

July 9, 1946.

E. D. BROWNING

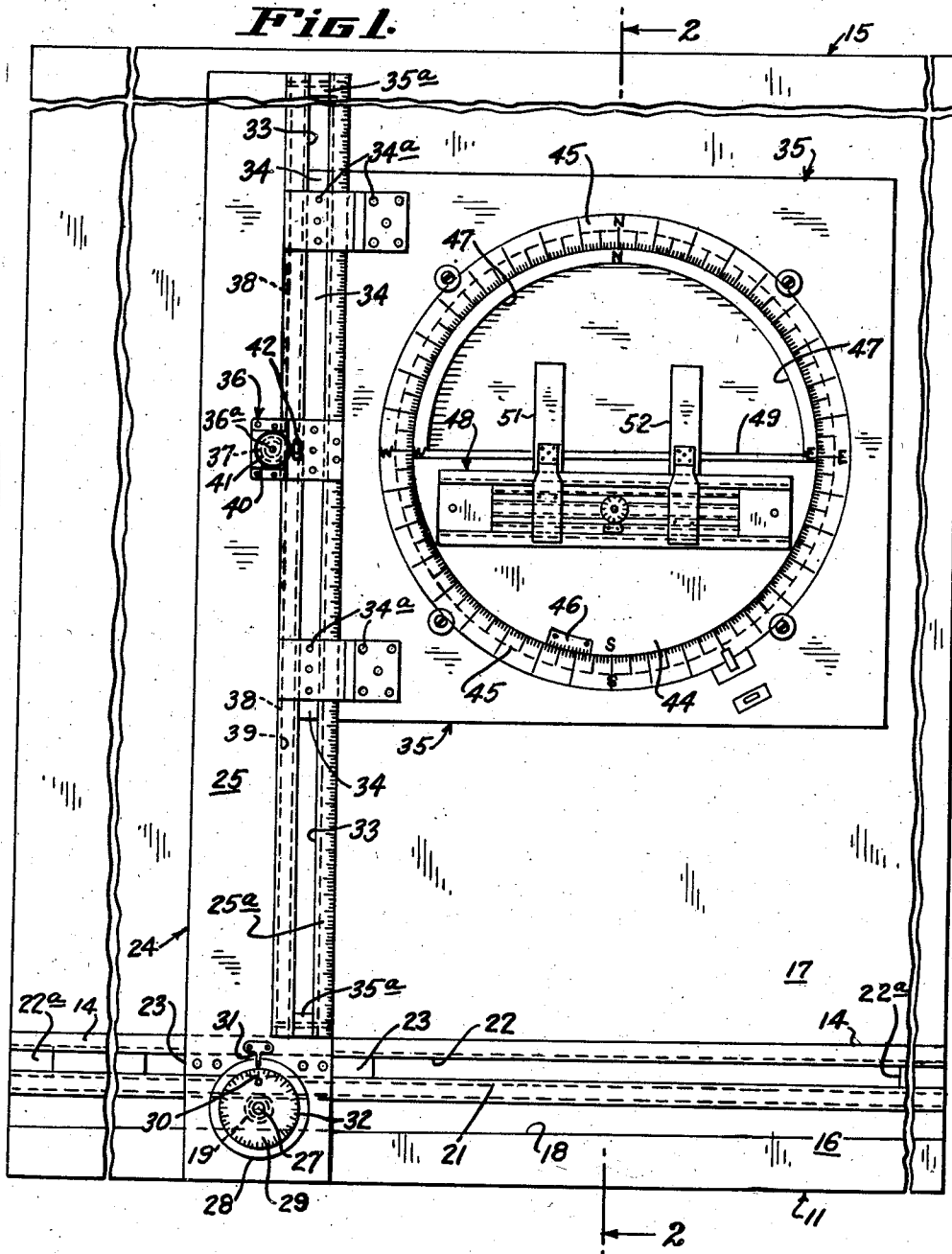
2,403,633

LAY-OUT MACHINE

Filed Nov. 25, 1942

3 Sheets-Sheet 1

Fig. 1.



INVENTOR.
EDWIN D. BROWNING
BY *Arlington C. White*
ATTORNEY.

July 9, 1946.

