May 2, 1967 A. L. BAKER ETAL 3,316,644

DRAFTING MACHINE

Filed July 18, 1960 4 Sheets-Sheet 1

FIG. 1

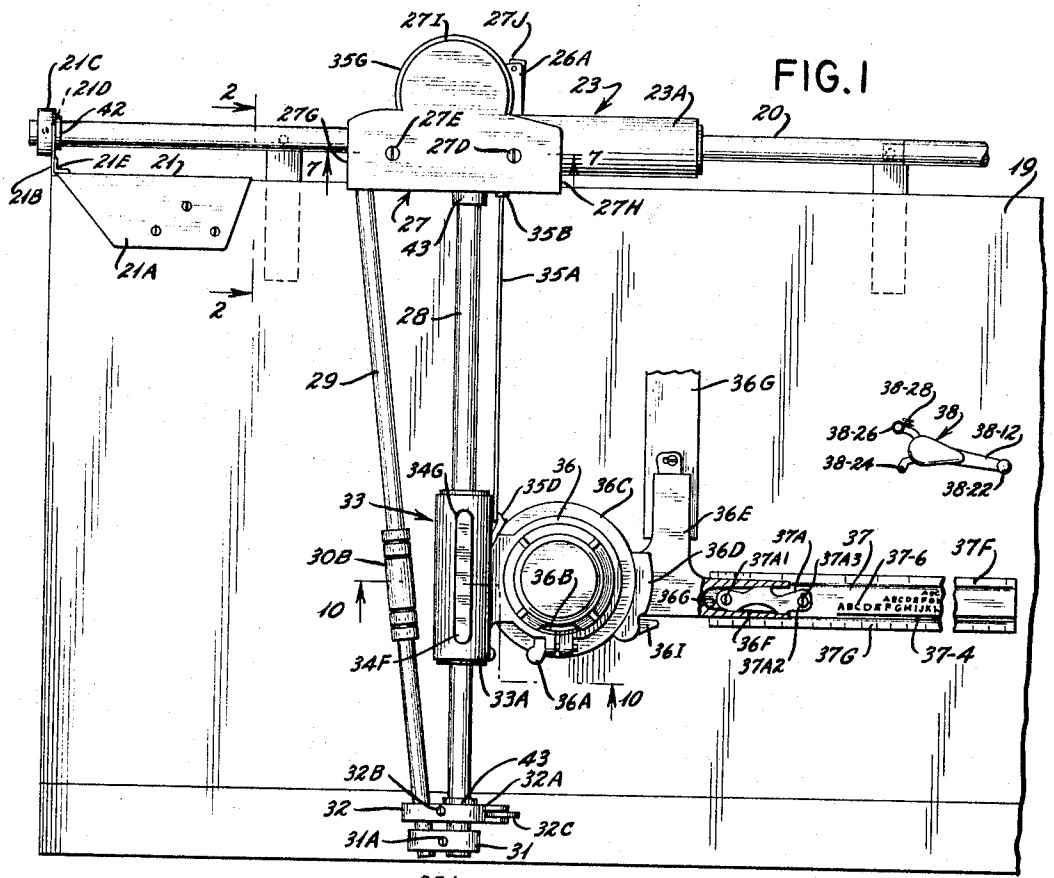
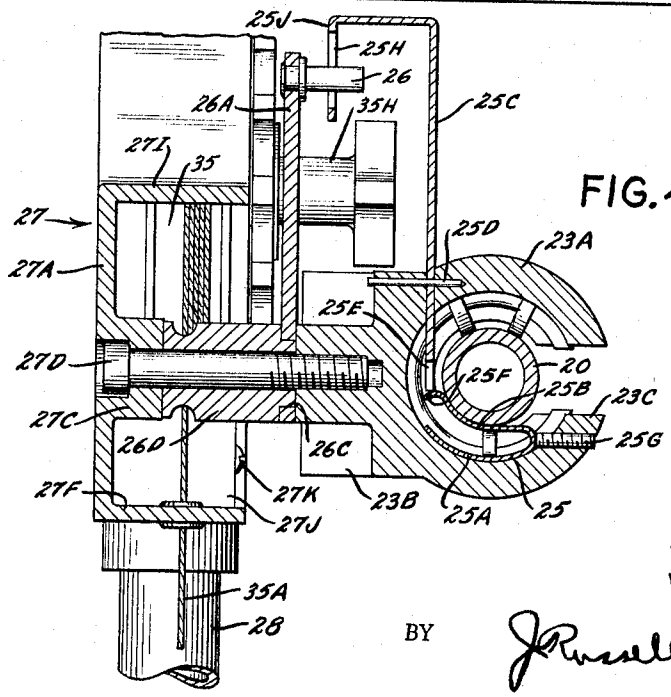


FIG. 4



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DRAFTING MACHINE

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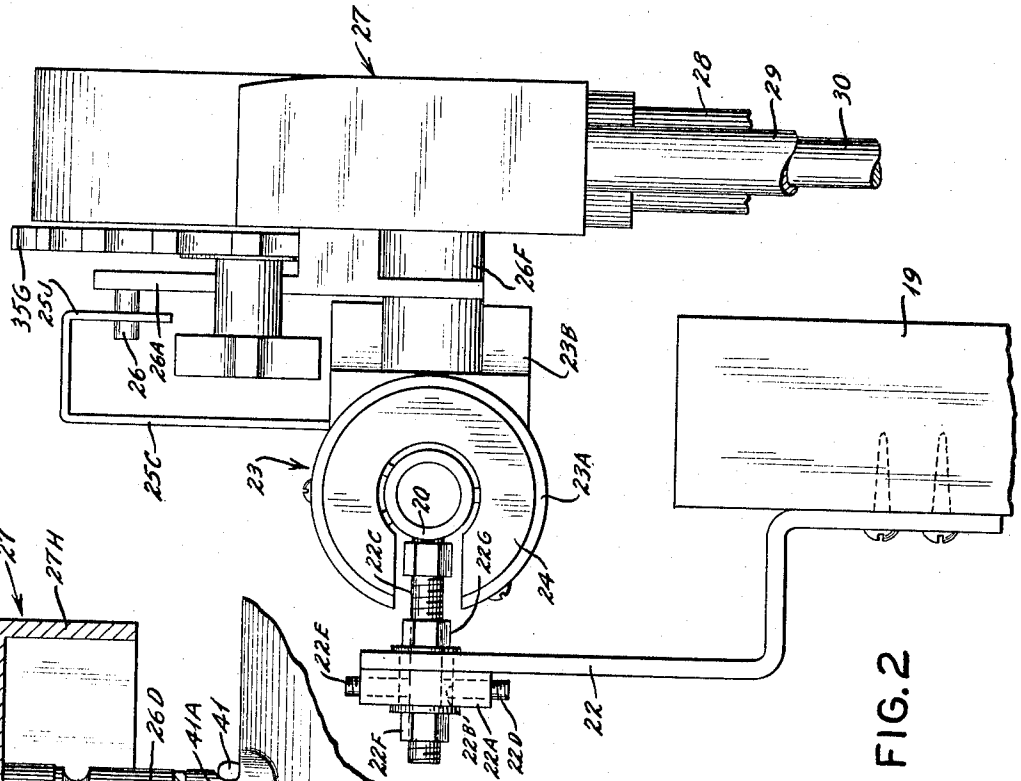


