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DRAFTSMAN'S PROTRACTOR

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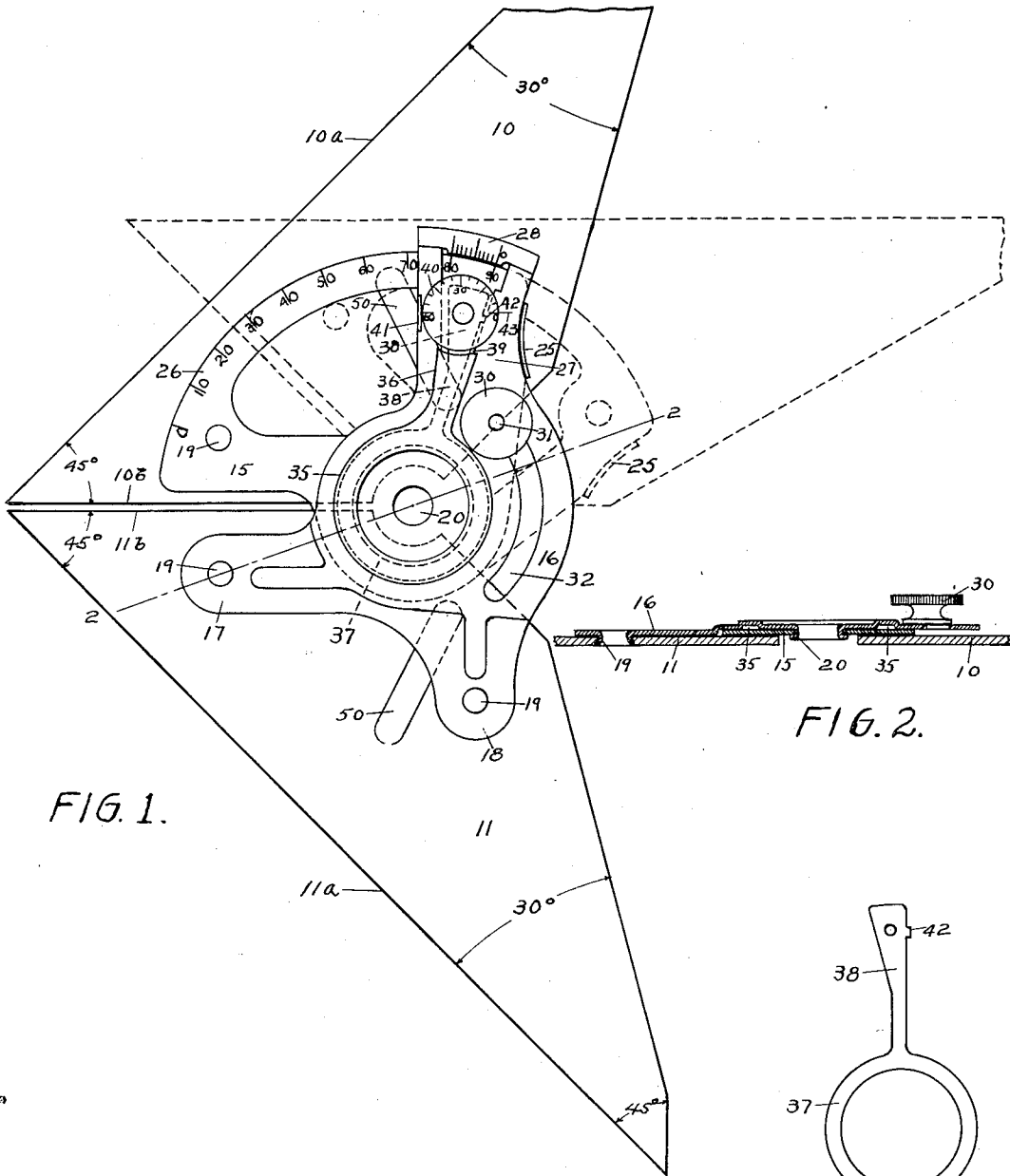


FIG. 1.

FIG. 2.

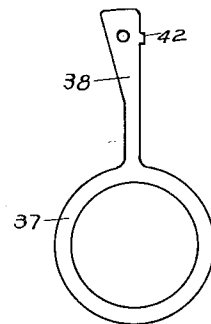


FIG. 3.

