No. 842,662. PATENTED JAN. 29, 1907.

J. A. HEYDRICK.

DRAFTING INSTRUMENT.

APPLICATION FILED FEB. 17, 1905.

6 SHEETS—SHEET 1.

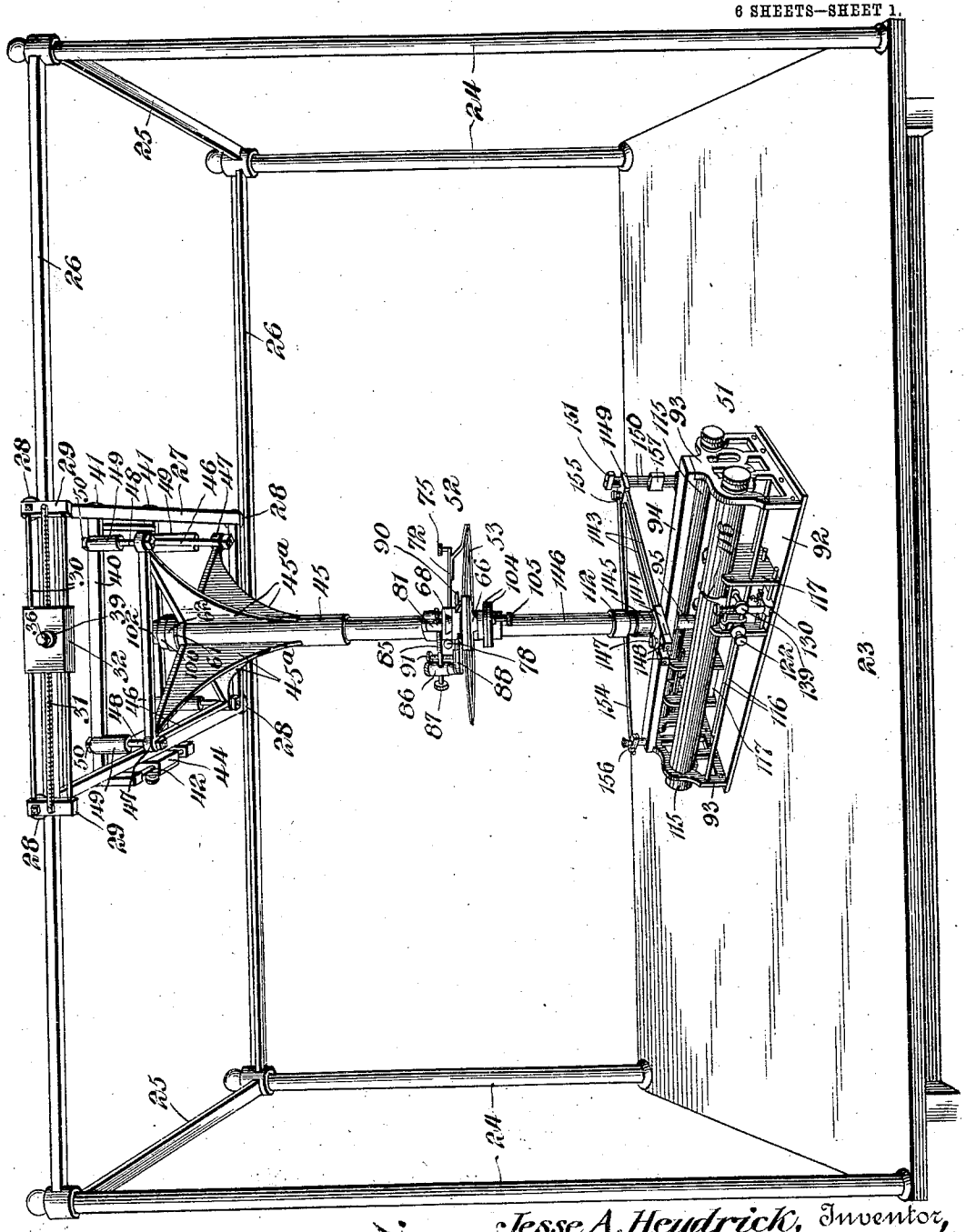


Fig. 1.

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6 SHEETS—SHEET 2.

Fig. 2.

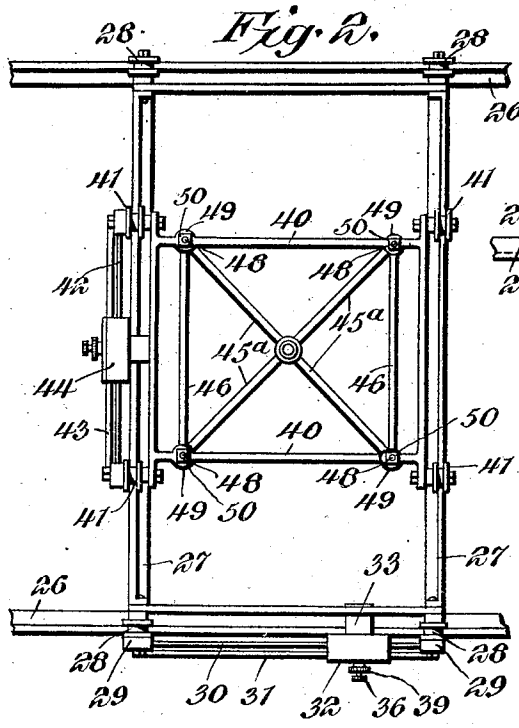


Fig. 3.

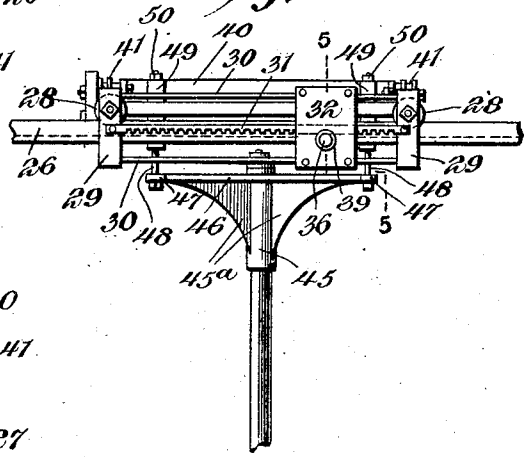


Fig. 3a.

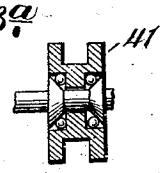


Fig. 5.

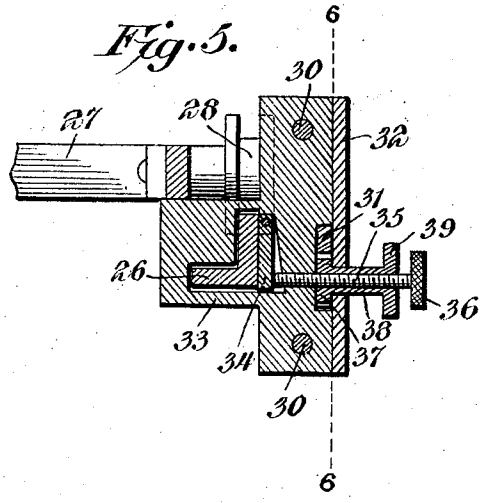
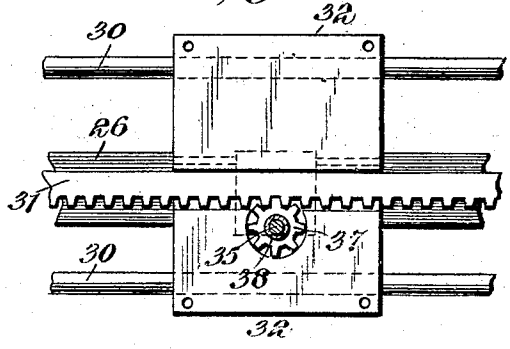


Fig. 6.



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6 SHEETS—SHEET 3.

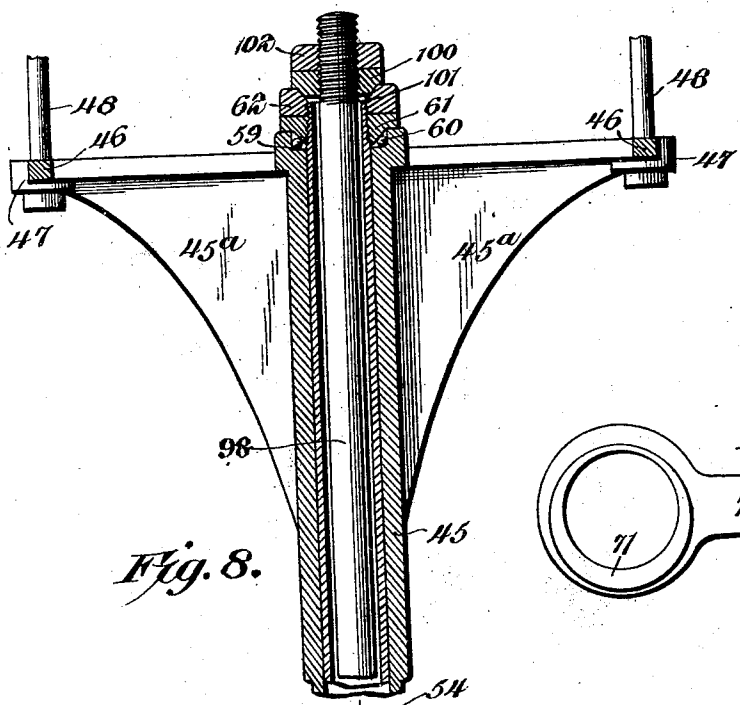


Fig. 8.

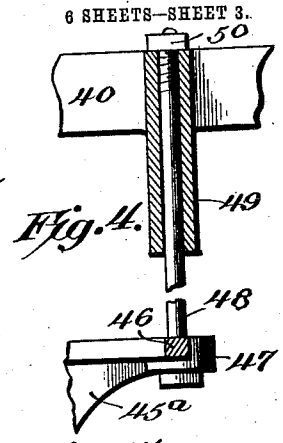


Fig. 4.

Fig. 14.

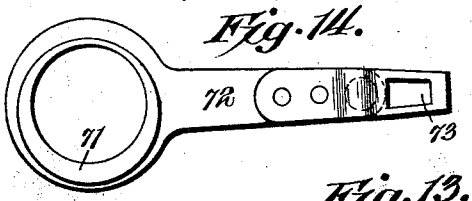


Fig. 13.

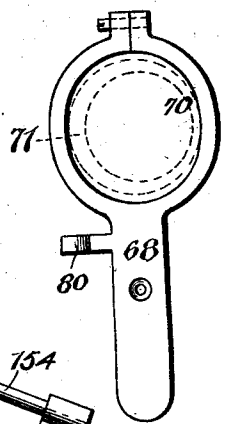
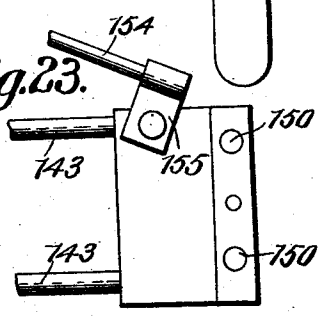


Fig. 23.