FIG. 2

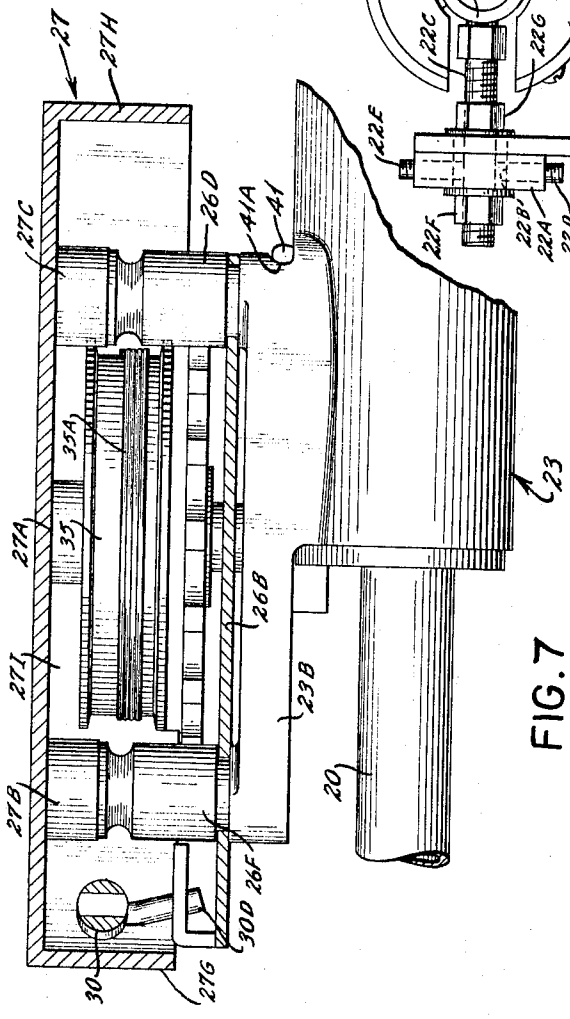


FIG. 7

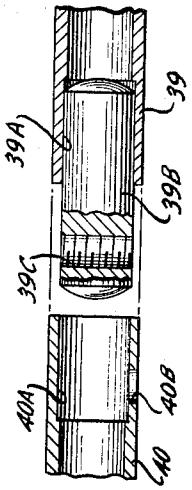


FIG. 9

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DRAFTING MACHINE

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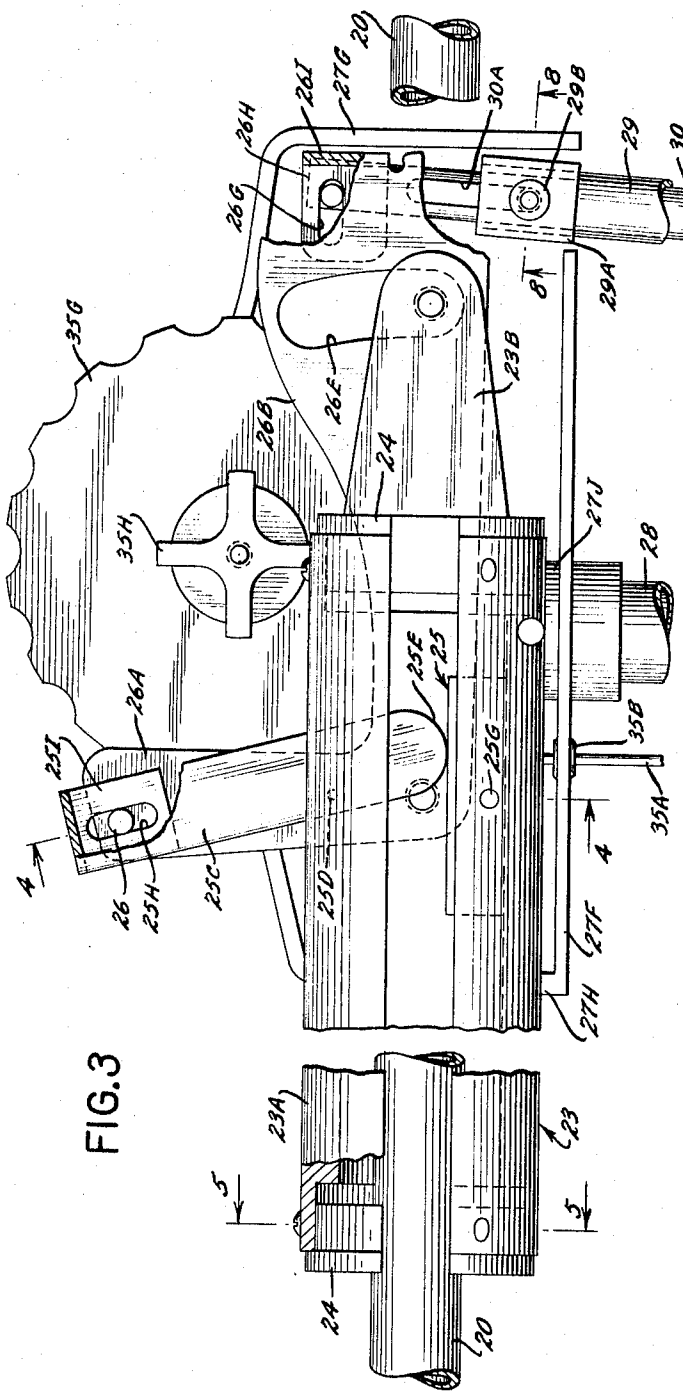


