

Feb. 23, 1943.

G. I. FISCHER

2,312,154

DRAFTING APPARATUS

Filed Dec. 30, 1940

4 Sheets-Sheet 1

Fig. III.

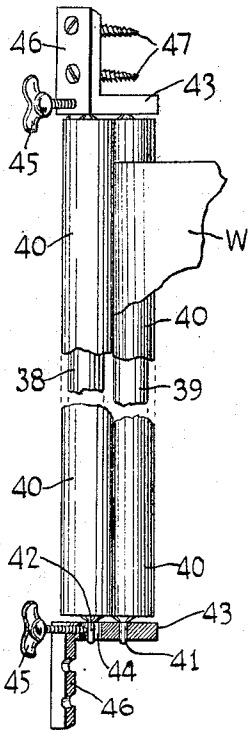


Fig. II.

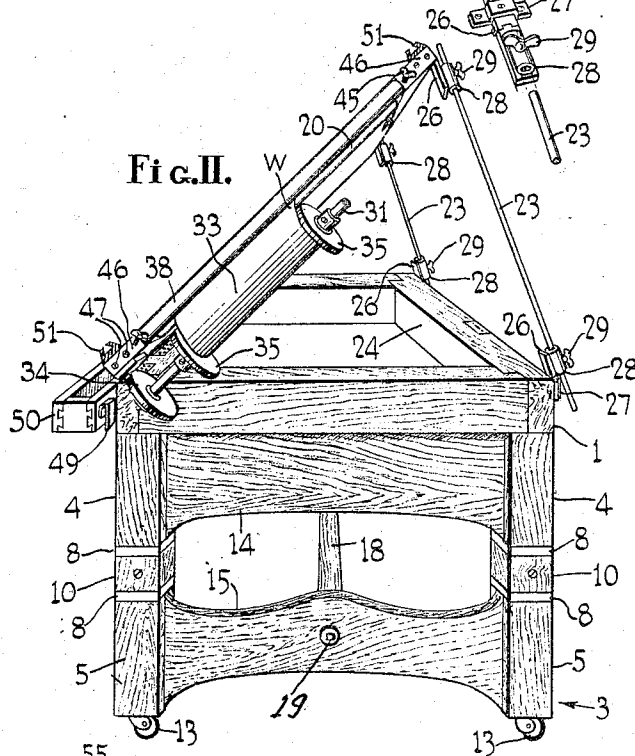


Fig. IV.

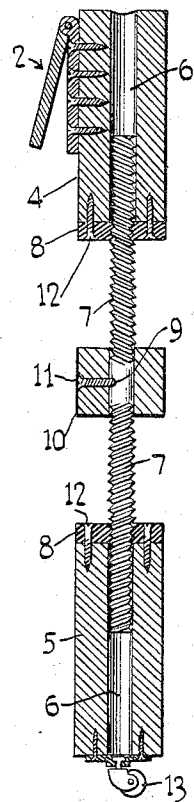
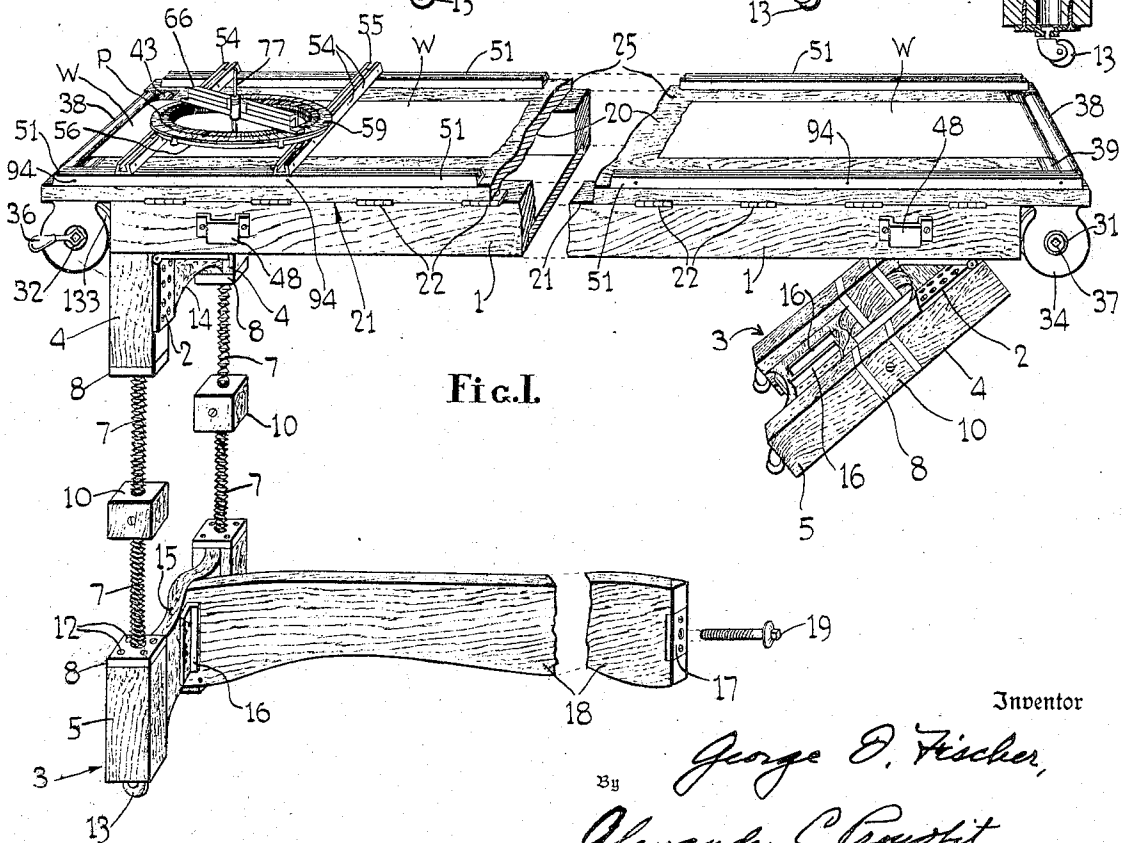


Fig. I.