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6 SHEETS—SHEET 4.

Fig. 18.

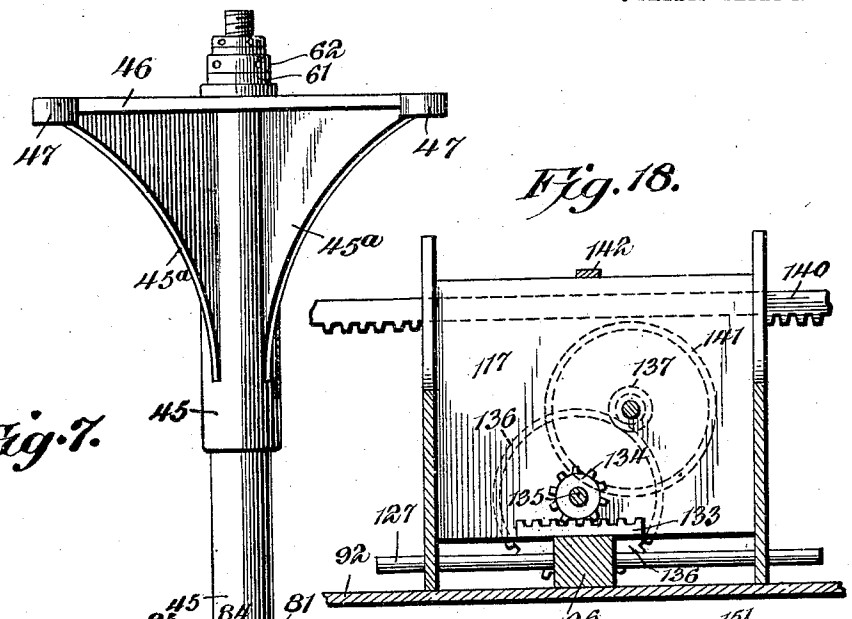


Fig. 7.

Fig. 21.

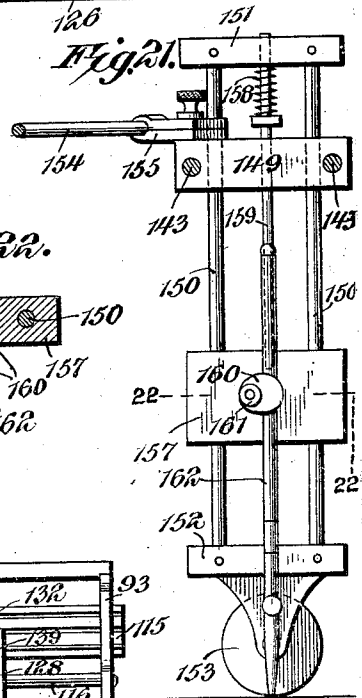
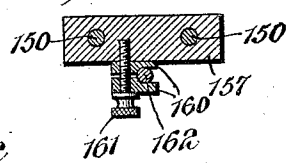
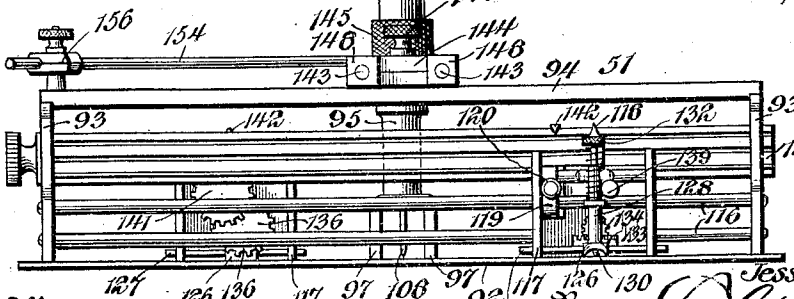


Fig. 22.





Witnesses

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6 SHEETS—SHEET 5.

Fig. 10.

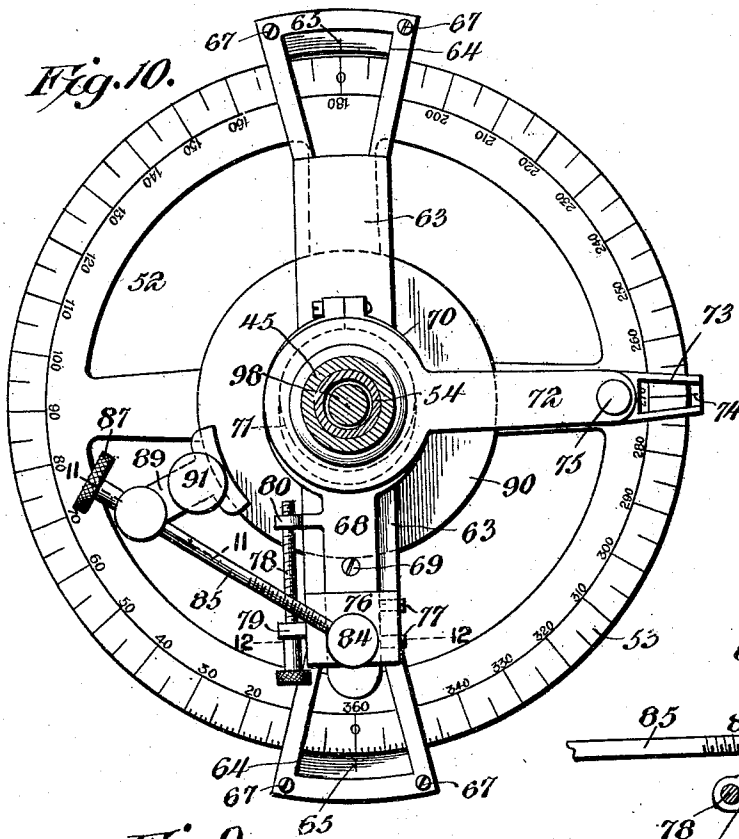


Fig. 11.

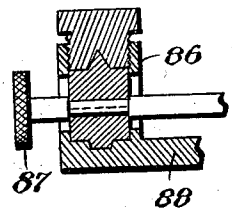


Fig. 12.

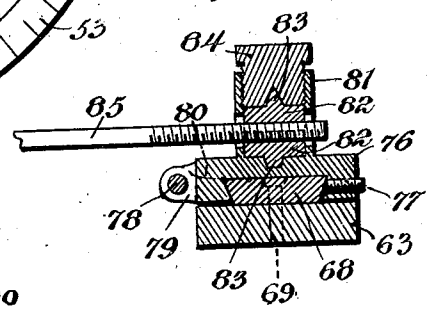
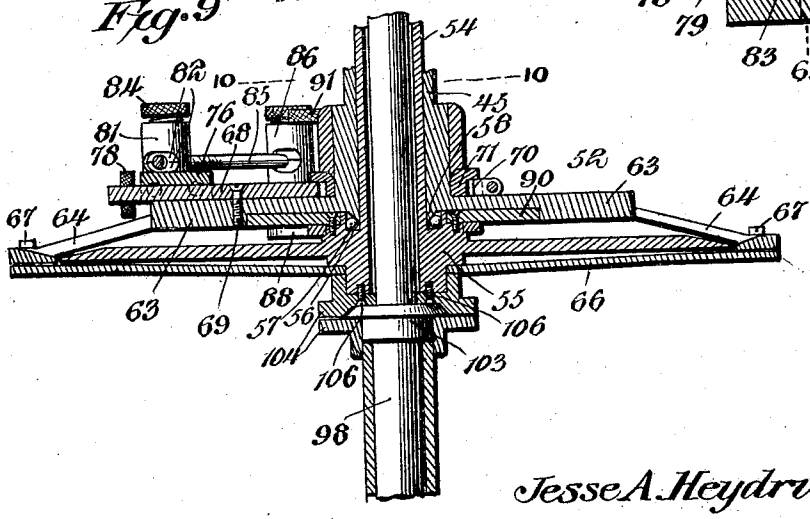


Fig. 9.



Witnesses

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No. 842,662. PATENTED JAN. 29, 1907.

J. A. HEYDRICK.

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6 SHEETS—SHEET 6.

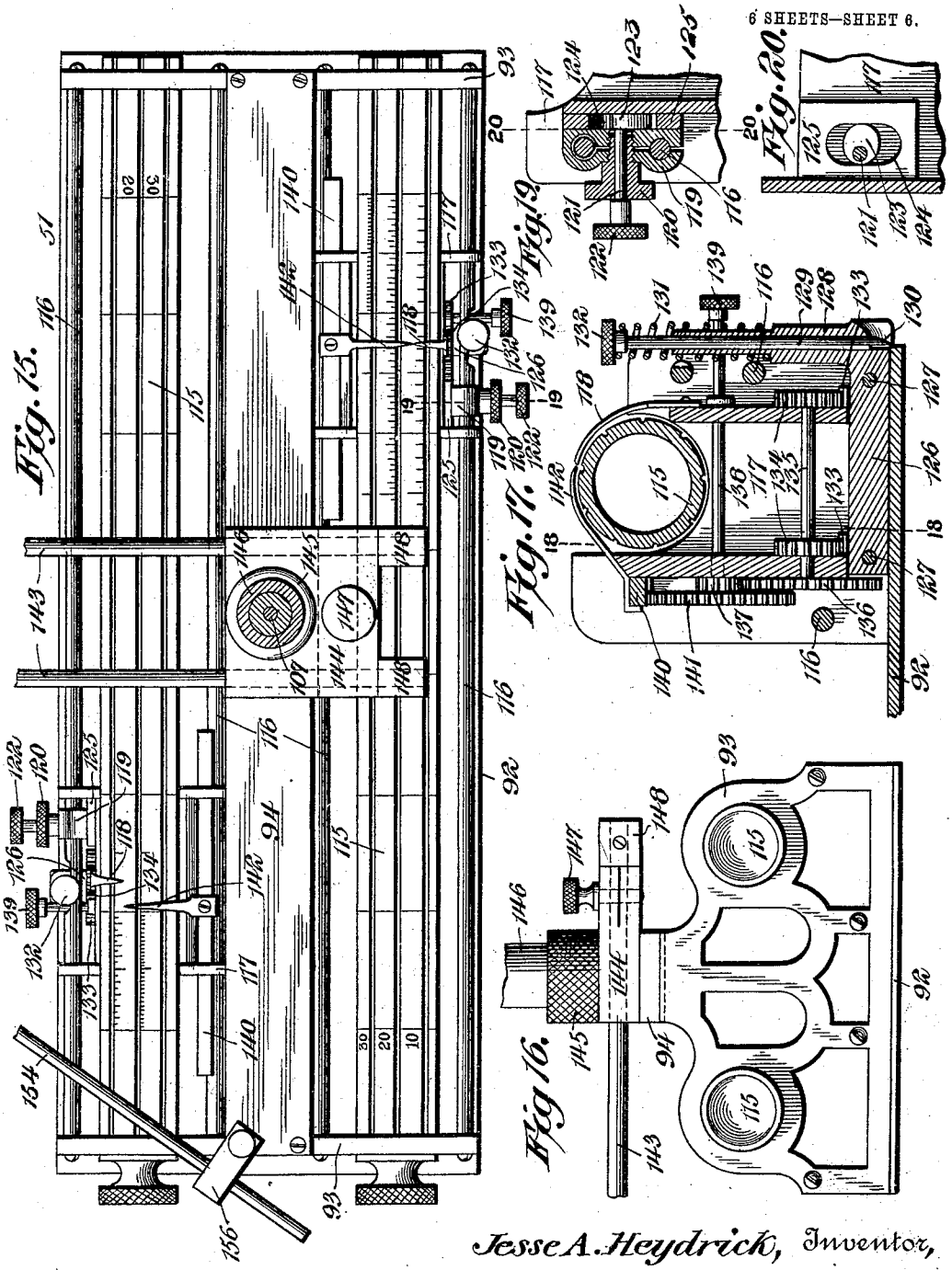


Fig. 15.