FIG. 3

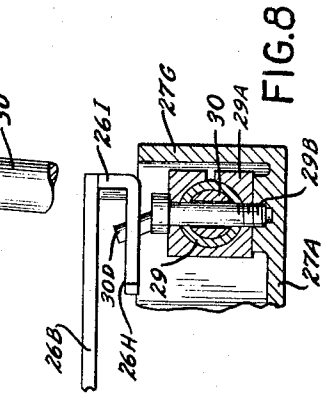


FIG. 8

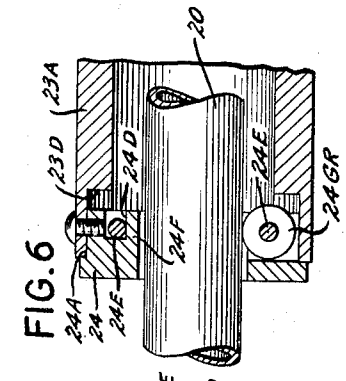


FIG. 6

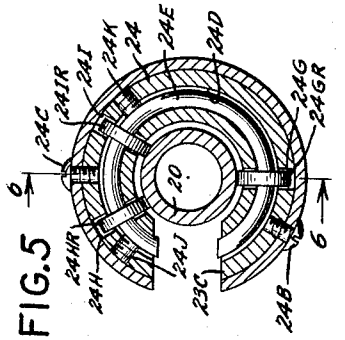


FIG. 5

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FIG.10

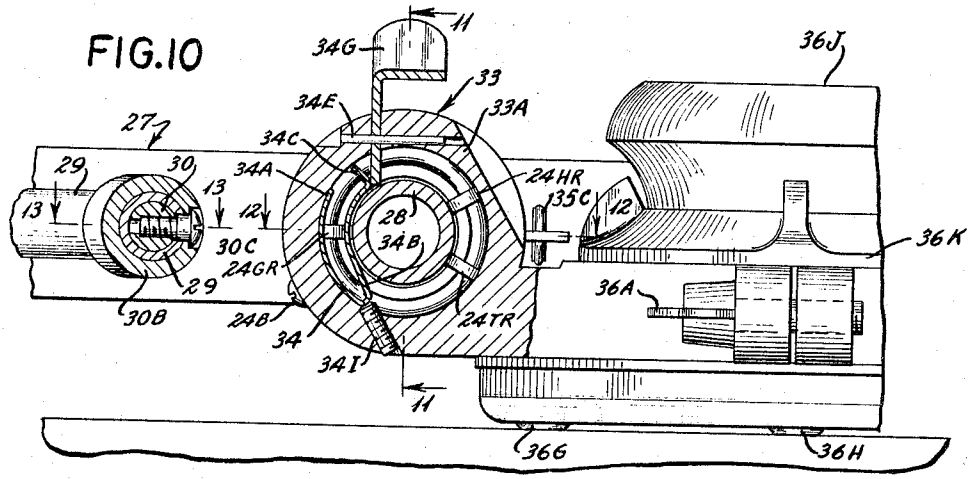
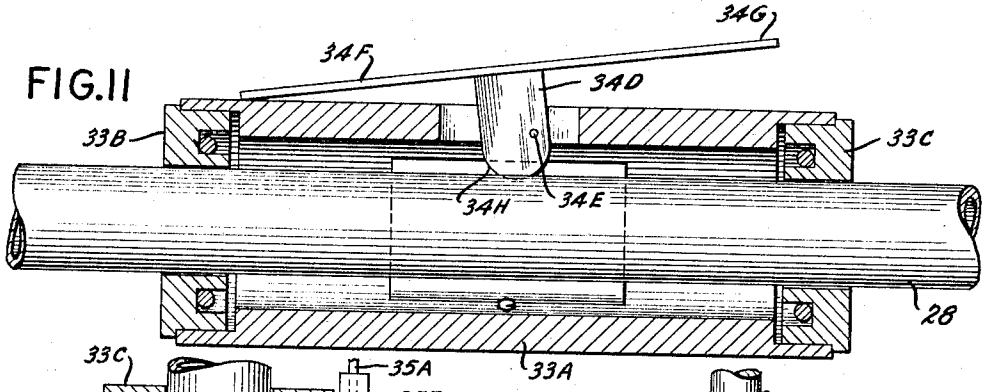


FIG.11



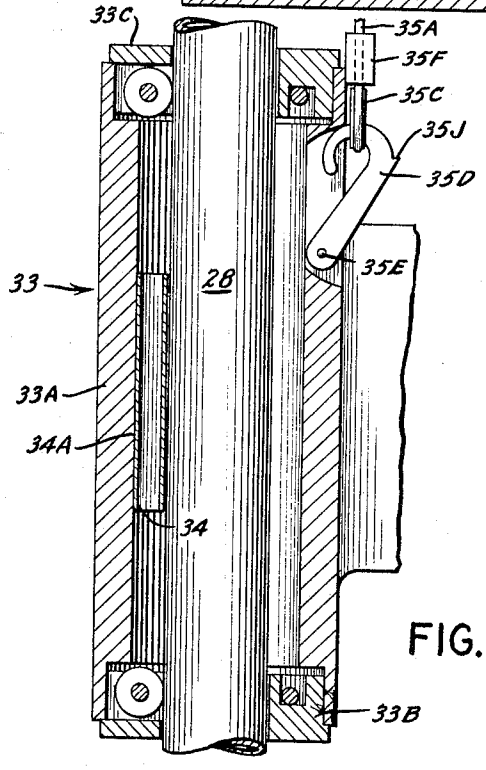
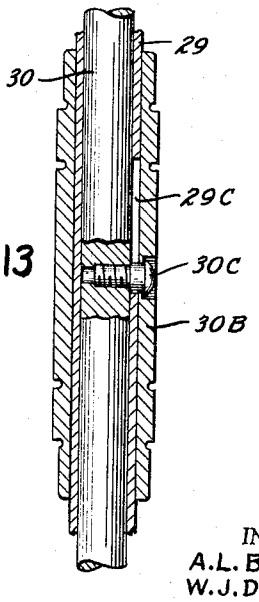


FIG.12

FIG.13



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United States Patent Office 3,316,644 Patented May 2, 1967

3,316,644

DRAFTING MACHINE

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Filed July 18, 1960, Ser. No. 43,642
13 Claims. (Cl. 33—79)

The present invention relates to drafting machines and more particularly to a drafting machine of the type adaptable for use on a substantially perpendicular inclined or horizontal drawing board and in which a rail is mounted at the top edge of the board with a first carriage movable along the rail, a second rail being mounted on the first carriage extending perpendicularly from the first rail with a second carriage mounted on the second rail for movement along the second rail whereby the second carriage can be moved in all directions. The second carriage is provided with a protractor having supporting means for detachably mounting line guiding means on the second carriage whereby lines in all angular directions can be guidedly drawn from the line guiding means.

Heretofore drafting machines have been provided in which horizontal and vertical movement of the line guide means has been provided, but the operation of the lock motion for the horizontal movement has interfered with the free movement of the line guiding means, and the operation of the horizontal motion lock has required a substantial reach for the operator involving time, effort and delays.

The counterbalancing cable for the protractor has been difficult to attach and it has accidentally become detached resulting in damage to the parts.

It has been difficult to use conventional template lettering equipment on a vertical positioned or steeply inclined drawing board.

The rail supporting arangement for the horizontal movement and the support for the horizontally movable carriage of a drafting machine has not been adequate to maintain extreme accuracy and the support for the movable carriages has been subject to variations in friction forces and subject to inaccurate guidance.

An object of the present invention is to provide a drafting machine which overcomes the difficulties enumerated above and which provides for continuous service with a minimum of upkeep and attention.