E. D. BROWNING

2,403,633

LAY-OUT MACHINE

Filed Nov. 25, 1942

3 Sheets-Sheet 2

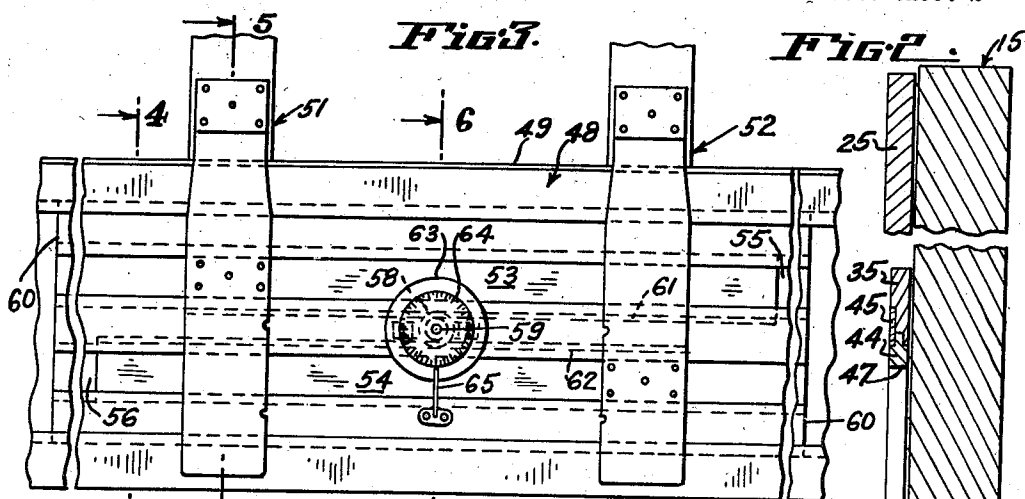
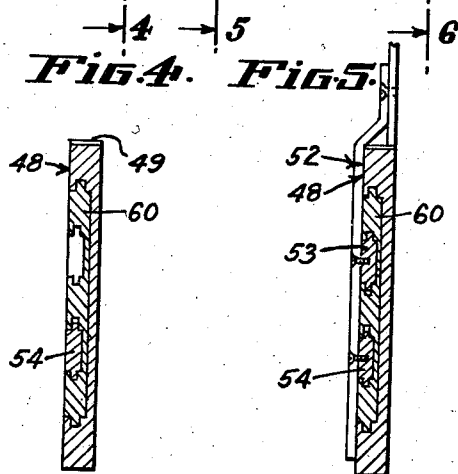
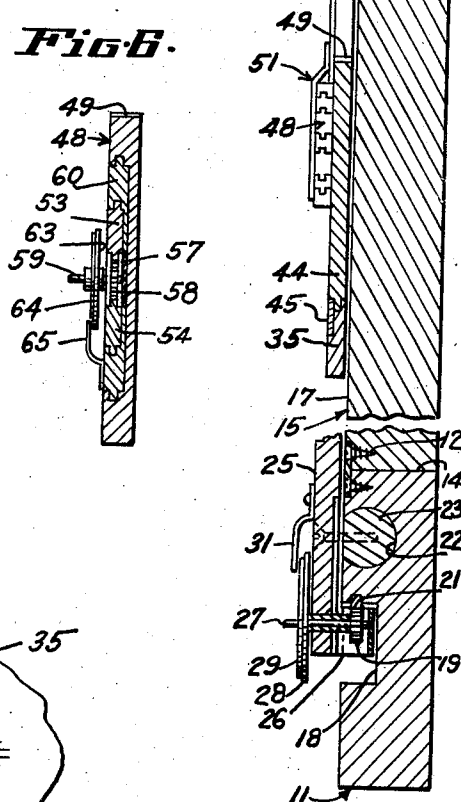
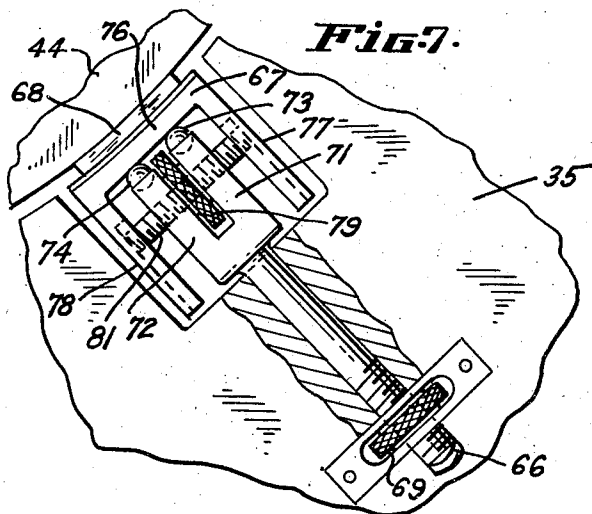


Fig. 6.



INVENTOR.
EDWIN D. BROWNING

BY *Arlington C. White*

ATTORNEY.

July 9, 1946.

E. D. BROWNING

2,403,633

LAY-OUT MACHINE

Filed Nov. 25, 1942

3 Sheets-Sheet 3

Fig. 8.