Fig. 19.

Fig. 20.

Fig. 17.

Fig. 16.

Witnesses

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UNITED STATES PATENT OFFICE.

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DRAFTING INSTRUMENT.

No. 842,662. Specification of Letters Patent. Patented Jan. 29, 1907.

Application filed February 17, 1905. Serial No. 246,107.

To all whom it may concern:

Be it known that I, JESSE A. HEYDRICK, a citizen of the United States, residing at Butler, in the county of Butler and State of Pennsylvania, have invented a new and useful Drafting Instrument, of which the following is a specification.

The present invention has particular reference to mechanism for plotting, producing drawings, and also reproducing drawings on enlarged or reduced scales and other work of an analogous nature.

One of the objects of the invention is to provide mechanism for effecting the various computations and securing the different stations and positions for architectural, engineering, and mechanical drawings with the utmost accuracy and expedition, the various manipulations necessary being easily comprehended, readily effective, and involving no intricate preliminary computations.

Another object is to provide plotting mechanism and indicating means operating from a relatively fixed meridian or index, but wherein said mechanism or means may be readily adjusted so that the said mechanism will properly operate with respect to any other meridian desired, at the same time leaving the indicating means in its original relation to be operated in the usual manner, thus avoiding any difficulties in operating the mechanism from a different meridian or index.

Still another object is to provide, in connection with plotting mechanism, proportioning means of a novel nature whereby drawings may be reproduced accurately on enlarged or reduced scales.

A further object is to provide novel means for securing angles of any size, including those containing fractions of seconds, said means dispensing with the necessity of a vernier and the confusing operations thereof.

There are other features also involved which will appear when the nature of the invenion as exemplified in the embodiment herewith presented is made clear, and it may also be stated that various features of the invention as herein set forth and claimed are clearly applicable to measuring and computing mechanisms, as will be clearly apparent to those skilled in the art.

The form of construction that is at present considered preferable is illustrated in the accompanying drawings and is described in the following specification; but an inspection of the claims hereto appended will indicate that the invention is by no means limited to the structure set forth, but is open to various changes and modifications.

In the drawings, Figure 1 is a perspective view of the complete apparatus. Fig. 2 is a top plan view of the movable carriage-support and carriage located thereon. Fig. 3 is a view in elevation of the same. Fig. 3ª is a detail sectional view showing one of the ball-bearing rollers or wheels for the carriage-support and carriage. Fig. 4 is a detail sectional view on an enlarged scale, showing one of the connections between the hanger-bracket and carriage. Fig. 5 is a detail sectional view of the carriage-adjusting means taken on the line 5 5 of Fig. 3. Fig. 6 is a sectional view on the line 6 6 of Fig. 5. Fig. 7 is a view in elevation, on an enlarged scale, of the limb-support and indicating means or protractor therefor. Fig. 8 is a vertical sectional view through the same. Fig. 9 is a detail sectional view taken at right angles to Fig. 8. Fig. 10 is a cross-sectional view taken on the line 10 10 of Fig. 9. Fig. 11 is a detail sectional view through one of the posts of the adjusting means, said section being taken substantially on the line 11 11 of Fig. 10. Fig. 12 is a similar view taken on the line 12 12 of Fig. 10. Fig. 13 is a plan view of the second adjusting-lever. Fig. 14 is a similar view of the seconds-hand and cam coacting with said lever. Fig. 15 is a plan view of the limb and proportioning means. Fig. 16 is an end elevation of the same. Fig. 17 is a cross-sectional view through said limb and proportioning means. Fig. 18 is a sectional view taken on the line 18 18 of Fig. 17. Fig. 19 is a detail sectional view on the line 19 19 of Fig. 15, showing the adjusting and clamping means for one of the indicators. Fig. 20 is a detail sectional view on the line 20 20 of Fig. 19. Fig. 21 is a front elevation of the compass-pen employed in connection with the structure. Fig. 22 is a sectional view on the line 22 22 of Fig. 21. Fig. 23 is a top plan view of the structure shown in Fig. 21.

Similar reference-numerals designate corresponding parts in all the figures of the drawings.

In the embodiment illustrated a suitable drafting-table 23 is employed, at the corners

of which are located upright standards 24, those at the corresponding ends being connected by tie-rods 25 and those at the corresponding sides being connected by parallel overhead tracks or rails 26, preferably formed of angle or ⊥ bars, the tracks being elevated a sufficient distance to leave an unobstructed working space above the table, or, in other words, permit a draftsman to work without inconvenience beneath the same and over the table 23.

A movable overhead carriage-support is employed consisting of an angular frame 27, having at its ends ball-bearing wheels 28, that run upon the upturned flanges of the tracks 26. Secured to the carriage-supporting frame at one end are depending blocks 29, located outside the adjacent track and connected by guide-rods 30 and a rack-bar 31, the latter being located between the former. A clamp in the form of a boxing 32 is slidably mounted on the rods 30 and the rack-bar 31 and has a portion 33 slidably receiving the adjacent track 26. The portion 33 coacts with a suitable plate 34, adapted to clamp upon the track, the same being operated by a screw 35, projecting from the boxing and having a knurled head 36. A pinion 37, located within the boxing 32, engages the rack-bar 31, said pinion being carried by a sleeve 38, that is revoluble upon the screw 35 and has an exposed head 39 arranged contiguous to the head 36. It will thus be seen that while the carriage is freely movable upon the tracks 26 by locking the boxing 32 to one of said tracks the carriage may be clamped against free movement and then may be manually adjusted by turning the head 39, the latter operating the pinion 37, and thereby moving the rack through the boxing, and consequently moving the carriage-support.

The frame 27, as its name indicates, constitutes a support for an overhead carriage, consisting of a frame 40, having ball-bearing wheels 41 corresponding in structural arrangement to those of the support and running upon the side rails of the frame 27, which are also preferably constructed of angle or ⊥ bars. It will thus be clear that the carriage has a movement at right angles to the path of movement of the carriage-support. One end of the carriage-frame is provided with guide-rods 42 and a rack-bar 43. A boxing 44, similar in all respects with the boxing 32 of the carriage-support, slidably receives the rod 42 and rack 43 and contains the same clamping and adjusting mechanism. It is believed to be unnecessary to further describe the same, as it is believed the arrangement will be clear by reference to Figs. 1 and 2. Thus it will be seen that the carriage is capable of being moved in any direction over the drafting-table 23, as said carriage has a movement of its own in one direction upon the carriage-support 27 and said carriage-support has a movement with the carriage in a transverse direction. Furthermore, the overhead structure is important, as it is thus completely out of the way of the draftsman using the table.

Suspended from the carriage 40 is a depending non-rotatable supporting-bracket comprising a tubular portion 45, having angularly-disposed outstanding webs 45^a at its upper end connected by bars 46 and having eyes 47 at their outer ends. Through these eyes are passed vertical adjusting-bolts 48, which pass through depending sleeves 49, forming part of the carriage-frame 40, the bolts having adjusting-nuts 50 threaded upon their upper ends and resting on the frame. Thus by adjusting the nuts 50 upon the bolts 48 the depending supporting-bracket may be elevated or lowered. Furthermore, it will be apparent that this bracket, while movable in any direction over the table with the carriage, is non-rotatable, or, in other words, has a "fixed meridian." The depending bracket 45 45^a constitutes the direct supporting means for a limb, (designated as a whole by the reference-numeral 51,) that operates over the table 23, and a protractor, (designated as a whole by the reference-numeral 52) the latter constituting means for determining the angles of the former.

The protractor consists of a circular dial-ring 53, which, as shown in Figs. 8 and 9, is carried by the lower end of a sleeve 54, journaled within the tubular portion 45 of the depending bracket, said sleeve having at its lower end a head 55, provided in its upper face with a ball-race 56, containing balls 57, which balls operate against a cone 58 on the lower end of the tube portion 45. The upper end of said tube portion is provided with a ball-race 59, containing balls 60, against which bears a cone-nut 61, that is threaded upon the upper end of the sleeve 54 and is locked by a jam-nut 62. It will thus be apparent that the dial 53 is capable of being freely rotated, as the sleeve 54, carrying it, can turn without interference in the tube 45, and the friction is reduced to a minimum by the ball-bearings. The said protractor-dial can, however, be adjustably locked to the tube portion 45, and the means employed for this purpose may be described as follows: The lower end of the tube portion 45 has, as shown in Fig. 9, an integral meridian or index arm 63, extending on opposite sides of said tube portion and, as shown in Fig. 10, extending over the dial-ring 53 and having at its ends openings 64, exposing therein the diametrically opposite portions of the ring, the ends of said arm being provided at the openings with meridian or index lines 65. The arm 63 is braced at its ends by an idler-plate 66, journaled upon the lower end of the head 55 of the sleeve 54 and extending outwardly

beneath the dial-ring, being suitably secured to the ends of the arm 63 by screws 67 or other suitable devices. Pivoted between its ends upon the arm 63 at one side of the tube portion 45 is a seconds adjusting-lever 68, the pivot thereof being shown at 69. The inner end of this lever is in the form of a split ring 70, loosely surrounding the tube portion 45 and receiving the cam 71 of a seconds adjusting-hand 72, the latter being also journaled upon the lower portion of the tube 45 within the ring 70. The hand 72 projects outwardly over the protractor-ring 53, being provided with an opening 73, movable over the scale on said ring and having an indicating-line 74 coacting therewith. A suitable handle-knob 75, carried by the hand 72, affords convenient means for actuating the same. Thus it will be seen that by swinging the hand 72 in one direction or the other the cam carried thereby will swing the lever 68 upon the meridian-arm 63. Slidably mounted on the adjusting-lever 68 and movable toward and from its axis 69 is a supporting-block 76, adapted to be secured at any point along said lever by means of screws 77, threaded through the block and engaging the same and being adjusted by a screw 78, one end of which is journaled in an ear 79, carried by the block, the other end being threaded into an ear 80, carried by the lever 68. The block 76 carries a threaded bearing peculiarly constructed and shown in detail in Fig. 12. An upstanding socketed stud 81 is carried by the block 76 and is interiorly threaded. In the same is arranged a nut comprising sections 82, having, respectively, upstanding and depending projections 83, one of which is received in a socket formed within the stud, the other being formed in a plug 84, threaded into the upper end of said stud, and thus clamping the sections of the nut together. Said nut is thus capable of turning on an upright axis and has threaded into the same an adjusting-screw 85, passing through suitable openings in the stud 81. This screw 85 is also journaled in another socketed stud 86 in a manner similar to that shown in Fig. 12 and illustrated in Fig. 11, the said screw being provided with a suitable knurled head 87. The socketed stud 86 is carried by an arm 88, loosely journaled upon the head 55 of the protractor-carrying sleeve 54. The arm carries a clamping-plate 89, arranged to clamp upon a holding-disk 90, secured to the dial-ring head 55. The plate 89 is moved into operative or clamping engagement with the disk by a suitable screw 91.