Another object of the present invention is to provide a drafting machine for use on drawing boards in which the line guiding means can be held in a selected controlled position including a position of a line guiding means in parallel relation to a path of movement of the line guiding means.

Another object is to provide drafting equipment which will provide for clearance of the line guiding means from the supporting structure during movement in substantially all directions on the drawing board without having some line guiding means contact portions of the supporting structure.

A further object is to provide a counterbalancing cable connection for the line guiding means supporting carriage to render the structure usable in all normal positions including horizontal and vertical positions of the drawing board.

Another object is to provide a line guiding pattern template for attachment to the line guiding supporting means of a drafting machine to avoid having separate loose pieces while enhancing the efficiency of making lines of a particular pattern.

A further object is to provide a roller assembly and mounting means for supporting a drafting machine on a drawing board to assure accurate rectilinear movement of line guiding elements to facilitate the operation and improve the accuracy of drafting.

A still further object is to provide means to selectively prevent movement of a line guiding means supporting carriage in either or both directions.

Another object is to provide a detachable hook arrangement for supporting the line guiding means from a counterbalance arrangement.

Another object is to provide a drafting machine which can be completely removed from the upper surface of a drawing board.

Other and further objects will be apparent as the description proceeds and upon reference to the accompanying drawings wherein:

FIG. 1 is an elevational view of the left portion of a perpendicularly positioned drawing board showing the drafting machine with the rail at the upper edge of the board with a first carriage movable thereof and a vertically movable carriage supported from a second rail supported on said first carriage and showing the lettering guiding line assembly mounted in horizontal position on the protractor.

FIG. 2 is an enlarged fragmentary vertical elevation of the horizontally movable carriage taken substantially on line 2—2 of FIG. 1 and showing an intermediate supporting bracket and the adjusting means for obtaining the intermediate support of the horizontal first rail at the top edge of the drawing board and showing part of the operating linkage for operating the horizontal motion lock.

FIG. 3 is a rear view of the horizontally movable first carriage on the same enlarged scale showng the C-shaped sleeve with the roller supporting members at each end engaging the horizontal first rail and showing the horizontal motion lock operating linkage including lever operating mechanism for the lock which provides for clearance of the line guiding means in the plane of the drawing.

FIG. 4 is a section taken on broken line 4—4 of FIG. 3 showing the horizontal motion lock and alignment adjusting means.

FIG. 5 is a detail section taken substantially on line 5—5 of FIG. 3 showing the roller assembly at one end of the C-shaped sleeve.

FIG. 6 is an axial section as seen from the rear through one end of the C-shaped sleeve and one C-shaped roller assembly and substantially in the plane of the spring pressed roller and taken substantially on line 6—6 of FIG. 5 showing the cooperation of the roller assembly with the horizontal supporting rail.

FIG. 7 is a fragmentary horizontal section taken substantially on line 7—7 of FIG. 1 looking upwardly and showing the support of the counterbalancing cable drum, the bell crank for operating the horizontal motion lock, and the attachment of the vertical rail carrying frame to the horizontally movable roller supported C-shaped sleeve of the horizontally movable carriage.

FIG. 8 is a fragmentary section taken substantially on line 8—8 of FIG. 3 showing the guiding arrangement for the vertically movable horizontal motion lock operating rod.

FIG. 9 is a fragmentary exploded section of a joint of an adjustable length horizontal rail.

FIG. 10 is a fragmentary section taken substantially on broken line 10—10 of FIG. 1 showing the roller guide arrangement for the vertically movable carriage supporting the protractor with the sliding guides of the protractor engaging the drawing board and showing the horizontal motion lock operating rod and its attachment

to its operating handle, and also showing the vertical motion lock in unlocked position.

FIG. 11 is a section taken substantially on line **11—11** of FIG. 10 showing the lever arrangement for the vertical motion lock in unlocked position.

FIG. 12 is a section taken substantially on line **12—12** of FIG. 10 showing the releasable hook attachment to the cable of a counterbalancing arrangement.

FIG. 13 is a longitudinal section taken substantially on line **13—13** of FIG. 10 showing the slidable tubular handle and the horizontal motion lock operating rod slidably supported on the tubular brace rod for the vertical rail for controlling the horizontal motion lock.

Briefly, the present invention comprises a drafting machine for application to a drawing board and is useful in vertical, inclined and horizontal positions. The machine includes a horizontal rail with mounting means for securing the rail to the top edge of the drawing board at the ends of the board and intermediate positions. A first and horizontally movable carriage is accurately supported on roller assemblies for movement along said horizontal rail. The first carriage and the roller assemblies thereon are of C-shape providing for clearance of the intermediate supports of the horizontal rail while permitting pivotal movement of the drafting machine from an operative position on the front face of the drafting board to an inoperative position spaced therefrom. Said first carriage supports a vertical rail carrying frame which frame supports a vertical rail extending substantially radially of said horizontal rail. A second carriage is supported by roller assemblies on the vertical rail and carries an adjustable protractor with arms for supporting line guiding scales. The horizontal motion of the first carriage and the vertical motion of the second carriage provide for movement in all directions on the drawing board so that the line guiding scales can be positioned at all points on the drawing board.

A tubular brace rod extends from the vertical rail supporting frame to the free end of the vertical rail and is fixed to such frame and rail thereby assuring the rigid support of the vertical rail with respect to the horizontally movable first carriage. A lock operating handle on the tubular brace rod controls a brake shoe on the first carriage through a linkage which is out of the path of the line guiding scales to prevent horizontal movement thereof while a lever operated brake shoe on the vertically movable carriage provides for locking the vertically movable carriage in a fixed position on the vertical rail.

A counterbalancing cable is supported on a drum on the vertical rail supporting frame and has its free end extending to the vertically movable carriage and connected to an inverted J-shaped hook which is positioned and mounted in such a way as to prevent accidental release of the counterbalancing cable.

A lettering template line guiding scale is provided for mounting on a scale supporting arm of the protractor to provide for template formation of letters in vertical as well as horizontal positions of the drawing board.