Inventor

George O. Fischer,

Alexander C. Brown

Attorney

Feb. 23, 1943.

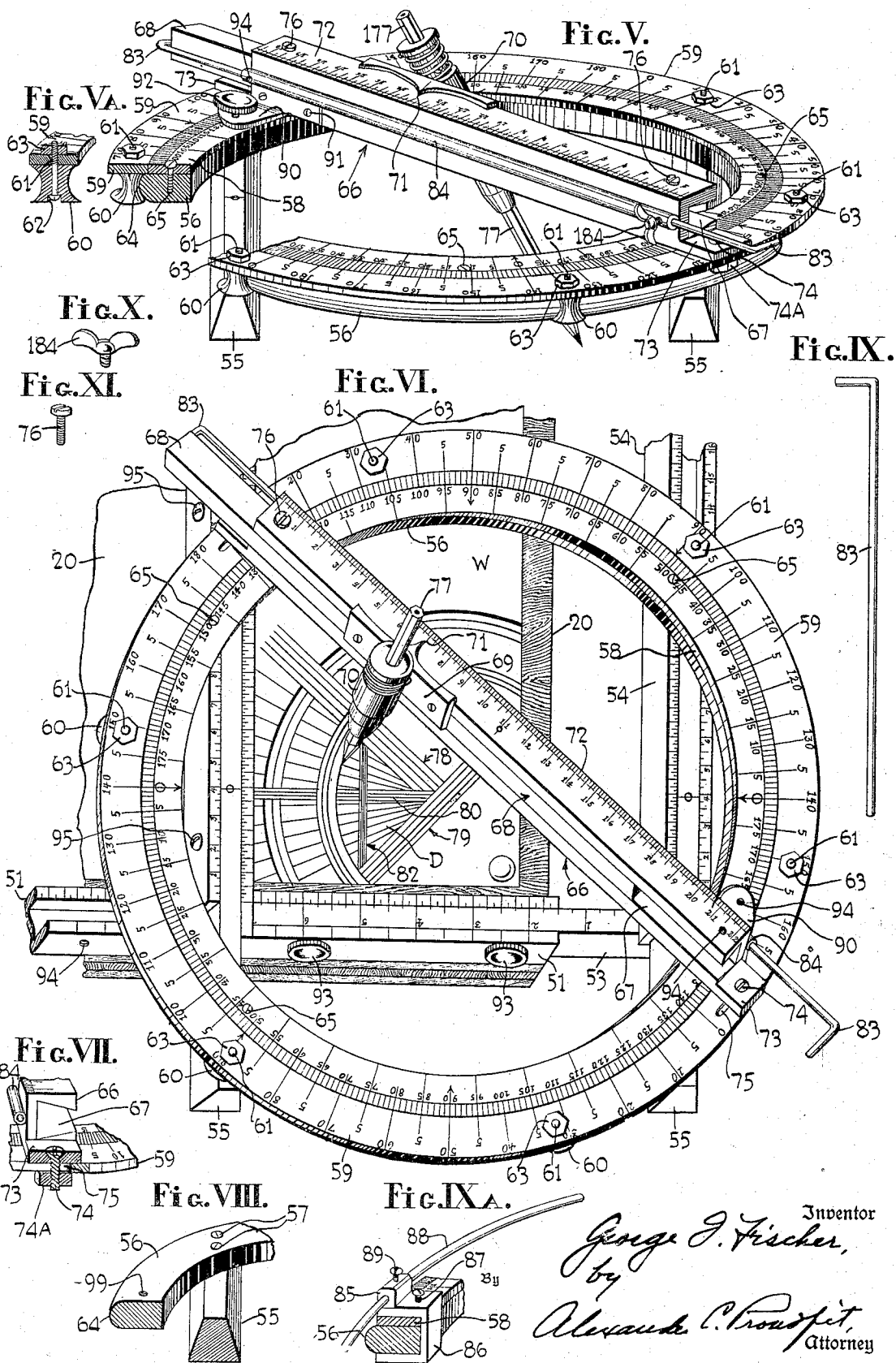
G. I. FISCHER

2,312,154

DRAFTING APPARATUS

Filed Dec. 30, 1940

4 Sheets-Sheet 2



Inventor
George J. Fischer,
by
Alexander C. Bondy,
Attorney

Feb. 23, 1943.

G. I. FISCHER
DRAFTING APPARATUS

2,312,154

Filed Dec. 30, 1940

4 Sheets-Sheet 3

Fig. XII.

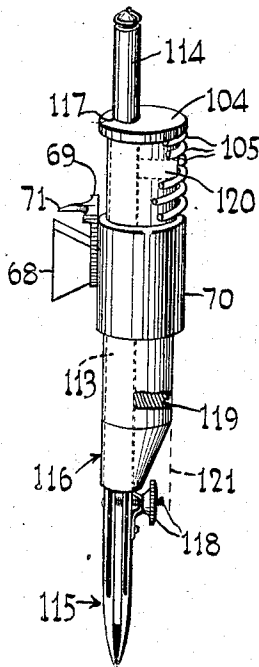


Fig. XIII.

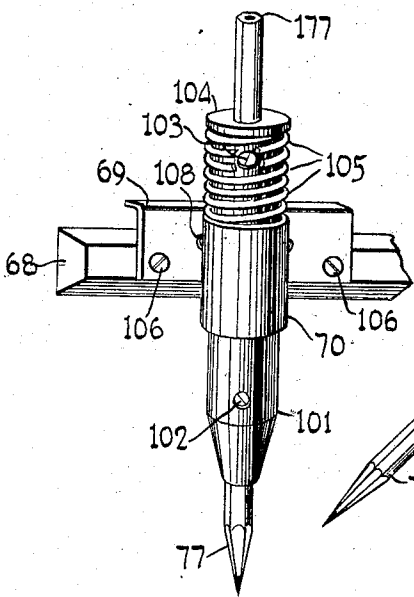


Fig. XIV.