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DRAFTSMAN'S PROTRACTOR

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7 Claims. (Cl. 33—75)

This invention relates to adjustable protractors of the kind used by draftsmen. It resembles in some respects the instrument which I disclosed in my U. S. Patent Number 1,127,033, Feb. 2, 1915, but it embodies various improvements thereover.

Briefly stated, my protractor comprises two triangles pivotally joined, a graduated scale whereby the triangles may be set in various relative angular positions, from 0° to 90°, and secured in any position with a thumb nut. One of the present improvements consists in a new form of graduated scale, having the merit of being very easily read. Another advantage of this scale is that it can be made at a low cost.

As in my earlier invention I make the triangles of some transparent composition, such as celluloid, and one of the present improvements resides in mounting the triangles on metal supporting members, which members are pivotally united. These members carry the graduated scales and other mechanism, thereby tending to maintain the accuracy of the instrument. Another new feature is a mechanical vernier, and another consists in a stop whereby without consulting the graduations the triangles can be set at the relative angularity in which they are most used, namely, with the major edges of the triangles forming an angle of 90°, thereby permitting the 45° edges to be used for ruling or other purposes.

I also provide means for relieving the triangles of stresses due to their being riveted to metal supporting members, thereby preventing warpage or other changes in the triangles, such as often occur when composition parts are riveted to metal parts. I shall now describe my invention in detail with the assistance of the accompanying drawing, in which

Fig. 1 is a plain view of the instrument, showing the triangles in the 90° position, but in dotted lines showing one of the triangles moved with reference to its companion to an angle much less than 90°;

Fig. 2 is a sectional view on line 2—2 of Fig. 1. This view is only intended to show certain features of the construction, and is therefore somewhat incomplete, and

Fig. 3 shows one of the parts belonging to the mechanical vernier.

My instrument comprises two triangles, 10 and 11, composed of some non-metallic composition. As these triangles are similar to those shown in my patent previously mentioned it will suffice to say that each includes angles of 30° and 45°.

These triangles are pivotally united by a metal supporting structure, which I shall now describe.

Secured to the triangle 10 is a base plate which is indicated generally by the numeral 15. This plate is made of sheet metal and lies flat against the triangle. Superimposed on this supporting member or base plate 15, is the supporting member for the triangle 11, which member is indicated generally by the numeral 16. This member also is made of sheet metal, and in order to bring the triangle it supports into the same plane with the triangle 10, the two ears 17 and 18, whereby the member is attached to the triangle 11, are off-set downward to bring them into the plane of the plate 15. Each of these ears is perforated by a die to form an eyelet 19, which, having been inserted in a hole in the triangle, is bell-mouthed to secure it in the hole. See Fig. 2. The member 15 is attached to the triangle 10 by two similar eyelets, only one of which is seen in the drawing. The members 15 and 16 are pivotally united by a similar eyelet, as is clearly seen at 20 in Fig. 2. The triangles may be moved on the pivot 20 relative to each other, from the position they occupy in Fig. 1, wherein the major edges 10a and 11a form an angle of 90°, to a position where said edges are parallel.

As the instrument is used in the 90° position more than in any other, and must therefore be moved to that position very frequently, I provide a stop 25 on the base plate 15, which the member 16 engages when the triangles reach the 90° position. This is an improvement over my former invention, in which the 45° edges of the triangles themselves came together at the 90° position.

In my present structure the triangles are so positioned on the supporting members that when the triangles are in the 90° position their edges 10b and 11b do not come quite together; they remain separated by a narrow space of uniform width. Preferably this space is about one-sixteenth of an inch wide, which is sufficient to admit the point of a pencil. Thus these 45° edges may be used for ruling lines when the triangles are in the 90° position, which could not be done with my former instrument.

I shall now describe my improved graduated scale. The base plate 15 has a segmental portion 26, which is concentric to the pivot 20. This segment carries a series of graduations spaced 10° apart. The supporting member 16 has an arm 27 which extends across the segment 26 and terminates in a segment 28, carrying a scale 10° in length and graduated in degrees. The arm 27 is provided with a sight opening through which the scale on the segment 26 is visible, and at the outer edge of the scale 26 the arm 27 is offset

downward, in order to bring the segment 28 into the same plane as the segment 26. The graduations on the scale 26 are numbered 0, 10, 20, 30, respectively, up to 90, and when the triangles are in the position which brings their edges 10b and 11b into juxtaposition, as in Fig. 1, the graduation marked 90 coincides with the 0 graduation on the scale 28, indicating that the protractor is set at 90°. When the protractor is to be set, say at 45°, the triangles are moved to a position where the 5° mark on scale 28 coincides with the 40° mark on scale 26. In like manner other settings are made by combining the two scales.