From the above description, taken in connection with the drawings, it will be seen that the clamping arm and plate 88 and 89 are adjustably connected with the non-rotatable tube portion 45 of the depending bracket through the medium of the screw 85, the lever 68, and the arm 63, so that when said arm 88 is clamped to the disk 90 the dial-ring will also be held against rotation; but even after it has been clamped the dial-ring may be adjusted by means of the screw 85, in which event the disk 90 will be turned, or by swinging the seconds-hand 72, this latter movement effecting the swinging of the lever 68 through the medium of the cam 71, and consequently moving the screw 85 bodily in a longitudinal direction with the corresponding movement of the arm 88 and disk 90. On the other hand, if the disk 90 is unclamped by loosening the screw 81, and thus releasing the plate 89 therefrom, the protractor dial-ring can be readily turned without interference in any direction.

The limb or element coacting directly with the table is in the form of a plate 92, having right-angularly-disposed straight edges, along which a pencil, pen, or other marking implement may be drawn. This plate carries a frame consisting of end pieces 93, connected by a longitudinal bar 94. A tubular connection 95 is made between the center of the bar 94 and the center of the plate 92, the latter having an opening 96, straddled by legs 97, formed at the lower end of the tubular connection 95, and thus permitting a sight of the exact center of the limb. This limb is suspended just over the surface of the table or paper placed thereon by means of a rod 98, the lower end of which is threaded, as shown at 99, into the tubular connection 95, the upper portion extending longitudinally and centrally through the protractor-carrying sleeve 54 and having its upper end threaded to receive a cone-nut 100, seated in a socket 101 in the jam-nut 62 of the sleeve 54. A locking-nut 102, threaded upon the upper end of the limb-supporting rod 98, holds the nut 101 against movement, while the cone of said nut 101 properly centers the rod with respect to the remainder of the mechanism. For the purpose of securing the protractor-carrying sleeve and the limb against relative rotation the limb-supporting rod is provided just below the head 55 of the protractor-carrying sleeve with an annular flange 103, and a pair of clamping members 104, embracing said flange, are arranged to be clamped thereto by screws 105, one of the clamp members being secured directly to the head 55 of the protractor-carrying sleeve by any suitable means—as, for instance, screws 106. Thus by loosening the clamp members 104 and the nuts 101 and 102, the limb-supporting rod 98, and consequently the limb, may be turned with respect to the protractor; but when the rod is clamped to the tube and protractor the limb and protractor must rotate together.

For the purpose of marking the exact center of the apparatus a marking-stem 107 is slidably mounted in the lower end of the rod 98 and the tubular connection 95, this stem

having a lower pointed end 108, that is movable downwardly through the opening 96 of the plate 92, so as to prick the paper located therebeneath. It is normally held in elevated position, however, by a spring 109, coiled about the stem, the lower end of said spring bearing upon a block 110, threaded into the tubular connection 109, the upper end bearing against an enlargement 111 upon the stem. The upper end of said stem is connected to an actuating-collar 112 by means of a cross-pin 113, passing through the upper end of said stem and the collar, said cross-pin being movable in a slot 114, formed in the rod.

With an understanding of the foregoing it is believed that the manner in which the machine may be employed can now be explained. For ordinary work the side edges of the limb-plate 92 are located parallel to the vertical plane in which the zero-marks of the protractor-scale are disposed, and thus when said zero-marks are alined with the index-marks 65 of the meridian-arm 63 the said side edges of the limb-plate 92 will be parallel to the meridian or index. In this position the limb can be moved to any position upon the table because of the relatively movable carriage and carriage-support, and, moreover, may be centered accurately by means of the pointer-stem 107. If now it is desired to project a line at an angle from the meridian, it is only necessary to loosen the clamp 89 from the disk 90, whereupon the protractor-ring 53 will be released and may be turned to the desired degree. As the limb is secured to the protractor through the mechanism already described, of course the side edges of the limb-plate 92 will be moved to a corresponding angle. In operating the mechanism the dial-ring is moved by hand to substantially the degree indicated by the marks 65, and afterward it is clamped by means of the arm 88 and clamp-plate 89. A minute adjustment of the dial can then be secured by means of the screw 85 until the desired degree is exactly obtained. If, for instance, small fractions of a degree are involved, such as seconds or even fractions of such seconds, the same is readily obtained through the medium of the seconds-arm 72, the cam 71, and lever 68. The block 76, as already stated, is adjustable upon the lever 68 and may be moved toward and from the axis 69 of the lever. In actual practice this position is such that when the seconds-hand 72 is swung a certain number of degrees the lever 68 will swing sufficiently to move the dial-ring a predetermined number of seconds or fractions thereof. Thus, for instance, if the block 76 is set at the required distance from the axis 69 of the lever the dial may be turned one second to each degree of movement on the part of the hand 72. Consequently it will be observed that outside of the fine adjustment obtained by the screw 85 a much more minute movement is secured by the seconds-hand. The result is that the use of the vernier is dispensed with, together with its confusing computations, and while a minute and accurate movement of the protractor is obtained the movement of the actuating means therefor is sufficient to enable it to be operated without the use of a magnifying-glass. Furthermore, a very important feature of this mechanism resides in the fact that the parts operated always move in the same direction as the actuating devices moving them, so that there is no danger of confusion due to reverse movements, particularly where such movements are so small as to be practically indistinguishable. Furthermore, in this connection it is desired to call attention to the structure of the adjusting means between the clamp and the meridian-arm, or rather the adjusting-lever, 68. The screw 85 must be so arranged that there is no play on the parts, and, furthermore, must have tight enough bearings so that it will not become accidentally turned. This is fully provided for by the bearings shown in Figs. 11 and 12, wherein the wear and all looseness can be readily taken up. The various parts, furthermore, are properly centered, so as to be accurate, and the main members, which are relatively movable, are provided with ball-bearings to secure their easy operation.

It often happens that in fine kinds of work—as, for instance, in reproducing drawings—the indicia or meridian of the original will not correspond to the meridian or index of the apparatus, as shown by the mark 65 65 of the meridian-arm 63. In order to compensate for this and yet leave the indicating mechanism of the protractor in the same relative positions and operating in the same manner as above described, the limb 51 is made rotatable with respect to the dial-ring 53. Thus assuming that the meridian from which a drawing is to be made or reproduced is at an angle of thirty degrees from the meridian of the apparatus the limb and protractor-dial may be swung together until the thirty-degree angle is shown upon the protractor. The limb-supporting rod 98 can then be released from the protractor-supporting sleeve 54 by unclamping the flange 103 of said rod and by loosening the nuts 101 and 102. The dial-ring can then be moved back to its original position, with the zero-marks in alinement with the mark 65 of the meridian-arm, after which the limb and dial-ring are again fastened against relative rotation. The two parts can thereupon be revolved together and angles plotted by using the protractor in the ordinary manner, the limb, however, working from the new meridian, as will be apparent to those skilled in the art.

For the purpose of determining the length

of lines, as well as proportioning the same in reducing and enlarging drawings, suitable mechanisms are carried by the limb, and said mechanisms will now be described. As the mechanisms are duplicates in all respects, it is believed that a description of one will be sufficient for an understanding of both. The end pieces 93 of the limb constitute journals for a rotatable scale-cylinder 115, provided with scales of different proportions. Beneath this cylinder is slidably mounted on guide-rods 116 a carriage 117, said carriage having a pointer 118, secured rigidly thereto and arranged to coact with any of the scales. The carriage is adapted to be locked at any point along the scale-cylinder by means of a split clamp 119, embracing certain of the rods 116 and operated by a thumb-screw 120. This clamp is not secured directly to the carriage, and the screw 120 has journaled therein a shaft 121, carrying at its outer end a knurled wheel 122 and at its inner end a cam 123, operating in a slot 124 against the walls thereof, said slot being formed in a plate 125, that is secured directly to the carriage. A supporting-bar 126 is slidably mounted in the lower portion of the carriage and is movable longitudinally of the scale-cylinder, being carried on guide-rods 127, forming a part of the carriage. This bar has at its front end an upstanding sleeve 128, in which is slidably mounted a vertically-disposed indicator 129, having a lower sharpened pricking-point 130, the stem being held in elevated position by a coiled spring 131, bearing beneath a head 132, carried by the stem. The bar 126 is provided with transversely-disposed racks 133, engaged by pinions 134, carried on a shaft 135, journaled in the carriage. The shaft is also provided with a large gear-wheel 136, meshing with a pinion 137 on another shaft 138, journaled transversely in the carriage and having a projecting portion provided with a head 139. A rack-bar 140, slidably mounted on the rear of the carriage and movable longitudinally of the scale-cylinder, is in mesh with a gear-wheel 141, that is also carried by the actuating-shaft 138. This rack-bar carries a forwardly-extending pointer 142, the free end of which is located over the scale-cylinder just in rear of the free end of the pointer 118. The gearing described is such that the pointer 142 will move ten times the distance of the indicator-stem 129, this ten-to-one movement being provided for a purpose hereinafter described. As already stated, a set of these mechanisms is placed upon either side of the limb, so that the pointers 130 thereof will coact with the adjacent longitudinal straight-edge. If now it is desired to measure off a predetermined distance along the straight-edge, the carriage is moved until the pointer 118 is at one point and the stem 129 is then depressed, thereby pricking the paper beneath the same. After this the carriage is moved along its scale the desired distance and the other point pricked in the same manner. If such distance involves a minute calculation, the same may be readily secured by means of the coacting pointers. Thus, for instance, if it is desired to measure one inch and one-hundredth the scale-cylinder is turned until the scale showing ten divisions to the inch is disposed beneath the coacting ends of the pointer. The carriage is then moved until the pointer 118 is at the starting-point, and after this point has been pricked upon the paper the carriage is moved until the said pointer 118 is contiguous to the one-inch point. It is then locked, by means of the clamp 119, to the rod 116, after which the carriage is adjusted by means of the cam 123 until the pointer 118 is exactly at the one-inch distance. This will place the indicator 129 at the same distance from the original mark. The additional distance of one-hundredth of an inch is then secured by rotating the head 139 of the shaft 138 until the pointer 142 has been moved to one-tenth of an inch upon the exposed scale. This movement on the part of the pointer indicates a one-tenth part of the movement on the part of the indicator-stem 129, or, in other words, said stem 129 has now been moved one-hundredth part of an inch, and the point pricked will be at the desired distance. This is merely a simple example that can be readily understood from the drawings, and it will be apparent that with scales of more minute divisions the marks may be made with the utmost accuracy.