Referring more particularly to the drawings, the drafting machine includes a horizontally extending rail **20** supported by its ends on L-shaped brackets in which the long leg **21** is positioned on the top of the drafting board **19** and a flange **21A** is secured to said long leg and fastened to the front face of the drawing board with screws or the like. The short leg **21B** carries a bushing **21C** which snugly receives the horizontal rail **20** and the rail is secured to the sleeve by a set screw **21D** threaded radially into the rear portion of the bushing **21C**. The L-shaped bracket is reinforced with an angle bracket **21E** positioned in the concave dihedral angle formed between the legs of the L-shaped bracket, and it will be understood that a mirror image L-shaped bracket is provided at the other end of the drawing board. The horizontal rail **20** is supported intermediate its ends by a Z-shaped bracket **22** secured to the rear of the drawing board by screws and carrying an enlargement **22A** at its free end with such enlargement being provided with an elongated aperture **22B** which adjustably receives a stud **22C** fixed to the rear side of the horizontal rail **20** by any suitable means and extending radially therefrom. Adjusting set screws **22D** and **22E** are provided at the upper and lower ends respectively of the enlargement **22A** and are adapted to engage the stud **22C** to raise or lower the stud and thereby raise or lower the intermediately supported portions of the rail **20**. When proper adjustment is obtained lock nuts **22F**, **22G** on stud **22C** are tightened against washers on enlargement **22A** to fix the adjustment, the position of such nuts determining the position of the rail with respect to the front surface of the drawing board **19**. Supported on the horizontal first rail **20** is a carriage **23** which includes an elongated C-shaped sleeve **23A** having an axially extending arm **23B** located forwardly from the axis of the sleeve and opposite the rearwardly opening radially and longitudinally extending slot **23C**, it being apparent that the opening **23C** provides for clearance of the supporting studs **22A** as shown in FIG. 2 as the carriage moves along the horizontal rail **20**.

The ends of the tubular sleeve **23A** are provided with rabbets **23D** which receive roller supporting C-shaped ring-like elements **24** which are also provided with a cooperating rabbet **24A** which telescopes into the rabbet **23D** and such ring is retained in position by unsymmetrically positioned and different size retaining screws **24B** and **24C** which pass through openings in the rabbeted end portion of the sleeve **23A** and are threaded into tapped openings in the ring **24**. The C-shaped ring **24** is provided with a circumferential groove **24D** intermediate its inner and outer peripheries which receives a C-shaped spring-like ring **24E** which is biased in a direction to tightly grip the inner flange **24F** defining the groove **24D**. A plurality of radially extending slots **24G**, **24H**, **24I** are provided in the ring **24** and communicate with the circumferential groove **24D** and rollers **24GR**, **24HR**, and **24IR** are positioned in such slots and are retained in such slots by the spring ring **24E** and such spring ring is retained in position on the ring **24** by Allen head screws **24J**, **24K** located adjacent the pair of rollers **24HR** and **24IR** so that the axes of such rollers are maintained in a definite fixed relation at all times while the roller **24G** may move radially against the bias of the C-shaped ring spring **24E** thereby assuring a uniform pressure contact of the rollers with the horizontal rail **20** and since a roller assembly is provided at each end of the C-shaped sleeve the carriage **23** is accurately guided. It will be evident that the pair of rollers **24HR** and **24IR** are located along the upper side of the rail **20** when the drafting machine is mounted on a vertically positioned drafting board **19**. Each roller includes an inner race supported on the axle formed by spring ring **24E** and an outer race which engages the rail **20** with suitable anti-friction bearings between such inner and outer races to assure substantially frictionless movement of the carriage along the rail **20**.

A lock is provided to prevent axial movement of the carriage **23** along the rod **20** and such lock includes a U-shaped spring **25** having one leg **25A** with a convex exterior surface and the other leg **25B** with a concave exterior surface with such exterior surfaces engaging the inner periphery of the C-shaped sleeve **23A** and the horizontal rail **20**, respectively, with the leg **25B** serving as a brake shoe and being provided with a layer of friction material on its outer concave surface. To operate such lock, the resiliency in the spring **25** of U-shaped section normally urges the brake shoe against the rail **20** and such brake shoe is released from the rail **20** by an inverted J-shaped lever **25C** which is pivoted in a slot through the sleeve **23A** on a pivot pin **25D** adjacent the right edge of such lever as viewed in FIG. 1 and the lower

curved end of such lever engages the flange extension 25F on the brake shoe 25B. The bight portion of the U-shaped spring 25A engages an abutment screw 25G threaded into a generally tangential aperture in the sleeve 23A so that the spring 25 is effectively retained between the screw abutment 25G and the lower end 25E of the lever 25C so that the operation of such lever includes motion past a dead center position to release the brake shoe from the rail 20 and permit horizontal movement of the first carriage 23. Since the brake is applied by the resiliency of the spring, when the lever is in the positions shown in FIGS. 3 and 4 the brake or lock is effective preventing horizontal movement. The inverted J-shaped lever 25C is provided with an elongated slot 25H in the shorter leg 25I for cooperation with a stud 26 on one end of the vertical arm 26A of a bell crank lever which also includes horizontally extending arm 26B. The bell crank lever is provided with a pivot aperture 26C at its knee which aperture receives a reduced cylindrical portion of a spacing sleeve 26D which provides a bearing surface with limited axial play for the bell crank lever. The arm 26B of the bell crank lever is provided with an arcuate slot 26E which receives a reduced cylindrical portion of a second spacing sleeve 26F which serves to additionally guide the arm 26B whereby the bell crank is effectively guided for limited arcuate movement by the spacer 26D, 26F and cooperating bosses on the extension 23B of the carriage.

A vertical rail carrying frame housing 27 includes a front wall 27A having a pair of bosses 27B, 27C in alignment with the spacers 26F and 26D respectively. Frame attaching Allen head screws 27D, 27E secure the frame 27 to the horizontally movable carriage 23 and provide for limited angular adjustment by the provision of enlarged bores in the bosses 27C and 27B as well as in the spacers 26D and 26F to permit limited angular adjustment of the vertical rail 28 which is secured to the frame 27 so that such rail 28 will be precisely perpendicular to the rail 20. The frame housing 27 includes a bottom 27F, side walls 27G, 27H and a top wall 27I of arch shape with a major portion of the top wall being of circular outline for housing the counterbalancing drum. The bottom wall 27F and the front wall 27A are formed integrally with a boss 27J which provides a socket for receiving the upper end of the vertical rail 28 and such vertical rail is maintained in the socket in a fixed relation by a set screw 27K.

A tubular brace rod 29 is mounted on the frame housing 27 by a split block 29A which rests against a rearwardly projecting boss on the front wall 27A of the frame housing and an anchoring bolt 29B passes through the split block 29A and is threaded into screw threads in the boss on the front wall 27A of the frame housing. Within the brace tube 29 is a horizontal motion lock operating rod 30 which is telescopically received in the tubular brace 29 and such rod is provided with a longitudinally extending slot 30A at its upper end which is of sufficient size to straddle the anchoring screw 29B and of sufficient length to permit vertical movement of the horizontal motion lock operating rod 30. The brace rod 29 is provided with a slot 29C intermediate its ends and the rod 30 is provided with a threaded aperture in alignment with the slot while a tubular handle 30B which is slidable on the exterior of the brace rod 29 and is connected to such brace rod by a shouldered set screw 30C passing through a counterbored opening in the tubular handle 30 and threaded into the threaded aperture in the horizontal motion lock operating rod 30 whereby motion of said handle 30B will cause the lock operating rod 30 to reciprocate to a downward horizontal motion unlocked position to an upward locked position.