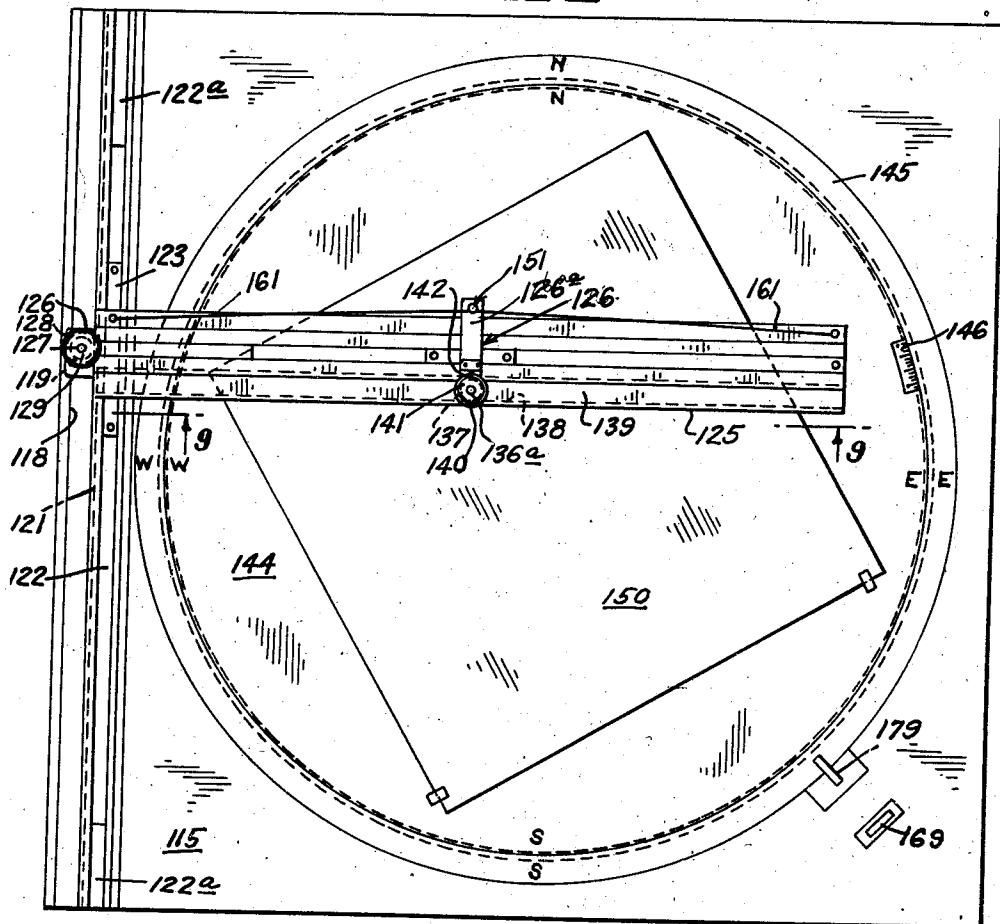


Fig. 10.

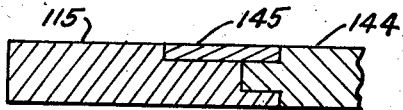
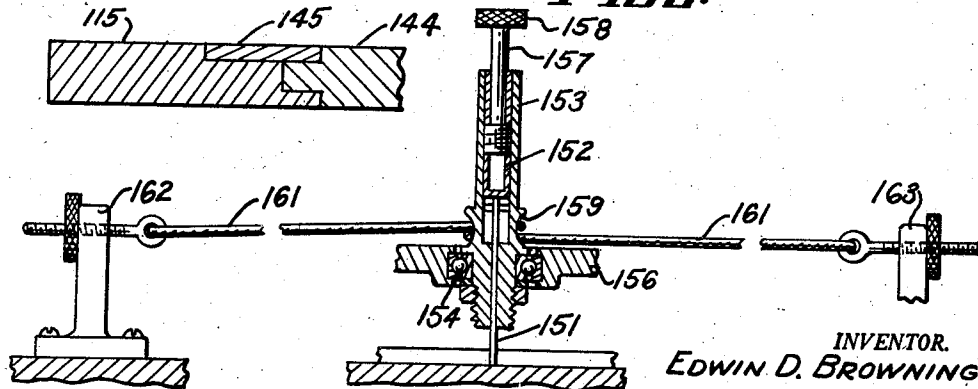


Fig. 9.



INVENTOR.
EDWIN D. BROWNING

BY *Alington L. White*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,403,633

LAYOUT MACHINE

Edwin D. Browning, Alameda, Calif.

Application November 25, 1942, Serial No. 466,836

3 Claims. (Cl. 33—76)

1

The invention, in general, relates to means for enabling the precision production of tools, machines, devices or parts thereof. More particularly, the invention relates to a dual function, improved lay-out device for enabling either direct production from work stock of any desired tool, device, machine or parts thereof, or the preparation of patterns or working drawings for use in the making of the aforesaid products or articles.

Heretofore, it has been the common practice to have draftsmen prepare working drawings and blue-prints which are followed by craftsmen in making various devices, machines, parts thereof, tools and the like as well as patterns for die-casting and like work. While most of this drafting work has been done on suitable drawing paper, tracing paper and the like, it also has become a general practice to ascribe patterns or lay-outs directly upon work stock by means of suitable guides directly upon the work stock for a tool, such as a drill, a cutter, or similar device, to follow in producing a given part or parts from such stock. The foregoing practices are somewhat disadvantageous for rapid production, and are time consuming. Moreover, such practices require separate handling of T-squares, triangles, protractors as well as various and numerous other individual or separate instruments of common drafting paraphernalia.

A primary object of my present invention is to provide a unitary, compact improved lay-out machine which can readily be employed by the skilled and unskilled alike for the preparation of patterns or working drawings to any scale desired.

Another object of my invention is to provide a machine of the indicated nature which is further characterized by its function of being readily usable in conjunction with other tools or equipment for directly producing parts of devices, tools or machines from work stock or work pieces.

A still further object of the present invention is to provide a lay-out device of the aforementioned character which is capable of making lay-outs on adjacent surfaces in different planes.

A still further object of my improvement is to provide a device of the indicated nature which is additionally characterized by its capability of measuring angular relationships as well as linear distances between points on adjacent surfaces in different planes.

