said spacing clutch, two stops on said carriage against which the spacing clutch is held by said spring in its disengaged position until pressure on its outwardly extended end, by the operator, moves it into engagement with said channeled guide, where it remains stationary while pressure on said disengaging means of the first mentioned clutch, by the operator, disengages it and advances the carriage until the stop on said graduated edge contacts with the spacing clutch.

14. A channeled guide, a member having means mounting it for movement longitudinally on said guide, spacing mechanism carried by said guided member, comprising, a graduated edge on said guided member, a stop having means holding it adjustable along said graduated edge, a spacing clutch having two shoulders spaced to contact with the opposite side edges of the channel of said guide at points obliquely across the channel from one point of contact of said shoulders to the other, a spring having one of its end attached to said guided member and its other end attached to said spacing clutch, two stops on said guided member against which the spacing clutch is held by said spring in its disengaged position, means for moving the spacing clutch into engagement with said channeled guide where it remains stationary while the guided member is advanced until the stop on said graduated edge contacts with the spacing clutch, after which the spacing clutch is released, and means for preventing rearward movement of said guided member while said spring slides said spacing clutch to its disengaged position against said two stops.

15. A channeled guide, a member adapted to be guided by said channeled guide longitudinally thereof, a clutch carried by said guided member for holding it fast on said channeled guide, consisting of a pair of similar clutch members each having two shoulders, means for holding the shoulders of each clutch member in contact with the respective opposite side edges of the channel of said guide at points obliquely across said channel from one point of contact of said shoulders to the other, means flexibly connecting one end of each clutch member with said guided member, the clutch members being substantially reversed with respect to each other, whereby, one clutch member prevents movement of said guided member in one direction longitudinally of said channeled guide, and the other clutch member prevents movement of the guided member in the opposite direction, and means for disengaging the clutch.

16. In a drafting machine, a protractor, comprising, a support, a graduated arc fixed to said support, a rule-holder and rule, and means mounting the rule-holder on said support for angular movement with respect to said graduated arch, a V-clutch held in place under said arc by said rule-holder, having a shoulder near each

of its two diverging ends, and a shoulder near its opposite end, the shoulders engaging the opposite edges of said arc with slight resiliency, a stud on said rule-holder with the sides of which the inner sides of the diverging ends of said clutch contact, whereby the frictional resistance of said clutch holds the rule-holder stationary, means on said rule-holder for engaging the opposite end of said clutch holding it rigid with the rule-holder thereby preventing gripping of the clutch, for sliding it on the arc for changing the angle of the rule-holder and rule.

17. A straight guide, a member adapted to be guided by said guide, for movement longitudinally thereof, a clutch for holding said guided member fast on said guide, comprising, a body portion having a slot across it closely engaging opposite sides of said guide, means pivotally attaching one end of said clutch to said guided member, the pivotal axis being at right angles to the plane of said slot, the proportional length of said engaging slot to the distance from said slot to the pivotal bearing of the clutch being such as to give the required leverage to prevent sliding of the clutch on said guide by pressure against its pivotal end in either direction longitudinally of the guide, and means carried by said guided member adapted to engage said clutch near its gripping end, holding the clutch rigid with the guided member, thereby preventing said leverage action, the operation of which means, permitting the guided member to be moved longitudinally of the guide.

18. A straight guide, a member adapted to be guided by said guide, longitudinally thereof, a clutch for holding said guided member fast on said guide, comprising, a body portion having one end formed into a deep transverse slot closely engaging with slight resiliency opposite sides of said guide the depth of said slot and the thickness of the material forming said slot being proportioned for obtaining said slight resiliency the slot not engaging its full depth with said guide, means pivotally attaching the opposite end of said clutch to said guided member, the pivotal axis being at right angles to the plane of said slot, the proportional length of the engaging slot to the distance from the engaging slot to the pivotal bearing of the clutch being such as to give the required leverage to prevent sliding of the clutch on the guide by pressure against the pivotal end of the clutch in either direction longitudinally of the guide, and means carried by said guided member adapted to engage said clutch near its gripping end, holding the clutch rigid with the guided member, thereby preventing said leverage action, the operation of which means, permitting the guided member to be moved longitudinally of the guide.