Either set may be employed for the above purposes, and, further than this, both sets can, if desired, be used in enlarging and reducing drawings, for having obtained the length of a line by means of one set of mechanisms from an original drawing the apparatus can be shifted over to the new drawing being reproduced and the other set employed in reproducing the lengths, but on a different scale. Thus, for instance, if the length of a certain line on an original drawing be found to be one inch and one-twentieth, or, in other words, twenty-one twentieths upon a scale, and it is desired to reproduce the drawings on a scale as large again, the tenth scale of the other mechanism is employed, and the distance is laid out on this, scale of twenty-one tenths.

So far as thus described the apparatus is particularly useful in plotting and drawing straight lines, and in this connection it may be stated that parallel lines may be made with great rapidity and accuracy by merely locking the limb against rotation and moving it over the board. Means are, however, provided for inscribing circles, curves, and the like, and this means is preferably constructed as follows: A beam is employed consisting of

spaced rods 143, the inner ends of which are slidably mounted in a block 144, rotatably mounted on the lower end of the limb-supporting rod 98 and capable of being clamped against rotation by a nut 145, that is threaded on a sleeve 146, located beneath the flange 103 of said rod. The rear portion of the block 144 is split so that it can be clamped upon the said rods 143, this clamping action being secured through the medium of a screw 147, connecting the sections of the block. The outward movement of the limb is limited by stop-blocks 148, carried by the inner ends of the rods. The outer ends of said rods are connected by a head 149, in which is mounted a vertical frame consisting of side rods 150, connected at their upper ends by a cross-bar 151 and at their lower ends by a bracket 152, to which is journaled a roller 153. While the beam 143 and the frame carried thereby are capable of being swung around the limb 51, they are ordinarily held stationary with respect thereto, not only by the clamping-nut 147, but also by a brace-rod 154, connected by an ear 155 to the head 149, the rear end of said rod being attached by a clamp 156 to one end of the bar 94 of the limb, said brace-rod being detachable from the clamp. Slidable in a vertical direction on the rod 150 is a carrier-block 157, yieldingly urged in a downward direction by a spring 158, surrounding a shank 159, that is carried by the carrier-block 157 and slidably passes through the head 149 and the cross-bar 151. This carrier-block is provided with a clamping device consisting of leaves 160, connected by a screw 161, the leaves being arranged to receive between them a suitable marking implement, such as a pencil or ordinary ruling-pen 102. Now it will be clear that this latter-described structure constitutes, in effect, a beam-compass, the radius of which can be varied by adjusting the rod 143 in the holding-block 144. Consequently circles and curves may be conveniently made, the yielding pressure of the carrier upon the marking device effecting the proper engagement of the same with the paper. When not wanted for use, this beam-compass may be swung around longitudinally of the bar 94, where it is out of the way.

It will thus be seen that apparatus is provided, by means of which a comparatively inexperienced person may plot, design, and draw with accuracy and speed and with practically no mental effort or exertion.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In apparatus of the character described, the combination with a fixed drafting-table, of overhead supporting means elevated above the table, leaving an unobstructed working space for the draftsman over said table, and plotting mechanism movably suspended from the supporting means, said plotting mechanism being movable over the table and comprising relatively movable elements, certain of which coact with the table, indicating means comprising relatively movable coacting scale and index devices respectively carried by said elements and located between the table and support for indicating the relative positions of the elements, and means connecting the devices for effecting the relative adjustment of said elements.

2. In apparatus of the character described, the combination with a drafting-table, of an overhead track supported above the same leaving an unobstructed working space for the draftsman over said table, and plotting mechanism movably suspended from the track and coacting with the table, said mechanism comprising relatively rotatable parts, means for indicating the relative positions of said parts, said means comprising relatively movable scale and index elements carried by said parts and disposed between the table and track, and adjusting means adjustably adjusting the elements.

3. In apparatus of the character described, the combination with a drafting-table, of standards located at the corners of the table and projecting above the same, spaced overhead tracks connecting certain of the standards, tie connections between said standards, said tracks and tie connections being of sufficient height to leave an unobstructed working space for the draftsman below the same and over the table, supporting means having wheels that run upon the tracks, and plotting mechanism suspended from the supporting means between the tracks, said plotting mechanism including relatively movable elements that are movable over the table and coact therewith, and indicating means for the elements disposed between the table and tracks.

4. In apparatus of the character described, the combination with a drafting-table, of an overhead support movable over the table in one direction, an overhead carriage movable on the support in a direction transverse to the direction of movement of the support, said support and carriage leaving an unobstructed working space for the draftsman between the same and the table, and plotting mechanism suspended from the carriage, extending across the working space and coacting with the table, said mechanism including relatively movable parts, one of which is fixed to the carriage, and means connecting the parts for relatively rotating the same, said means being located between the carriage and table.

5. In apparatus of the character described, the combination with a drafting-table, of overhead tracks supported thereover, an overhead carriage-support movable on said tracks and provided with other tracks dis-

posed in angular relation to the supporting-tracks, a carriage movable on said latter tracks, said tracks, carriage-support and carriage leaving an unobstructed working space for the draftsman over the table, and plotting mechanism suspended from the carriage, extending across said working space, and being movable over the table, said mechanism including relatively rotatable parts, one of which is fixed to the carriage, the other coacting directly with the table, an outstanding index element carried by one part, a scale-ring carried by the other part, said index element and scale-ring being disposed in coacting relation and being located beneath the carriage and over the table, and means connecting the ring and index element for relatively adjusting the said parts.

6. In apparatus of the character described, the combination with a drafting-table, of an overhead track member located above the table and leaving an unobstructed working space for the draftsman over said table, a carrier member also located over the table, said members being relatively movable, means fixing one of the members against movement with respect to the drafting-table, mechanism movable with relation to both members, a lock for securing the adjusting mechanism to one of said members, said mechanism having an adjustable engagement with the other member, and plotting mechanism supported on the carrier member, extending across said working space and coöperating with the table.

7. In apparatus of the character described, the combination with a drafting-table, of overhead supporting means fixed with relation thereto, leaving an unobstructed working space for the draftsman over the table, a carrier movable on the supporting means, a clamp arranged to be secured to the supporting means, adjusting mechanism carried by the clamp and engaging the carrier, and plotting mechanism mounted on the carrier.

8. In apparatus of the character described, the combination with supporting means, of a carrier movable thereon and having a rack, a clamp arranged to be secured to the supporting means, an actuating-pinion journaled on the clamp and engaging the rack, and plotting mechanism mounted on the carrier.

9. In apparatus of the character described, the combination with supporting means including a track, of a carrier movable on the track, a block also mounted on the track, a clamping device for securing the carrier against movement on the track, a rack-bar secured to the carrier, a pinion journaled on the block and engaging the rack-bar, and plotting mechanism supported from the carrier.

10. In apparatus of the character described, the combination with spaced tracks, of a carrier comprising a frame having rollers movable on the tracks, guide-rods also constituting a part of the carrier and arranged alongside the track, a rack-bar disposed contiguous to the guide-rods and mounted on the carriage, an adjusting-block slidably mounted on the guide-rod and the track, a clamp device carried by the block, means for moving said device into engagement with the track, an actuating-pinion having an exposed head, said pinion engaging the rack-bar and being carried by the block, and plotting mechanism supported from the carrier.

11. In apparatus of the character described, the combination with a supporting member, of a carrier member movable on the supporting member, a rack carried by one member, a pinion engaging the rack, a mounting for said pinion adjustably carried on the other member, means for securing the mounting against movement on the member carrying it and in different positions, and plotting mechanism mounted on the carrier member.

12. In apparatus of the character described, the combination with a support including relatively movable members, of a mounting adjustable on one member, a clamp for holding the mounting against movement on the member, means engaging the other member for moving the same, separately-rotatable actuating devices for the clamp and moving member, said devices having concentric axes of movement, and plotting mechanism mounted on the support.

13. In apparatus of the character described, the combination with a support including a track, of a mounting adjustable along the track, a carrier movably supported on the track and having a rack, a pinion journaled on the mounting and engaging the rack, and plotting mechanism supported on the carrier.

14. In apparatus of the character described, the combination with a support including a track, of a mounting adjustable along the track, a clamp carried by the mounting and engaging the track to secure said mounting in different positions on the track, a carrier movable on the track and having a rack located alongside the track, a pinion journaled on the mounting and engaging the rack, means for moving the clamp and pinion, and plotting mechanism supported on the carrier.

15. In apparatus of the character described, the combination with supporting-tracks, of a carrier movable thereon, adjusting means for the carrier including a clamp arranged to engage the tracks, a rack and pinion associated with the tracks and carrier, a carriage mounted on the carrier and arranged to move transversely of the supporting-tracks, adjusting means between the

carrier and carriage, said adjusting means including a rack and pinion, and plotting mechanism supported on the carriage.

16. In apparatus of the character described, the combination with spaced supporting-tracks, of a carrier having rollers movable thereon and including tracks disposed transversely of the supporting-tracks, adjusting mechanism between the supporting-tracks and carrier having a clamping engagement with one of said tracks, a carriage movable on the tracks of the carrier, adjusting mechanism between the carriage and carrier including a clamping device arranged to engage one of the tracks of said carrier, and plotting mechanism supported by the carrier.

17. In apparatus of the character described, the combination with a drafting-table, of standards extending above the same, spaced tracks supported by the standards, a carrier-frame movably mounted on the tracks and extending over the table, said carrier-frame including tracks disposed at right angles to the supporting-tracks, means for adjusting the carrier on the tracks, said means having an adjustable engagement with both the carrier and one of the tracks, a carriage movable on one of the carrier-tracks, means for adjusting said carriage upon the carrier, said means having an adjustable engagement with the carriage and the carrier, and plotting mechanism suspended from the carriage and operating over the table.

18. In apparatus of the character described, the combination with a drafting-table, of an overhead support located over the table and leaving an unobstructed working space for the draftsman beneath the same and over the table, a movable overhead carriage mounted on the support, a hanger suspended from the carriage, plotting mechanism rotatably mounted on the lower end of the hanger below the carriage and coacting with the table, and adjusting and indicating means comprising relatively movable elements respectively mounted on the hanger and plotting mechanism, and located below the carriage.