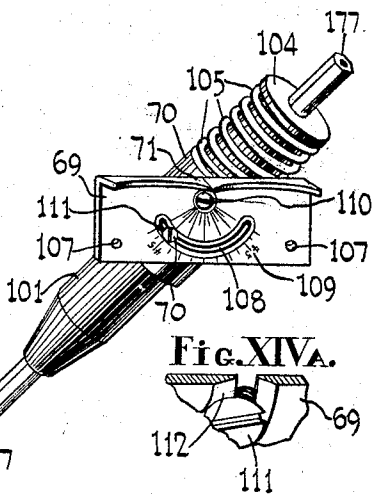


Fig. XIVa.



Fig. XVII.

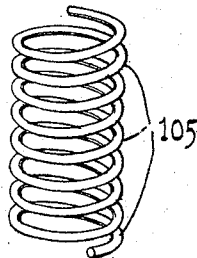


Fig. XV.

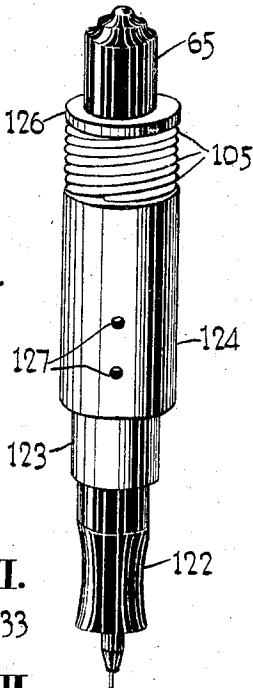


Fig. XVI.

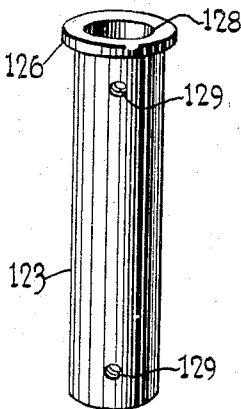


Fig. XVIII.

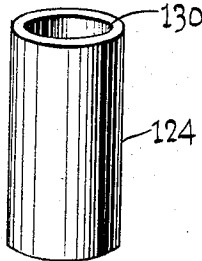


Fig. XIX.



Fig. XXI.



Fig. XX.

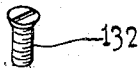


Fig. XXII.



Inventor

George J. Fischer,

Alexander C. Proudfit

Attorney

Feb. 23, 1943.

G. I. FISCHER

2,312,154

DRAFTING APPARATUS

Filed Dec. 30, 1940

4 Sheets-Sheet 4

FIG. XXIII.

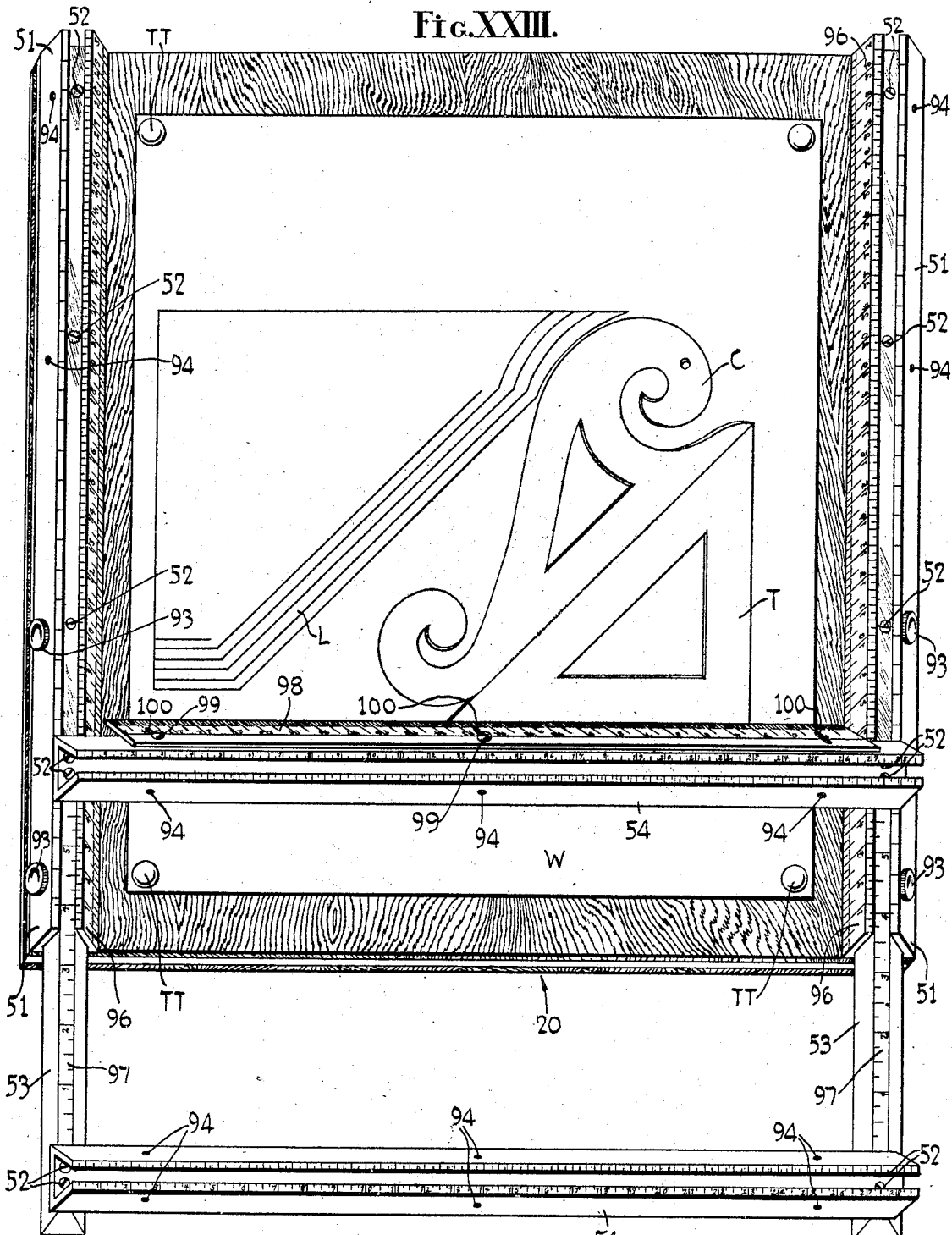


FIG. XXIV.