Another object of the invention is to provide a device of the aforementioned character which

2

can be geared to any degree of fineness and which accurately measures every movement of an instrument in any direction as the movement is made over a work-piece or drafting board, as well as enabling the user of the device to check back to a starting point or any other point.

A still further object of my invention is to provide a device of the indicated nature which can serve as a tool or work unit guide and conveyor in the direct production of any desired part of a machine, device or portion of equipment.

Other objects of the invention, together with some of the advantageous features thereof, will appear from the following description of a preferred and one modified embodiment of the invention which are illustrated in the accompanying drawings. It is to be understood, however, that I am not to be limited to the precise embodiments shown, nor to the precise arrangement of the several elements thereof, as my invention, as defined in the appended claims, can be embodied in a plurality and variety of forms.

Referring to the drawings:

Figure 1 is a fragmentary plan view of a preferred embodiment of my invention as applied to a drafting board or a work-piece.

Figure 2 is an enlarged, fragmentary view of the preferred embodiment of my invention, this view being taken on the line 2—2 of Figure 1.

Figure 3 is an enlarged, fragmentary view of a portion of the preferred embodiment of the invention.

Figure 4 is a cross-sectional view of the preferred embodiment of the invention, this view being taken on the line 4—4 of Figure 3.

Figure 5 is a view similar to Figure 4 but taken on the line 5—5 of Figure 3.

Figure 6 is another view similar to Figure 4 but taken on the line 6—6 of Figure 3.

Figure 7 is an enlarged, fragmentary plan view illustrating an adjustment and set screw mechanism forming a portion of the preferred embodiment of my invention.

Figure 8 is a plan view of a modified embodiment of the present invention.

Figure 9 is an enlarged, broken elevational view of certain elements of the modified embodiment of my present invention.

Figure 10 is a fragmentary, sectional elevational view depicting the mounting of certain elements of the modified embodiment of my invention shown in Figure 8.

In its preferred form, the lay-out machine of my present invention preferably comprises a base strip having a longitudinally extending recess

therein; said base strip being adapted to be detachably fastened to a drawing board or a work-piece, a T-square including a head and a tongue having a longitudinally extending recess therein; said T-square head being slidably mounted in the recess of said base strip for transverse movement across said board, together with a turn-table holder slidably mounted in the recess of said tongue, a turn-table mounted on said holder, a protractor ring supported adjacent the periphery of said turn-table, and a pair of calipers movably mounted on said turn-table for rotation therewith.

While the machine of my present invention can be efficaciously employed, as indicated above, for making patterns directly from a suitable work-piece, or for producing parts or tools or devices directly from work-pieces when used with requisite tools, such as cutters, saws, drills, burners and the like, the machine of the present invention is equally suitable and has been devised for use in making working drawings, plans and designs on drafting paper and in connection with a drawing board. Accordingly, I have illustrated the machine, and shall describe the same in the latter environment for purposes of simplicity and explanation.

As particularly illustrated in Figure 2 of the drawings, the preferred embodiment of my invention includes means for removably supporting the machine in spaced relationship with respect to a drawing board. While any suitable means may be employed for this purpose, I preferably provide a base strip 11 which can be fabricated of metal, wood or plastic material, and which is adapted to be detachably fastened by means of a plate and counter-sunk screws 12 to and alongside one end 14 of a drawing board 15. If the drafting work to be done requires the makings of drawings upon a plurality of adjacent surfaces in different planes, different sizes of blocks, not shown, may be interposed between the base strip 11 and the end 14 of the drawing board for holding the base strip and its associated elements at a desired elevation with respect to the board and, hence, with respect to adjacent surfaces in several different planes. However, if the drawing is to be made upon a flat surface, as is customary, such block is not employed and the base strip 11 is fastened directly to the end of the board so that the upper surface 16 of the base 11 is substantially flush with the upper surface 17 of the drawing board. As shown, the base strip 11 preferably is formed with a transversely extending, relatively wide groove 18 therein for accommodating a gear 19 which is supported for meshing and rolling engagement with a rack 21 secured within the base strip 11 at one side of the groove 18. In addition, base strip is so formed as to provide therein a transversely extending recess for snugly yet slidably receiving the head 23 of a T-square, the latter being designated generally by the reference numeral 24. The fact that the upper surface 16 of the base strip 11 is supported substantially flush with the upper surface 17 of the drawing board 15 brings the supported T-square slightly above the top surface of the board, permitting the slipping of a sheet of drafting paper, not shown, under the T-square and the fastening of the same by suitable thumb-tacks or tape to the drawing board. With the head 23 of the T-square snugly yet slidably mounted in the recess 22 of the base strip 11, it is clear that the T-square can be manually moved at will transversely with respect to the drawing board. Suit-

able stops 22a are provided within and at each end of the recess 22 to limit the movement of the T-square in both directions.