19. A stationary guide, a guide and means adapting it to be guided by said stationary guide, longitudinally thereof, and for maintaining it at right angles thereto, a carriage having means cooperating with said movable guide, for guidance of the carriage longitudinally thereon, a clutch having means for operating it, carried by said movable guide for holding the movable guide fast on the stationary guide, a wheel and means rotatably securing it to the operating means of said clutch, a wheel and means rotatably securing it to the lower end of said movable guide, a cord running over the peripheries of said wheels, having one end attached to said carriage, and a member carried by said carriage, adapted for a to and fro movement, to which member the other end of the cord is attached, and by the operation of which member said clutch is operated from the carriage.

20. A stationary guide, a guide and means adapting it to be guided by said stationary guide, longitudinally thereof, and for maintaining it at right angles thereto, a carriage adapted to be guided by said movable guide, longitudinally thereof, a clutch, consisting of two pointed toggles pivotally mounted on said movable guide in position for their points to contact with said stationary guide obliquely from their pivotal centers, for toggle action, mounted substantially reversed with respect to each other to prevent movement of the movable guide in either direction longitudinally of the stationary guide, means holding their points in engagement with the stationary guide, and means operated from said carriage, for disengaging the clutch from said stationary guide.

21. A guide, a member adapted to be guided by said guide, for movement longitudinally thereof, a clutch carried by said guided member for holding the guided member fast on said guide, comprising two pointed toggles pivotally mounted on said guided member in position for their points to contact with said guide obliquely from their pivotal centers for toggle action, mounted substantially reversed with respect to each other to normally prevent movement of said guided member in either direction longitudinally of the guide, a spring for holding their points in contact with said guide, and means for releasing the points thereof from contact with said guide, whereby the guided member may be moved longitudinally of the guide.

22. A guide, a member having means engaging said guide for guidance of the member longitudinally of the guide, a clutch, comprising two pointed toggles pivotally mounted on said guided member in position for their points to contact with the guide obliquely from their pivotal centers, for toggle action, mounted substantially reversed with respect to each other to prevent movement of said guided member in either direction longitudinally of the guide, a spring connected with the toggles holding their points in contact with said guide, and a linkage between said toggles, whereby movement of one toggle moves the other toggle for disengaging their points from said guide.

23. A guide, a member adapted to be guided by said guide longitudinally thereof, a clutch for holding the guided member fast on said guide, comprising, two pointed toggles pivotally mounted on said guided member in position for the points thereof to contact with said guide obliquely from the pivotal centers of the toggles, for toggle action, mounted substantially reversed with respect to each other, to prevent movement of the guided member in either direction longitudinally of the guide, each toggle having an arm, said arms being connected with each other end to end, whereby movement of one moves the other in the reverse direction, means for holding the points of said toggle in contact with said guide, and means for disengaging the points therefrom for movement of the guided member longitudinally of the guide.

24. A guide, a member adapted to be guided by said guide, longitudinally thereof, a clutch for holding the guided member fast on said guide, comprising, two pointed toggles pivotally mounted on said guided member, in position for their points to contact with said guide obliquely from the pivotal centers of the toggles, for toggle action, the toggles being mounted substantially reversed with respect to each other, to prevent

movement of the guided member in either direction longitudinally of the guide, and a spring holding the points of said toggles normally disengaged.

25. A guide, a member adapted to be guided by said guide longitudinally thereof, a clutch for holding the guided member fast on said guide, means for operating said clutch, a spring having one end operatively connected with said operating means and its other end pivoted to said guided member in position to direct its force toward one side of its pivotal bearing for holding the clutch engaged at one extremity of the movement of said operating means, and for directing its force toward the opposite side of its pivotal bearing for holding the clutch disengaged at the other extremity of the movement of said operating means.

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