The lower ends of brace rod 29 and vertical rail 28 are securely connected together by a two part clamp having substantially semi-cylindrical recesses for receiving the lower ends of the brace rods and the vertical rail and a clamp bolt 31A positioned between brace rod 29 and vertical rail 28 and securely tightened to maintain the triangular brace relation between the brace rod 29, the vertical rail 28 and the frame housing 27.

At the upper end of the lock operating rod 30 a pin 30D projects rearwardly and to the right as seen in FIG. 1 and such pin is received in a slot 26G of the bell crank lever which slot is formed in a parallel extension 26H connected by a bight portion 26I to the arm 26B of the bell crank lever whereby operation of the handle 30B will operate the bell crank lever 26B, 26A and thereby operate the horizontal brake operating lever 25C and brake shoe 25 so that downward motion on the rod 30 and the handle 30B will cause the rounded end 25E of the brake operating lever 25C to force the brake shoe 25B away from the rail 20. There is a counterbalancing effect from the spring brake 25 counterbalancing the weight of the rod 30 and the handle thereon and the movement of the brake operating lever 25C past dead center and the frictional engagement with the brake shoe assures positive retention of the brake in unlocked position.

A roller guide support for the lower end of the rail 28 includes an upper clamping member 32 and a lower wheel supporting fork member 32A which have cooperating substantially semi-circular recesses for engaging the vertical rail 28 and cooperating quarter circular recesses with tangentially extending walls for slidably embracing the brace rod 29 to provide for vertical adjustment even with the angular relation between the brace rod 29 and the vertical rail 28C while a clamping set screw 32B secures the parts of the roller support together. A roller 32C is supported in the forked end of the lower clamping member 32A and engages the lower edge portion of the face of the drawing board or a rail mounted on the drawing board to effectively support the lower end of the vertically extending rail 28 to maintain a substantially parallel relation to the face of the drawing board.

The vertically movable carriage 33 includes a sleeve 33A which has a roller assembly 33B at its lower end and a roller assembly 33C at the other end. Such roller assemblies are substantially similar to the roller assembly 24, but are completely circular. The retaining screws and the retaining spring are substantially identical and corresponding parts are therefore identified with the numerals corresponding to those shown in FIGS. 5 and 6 and a repetition of the description is believed to be unnecessary.

To limit the vertical movement of the carriage 33, an elongated spring member of U-shaped cross section 34 includes an externally convex portion 34A which is received in the bore of the sleeve 33A and an externally concave brake shoe portion 34B covered with a friction material engages the vertical rail 28 for maintaining the vertically movable carriage in a fixed position relative to the rail. Such concave brake shoe portion 34B has a laterally extending flange 34C which engages the lower curved end of the stem portion 34D of a T-shaped lever pivotally mounted on a pin 34E at one edge of the stem portion. The cross bar of the T-shaped lever includes a lower section 34F and an upper portion 34G whereby pressure on the lower portion 34F will cause the lower end 34H of the stem of the T-shaped lever to engage the flange 34C thereby forcing the brake shoe 34B away from the vertical rail 28 releasing the vertical motion lock and permitting free movement of the carriage along the rail.

The spring brake 34 is maintained in position by the reaction of an adjusting screw 34I engaging the bight portion of the brake spring and the flange portion 34C of the spring engaging the free end 34H of the T-shaped lever.

To counterbalance the weight of the carriage 33, the vertical rail supporting frame housing rotatably supports a drum 35 which is spring biased to rotate in one direction and a cable 35A is secured to said drum and extends through a rubber like bushing 35B in an opening in the lower wall 27F of the frame housing and the free end of

such cable is provided with an eye 35C which provides for the reception of the hook portion of an inverted J-shaped hook 35D which is pivotally mounted on a pivot pin 35E in a radially and longitudinally extending slot in the sleeve 33A. The pivot point 35E is spaced inwardly an appreciable distance from the periphery of the sleeve 33A so that when the eye 35C of the cable 35A is in tension the inverted J-shaped hook is urged into a position in which the end of the hook is sheathed in the slot. A finger nail notch 35J is provided to assist in moving the hook out of the sheath slot for detachment of the cable 35A therefrom. A rubber like bushing 35F is provided adjacent the eye for preventing metallic contact with the sleeve 33A and also providing a bumper for engagement against the bushing 35B when the cable 35A is released from the hook to prevent damage to the parts. The tension in the spring for rotating the drum 35A is adjusted by the adjusting disk 35G and the adjustment is maintained by the locking hand operated nut 35H.

The carriage 33 includes a laterally extending integral split ring 36 with the ends of such split ring being clampingly moved together by a lever operated nut 36A on a screw and such split ring adjusted receives the cylindrical mounting portion 36B of the protractor assembly or drafting head and provides for obtaining precise adjustment of the protractor 36C and the scale mounting arms 36E and 36F with respect to the horizontal and vertical rails 20 and 28. The protractor assembly carries the usual vernier scale 36D which is selectively adjustable with respect to the protractor in a well known manner and such vernier scale carries scale mounting arms 36E, 36F at substantially right angles to each other. A conventional scale 36G is shown in the vertical arm while a new type combination lettering template and scale 37 is mounted on the horizontal arm 36F for tracing letters by the use of a template and a scribing device.

To facilitate sliding of the protractor assembly, a dome shaped glide 36G is provided at the left and a similar glide 36H is provided at the lower edge of the bottom covering plate for the protractor assembly and assures satisfactory sliding of the protractor assembly with the scales thereon over a drawing to provide for ease of location of the scales and ease of making the drawings.

To release the vernier scale and the scale carrying arms to permit rotation, the thumb operated release lever 36I, the circumferential knob release 36K and the hand operating knob 36J are provided.

It will be evident that the combination lettering template and scale 37 may be used with the drawing board in vertical or inclined position by locking the vertical motion and freeing the horizontal motion to permit the carriage 23 to move horizontally. Pressing the upper end 34G of the lever on vertically movable carriage 33 causes the brake shoe 34B to engage the vertical rail 28 thereby preventing vertical adjustment of the combination lettering template and scale 37.

A scribing device of the type shown in the Anderson Patent 2,616,170 or an equivalent scribing device may then be used with the template shown by laterally moving the combination lettering template and scale 37 thereby avoiding the necessity of a loose slidable template as in conventional practice and always having the template convenient for use.

The lettering template 37 shown in FIG. 1 includes the elongated tail pin groove 37–4, the character grooves 37–6 for a number of sizes of letters, numbers, trademarks or the like. A scriber of known construction such as that shown in Anderson Patent 2,616,179 is generally indicated by reference numeral 38 and the corresponding parts of the scriber shown in the Anderson patent are identified by the reference numeral 38 with a postscript of the reference numeral used in the Anderson patent and the writing instrument includes a scriber plate 38–12 with a knob 38–10 supported thereon and in actual practice the tail pin 38–22 of the scriber is engaged in the tail pin groove 37–4 and the tracer pin 38–24 is engaged in the selected character grove 37–6 in one of the rows of characters so that the writing instrument 38–26 will then make the desired character in the correct position. The correct position is determined by moving of the vertically movable carriage 33 laterally to position the writing instrument in proper location for the characters on the drawing. It will be evident that the vertical spacing of the lines can be accomplished by movement of lever portion 34F toward sleve 33A releasing the lock for the vertical motion and moving the template 37 to the next line position and relocking by pressing lever portion 34G.