Fig. XXV.

Inventor

George J. Fischer,

Alexander C. Prussitt,
Attorney

UNITED STATES PATENT OFFICE

2,312,154

DRAFTING APPARATUS

George I. Fischer, Savannah, Ga.

Application December 30, 1940, Serial No. 372,406

8 Claims. (Cl. 33—80)

This invention relates to drafting apparatus, especially to a draftsman's table, and more particularly to such a table in combination with a drafting mechanism of improved form.

In the conventional drafting operation, which is performed by the use of pencils and pens held in compasses or supported exclusively by hand when moved along rulers, T-squares, protractors, triangles and various curved forms laid directly upon the sheet of drawing-paper, cloth or other material tacked upon a drawing board, serious inconveniences and defects arise from puncturing of the sheet material by the point of the compass, also from rubbing of the drawing which results from slipping and sliding of the above-mentioned drawing-aids, with soiling of the sheet, obliteration of technical points in the partially completed drawing, and often the area upon which the details of the drawing are being inscribed is unduly obscured, this being a prolific source of inaccuracies.

Accordingly, the primary object of the invention is to eliminate the need for using separate protractors, T-squares, compasses, triangles, etc., moving in contact with the surface of the drawing material, and thus to avoid the above-mentioned inconveniences while retaining the advantages characteristic of the basic use of drawing instruments and drawing-aids which have been developed by experienced draftsmen over many centuries.

Another object of the invention is to provide a holder for the various drafting instruments to be used and means by which such a holder can be disposed selectively at every point upon the surface of the drawing sheet material without contacting therewith, so that the pencil or pen in use constitutes the only moving part in working contact with the material being inscribed.

A further object of the invention is to provide means for stretching a continuous band or web of sheet-material such as drawing-paper or tracing-cloth, having it may be a length of one hundred feet or more, over the drawing table in a drawing apparatus so constructed and arranged that the web may be adjusted over the table between two rolls at opposite ends of the table, one of which rolls serves as a supply while the completed drawing may be wound up and stored upon the other roll, thus making it possible to present the drawing material in position to receive thereon substantially continuous drawings of extended structures, such as railroad track embankments, bridges, city streets, plans of airplanes, and in general all kinds of mechanical and architectural

designs, which can be made with speed and accuracy by reason of the ease with which the necessary adjustments may be effected.

Still another object is to provide a draftsman's table comprising a table-supporting structure including pairs of support-legs that can be folded up against the lower surface of the top for convenience in storage or transportation, or can be extended below the top frame in the set-up position of the table structure, the legs being adjustable in length respectively, with means to brace them in pairs and to brace the pairs lengthwise of the table, the latter being constructed and arranged to support the drawing table proper, with its supply of drawing material, at various degrees of angular elevation from the horizontal.

The invention comprises also the provision upon the table top of parallel guideways disposed lengthwise thereof, substantially from end to end, with a pair of sliding bars therein that are connected together by a pair of transverse guideways in which are mounted slidingly cross-bars connected to form a cross-head that carries a protractor element which can be moved bodily both lengthwise of the table and transversely thereof.

Other objects of the invention include the provision of an instrument-holder so combined with a novel protractor structure that by rotation of a suitable protractor element carrying the pencil or other drawing instrument the latter may be moved to inscribe circles on the drawing material, and by movement bodily of the protractor structure, with the instrument-holder, the instrument may be moved to draw lines in any desired direction.

In carrying into effect the last-named object, provision is made of an inventive feature possessing complete novelty and great utility, comprising a protractor structure which includes a ring-shaped base or bolster, an inner annular protractor element, and an outer protractor element, the bolster and inner element being fixed to, and forming part of, the cross-head already mentioned, while the outer protractor element is supported rotatably against the inner element, carrying in its turn a bridge fastened securely thereto and fitted with a slide movable substantially along a chord of the annular structure of the assembled protractor elements, the bridge-slide being provided with a clamping member in which is supported an instrument-holder adapted to mount a pencil, a drawing pen, or any suitable drawing or other working instrument.

It is to be observed, moreover, that the structures and arrangements hereinafter illustrated

and described are notably of a character to permit construction of my improved drafting apparatus with great economy and ease of manufacture, and this in itself constitutes a cognate object of my invention.

The instant invention consists, therefore, in the various constructions and arrangements hereinafter illustratively set forth, with such modifications thereof as may occur to those skilled in the art of making drafting apparatus, and other objects and features of the invention will appear as the description of the drawings illustrative of a preferred embodiment of the invention proceeds.

In the accompanying drawings, like reference characters are applied to corresponding parts throughout the several views which make up the drawings, in which:

Figure I is a view in perspective of a drafting apparatus in the construction of which the instant invention has been embodied, parts of the same being broken away to reveal interior construction;

Figure II is a view in perspective looking toward an end of the apparatus of Figure I, and showing the tilting drawing table with its associated parts adjusted to a desired degree of angular elevation from the horizontal;

Figure IIA is a fragmentary detail view in perspective of part of an adjustable upright with one of the clamps by which the table top may be secured in adjusted position;

Figure III is a fragmentary detail view in plan showing one of the sets of rolls through which a band of sheet drawing material is stretched from end to end of the drawing table;

Figure IV is a detail view in medial longitudinal section of one of the table legs and the hinges by which it is connected pivotally to the top frame of the table;

Figure V is a detail view in perspective on a larger scale of the double protractor and instrument-holder shown near the left-hand end of Figure I.

Figure VI is a detail view in plan on a still larger scale of the parts shown in Figure V;

Figure VA is a similar perspective detail of a mounting for the protractor element, as shown at the left-hand side of Figure V;

Figure VII is a fragmentary detail view in perspective with parts shown in vertical section, of the end of the bridge for an instrument holder illustrated at the right-hand side of Figure V;

Figure VIII is a fragmentary detail view in perspective of the mounting for the fixed annular member of the protractor element as shown in Figure V;

Figure IX is a detail view in side elevation of a limit rod for the instrument holder as shown in Figure V;

Figure IXA is a fragmentary detail view in perspective of a curved limit rod and means to clamp it in an adjusted position on the protractor structure;

Figure X and Figure XI show respectively in perspective a wing screw and a cap screw for securing in adjusted position parts to be hereinafter described.