In accordance with my invention, means are provided for enabling the ready ascertainment of the relationship between center lines on the drafting paper made with the T-square and a pencil or ruling pen, as well as for measuring the linear distance, either in inches or units of the metric system, between two or more of such lines or the full linear distance travelled in either direction by the T-square as it is moved. To this end, I provide a specially formed tongue 25 on the T-square which extends, as in standard T-squares, at right angles to the head 23 and which serves the dual function of supporting the means for measuring the distances travelled transversely of the drawing board 15, or work-piece, by the T-square and of supporting a turn-table holder for permitting longitudinal movement of the turn-table holder across the drawing board 15 or work-piece, as hereinafter explained. As particularly shown in Figure 2 of the drawings, one end of the tongue 25 of the T-square 24 extends over the base strip 11, and a cabinet or housing 26 is fastened to such extended end of the tongue 25 to depend therefrom. Journaled in the cabinet 26 is a pin 27 on the lower end of which the gear 19 is secured for meshing engagement with the rack 22 mounted in the groove 18 of the base strip 11. On the upper end of the pin 27 I provide a circular plate 28 upon which is mounted, for rotation relative to the plate as well as rotation therewith, a measuring disc 29 having a zero point 30 delineated thereon for aligning the disc whenever desired with a pointer 31 fastened to the upper surface of the T-square 24 at the transverse center of the tongue 25 thereof. See, in this connection, Figure 1 of the drawings. In addition to the zero point 30, the measuring disc 29 is delineated with a series of circumferentially arranged markings 32 designating either fractions of a foot or fractions of a meter, depending upon whether the device is to be used in countries employing the metric system or is to be used in this country. It is to be understood that the pitch circumference of the gear 19 is made equal to an inch, or corresponding division of a similar unit of the metric system, and the relationship between gear 19 and the disc 29 is such that each revolution of the gear 19 as well as of the disc 29 automatically measures the linear distance, say one inch, travelled by the T-square 24 as it is moved manually transversely with respect to the drawing board 15. In this connection, it is further to be understood that the fractional markings 32 on the upper face of disc 29 can be either in hundredths, ninety-sixths, sixty-fourths, thirty-seconds, sixteenths or any other fractional division of an inch, or in fractional units of the metric system. Moreover, that a series of interchangeable measuring discs 29, carrying different fractional markings 32, may be provided so that any selected one of such series of interchangeable measuring discs 29 can be mounted on plate 28 for rotation therewith in response to the rotation of the pin 27 as it is rotated by the rolling of gear 19 along the rack 22 as the T-square is manually moved across the board.

In accordance with my invention, the tongue 25 of the T-square is formed with a longitudinally extending recess 33 therein for snugly yet slidably receiving a depending strip 34 fastened by any suitable means, such as screws 34a, to the under side of a turn-table holder 35, all as depicted in

5

Figure 1 of the drawings. By this mounting, as in the case of the head 23 of the T-square on the base strip 11, the turn-table holder 35 may be manually moved at will longitudinally across the board 15 or any work-piece in connection with which the lay-out machine is employed; it being understood that such mounting supports the turn-table holder 35 slightly above the upper surface of the drawing board so that a sheet of drafting paper may be interposed between the turn-table holder and the board and fastened to the latter by suitable thumb-tacks or tape. Suitable stops 35a are disposed in the recess 33 at opposite ends thereof to limit the lengthwise movement of the turn-table holder 35. Means are provided, in association with the tongue 25 of the T-square, for measuring the linear distance that the turn-table holder 35 travels as it is moved manually by the user of the device to and fro lengthwise of the underlying drawing board 15. I preferably utilize for this purpose substantially similar means as described above for measuring the linear distance travelled by the T-square transversely of the drawing board and to this end a cabinet or housing 36 is fastened at one side of the T-square tongue 25 and depends therefrom; the cabinet serving as a means for rotatably mounting a pin 36a to the lower end of which is secured a gear 37 so disposed as to be in meshing and rolling engagement with a rack 38 which is secured at one side of a longitudinally extending groove 39 formed in the T-square tongue. The gear 37 and rack 38 are shown in dotted lines in Figure 1 of the drawings. In addition to the foregoing elements, the measuring means for automatically ascertaining the lengthwise movement of the turn-table holder 35 as the movement is made include a circular plate 40 secured to the upper end of the pin 36a together with a measuring disc 41 which not only is rotatable with the plate 40 when the pin 36a rotates in response to the rolling of gear 37 along rack 38 but also is adjustable relative to the circular plate 40 so that other discs may be interchanged for any other similar measuring disc 41, whenever desired. While not shown in Figure 1, the disc 41 carries delineations, similar to the delineations of the measuring disc 29, including a zero point for aligning the disc 41 with a pointer 42 fastened to the upper surface of the tongue 25 as well as fractional divisions of a unit of the metric system or of an inch, as desired. It is to be understood that the pitch circumference of the gear 37 is made to one inch or any corresponding length of the metric system, so that each revolution of the gear 37 and a corresponding or responsive single revolution of the measuring disc 41 indicates a linear unit distance travelled by the turn-table holder 35 as it is manually moved to and fro across the drawing board 15. I conveniently delineate a linear scale 25a, divided into inches or equivalent fractions of the metric system, as desired, on the upper surface of the tongue 25 adjacent one edge thereof to assist the user of the device in making drawings upon the underlying drafting paper, not shown, or work-piece.