It will also be evident that the combination lettering template and scale 37 can be mounted on the arm 36E and by locking the horizontal motion of carriage 23 and permitting free movement of the carriage 33, template guided lettering can be accomplished in vertical lines.

The lettering template and scale 37 includes calibrated scales 37F, 37G and attaching dovetail tongue 37A. The combination lettering template and scale 37 provided with three point adjustable wedge type dove tail tongue 37A, cooperates with a wedge type dove tail slot 36G on the under surface of the arms 36E or 36F. The dove tail tongue 37A is angularly adjustable by a pivot screw 37A at one end and a lock screw 37A2 passing through an arcuate slot 37A3 with both screws threaded into suitable nuts in the template scale 37 for clamping action to obtain the desired alignment with respect to the protractor 36C and the rails 20 and 28 by procedure outlined in the attached instruction pamphlet. Both scales of the template scale 37 read in the position.

Applicants have provided a drafting machine of general utility which provides for ease of operation of locking mechanisms, accurate alignment of the horizontal rail, the accurate support of the vertical rail, and the counterbalancing of the vertically movable carriage. The arrangement of the horizontal motion lock provides clear unobstructed movement of the vertical scale 36F beyond the top of the board. The combination lettering template scales provide for rapid lettering without loose pieces in all positions of the drawing board and without requiring a change of scales.

Upon reference to FIGURE 9, rail portions 40, 39 of the horizontal rail are shown with a detachable connection therebetween. The rail section 40 includes a counter bored portion 40A while the rail section 39 includes a counter bored section 39A in which a stud 39B approximately the length of both counter bore is fixedly mounted. Stud 39B is provided with a transverse aperture 39C which is threaded, while the section 40 is provided with an alignable opening 38B which receives one of the supporting studs 22C thereby providing a method of securing the stud to the rail and also providing means for securing the rail sections positively together and in accurate alignment to assure smooth operation of the carriage 23 along the rail sections 40 and 39. The stud 22C can be provided with a shoulder to engage the outer periphery of the counter bored portion of the section 40 or the end of the stud may engage the inner periphery of the counter bore 40A. Also, a lock nut and/or washer can be used so that the lock nut will retain the parts assembled. Also, the stud 22 may engage the inner periphery of counter bore 40A and the lock nuts also used.

A rubber like scale edge protector 41 is mounted in a groove 41A extending vertically and located between the horizontally movable carriage sleeve 23 and the extension 23B adjacent the spacer 26D. Such rubber like bumper prevents damage to the edge of the scale when the scale projects beyond the top edge of the drawing board since such rubber like bumper 41 is substantially in the plane of the drawing board.

Rubber bumper like sleeves 42 are provided adjacent each end of the rail 20 abutting the bushings 21C and are adapted to be engaged by C-shaped ring like elements

24 on the carriage 23, the rubber bumper sleeves preventing shock and metal to metal contact in the event that the drafting machine is moved horizontally to the end of its motion. Similar rubber like bumper sleeves 43 are provided at the ends of the vertical rail for a similar purpose.

Where a rail is provided adjacent the bottom edge of the drawing board and such rail is of substantial thickness, spacing washers of equal thickness to the thickness of the rail at the bottom of the board are inserted between the spacing sleeves 26D and 26F and the bosses on the extension 23. This arrangement is also useful where the drawing is made on material of substantial thickness where the thickness of the drawing material must be taken into account so that the scales will lie on the surface in accurate relation.

It will be evident that various changes may be made within the scope of the invention as defined by the valid interpretation of the appended claims.

What is claimed is:

1. A drafting machine and drafting board adapted for use in horizontal and inclined positions comprising a first cylindrical rail mounted on a drafting board, a first carriage including an elongated C-shaped sleeve mounted for movement along and for angular rotation about the cylindrical rail, means to support said cylindrical rail on the drafting board adjacent the ends, intermediate support means for said cylindrical rail including narrow struts extending radially from said rail, each strut being of smaller transverse dimension than the slot in said C-shaped sleeve and each strut being positioned to be received in the slot opening in said C-shaped sleeve, strut support means mounted on said drafting board and supporting said struts, a roller assembly mounted on said C-shaped sleeve adjacent each end thereof, each roller assembly including a pair of generally cylindrical rollers spaced apart substantially less than 180 degrees and located on one side of the C-shaped sleeve and engaging the cylindrical rail on one side of the rail, and at least another generally cylindrical roller positioned on the other side of said C-shaped sleeve and engaging the other side of said rail, said at least another roller being spaced an amount appreciably less than 180 degrees from an adjacent roller, resilient means urging said at least another roller toward said one side of said C-shaped sleeve and toward said rail, each generally cylindrical roller being mounted for rotation on an axis lying in a plane perpendicular to the axis of the cylindrical rail and perpendicular to a radius of the cylindrical rail, the position of the axis of each of said pair of rollers being fixed relative to said C-shaped sleeve, a brake mounted in said C-shaped sleeve intermediate the ends thereof on the said other side of said C-shaped sleeve adjacent said at least another roller producing a braking force on said other side of the cylindrical rail with the brake reaction being taken by said at least two rollers on the said one side of the C-shaped sleeve and on the said one side of said cylindrical rail, means to apply and release said brake causing said first carriage selectively to be held against movement and permitting said first carriage to freely move along and about said cylindrical rail, a second rail lying in a plane perpendicular to said cylindrical rail to overlie the front surface of said drafting board, a second carriage mounted on said second rail for movement therealong, line guide means on said second carriage for guiding a line forming instrument, and means to maintain said second carriage in adjusted position on said second rail.

2. The invention according to claim 1 in which the second rail is cylindrical and the second carriage includes a sleeve and an assembly of generally cylindrical rollers at each end of the sleeve supporting said second carriage from said second cylindrical rail.

3. The invention according to claim 1 in which a spring operated counterbalance take up is mounted on said C-shaped sleeve and includes a pull cord with detachable connecting means at its free end, and said second carriage is provided with cooperating connecting means for attachment to said connecting means on said pull cord whereby the pull cord is maintained in operative position with respect to said second carriage.

4. The invention according to claim 3 in which means are provided to adjust the spring counterbalance and the tension on said cord.

5. The invention according to claim 1 in which the line guide means includes a drafting head having two scale mounting arms which are rotatably mounted on the second carriage and a combination lettering template and scale is detachably mounted on one of the arms whereby the combination template and scale can be used to accurately locate the letters on a drawing without additional loose pieces.