19. In apparatus of the character described, the combination with a drafting-table, of an overhead support located over the table and leaving an unobstructed working space for the draftsman beneath the same and over said table, a movable overhead carriage mounted on the support, a hanger suspended from the carriage, plotting mechanism centrally and rotatably carried by the lower end of the hanger and projecting on opposite sides thereof in coaction with the table, and adjusting means connecting the plotting mechanism and hanger and located between the carriage and table for rotating said plotting mechanism on said hanger.

20. In apparatus of the character described, the combination with a drafting-table, of overhead tracks supported over the table, an overhead carriage-support movable on the tracks and having tracks at substantially right angles thereto, an overhead carriage movable on the tracks of the carriage-support, said supporting-tracks, carriage-support and carriage leaving an unobstructed working space for the draftsman beneath the same and over the table, a hanger suspended from the carriage and depending beneath the same and the supporting-tracks, plotting mechanism rotatably suspended from the lower end of the hanger beneath the carriage and coacting with the table, coacting scales and index element carried by the hanger and plotting mechanism and located beneath the carriage and operating means connecting the hanger and the plotting mechanism and located beneath the carriage.

21. In apparatus of the character described, the combination with a table, of a carriage movably supported thereover, a hanger member, a plurality of adjusting-bolts connecting the hanger member and carriage for fixedly supporting the hanger member at different distances from the table, and plotting mechanism movable with the hanger member.

22. In apparatus of the character described, the combination with a table, of a carriage movably supported thereover and having upright eyes, of a hanger-bracket having outstanding web portions provided with eyes alined with the carriage-eyes, adjusting-bolts passing through the eyes, and plotting mechanism supported on the hanger-bracket.

23. In apparatus of the character described, the combination with a table, of an overhead support located over the table, a hanger having an upright journal-bearing, adjustable connections between the upper end of the hanger and the support, and plotting mechanism journaled in the bearing and suspended from the lower end of the hanger, said plotting mechanism coacting with the table.

24. In apparatus of the character described, the combination with a drafting-table, of an overhead support located over the table, a hanger movably suspended from the support, plotting mechanism movably mounted on the hanger below the support and coacting with the table, indicating means for the plotting mechanism located below the support, said means comprising relatively movable coacting scale and index elements mounted on the hanger and plotting mechanism respectively between the support and table, and means connecting the elements for effecting their relative movements.

25. In apparatus of the character described, the combination with a drafting-table, of an overhead support located over the

table, a hanger suspended from the support and movable thereon in any direction, drafting mechanism movably mounted on the hanger below the support and coacting with the table, indicating means between the drafting mechanism and hanger comprising relatively rotatable scale and index elements carried by the hanger and drafting mechanism respectively, said means being located between the support and table, and means connecting the scale and index elements for effecting the movement of the drafting mechanism upon the hanger.

26. In apparatus of the character described, the combination with a drafting-table, of an overhead support over the table, plotting mechanism suspended from the support and coacting with the table, said mechanism including relatively movable members, and means connecting the members below the support for effecting their relative movements.

27. In apparatus of the character described, the combination with a drafting-table, of an overhead support over the table, plotting mechanism suspended from the support and coacting with the table, said mechanism including an upper hanger member and a lower drafting member rotatably suspended therefrom, and actuating means connecting the members below the support and above the table for effecting their relative rotation.

28. In apparatus of the character described, the combination with a drafting-table, of an overhead support over the table, plotting mechanism suspended from the support and coacting with the table, said mechanism including an upper hanger member depending below the support and a lower drafting member rotatably suspended from the lower end of the hanger member and coacting with the table, and actuating and indicating means connecting the members below the support and above the table for respectively effecting their relative rotations and indicating their relative positions.

29. In apparatus of the character described, the combination with supporting means, of plotting mechanism movable with respect to the supporting means, and adjusting means for the plotting mechanism including an adjusting-screw and split revoluble devices, one of which rotatably receives the screw, the other having a threaded engagement therewith, said devices respectively having connections with the supporting means and plotting mechanism.

30. In apparatus of the character described, the combination with supporting means, of plotting mechanism movable with respect thereto, adjusting means for the plotting mechanism including mountings carried respectively by the means and mechanism and adjustable thereon in angularly-disposed paths, bearings rotatably secured in the mountings, and a screw rotatably mounted in one of the bearings and having a threaded engagement with the other.

31. In apparatus of the character described, the combination with supporting means, of plotting means rotatably associated therewith, adjusting mechanism for the plotting means including devices adjustably mounted on the respective means and adjustable in angularly-disposed lines of movement, and a connection between the devices.

32. In apparatus of the character described, the combination with supporting means, of plotting means rotatably associated therewith, adjusting mechanism for the plotting means including devices, one of which is adjustable substantially concentric to the axis of rotation of the plotting means, the other being adjustable toward and from such axis, and a connection between the devices.

33. In apparatus of the character described, the combination with supporting means, of plotting means rotatably associated therewith, adjusting mechanism for the plotting means including devices, one of which is mounted on one of the means and is adjustable thereon toward and from the axis of rotation of the plotting means, the other device being carried by the other means, and an adjustable connection between the devices.

34. In apparatus of the character described, the combination with a support having an arm, of plotting mechanism rotatably mounted on the support and including a ring, a post adjustably mounted on the ring in a direction substantially concentric to the axis of rotation of the plotting mechanism, said post having a bearing rotatably mounted therein, another post mounted on the arm and adjustable toward and from the axis of rotation of the plotting mechanism, and an adjusting-screw connecting the posts.

35. In apparatus of the character described, the combination with a support, of plotting mechanism rotatable on the support and including a ring, a post adjustably mounted on the ring and having a bearing rotatably mounted therein, another post mounted on the support and adjustable thereon toward and from the axis of rotation of the plotting mechanism, and an adjusting-screw connecting the posts and having an engagement with the rotatable bearing.

36. In apparatus of the character described, the combination with supporting mechanism, of plotting mechanism revoluble thereon, a clamping device adjustably engaging one mechanism, another device adjustable on the other mechanism, means for

effecting the movement of said latter device and adjusting means connecting the clamping device and the other mechanism.

37. In apparatus of the character described, the combination with supporting mechanism, of plotting mechanism revoluble thereon, a clamping device adjustably engaging the plotting mechanism, another device adjustable on the other mechanism for effecting the movement of said latter device and means connecting the said devices.

38. In apparatus of the character described, the combination with a drafting-table, of overhead supporting mechanism mounted thereover and including a device movable to different positions with respect thereto, means for suspending said supporting mechanism, a hanger depending from the overhead supporting mechanism, plotting mechanism revolubly suspended from the hanger and coacting with the table, means connecting the plotting mechanism and hanger below the supporting mechanism for effecting the partial rotation of the plotting mechanism, and means disposed below said supporting mechanism for indicating the positions of the plotting mechanism with respect to the hanger.

39. In apparatus of the character described, the combination with a drafting-table, of overhead supporting mechanism including a carriage movably mounted thereover and movable to different positions with respect thereto, means for suspending said overhead supporting mechanism, a hanger depending from the overhead mechanism, plotting mechanism revolubly suspended from the hanger and coacting with the table, means for indicating the position of the plotting mechanism with respect to the supporting mechanism, said means including a graduated scale and a pointer coacting with the scale, one of the same being carried by the hanger, the other by the plotting mechanism, and means connecting the mechanisms for effecting the rotation of the plotting mechanism, said rotating means and indicating means being located between the overhead supporting mechanism and the table.

40. In apparatus of the character described, the combination with supporting mechanism, of plotting mechanism revoluble thereon and including a disk, a clamp comprising elements that embrace the disk and are arranged to engage the same at different points around the same, a post carried by the clamp, another post carried by the supporting mechanism and adjustable thereon toward and from the axis of rotation of the plotting mechanism, and an adjusting device connecting the said post.

41. In apparatus of the character described, the combination with a drafting-table, of overhead supporting mechanism including a depending portion that is movable in different directions over the table, plotting mechanism rotatably suspended from the depending portion, and means including a manual actuating device connecting the depending portion and the plotting mechanism beneath the overhead supporting mechanism for effecting the partial rotation of the plotting mechanism.

42. In apparatus of the character described, the combination with a table, of supporting mechanism including a tubular portion movable to different positions on the table, rotatable plotting mechanism including a limb journaled in the tubular portion and movable therewith, and means for rotating the plotting mechanism including adjusting means connected to the tubular portion and the limb journaled therein.

43. In apparatus of the character described, the combination with supporting mechanism including a carriage having a depending tubular portion, of plotting mechanism including an element journaled in the tubular portion, and a disk carried by said element and located contiguous to the lower end of the tubular portion, a clamp arranged to engage the disk, and an adjustable connection between the clamp and tubular portion.

44. In apparatus of the character described, the combination with a table, of a carriage movably supported over the table and having a depending tubular portion, plotting mechanism rotatable with relation to the carriage including an element journaled in the tubular portion, a disk carried by the slotting mechanism and disposed contiguous to the lower end of the tubular portion, a clamp rotatable with relation to the disk and arranged to engage the same and be thereby held against rotation, and adjusting means connecting the clamp and the tubular portion.

45. In apparatus of the character described, the combination with a support, of plotting mechanism rotatable with respect to the support, and means for effecting the movement of the plotting mechanism, said means including a lever connected to the plotting mechanism, and an actuating-cam operating against the lever and having its axis of movement substantially coincident to the axis of rotation of the mechanism.

46. In apparatus of the character described, the combination with a supporting-hanger having a bearing, of plotting mechanism journaled in the bearing, and means for effecting the movement of the plotting mechanism, said means including an actuating-cam surrounding the bearing and having its axis of movement substantially coincident to the axis of movement of the plotting mechanism.

47. In apparatus of the character described, the combination with a support, of plotting mechanism movably mounted on

the support, a lever fulcrumed between its ends on the support, a connection between one end of the lever and the plotting mechanism, and a rotatable device bearing against the opposite end of the lever for operating the same.

48. In apparatus of the character described, the combination with a support, of plotting mechanism movably mounted on the support, an actuating-lever fulcrumed on the support, a connecting device, means for adjustably securing the connecting device to the plotting mechanism, and means for adjustably securing the connecting device to the lever at different distances from its fulcrum.

49. In apparatus of the character described, the combination with a support, of plotting mechanism movably mounted on the support, an actuating-lever fulcrumed on the support, a post adjustably mounted on the plotting mechanism, a post adjustably connected to the lever, and an adjustable connection between the posts.

50. In apparatus of the character described, the combination with supporting mechanism, of plotting mechanism rotatable with respect thereto, and means for effecting the said rotation of the plotting mechanism, said means including a lever pivoted on one of the mechanisms and having a connection with the other mechanism, and means for moving the lever.