Figure XII is a detail view in side elevation of the instrument holder shown in Figure V, with a tracing pen in place, this view being on a larger scale;

Figure XIII is a similar view in front elevation and on a larger scale of the instrument holder, pencil and clamping device shown in Figure V;

Figure XIV is a view of the same in rear elevation, showing the setting devices;

Figure XIVA is a fragmentary detail view of the setting device of Figure XIV on a larger scale;

Figure XV shows, on a still larger scale, a modified form of instrument holder, comprising a spring socket with a stylographic pen in place therein;

Figure XVI is a detail view in perspective of a bushing member of the socket shown in Figure XV, taken separately;

Figure XVII shows separately the coil spring of Figure XV;

Figure XVIII shows separately the socket sleeve member of Figure XV;

Figures XIX, XX, XXI, XXII are respectively detail views in perspective of screws to be described hereinafter;

Figure XXIII is a view in isometric perspective on a larger scale of the longitudinal bars and cross bars of the Figure VI structure from which the protractor and associated parts have been omitted, giving free access to a sheet of drawing paper mounted on an underlying drawing board, for free-hand drawing;

Figures XXIV and XXV are views in perspective of screws to be described.

In the embodiment of my invention selected for illustration and description to enable ready and complete understanding of my improvements, the part designated generally by the reference character 1 is the top frame of a drawing table, this frame comprising side and end members and a bottom member, which enclose a recess adapted to receive various detachable parts of the table structure when not in use, and such other articles as it may be desirable to protect.

Near each end of the frame 1 is hinged, as at 2, a pair of leg sets 3, each of which can be folded up against the bottom of the frame 1 when the legs are adjusted to their shortest length, as shown at the right-hand end of Figure I, where the pair of legs is swung part way up, while at the other end of the top frame the pair of legs is shown extended to full length.

Each leg includes a set of members 4 and 5, the leg members of each set being formed with sockets 6 (see Figure IV) to receive the right-and-left threaded parts 7 of a shaft and these parts are in threaded engagement with face plates 8 cooperating therewith to lengthen and shorten the several legs at will. The medial portion 9 of the shaft may desirably be provided with means by which the shaft may be rotated in either direction selectively, and for this purpose is shown a nut or block 10 fastened to the portion 9 by a set-screw 11. The plates 8 are secured to the leg parts as by screws 12.

The blocks 10 are of the same peripheral dimensions as those of the leg members 4 and within which the shaft parts 7 are concealed entirely when disposed in the short adjustment at the right of Figure II, where the blocks 10 are shown as fitting snugly between the plates 8. In Figure I, at the left hand end, the shafts 7 of the leg sets have been turned by the blocks 10 to lengthen the legs, the range of adjustment being such as to meet the requirements of different draftsmen. Each leg has a castor 13.

The leg sets of each of the end pairs are braced at 14 near the top, and at 15 near the free ends of the respective pairs. At the medial portion of the inner side of each of the cross braces 15 pro-

vision is made for a fitment 17 in the form of a tapped plate fast upon the end of a longitudinal strut 18 which, when in place, (as at the left-hand end of Figure I) is held by a bolt 19 in the slot between the flange-shaped members 16 which define the walls of the slot and constitute fitments on the braces to receive the strut-ends. The bolts 19 transfix the braces 15, entering the tapped fitments 17 in the ends of the strut 18, and the strut extends from the bottom brace 15 at one end of the table to that at the other end, serving to brace the leg pairs rigidly in their various extended positions. When not in use the strut 18 and the bolts 19 may be stored in the body recess of the top frame 1.

The recess may be closed by a table top 20 which is herein referred to as the drafting table, and which is connected pivotally to the front side upper edge 21 of the frame, as by hinges 22, so that the drafting table 20 may be tilted on its hinges to any desirable degree of angular elevation from the horizontal, as for example at the angle illustrated in Figure II.

Suitable means are provided to hold the table at the angle selected, and as a convenient construction for this purpose uprights 23 are illustrated, taking the form of rods, each of which is secured detachably to the rear top frame member 24 or to the upper free edge 25 of the table, as by clamps 26, of which four are shown in Figure II and one is shown separately in Figure IIA. As these clamps are preferably of identical construction, it will be sufficient to describe that shown in Figure IIA, which comprises a hinged bar 26 adapted to be secured in place by a strap 27, intended to be fastened by screws to the table edge or top frame member 24, as the case may be. Each bar 26 has a socket sleeve 28 transfixed by a wing-headed set screw 29 which is set-up against the corresponding part of one of the rods 23 to hold the latter in adjusted position. As shown clearly at the lower end of the nearest rod 23 in Figure II, the hinged member 26 accommodates itself to every angle to which the drafting table may be elevated.

Usually the screw 29 of the lower clamp will be loosened when a change of elevation is to be made. The rods 23 may be left in place when the table is lowered to its horizontal position, or the rods may be detached and stored in the recesses of the top frame.

In pursuit of another important object of the invention, provision is made of means to stretch from end to end of the drafting table a continuous band or web W of drafting material such as drafting paper, tracing, transparent linen fabric or the like, and in the preferred form of the construction designed for this purpose, a shaft is provided for this purpose at each end of the drafting table, below the level thereof, one of these shafts, as 31, being designed to receive and let-off gradually, a supply roll 33 of the drafting sheet material, between the shafts and extending over the drafting table, and the other to wind up for storage, from time to time, the completed sections of the drawing.

The shafts 31 and 32 are mounted rotatably in suitable end brackets 34 depending from the under surface of the drafting table, and each shaft has a pair of collars 35 which may be fixed adjustably at suitable distances apart to accommodate and confine the supply roll 33 and the wind-up roll 33, respectively. The shaft 32 has a crank handle 36 fitted to a squared part at the end of the shaft 32, to enable it to be turned

manually, and this handle may be shifted to a similar square 37 on the shaft 31 at the other end of the table, if it is desired to reverse the direction of adjustive movement of the web W.