In addition to the foregoing elements, the improved layout machine of my present invention includes a turn-table 44 which is rotatably mounted in the turn-table holder 35 and which preferably is marked with suitable delineations indicating one point or all points of the compass as guides for the user of the device, all as depicted in Figure 1 of the drawings. The turn-table 44

6

is so mounted that its periphery fits under the inner edge of a protractor ring 45 which preferably is fabricated of metal and which is securely fastened by means of suitable screws and washers to the turn-table holder 35. The protractor ring 45 is of the conventional type having a standard scale with fractional divisions delineated upon its upper surface adjacent to its periphery, as shown in Figure 1. In order to afford precision work, a suitable block upon which a vernier scale 46 is delineated is fastened to the turn-table 44 for reading the vernier scale in conjunction with the scale of the protractor 45. As particularly shown in Figure 1 of the drawings, both the turn-table holder 35 and the turn-table 44 are cut away to define a substantially semi-circular opening 47 therethrough so that the user of the device may lay-out the work desired upon an underlying sheet of drafting paper or directly upon a work-piece. As shown, the improved lay-out machine of my present invention also includes a caliper frame, which is designated generally by the reference numeral 48 in Figures 1 to 6 inclusive of the drawings, having a drawing edge 49 thereon adjacent to the opening 47; such drawing edge 49 preferably being fabricated of plastic material. The caliper frame is securely mounted on the upper surface of the turn-table 44 and is so constructed as to provide a pair of movably mounted calipers including two caliper wings 51 and 52 which extend over the opening 47 and which are bent downwardly, as shown in Figure 5 of the drawings, so as closely to overlie the drafting paper on drawing board 15, or a work-piece as the case may be.

In accordance with my invention, and as particularly illustrated in Figures 3 to 6 inclusive of the drawings, substantially the same means are provided for movably mounting the pair of calipers as the means described above for mounting the T-square head 23 and the turn-table holder 35. To this end, oppositely extending strips 53 and 54 are fastened to the under sides of the caliper wings 51 and 52, respectively, so that strip 53 extends underneath the wing 52 while the strip 54 extends underneath the opposite wing 51. Strips 53 and 54 are disposed for slidable movement in a pair of spaced parallel recesses 55 and 56, respectively, which are formed in a movable member 60 slidable as a unit in the caliper frame 48. Approximately at the transverse and longitudinal center of the caliper frame 48, I provide a chamber 57, see Figure 6, for housing a gear 58 which is secured on the lower end of a pin 59 journaled in the caliper body 48, such gear being so disposed as to be in meshing engagement with a pair of racks 61 and 62 which are mounted on the strips 53 and 54, respectively, on the sides thereof adjacent to the gear 58. In the same manner as provided for measuring the linear distances travelled transversely of the drawing board 15 by the T-square and the linear distance travelled longitudinally of the board by the turn-table holder 35, the caliper assembly is provided with means for measuring the linear distance travelled by the calipers in each direction as they are moved to and fro within the confines of the turn-table 44 and protractor ring 45. To this end, a circular plate 63 is securely fastened to the upper end of the pin 59, and a measuring disc 64 is adjustably fastened on top of the plate 63 so that the disc rotates, when fixed to the plate 63, with the pin 59 as it rotates in response to the movement of racks 61 and 62 back and forth with the movement of the strips 53 and 54. The

adjustable mounting of measuring disc 64 on plate 63 is to afford interchangeability of discs of the same dimensions but carrying different fractional divisions of a unit of measurement. It is to be understood that the pitch circumference of gear 58 is made to a desired length, say one inch or corresponding division of the metric system, and that the pitch dimension of measuring disc 64 is such that a single revolution of the gear and disc affords automatic measurement of the linear distance travelled by the wings of the calipers in both directions as the movements are made. Accordingly, and as in the case of the measuring disc 29 and 41, a zero point as well as fractional divisions of a unit of measurement are delineated upon the upper surface of disc 64, such fractional divisions being made, as desired, in hundredths, ninety-sixths, sixty-fourths, thirty-seconds, sixteenths or other divisions of an inch or of a unit of the metric system, as desired. The zero point of the disc 64, because of the adjustable mounting of the disc on the plate 63, can readily be brought at any time into alignment with a pointer 65 secured to the upper surface of the caliper frame 48. In view of the described mounting of the calipers upon the turn-table 44, which rotates within the stationary protractor ring 45, it is clear that angular relationships between all lines drawn upon an underlying sheet of drafting paper in conjunction with the calipers can be accurately measured by the protractor ring and the associated vernier scale 46. Moreover, the slidable mounting of the calipers in the assembly mounted on the turn-table 44, and the provision of the measuring disc 64 which moves in response to the movement of the strips 53 and 54 with their racks 61 and 62, affords accurate measurement of the linear distance travelled by the calipers in both directions as they are manually moved by the user of the device within the confines of the protractor ring 45. A suitable scale, not shown, but similar to the scale 25a on the tongue 25 of the T-square, may be delineated on the upper surface of the caliper frame 48 adjacent to the ruling edge 49 thereof as a convenience for the user of the machine. It is clear also that the edges of the wings 51 and 52 of the calipers can be utilized as guides in making drawings or plans on an underlying sheet of drafting paper, or upon a work-piece as the case may be.