51. In apparatus of the character described, the combination with a support, of plotting mechanism movable thereon and having a scale that is movable therewith, an index element carried by the support and coacting with the movable scale, and means mounted on the support for moving the plotting mechanism, said means including an indicating element that is movable with respect to and coacts with the movable scale.

52. In apparatus of the character described, the combination with a support, of plotting mechanism rotatable thereon and having a scale that is rotatable with said plotting mechanism, an index element carried by the support, said movable scale coacting with the index element, and means mounted on the support for moving the plotting mechanism, said means including an indicating element that is movable on the support and with respect to the scale and said indicating element coacting with the movable scale.

53. In apparatus of the character described, the combination with a support, of plotting mechanism rotatable thereon and having a scale rotatable with the plotting mechanism, and means movably mounted on the support and connected to the plotting mechanism for moving the same, said means including an actuating device that is movable with respect to the support, the plotting mechanism, and the scale and coacting with said scale.

54. In apparatus of the character described, the combination with a support, of plotting mechanism rotatably mounted on the support and having a rotatable dial provided with a circular scale, means movably mounted on the support and connected to the plotting mechanism for moving the same, said means including an indicating element that is movable with respect to both the support and scale and coacts with the latter.

55. In apparatus of the character described, the combination with a support, of plotting mechanism rotatably mounted on the support and having a rotatable dial provided with a circular scale, means movably mounted on the support and connected to the plotting mechanism for moving the same, the said means including an actuating-arm movable on the support concentric to the scale, said arm moving over the scale and constituting an indicating element that coacts with said scale.

56. In apparatus of the character described, the combination with a support having an arm, of plotting mechanism rotatably mounted on the support and having a dial provided with a scale, said scale coacting with the arm, which constitutes an index element, means movably mounted on the arm and connected to the plotting mechanism for moving the same, and a rotatable actuating device for said means movably mounted on the support and having its axis of movement substantially coincident with the axis of rotation of the plotting mechanism, said device moving over the scale and coacting therewith.

57. In apparatus of the character described, the combination with supporting mechanism having an index element, of a lever pivoted on the element, plotting mechanism rotatable with respect to the supporting mechanism, and an adjustable screw connecting the lever and plotting mechanism.

58. In apparatus of the character described, the combination with supporting mechanism, of a lever pivoted on the supporting mechanism, rotatable plotting mechanism associated with the supporting mechanism, a screw connection between the plotting mechanism and lever, and a cam for operating the lever.

59. In apparatus of the character described, the combination with supporting mechanism including a depending portion, of plotting mechanism rotatable on said depending portion, a lever pivoted on said depending portion, a cam journaled on said depending portion and engaging the lever, and a connection between the lever and the plotting mechanism.

60. In apparatus of the character described, the combination with supporting

mechanism including a depending tubular portion, of plotting mechanism including an element rotatably mounted in said tubular portion, an index-arm carried by the tubular portion, a lever pivoted between its ends on the arm and having a ring surrounding the tubular portion, a cam journaled on the tubular portion and engaging the ring, and a connection between the lever and the plotting mechanism.

61. In apparatus of the character described, the combination with a movably-supported overhead carriage, of a depending bracket carried thereby and having an index-arm at its lower end, plotting mechanism journaled in the bracket and including a disk, a clamp device rotatable with respect to the bracket and arranged to engage the disk, a lever pivoted on the index-arm, an adjusting-screw connecting the lever and clamp, and a cam journaled on the bracket and having a connection with the lever for moving the same.

62. In apparatus of the character described, the combination with a drafting-table, of supporting mechanism movable over the table, plotting mechanism rotatable on the supporting mechanism, and mechanism for rotating the plotting mechanism including a lever, and means connecting the lever to one of the mechanisms, said means being adjustable on the lever toward and from its fulcrum.

63. In apparatus of the character described, the combination with supporting mechanism, of plotting mechanism movable with respect thereto, a lever, means connecting the lever to one of the mechanisms, said means being adjustable on the lever toward and from its fulcrum, and a screw for thus adjusting the connection.

64. In apparatus of the character described, the combination with supporting mechanism, of plotting mechanism, a lever pivoted on the supporting mechanism, a block adjustable on the lever toward and from its fulcrum, means for securing the block at different positions on the lever, and a connection between the block and the plotting mechanism.

65. In apparatus of the character described, the combination with supporting mechanism, of plotting mechanism movable with respect thereto, a lever pivoted on the supporting mechanism, a block adjustable on the lever toward and from its fulcrum, an adjusting device for the block, means for holding the block against movement, means for effecting the movement of the lever, and a connection between the lever and the plotting mechanism.

66. In apparatus of the character described, the combination with supporting mechanism, of plotting mechanism revolubly mounted on the supporting mechanism, an index-arm carried by the supporting mechanism, a lever pivoted between its ends upon the index-arm, a block adjustable on the lever toward and from its fulcrum, a screw connection between the block and the plotting mechanism, and a cam journaled upon the supporting mechanism and engaging the lever.

67. In apparatus of the character described, the combination with a drafting-table, of an overhead carriage movable thereon in a plurality of directions and having a depending bearing, suspended plotting mechanism having an element journaled in said bearing, relatively rotatable scale and index elements carried by the bearing and plotting mechanism, and located wholly beneath the carriage for indicating the positions of the plotting mechanism with respect to the carriage, and means connecting the elements for adjusting the same and also holding them against relative movement.

68. In apparatus of the character described, the combination with a drafting-table, of an overhead carriage having a bearing, suspended plotting mechanism having an element journaled in said bearing, said mechanism being supported over the table and beneath the carriage, and means located beneath the carriage for rotating the plotting mechanism and holding it in different fixed positions relative to the carriage.

69. In apparatus of the character described, the combination with a drafting-table, of an overhead carriage having a depending hanger provided with an upright bearing, suspended plotting mechanism located beneath the hanger and having an element journaled in said bearing, said mechanism being supported beneath the carriage, and coöperating devices located at the lower end of the hanger beneath the carriage and movable with said carriage, one of the devices being rotatable with the plotting mechanism for indicating the different positions of said mechanism during its rotation.

70. In apparatus of the character described, the combination with a table, of an overhead carriage supported above the table and having a depending tubular portion provided with a ball-raceway, balls located in the raceway, and plotting mechanism revolubly suspended from the carriage and including an element journaled in the tubular portion and coacting with the balls.

71. In apparatus of the character described, the combination with an overhead carriage having a bearing, of suspended plotting mechanism having an element journaled in the bearing, means located beneath the overhead carriage and connecting the bearing and plotting mechanism for rotating the plotting mechanism and also holding the same against movement, and relatively rotatable coacting indicating devices also located

beneath the overhead carriage, one of said devices being held against rotation with respect to the carriage and being movable therewith, the other being rotatable with the holding means.

72. In apparatus of the character described, the combination with an overhead carriage having a bearing, of suspended plotting mechanism located beneath the carriage and having an element journaled in the bearing, and means mounted beneath the carriage and connecting the plotting mechanism and carriage for rotating said plotting mechanism upon the carriage, said means including an actuating device also located beneath the carriage.

73. In apparatus of the character described, the combination with an overhead carriage having a bearing, of suspended plotting mechanism located beneath the carriage and having an element journaled in the bearing, and common means connecting the carriage and plotting mechanism for adjusting said plotting mechanism and also holding it against relative movement, said adjusting means including actuating mechanism disposed beneath the carriage.

74. In apparatus of the character described, the combination with supporting means, of plotting mechanism including a movable limb member, a scale-dial movable with the limb member, means mounted on the supporting means for moving the plotting mechanism and including an actuating device coacting with the movable scale-dial, and an index separate from the actuating device carried by the supporting means and coacting with the scale-dial.

75. In apparatus of the character described, the combination with a drafting-table, of overhead supporting means located above the table, plotting means movably suspended from the supporting means, a scale carried by one of said means, an indicator carried by the other of said means and coacting with the scale, and means for relatively adjusting the plotting and supporting means including a device that also coacts with the scale.

76. In apparatus of the character described, the combination with a drafting-table, of overhead supporting means located above the table and including an overhead movable carriage having a depending tubular portion provided at its lower end with an index-arm, rotatable plotting mechanism journaled in the tubular portion and extending below the same, said mechanism having a dial provided with a protractor-scale cooperating with the arm, and adjusting means for the plotting mechanism connecting the arm and dial.

77. In apparatus of the character described, the combination with a table, of a carriage movably supported thereover, means for suspending the carriage over the table, a depending bracket suspended from the carriage and having an index-arm extending on opposite sides of the same, said index-arm being provided with index-marks, and plotting mechanism suspended from the bracket and journaled thereon, said plotting mechanism including a dial-ring having a scale coacting with the marks on the arm.

78. In apparatus of the character described, the combination with supporting mechanism, of plotting mechanism movable with respect thereto, a scale movable with the plotting mechanism, and means for moving the plotting mechanism including a cam device having a hand movably coacting with the movable scale.

79. In apparatus of the character described, the combination with supporting mechanism of plotting mechanism movable with respect thereto, a scale movable with the plotting mechanism, and means for moving the plotting mechanism including an actuating-hand movably coacting with the scale.

80. In apparatus of the character described, the combination with supporting mechanism, of plotting mechanism movable with respect thereto, a scale mounted on one mechanism, an index therefor mounted on the other mechanism, and means for moving the plotting mechanism including an actuating-hand movably coacting with the scale.

81. In apparatus of the character described, the combination with supporting mechanism having an index, of plotting mechanism movable with respect thereto and having a dial coacting with the index, said dial having a scale, and moving means for the plotting mechanism having a hand movably coacting with the scale.

82. In apparatus of the character described, the combination with a carriage having a hanger member, of an index device carried by the hanger member, plotting mechanism rotatably supported on the hanger member, a scale carried by the plotting mechanism and coacting with the index, and means for moving the plotting mechanism upon the hanger member including a hand movably mounted on said hanger member and coacting with the scale.

83. In apparatus of the character described, the combination with a table, of a carriage supported thereover and having an upright bearing, an index-arm carried by the lower end of the bearing, plotting mechanism operating over the table and having an element journaled in the bearing, a scale carried by the plotting mechanism and coacting with the arm, and means for moving the plotting mechanism with respect to the carriage, said means including an actuating-hand that movably coacts with the scale.

84. In apparatus of the character described, the combination with a table, of a carriage supported thereover and having a depending hanger-bracket provided with a vertical bearing, a limb member operating over the table and having an upright element journaled in the bearing, a scale-dial movable with the limb member, and means for effecting the movement of the limb member, said means including a cam journaled on the bracket and having an arm that extends over and coacts with the scale-dial.

85. In apparatus of the character described, the combination with supporting mechanism, of a limb member movable with respect thereto, and coacting indicating devices one of which is carried by the supporting member, the other being movable with the limb member, said latter device being adjustable with respect to said limb member which carries it.