6. The invention according to claim 1 in which an elongated brace extending diagonally of said rails is mounted between said first carriage and the outer end of said second rail providing for increased rigidity of said second rail and a brake operating handle is mounted on said brace and operatively connected to said brake on said first carriage for operating said brake on said first carriage.

7. The invention according to claim 6 in which an adjustable roller support is mounted on said second rail, and a roller is mounted on said roller support thereby providing for at least partially supporting said line guide means.

8. A brake for retaining a carriage against longitudinal movement on a rail comprising a carriage having a sleeve surrounding a portion of the rail, a U-shaped spring mounted on said carriage with the legs of the spring being arcuate about a substantially identical center when in operating position, the outer surface of one leg being convex and the outer surface of the other leg being concave, said sleeve having a fixed concave surface for engaging the convex spring surface on the one leg of the U-shaped spring, the concave leg serving as a brake shoe being adapted to engage the rail, lever means on said carriage for engaging the free end of the concave leg, the concave leg having an extension at its free end extending toward the convex leg for engaging the lever, and adjusting means mounted on said carriage to properly position the spring with respect to said lever means so the contacting surface of the extension of the free end of the concave leg with the lever means may produce the proper release of the brake.

9. A drafting machine comprising a drawing board, a horizontal rail mounted adjacent the top end of the board and substantially parallel to the front face of the board, a first bearing sleeve mounted on said horizontal rail, a vertical rail supporting housing frame adjustably mounted on said first bearing sleeve, a vertical rail lying in a plane substantially perpendicular to the horizontal rail and fixed to the vertical rail supporting housing frame, a tubular brace extending from said vertical rail supporting housing frame to adjacent the free end of the vertical rail and fixedly secured to said housing and to said free end of said vertical rail, a roller adjustably mounted on said vertical rail for supporting the free end of the said vertical rail, a second bearing sleeve slidably mounted on said vertical rail, said second bearing sleeve having a circumferential clamp, a drafting head adjustably mounted on said circumferential clamp for accurate indexing thereof with respect to the axes of said horizontal and vertical rails, and drawing guide means on said drafting head for guiding a marking instrument, horizontal motion locking means on said first bearing sleeve engageable with the horizontal rail an operating lever on said first bearing sleeve to operate said horizontal motion locking means, means on said brace rod for controlling said horizontal motion locking means operating lever including a rod slidable in said tubular

brace, a handle slidably mounted on said tubular brace and operatively connected to said slidable rod, said slidable rod being operatively connected to said operating lever on said first bearing sleeve, vertical motion locking means on said second bearing sleeve for locking motion of said second bearing sleeve relative to said vertical rail whereby accurate vertical and horizontal lines may be drawn by locking one of the horizontal and vertical motions, respectively, while permitting free movement of the other respectively, so that a marking instrument can be placed on a marking edge of a line guiding means in the vertical direction or in the horizontal direction respectively to produce accurate vertical and horizontal lines, respectively by the vertical and horizontal motions of the drawing guide means respectively.

10. A carriage for longitudinal movement on a rail comprising a bearing support sleeve of C-shaped cross section, a roller support of C-shaped cross section mounted on each end of said C-shaped sleeve with the radial openings in said sleeve and said roller support registering whereby the rail support may be located on the rail in alignment with the radial openings to permit the bearing housing to move longitudinally of the rail, an elongated spring member of U-shaped cross section in which one outer surface is convex and the other outer surface is concave with the concave leg being longer and having a flange extending toward said convex leg, said spring being mounted in said bearing sleeve with the bight portion adjacent the radial openings, an adjusting screw mounted in said C-shaped sleeve and engaging the bight portion of said spring, a lock lever pivotally mounted on said sleeve in a plane parallel to the axis thereof and with the pivot adjacent the other leg of the C-shaped sleeve and one end of said lever engaging said flange of said U-shaped spring member whereby said U-shaped spring member is retained by spring pressure between the said adjusting screw and one end of said lever, said lever providing for motion to permit the concave section of said U-shaped spring to engage said rail and arranged to move said convex section of said U-shaped spring to disengage said rail to thereby lock and unlock the relative motion between said sleeve and said rail, said screw providing for adjustment for properly locating said spring in proper operative relation.

11. The invention according to claim **10** in which said sleeve is provided with an extension extending beyond one end thereof and said extension and said sleeve are provided with mounting bosses, a vertical rail supporting frame adjustably mounted on said bosses, a bell crank lever pivotally mounted on the boss adjacent said first lever, a pin and slot connection between one arm of said bell crank lever and said lock lever, the other arm of said bell crank lever being provided with an arcuate slot receiving said boss on said extension, and a reversely bent flange on the end of said second arm of said bell crank lever having an aperture for reception of a pin receivable therein, a pin in said aperture and a rod secured to said pin movable in substantially straight line transverse to said pin for actuation of said bell crank lever.

12. A brake for retaining a carriage against longitudinal movement on a rail comprising a carriage having a sleeve surrounding a portion of the rail, a U-shaped spring mounted on said carriage with the legs of the spring being arcuate about a substantially identical center when in operating position, the outer surface of one leg being convex and the outer surface of the other leg being concave, said sleeve having a fixed concave surface for engaging the convex spring surface on the one leg of the U-shaped spring, the concave leg serving as a brake shoe being adapted to engage the rail, lever means on said carriage for engaging the free end of the concave leg, the concave leg having an extension at its free end extending toward the convex leg for engaging the lever, an adjusting screw mounted in said carriage and engaging the bight portion of the spring for properly centering the spring so that the contacting surface of the concave leg on the lever may produce the proper release of the brake.

13. Brake operating means for a carriage movable along a rail comprising a rail, a carriage movable on said rail, a rail engaging spring of sufficient bias to retain the carriage against movement along the rail and mounted on said carriage and serving as a brake, a lever pivotally mounted on the carriage and engageable with the spring to move the spring against the bias thereof to release the spring from the rail and permit movement of the carriage along the rail, a bell crank lever pivoted adjacent the pivot of the first lever and having one arm extending in the same general direction as said first lever, connection means between said one arm of said bell crank lever and said first lever whereby pivotal movement of said bell crank lever will cause pivotal movement of said first lever and thereby control said brake, a tubular brace extending from said carriage, a slidable brake operating rod in said tubular brace, a connection between the second arm of said bell crank lever and said brake operating rod, whereby said bell crank lever can be operated at a distance from said carriage along said tubular brace, a longitudinally extending slot in said tubular brace, a tubular handle slidably mounted on said tubular brace, connecting means between said tubular handle and said brake operating rod and extending through said longitudinally extending slot and positively connecting said handle to said slidable brake operating rod whereby the sliding movement of said handle will cause movement of said brake operating rod and thereby of said bell crank lever, said first lever and said brake thereby providing for control of said brake at a substantial distance from said carriage.

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