As illustrated in the enlarged view of Figure 7 of the drawings, I provide means for holding the turn-table 44 in any selected one of a plurality of adjustable positions as well as for enabling precision adjustments thereof with respect to the ring 45. To this end, the turn-table holder 35 is suitably recessed for receiving a set-screw 66 and a movable adjustment member 67, the latter preferably being fabricated of metal and having an edge 68 of rubber which bears against the periphery of the turn-table 44, when urged against the same by the movement of the set-screw 66. As shown, the set-screw 66 is threaded at one end thereof for receiving a thumb-nut 69 whereby the set-screw may be moved a relatively short distance in both directions longitudinally. The other end of the set-screw 66 is bifurcated to provide two legs 71 and 72 each of which supports in its outer end a ball bearing 73 and 74, respectively, which bear against the inner surface of a cross-piece 76 joining two legs 77 and 78 of the U-shaped movable adjustment member 67. When the thumb-nut 69 is rotated in one direction, the ball bearings 73 and 74 bear against the inner surface of cross-

piece 76 of adjustment member 67 to urge the rubber edge 68 thereof against the periphery of turn-table 44, underneath the protractor 45, and frictionally hold the same against rotation. However, rotation of the thumb-nut 69 in the opposite direction withdraws the rubber edge 68 of the adjustment member 67 from the periphery of the turn-table and the latter can then be freely rotated. To afford precision adjustment of the turn-table with respect to the protractor ring 45, I provide a thumb-nut 79 rotatably mounted on a screw 81 which spans the legs 77 and 78 of the adjustment member 67. Rotation of thumb-nut 79 in one direction draws the adjustment member 67 slightly in one direction to turn the turn-table 44 slightly, while rotation of thumb-nut 79 in the opposite direction effects slight rotation of the turn-table 44 in the opposite direction.

In Figures 8 to 10 inclusive of the annexed drawings I have illustrated a modified embodiment of the present invention which, in general, comprises a unitary drawing board and lay-out machine combination. As shown, I provide a drawing board 115, preferably fabricated of wood, and mount thereon for slidable movement transversely of the board a T-square including a specially formed tongue thereon. The slidable mounting of the T-square preferably is accomplished by forming a relatively narrow recess therein for receiving the head of the T-square in the same manner as mounting the T-square of the preferred embodiment of the invention. Likewise, the modified embodiment of Figures 8 to 10 inclusive includes substantially the same means for accurately measuring the distances travelled by the T-square as the means employed in the preferred embodiment. To this end, a relatively wide transversely extending groove 118 is formed in the drawing board adjacent to one side thereof, such groove being of sufficient width to accommodate a gear 119 which is so disposed as to mesh with and roll along a track 121 secured within groove 118. In addition, a relatively narrow recess 122 is formed in the board 115 substantially parallel to and alongside of groove 118 for slidably yet snugly receiving the head 123 of a T-square 124 which includes a tongue 125 extending at a right angle to the head and which overlies the drafting board with sufficient space therebetween to permit the sliding of a sheet of drafting paper under the tongue for attachment to the board.

As in the case of the preferred embodiment of the invention, the modification of Figures 8 to 10 inclusive is provided with means for accurately and automatically measuring the linear distance travelled by the T-square as it is manually moved to and fro transversely of the drawing board, thus furnishing the user of the device with the distances between center points and lines made on the drawing paper. As shown, a cabinet or housing 126 is fastened to one end of the tongue 125 of the T-square and depends therefrom, the cabinet serving as a means for rotatably mounting a pin 127 to the lower end of which the gear 119 is fastened and so disposed as to be in meshing engagement with the rack 121. On the upper end of pin 127 there is mounted a circular plate 128 upon which is adjustably mounted a replaceable measuring disc 129, the latter disc carrying similar delineations as the measuring disc 29 of the preferred embodiment of the invention; it being understood that any selected one of a plurality of interchange-

9

able disc 129 can be employed with the device and that each measuring disc carries different delineations of fractional divisions of an inch or of a similar unit of the metric system, as desired. It is further to be understood that, as in the case of the preferred embodiment, the pitch circumference of the gear 119 is made to a predetermined length, say one inch or a corresponding unit of the metric system, so that upon each revolution thereof, as well as each revolution of the measuring disc 129 in response to the movement of the gear, measures the linear distance in inches or in units of the metric system, that the T-square is moved in either direction transversely of the drawing board. Suitable stops 122a are disposed in the recess 122 at opposite ends thereof to limit the travel of the T-square.

Similarly, the T-square tongue 125 is provided with means for accurately and automatically measuring distances between center points and lines longitudinally of the drawing board 115. To this end, the tongue 125 movably supports a housing or cabinet 126 which includes an arm 126a extending transversely across the tongue and which serves as a means for rotatably mounting a pin 136a as well as for housing a gear 137 secured to the lower end of pin 136a and so disposed as to be in meshing and rolling engagement with a rack 138 mounted within a longitudinally extending groove 139 formed in the T-square tongue. The arrangement is such, therefore, that the cabinet arm 126a with its mounted elements is movable manually longitudinally of the drawing board with respect to the tongue 125 or to and fro across the board. On the upper end of the pin 136a I fasten a circular plate 140 for adjustably supporting a measuring disc 141 thereon. The plate 140 and disc 141, including fractional markings on the latter, not shown, are in all respects similar to the circular plate 40 and measuring disc 41 of the preferred embodiment of the invention described above and detailed explanation of the disc 141 is not required other than to state that a zero point on the disc is provided for aligning the disc whenever desired with a pointer 142 conveniently secured on the upper surface of the arm 126a of the housing 126.