86. In apparatus of the character described, the combination with supporting mechanism, of a limb member movable with respect thereto, coacting indicating devices, one of which is carried by the supporting mechanism, the other being movable with respect thereto and with respect to the limb member, and means for connecting the said other device to the limb member so that they will move together.

87 In apparatus of the character described, the combination with supporting mechanism, of a limb member rotatable with respect thereto, means connecting the limb member, and supporting mechanism for rotating the former, an index device carried by the supporting mechanism, a scale movable with respect thereto and with respect to the limb member, and means for connecting the said scale to the limb member so that they will move together.

88. In apparatus of the character described, the combination with a supporting member, of a limb member rotatably mounted on the supporting member, operating means connecting the members for rotating the limb member on the supporting member, coacting indicating devices separate from said operating means and carried respectively by the supporting and limb members, one of said devices being movable on the member carrying it, and means for securing the said movable indicating device and its member against relative movement.

89. In apparatus of the character described, the combination with a support, of a limb member rotatably suspended therefrom, means for connecting the support and limb member for rotating the latter, an index device mounted on the support, a scale coacting with the index device and rotatably supported from the support and with respect to the limb member, and means for adjustably connecting the scale and the limb member to hold the same in different relations.

90. In apparatus of the character described, the combination with a supporting member, of a limb member rotatably mounted on the supporting member, operating means connecting the members for rotating the limb member on the supporting member, a scale mounted on the limb member, said scale and limb member being relatively rotatable, means for securing the scale and limb member in different relations, and an index carried by the supporting member, said scale coöperating with the index.

91. In apparatus of the character described, the combination with a support having a bearing, of a limb member and an indicator having telescoped relatively rotatable elements journaled in the bearing, and means for connecting the elements to secure the limb member and indicator against relative rotation.

92. In apparatus of the character described, the combination with a support having a bearing, of a limb member and an indicator having telescoped relatively rotatable elements journaled in the bearing, and clamping devices for connecting the elements to secure the limb member and indicator against relative rotation.

93. In apparatus of the character described, the combination with a support having a bearing, of a sleeve journaled in the bearing and carrying an indicator, a limb member having a rod rotatable in the sleeve, and means for preventing the relative rotation of the indicator and limb member.

94. In apparatus of the character described, the combination with a movable support having an upright bearing, of a sleeve journaled in the bearing, an index-arm carried by the bearing, a dial carried by the sleeve and having a scale coacting with the arm, a limb member having a rod rotatable in the sleeve, a clamp for securing the rod and sleeve against relative movement in different relative positions, and a limb member carried by the rod.

95. In apparatus of the character described, the combination with a table, of a carriage movably supported thereover, a depending bracket suspended from the carriage and having an upright tubular portion constituting a bearing, an outstanding index-arm carried by the tubular portion, a sleeve journaled in the tubular portion, a protractor-dial having a scale coacting with the index-arm, adjustable connections between the dial and indicator-arm including an actuating-hand coacting with the dial-scale, a rod rotatable in the sleeve, means for clamping said rod and sleeve against relative rotation, and a limb member carried by the rod and movable over the table.

96. In apparatus of the character described, the combination with supporting mechanism, of a limb member rotatable thereon, a centering device arranged to be projected below the limb member, and means for supporting the device above the bottom of the limb member and raising it when the same is projected beneath the limb member.

97. In apparatus of the character described, the combination with supporting mechanism, of a limb member rotatable thereon, a centering device arranged to be projected below the limb member, and a spring for raising the device after it has been projected downwardly.

98. In apparatus of the character described, the combination with supporting mechanism including a rod, of a limb member carried by the rod, a centering device slidable in the rod and arranged to be depressed below the limb member, and a spring housed within the rod for yieldingly supporting the centering device and raising the same after its depression.

99. In apparatus of the character described, the combination with a table, of a carriage movably supported over the same, a limb member suspended from the carriage and movable over the table, and a yieldingly-supported centering device arranged to be projected downwardly through the limb between the ends thereof and into engagement with the table.

100. In apparatus of the character described, the combination with a table, of a carriage supported thereover, a limb member, a connection between the limb member and carriage including a rod, a yieldingly-supported centering-stem slidably mounted in the lower end of the rod, and an actuating-collar for the stem surrounding the rod and having a connection with said stem.

101. In apparatus of the character described, the combination with a drafting-table, of overhead supporting mechanism mounted thereon, a limb member movably suspended from the supporting mechanism and having a substantially horizontal straight-edge movable therewith over the table, guides disposed in rear of the straight-edge, a scale disposed in rear of the straight-edge, and a marking device movably mounted upon the guide and movable longitudinally along the straight-edge, said marking device having an indicator coacting with the scale.

102. In apparatus of the character described, the combination with a table, of a carriage movably supported thereover, a rotatable limb member suspended from the carriage comprising a base-plate having longitudinally-disposed guides, a longitudinally-disposed scale arranged parallel to the guides, a carriage movable on the guides and having an indicator coacting with the scale, and a vertically-movable marking device movably mounted on the carriage.

103. In apparatus of the character described, the combination with a table, of supporting mechanism located thereover, a limb member carried by the supporting mechanism and movable over and coacting with the table, said limb member comprising a base having longitudinal parallel guides, a scale located alongside the guides, a carriage movable on the guides and having an indicator coacting with the scale, and a marking device movably mounted on the carriage and having a fixed vertical path of movement, said device being movable to a position beneath the carriage and base and coacting with the paper placed upon the table beneath said base.

104. In apparatus of the character described, the combination with a drafting-table, of supporting mechanism mounted over the same in spaced relation thereto, a limb member movable with respect to the mechanism and coacting with the table, separate independently-adjustable carriages mounted on the limb member, independent manually-actuated marking devices mounted on the carriages and movable into and out of coaction with the table, and means for normally supporting the devices out of coaction with the table.

105. In apparatus of the character described, the combination with a table, of supporting mechanism located thereover, a limb member movable with respect thereto, relatively movable marking devices both of which are movably mounted on the limb member, and indicating mechanism for said devices.

106. In apparatus of the character described, the combination with a table, of supporting mechanism suspended over the table, a limb member movable with respect thereto, relatively movable marking devices both of which are movably mounted on the limb member, indicating mechanism for said devices, and means for moving the devices.

107. In apparatus of the character described, the combination with a drafting-table, of a limb memebr movably suspended over the table, and relatively independently movable manually-actuated marking devices mounted on opposite sides of the limb member and movable thereon past each other, said devices coöperating with the table.

108. In apparatus of the character described, the combination with a table, of a carriage movably supported over the same, a limb member suspended from the carriage and coacting with the table, said limb member having oppositely-disposed substantially parallel straight-edges, scales located on the limb member longitudinally of the straight-edges, carriages mounted on opposite sides of the limb to slide thereupon past each other and having indicators coacting

with the scales, and marking devices movably supported on said carriages.

109. In apparatus of the character described, the combination with a drafting-table, of an overhead carriage movably supported thereover, a stem rotatably journaled in the carriage, a limb carried by the lower end of the stem and coacting with the table, a beam mounted on the upper portion of the limb and extending outwardly from the stem, and means for mounting a marking device on the outer portion of the beam.

110. In apparatus of the character described, the combination with a drafting-table, of a carriage movably supported thereover, a stem rotatably journaled in the carriage, a limb carried by the lower end of the stem and coacting with the table, a beam mounted on the upper portion of the limb and extending outwardly from the stem, a brace for the beam connecting the outer portion thereof and the limb at one side of the stem, and means for mounting a marking device on the outer portion of the beam.

111. In apparatus of the character described, the combination with a drafting-table, of a carriage movably supported thereover, a stem rotatably journaled in the carriage, a limb carried by the stem and coacting with the table, a beam mounted on the limb and comprising spaced rods adjustably extending on opposite sides of the stem, and means for mounting a marking device on the outer portion of the beam.

112. In apparatus of the character described, the combination with a table, of a carriage movably supported above the same, a rod revolubly suspended from the carriage, a limb member carried by the rod and coöperating with the table, a beam adjustably associated with the rod, said beam being rotatable with the rod and limb member, and means for supporting a marking implement upon the beam.

113. In apparatus of the character described, the combination with a table, of a carriage movably supported above the same, a rod revolubly suspended from the carriage, a limb member secured to the lower end of the rod and coöperating with the table, a clamp device located on the rod, a beam comprising spaced rods slidably mounted in the clamp, and means for securing a marking implement to the beam.

114. In apparatus of the character described, the combination with a table, of a carriage movably supported thereover, a limb revolubly suspended from the carriage and coöperating with the table, a marking device adjustably associated with the limb and coacting with the table at one side of the limb, and means for securing said marking device against relative movement with the limb.

115. In apparatus of the character described, the combination with a table, of a limb member suspended over and coacting with the table, said member including a rod, a centering-stem slidably mounted in the lower end of the rod, and an actuating device for the stem disposed exteriorly of the rod and having a connection with said stem.

116. In apparatus of the character described, the combination with a table, of a carriage located over the same, means for supporting the carriage to permit its free movement over the table, a limb member rotatably suspended from the carriage and coacting directly with the table, and coöperating indicating devices comprising relatively rotatable scale and index elements, one of which is carried by the carriage and held against rotation, the other device being rotatable with the limb member, and means for effecting their relative rotation and thereby the rotation of the limb member.

117. In apparatus of the character described, the combination with a drafting-table, of an overhead carriage located over the same, overhead means for supporting the carriage to permit its free movement over the table, a limb member suspended from the carriage and rotatable on an axis substantially perpendicular to the table, said limb member being also laterally movable over the table directly adjacent thereto and being disposed below the carriage, an index element carried by the carriage and located beneath the same, a dial mounted on the limb member below the carriage and having a scale coöperating with the index element, and means connected to the dial for rotating the same and thereby the limb member.

118. In apparatus of the character described, the combination with a drafting-table, of overhead tracks supported over the table, an overhead carriage movable on the tracks and having other tracks, a limb suspended from the overhead carriage and cooperating directly with the table, said limb rotating in a plane substantially parallel to the upper face of said table, rotatable scale and index elements for indicating the position of the limb with respect to the carriage, said elements being carried by the carriage and limb respectively and located beneath the carriage, and means connecting the elements for relatively rotating the same and thereby the limb member.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

JESSE A. HEYDRICK.

Witnesses:
JNO. D. MARSHALL,
JOHN HUMPHREY.

Corrections in Letters Patent No. 842,662.

It is hereby certified that in Letters Patent No. 842,662, granted January 29, 1907, upon the application of Jesse A. Heydrick, of Butler, Pennsylvania, for an improvement in "Drafting Instruments," errors appear in the printed specification requiring correction, as follows: In line 90, page 6, the word "adjusting" should read *connecting;* in line 81, page 8, the word "scales" should read *scale*, same line, the word "element" should read *elements*, and in line 112, page 15, the word "memebr" should read *member;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of February, A. D., 1907.

[SEAL.]

F. I. ALLEN,

Commissioner of Patents.