In order that the paper may not slip lengthwise from any position to which it may be adjusted, provision is made at each end of the drafting table 20, above the shafts 31 and 32, of a set of gripping rolls 38, 39, shown in detail in Figure III, and between which the web W is drawn from end to end of the drafting table. Preferably a gripping surface 40 of elastic material is provided on each of the rolls of each set to exert a yielding grip on the web.

The shafts 41 and 42 of the rolls are fitted in bearings in brackets 43, one of the shafts, as 41, being in fixed position and the other shaft adjustable in slots 44, under the action of set screws 45. Each bracket has an angle-piece 46 by which it may be secured with fastening screws 47 to the ends of the drafting table 20. The gripping rolls, supply and windup rolls, and the web W of drafting material are moved to every position occupied by the drafting table 20 by the simple adjustment of the table already described, and without disturbing the drafting material.

At 48, fitments, preferably in the form of straps, are provided along the front face of the top frame, to receive brackets 49 upon a trough 50 intended to contain pencils, pens and other drawing accessories, in convenient position for use.

I will now describe a novel and improved drafting mechanism which is of particular utility when embodied in the construction of a draftsman's table of the class already described, but also possesses features capable of use to advantage with any form of drawing table or drafting board to which they may be rendered applicable by the nature of the improvements herein disclosed.

Having under consideration first the broad, generic aspect of this important portion of my invention, which is to provide for elimination of the need for compasses, T-squares and separate protractors, etc., this object is carried into effect, primarily, by providing upon the top of the drawing table 20 a pair of parallel guideways, as 51, extending substantially the entire length of the table and suitably fastened thereto, as by screws 52 (see Fig. XXIII), and in these guideways are fitted sliding bars 53, one near each edge of the drafting table 20.

These sliding bars 53 are connected together by transverse guideways 54 in which slide cross-bars 55 which constitute part of a cross-head that includes a protractor structure P (Fig. I), that can be moved bodily lengthwise of the drawing table by appropriate manipulation of the longitudinal bars 53 in their guideways 51, while other movements of the protractor structure at right angles to the longitudinal axis of the drawing table will be accomplished by transverse sliding movements of the bars 55 in their guideways 54, so that the protractor structure can, as the resultant of such lengthwise and crosswise movements of the cross-head, be superimposed above every point in the area of the sheet drawing material W upon which drawings are to be made.

The protractor structure comprises a ring-shaped bolster 56, fixed upon the cross-bars 55, as by screws 57, (Fig. VIII), and upon the bolster is fixed the inner of two annular protractor elements, 58, the outer protractor element 59 (see Fig. VI), being rotatable in the same plane as the inner, for which purpose provision is made of a series of six vertical rollers 60, each mounted at

the underside of the outer element, as by means of bolts 61, having their heads (Fig. VA), lying in countersunk recesses 62 so that they do not interfere with rotative movements of the element 59 when the rollers pass over the bars 55. These bolts are provided with nuts 63, and the circumference of the bolster 56 is curved, as at 64, so that the element 59 is held steadily in its various rotative positions.

The inner protractor element 58 is secured to the top of the bolster by screws 65, and is provided with a protractor scale, preferably having divisions corresponding to degrees and minutes from 1 degree to 180 degrees, occupying one-half of the circle, and a like scale occupying the other half, so that, together, the scales represent the complete 360 degrees of the circle. The outer protractor element 59 is desirably provided with scale markings disposed in multiples of five degrees, as shown clearly in Fig. VI.

In pursuance of that feature of the invention which has for its object the support of an instrument bodily movable so that it can be adjusted to any point within the area enclosed by the circular protractor structure, and can be there operated to draw circles, straight lines, in parallelism, and also in various angular positions relatively to each other, etc., provision is made of a bridge 66 spanning the protractor structure substantially along a chord subtending an arc of a circle, and taking the form of a guideway having a groove 67 in which slides a bar 68 mounting an instrument-holder 69.

This holder includes a holding clamp 70 for the instrument 71, and is formed with an indicator-pointer 71 designed to be read in connection with a scale 72 having divisions of any desired order, such as inches and fractions thereof, or millimetres, etc., if so designed.

As the axis of the instrument-holder is desirably somewhat removed from the body of the bridge, to avoid obstruction of the underlying area of the sheet material upon which the drawing is to be inscribed, provision is made whereby the bridge may be adjusted relatively to the center of the protractor circle, in order to permit the operator to set the pencil point, for example, at that exact center initially. For this purpose each end of the bridge is formed with a shoulder 73, transfixed by a bolt 74 which passes through a slot 75 in the margin of the outer protractor element and is there held in adjusted position by a nut 74A, as shown in Fig. VII.

In the instance illustrated, the scale 72 on the bridge is graduated from 1 to 22, so that its midpoint is at 11 on the scale, this being indicated by a "0" marking on the scale, and by way of illustration the holder-bar 68 has been so disposed as to bring the indicator pointer 71 opposite the "1" on the bridge-scale. The bar may be set there by one or more set-screws 76 (shown in detail in Fig. XI), and if the bridge be turned manually, with the operator's forefinger pressed gently on the upper end 177 of the pencil shown in the instrument-holder (Fig. V), a perfect circle having a diameter of eight inches will be described upon the drawing paper W.

After loosening the set-screw 76, the holder-bar 68 may be set in successive positions for ruling parallel lines, as at 78. By rotating the outer protractor element manually, the bridge may be brought to a position displaced angularly by 90 degrees from that shown in Fig. VI, and the holder-bar may then be operated to rule the group of parallel lines 79, etc. The straight lines repre-

sented by group 82 may be produced by sliding the bars 55 in their guideways 54 to carry the protractor structure bodily, with the pencil; so also, the group 80 may be produced by sliding the bars 53 in guideways 51. Radial lines are indicated generally by the reference character D, and may be formed after turning the bridge 66 to various appropriate diametrical positions of the bridge.