In accordance with the modification of the present invention, a turn-table 144 is rotatably mounted directly on the drawing board 115 and hence, is not shiftable longitudinally on the T-square tongue as in the case of the preferred embodiment of the invention. As depicted in Figure 10, the periphery of the turn-table fits under a protractor ring 145 which is fixedly secured to the drawing board and which carries the standard scale, not shown, of all conventional protractors. A suitable block carrying a vernier scale 146 is fastened to the turn-table 144 adjacent to the inner edge of the protractor ring 145 in order that precise measurements can be taken for making drawings on the sheet of drafting paper 150.

In the present modification of my invention a mechanical pencil 151 is mounted on the end of cabinet arm 126a opposite to the end of the cabinet carrying the pin 136a for enabling a user of the machine to draw the pencil along the edge of the tongue 125 of the T-square in making desired lines on the underlying sheet of drafting paper. The pencil 151 is of the conventional type and is carried in a barrel 152 adjustably mounted in a sleeve 153 which, in turn, is mounted for rotation by means of ball bearings 154 in a depending bracket 156 on the cabinet 126. The

10

barrel 152 supports a shank 157 having a knurled head 158 thereon to facilitate turning of the pencil manually whenever desired to extrude the lead. The sleeve 153 is grooved externally to provide, in effect, a pulley 159 around which is trained a cord 161 which is adjustably fastened to opposed standards 162 and 163 affixed to opposite ends of the T-square tongue 125. By this mounting of the pencil and the provision of the pulley and cord, the pencil is rotatable to afford the maintenance of a sharp point thereon at all times.

As in the case of the preferred embodiment of the invention, the modification of Figures 8 to 10 inclusive includes similar means for holding the turn-table 144 in any selected one of a plurality of positions and to enable precision adjustments thereof relative to the encircling protractor ring 145. These means are in all respects the same as those illustrated in Figure 7 of the drawings and the details are therefore not shown in Figure 8, it being deemed sufficient to depict only the thumb-nuts 169 and 179 of such set-screw and adjustment means.

This modified embodiment, being a unitary structure including a drawing board and inserted turn-table, is usable to nearly the same effect as the preferred embodiment of the invention. The drafting paper 150, being fastened to the top of the turn-table 144, is of course movable therewith to any desired position relative to the T-square tongue 125, and the T-square, per se, is movable manually transversely of the drawing board. The use of the pencil 151 in conjunction with the edge of the tongue of the T-square, the turn-table 144 and protractor ring 145, enables the making of drawings with lines running at any desired angular relationship with one another on the underlying drafting paper 150. And it is clear that the measuring discs 129 and 141 afford accurate and automatic measurements between center points and lines as the T-square 124 is moved and as the arm 126a carrying pencil 151 is moved.

It is to be understood that the appended claims are to be accorded a range of equivalents commensurate in scope with the advance made over the prior art.

I claim:

1. In a lay-out machine for precision production of tools or devices as well as the making of working drawings, a base including means for detachably fastening the machine to a work-piece or a drawing board; said base having a transverse groove and transverse recess therein, a rack mounted in said groove, a T-square comprising a head and a tongue; said head being slidably mounted in said recess, a housing depending from said tongue, a pin journaled in said housing, a gear carried on said pin in meshing engagement with said rack, and a measuring disc mounted on said pin for measuring the linear distance moved by said T-square as it is moved slidably in said recess.

2. In a lay-out machine for precision production of tools or devices as well as the making of working drawings, a base including means for detachably fastening the same to a work-piece or to a drawing board; said base having a transverse groove and a transverse recess therein, a T-square comprising a head and a tongue having a longitudinal recess and also a longitudinal groove therein; means on said head for slidably mounting said T-square in said transverse recess of said base, a first rack secured to said base with-

11

in said transverse groove, a first pin journaled in said tongue, a first gear on said first pin in meshing engagement with said first rack, a turntable holder slidably mounted in the recess of said tongue, a second rack mounted in said groove of said tongue, a second pin journaled in said tongue, a second gear on said second pin in meshing engagement with said second rack, a turntable rotatably mounted on said turn-table holder, a caliper frame securely mounted on said turn-table; said caliper frame having a channel as well as a chamber therein, third and fourth racks mounted in said channel of said frame, a third pin journaled in said frame and extending into the chamber thereof, a pair of calipers movably mounted on said frame, a third gear on said third pin in meshing engagement with said third

12

and fourth racks, and measuring discs on said first, second and third pins for automatically measuring the linear distances travelled by said T-square, said turn-table holder and said pair of calipers as movements thereof are made.

5 3. In a lay-out machine of the character described, a turn-table holder, a turn-table mounted for rotation in said holder, a caliper frame securely mounted on said turn-table, a pair of caliper strips slidably mounted in said frame, a pin journaled in said frame, a rack mounted on each of said strips, a gear carried by said pin in meshing engagement with said racks, and a measuring disc on said pin for automatically measuring the linear distances moved in both directions by each of said pair of caliper strips as they are moved.

EDWIN D. BROWNING.