In order to insure an accurate setting of the holder-bar recurrently at a predetermined position, provision is made of a limit stop 83 at each end of the guideway 67 of the bridge 66. Such a stop is shown in operation at the left-hand side of Fig. VI, and the stop is shown separately in Fig. IX, being formed of wire, with a shank designed to be held adjustably in a tube 84 secured along the rear face of the bridge 66 (Fig. V). In Figs. V and X is shown a wing set-screw 184 suitable for holding one of the stop members 83 in its adjusted position by engagement with its shank, such a screw being shown in operation at the right-hand side of Fig. V.

Similar limit stops may be utilized to determine the range of movement of the bridge to different positions of angular displacement around the center of the protractor structure, and in Fig. IXA is shown means for this purpose constituting a feature of the present invention. A curved wire 88 is illustrated, mounted slidably in a block 85 upon a clamping member 86 which embraces the bolster 56 and an adjacent part of the inner protractor element 58, the clamping member being secured in place detachably by a set-screw 87. The stop wire 88 may be set at any desired point to limit rotative movement of the bridge, being held in position by a set-screw 89, and if two such stops are provided, the distance between them will define the length of the arc to be described by the rotation of the bridge with the pencil.

Such limit wires operate to produce arcs of any diameter, and constitute a highly important aid to the rapidity and accuracy of operation of the mechanism.

As a desirable means for holding the bridge at any rotative position, a flanged bracket 90 is shown (Figs. V and VI), attached by screws 91 to the rear face of the bridge member and having its flanged part overlying the inner protractor element, with a binding screw 92 adapted to be operated rapidly into engagement with the underlying protractor element, and also operable easily to release the bridge for rotative movement. Similar rapidly operable set-screws with milled heads are provided elsewhere, as for example at 93 (see Figs. VI and XXIII), to hold the bars 53 in every position of adjustment, these screws operating in tapped holes 94 extending through the walls of guideways 51. One of these screws 93 is shown in Fig. XXV. They are preferably formed as accurately threaded machine screws, and in general all of the set-screws herein shown are of the machine screw type, and wherever possible the components of the drafting mechanism are made of metal, machined to provide a close sliding fit between all contiguous moving parts.

Flanged bracket 90 at the right-hand side of Fig. VI shows a similar tapped hole 94 to receive the milled head screw 92 of Fig. V. Such tapped holes are also shown at various other regions of the mechanism where the appropriate set-screws may be inserted at will, the reference character 94 being applied thereto indiscriminately. When desired, the set-screws may take

the conventional form designated 95 and illustrated separately in Fig. XXIV.

In Fig. XXIII I have shown a portion of the drawing board 20 with longitudinal guideways 51 secured thereto in parallel spaced relation by countersunk screws 52 as hereinbefore described, the inner sides of the upper margins of the undercut guideways being provided, as at 96, with scales which may desirably be divided into inches and fractions thereof. The tenon-shaped sliding bars 53 are desirably provided with scales 97 having conventional divisions into inches, etc., adapted to be read in connection with the scales 96.

As noted in the brief description of Fig. XXIII, the protractor structure shown in Figs. V and VI has been omitted in Fig. XXIII, to reveal a modification of the cross-guideways 54 as shown at 98, which designates a ruler secured to the guideway by suitable fastening means, such as the screws illustrated at 99. The ruler is provided with slots 100 so that the ruler may be set at any desired distance from the underlying drawing sheet W, to which free access is thus permitted for the use of a conventional triangle T, curves C and other drawing aids. Those skilled in the art will understand readily the use of such aids in the inscription of groups of lines like that shown at L. Conventional thumbtacks TT are shown, for holding a sheet of draw-material upon the board 20.

The ruler 98 may be desirably constructed and arranged, as shown, so as not to interfere with use of the protractor structure, when desired, and the ruler may be removed from the far side of the guideway on which it is shown and fastened to the near side of the guideway, where there are suitable tapped holes 94 to permit such attachment. So, also, the bars 53 may be reversed, side by side, leaving the cross-guideways in their attached positions, which will bring the ruler 98 away from the drawing board 20.

In like manner, the protractor structure P with its supporting bars 55, shown in Figs. I, V and VI, may be removed bodily, then turned around, and remounted in reversed position with the cross-bars 55 changed correspondingly in the cross-guideways 54, thus adapting the drafting mechanism for use by a left-handed draftsman, or by a person having but one arm.

In the best constructions now known to me, provision is made of an instrument-holder adapted to receive a pencil, a drawing pen, a fountain pen, and other desirable types of drawing or working instruments, and in each of the forms herein shown illustratively, an instrument-holder is included which is adaptable for use selectively with more than one such instrument.

Referring to Figs. XII, XIII and XIV, it will be seen that an instrument-holder such as that shown at 70 can be utilized to hold either a pencil, as 77, or a drawing pen, as 115, and when used for a pencil, as in Figs. XIII and XIV, it is desirable to make provision for certain adjustments that may also be employed when the drawing fountain of Fig. XII and that of Fig. XV are employed selectively.

The clamping member 69, attached by screws 106 to the bridge-slide-bar 68 as already described briefly, is formed with holes 107, as shown in detail in Fig. XIV, from the rear, and is provided with an arcuate slot 108 having bevelled walls 112 (Fig. XIVA) to be engaged snugly by the head of a screw 111 which passes through the slot into the adjacent wall of the

holder 70, the latter swinging for adjustment around the screw 110 by which it is secured pivotally to the clamp member 69. A scale 109 is preferably provided to aid in accomplishing this adjustment with accuracy.

I have shown within the holder member 70 a bushing 101 movable therein telescopically and biased normally to its upper position by a coil spring 105, the latter being held under compression between the upper edge of the holder member 70, and a collar 104 through which extends the upper end 177 of the pencil, a set-screw 103 being used to bind the pencil against slippage within the bushing 101, but not interfering with the telescoping action of the bushing within the holder member when a draftsman presses gently downward against the upper end 177 of the pencil to bring the point 77 into contact with the drawing material.

In Fig. XIV the pencil is shown in an inclined position suitable to compensate for the angular setting of the pencil and holder relatively to the plane of the drawing paper W (see also Fig. V). Another set-screw, as 102, may be desirably provided to hold the shank of the pencil firmly in the bore of bushing 101.

The holding member 70 of Fig. XII serves similarly to receive the shank 114 of a conventional drawing pen, the nib 115 of which extends below the nozzle of a bushing 116 similar in essential respects to the bushing 101 of Fig. XIII and Fig. XIV, already described, and for which it may be substituted at will in the holder 70 when a pen is to be used rather than a pencil.

The coil spring 105 in Fig. XII is broken away to permit a more complete understanding of the arrangement, indicated in dotted lines, by which the set-screw 120 holds the shank 114 of the ruling pen in the bore of the bushing 116; also the similar action of the set-screw 119. The bore 113 is formed near the wall of the bushing adjacent to the clamp 69, so that the shank of the pen occupies a position set off from the axis of the bushing, and thus it is possible to withdraw the bushing upward bodily out from the holder member 70, without interference by the screw 118 with which such ruling pens are conventionally provided to adjust the nib for ruling lines of different thicknesses. The dash line 121 indicates that such a clearance exists between the screw 118 and the inner wall of the holder 70.

In Fig. XV, a rear view in perspective, is shown an instrument taking the form of a conventional fountain pen, such as a stylographic pen, 122, the barrel 65 of which is mounted in the bore 128 of a bushing 123 which takes the place of the bushings 101 and 116 in the structures of Figs. XIII and XII.

The bushing 123 has tapped holes 129 to receive set-screws of the headless type shown separately in Fig. XXI at 139, and a lip 126 is shown to confine the coil spring 105, shown separately in Fig. XVII, and also shown in Fig. XV, compressed between the lip 126 and the upper edge 130 of a holder member 124, (see Fig. XVIII).

In Fig. XV the member 124 is shown as provided with tapped holes 127 to seat the screws 110 and 111 of the Fig. XIV assembly, so that the fountain pen assembly of Fig. XV may be substituted readily for the pencil 77, operating in like fashion to that already described with respect to the pencil.

What is claimed is:

1. A protractor structure comprising a bolster annulus, a pair of annular protractor plates su-

perimposed upon the bolster and in the same plane, the inner protractor plate being secured to the bolster and the outer protractor plate being in edge contacting relation with the outer edge of the inner plate, and elements carried by the outer protractor plate and having rolling contact with the outer periphery of the bolster, said elements and bolster outer periphery being constructed and arranged to maintain the outer plate in the plane of the inner plate while permitting turning of the outer plate around the inner plate.

2. A protractor structure of the character described comprising an annular bolster having a transversely rounded outer peripheral edge, a pair of annular protector plates superimposed upon the bolster and lying in the same plane, the inner plate being secured to the bolster, and a plurality of rollers rotatably mounted upon the under side of the outer plate and each having an encircling channel formed to receive the outer peripheral portion of the bolster, the rollers and said outer peripheral portion of the bolster cooperating to maintain the outer plate against movement out of said plane, while facilitating the turning of the outer plate around the inner plate.

3. A structure as set forth in claim 1, including a straight-edge beam disposed in a plane above and extending across the diameter of the protractor plates whereby an edge of the beam extends across the top surfaces of the two protractor plates for coaction with scale markings thereon.

4. A protractor structure as set forth in claim 1, including a straight-edge beam lying in a plane above said plates and extending diametrically across the circles defined thereby, said beam having a flat ear at each end, resting upon the top surface of the outer protractor plate, said outer protractor plate having a short tangentially directed slot therein beneath each ear, and a guide pin carried by each ear and slidably disposed in the adjacent slot, the pin and slot connection between the ears and outer plate facilitating shifting the beam in a horizontal plane paralleling the top faces of the plates, relative to the radial center of the plates.

5. A protractor structure as set forth including a bolster annulus, a pair of annular protractor plates superimposed on the bolster and in the same plane, the inner protractor plate being secured to the bolster and the outer protractor plate being in edge contacting relation with the outer edge of the inner plate, roller elements carried upon the under side of the outer plate and having rolling contact with the outer periphery of the bolster, the said bolster periphery and roller elements being so constructed and arranged as to have a cooperative action to maintain the outer plate in the plane of the inner plate

while permitting the turning of the outer plate around the inner plate, a straight edge beam lying above and diametrically across the plates and including two parallel longitudinal portions, one of said portions having its ends attached to the outer plate and the other portion being longitudinally shiftable on the said one portion, and coacting means between said portions for determining the extent of movement of the shiftable portion with respect to the radial center of the plates, an element of said means functioning as a working position indicator for a scribing implement.

6. An implement of the character described comprising a pair of annular plates disposed in one plane in edge contacting relation, one of said plates being fixed relative to the other and the top surfaces of said plates having coacting scales designating degrees of a circle, the said other plate being rotatable, a straight-edge beam disposed in a plane above and extending across said plates, means connecting the beam to the rotatable plate for movement in a plane paralleling the top surfaces of the plates, said beam comprising a longitudinally channeled portion having a longitudinal edge scale and a bar slidably supported in the channel, and pointer means carried by the bar for coaction with said longitudinal scale, said pointer means functioning as a position indicator for a scribing implement when held against a side edge of the beam.

7. A drafting instrument of the character set forth comprising a pair of flat annular plates disposed in a common plane and in edge contacting relation, one of said plates being fixed and the other plate being rotatable relative thereto, said plates having their top faces provided with coacting scales representing degrees of the circle, a straight-edge beam disposed in a plane above the plates and extending diametrically across the same, said straight-edge beam comprising a longitudinally channeled portion and a bar portion slidably supported within the channel, said channeled portion having end ears resting upon the top of the rotatable plate, means coupling said ears with the rotatable plate by which limited shifting movement of the beam is obtainable in a plane paralleling the top surfaces of the plate, and a combined pointer and scribing implement positioning means carried by the bar, the said channeled portion having a linear scale thereon with which said pointer means coacts.

8. An instrument as set forth in claim 7, including a limit stop for said bar portion consisting of a rod slidably adjustably secured to the channeled portion and having a terminal finger extending across an end of the channeled portion in the path of movement of the bar portion.

GEORGE I. FISCHER.