One advantage of my improved scale is the ease with which it can be read. This is due to the scale 26 having but few marks, with much space between them. The scale 28 is easily read because it is very short, and notwithstanding it is graduated in degrees only one mark on the scale 26 is opposite it when reading is made. Another advantage is found in manufacturing the instrument. In the interest of economy it is better to impress the graduations of the scale 26 with a die, than to cut them in the usual way with a tool mounted in a dividing machine. Impressing graduations in metal with a die tends to stretch the metal, however, and if the scale 26 were graduated in degrees the metal would be stretched to such an extent as to make the scale inaccurate. Moreover, the cost and maintenance of a die for the purpose would be considerable. All of this is avoided by using the few widely separated graduations such as I put on the scale 26. Not only is the stretching of the metal so much less as to make it negligible, but the cost of the die is much less and it is easy and inexpensive to maintain. The cost of cutting the scale 28, having only eleven graduations, would be comparatively small, but because of its shortness it can be stamped without serious consequences in the way of stretching the metal.

For the purpose of securing the triangles in any desired position I provide a thumb nut 30, which is screwed on a stud 31, the lower end of which is fixed in the base plate 15. This stud extends up through an arcuate slot 32 formed in the supporting member 16.

I shall now describe my mechanical vernier. A circular chamber or housing 35 is pressed upward in the member 16, concentric to the axis 20. This housing has an extension 36 which runs part way out on the arm 27. Confined in this housing is a circular member 37, made of sheet metal, and having an arm 38 which lies in the part 36 of the housing. The housing 36 terminates at a recess 39 formed in the arm 27, which recess is an extension of the sight opening previously referred to. The arm 38 is long enough to overlap the segment 26 a short distance, and the portion 36 of the housing is broad enough to allow the arm 38 a small amount of play to and fro in the recess 39. Revolvably mounted on the arm 38, and practically covering said recess, is an eccentric 40, bearing graduations representing 5' each. A small lug 41 carried by the arm 27 is in a position permitting it to be engaged by the eccentric when the arm 38 swings in one direction, and when the arm swings in the opposite direction a small lug 42, on the arm, engages the side of the recess and arrests the motion of the arm. A mark 43 on the arm 27 is used for setting the eccentric 40, and the parts are so proportioned that when the 0 graduation on the eccentric coincides with the mark 43, the lug 42 being in contact with the side of the recess and the eccentric

40 in contact with the lug 41, the arm 38 will be immovable relative to the arm 27. This is the position of the parts in Fig. 1. Moving the eccentric so some other graduation, say the 20' graduation, coincides with the mark 43, the arm 38 will have play with reference to the arm 27 a distance equal to 20' on the scale 28. And in this way the play of the arm 38 with reference to the arm 27 may be varied, according to the reading in minutes on the eccentric 40.

In using the vernier, suppose it is desired to set the instrument at 47°—25'. The triangles are first set to 47°. Then the eccentric 40 is turned to bring the 25' graduation to the mark 43. With the lug 42 in contact with the side of the recess the operator presses the end of the arm or stop member 38 firmly down on the segment 26, so as to hold the arm immovable with reference to the segment. Then he moves the triangle 11 with reference to the triangle 10 until the movement is arrested by the lug 41 engaging the eccentric, which movement will be equal to 25' on the scale 28. In practice the operator will hold the arm to the segment by pressure on the eccentric 40, and in order to prevent pinching the arm 27 between the eccentric and the segment 26, the member 37—38 should be made of slightly thicker metal than the metal used in making the arm 27.

Instead of using an eccentric for varying the extent of play between the arms 27 and 38, the revolvable member 40 may have a spiral periphery, in which case the length of the graduations could be increased, since the graduations might extend about five-sixths of the distance around the member 40. Or more divisions, representing less than 5 minutes each, might be used, if desired.

It is not to be understood that the mechanical vernier is limited to the construction shown. The device is very simple in principle and it is plain that it can be embodied in various forms. Any arrangement can be employed, whereby a stop-member adapted to be held in a fixed position with reference to the segment 26, can be arranged to have play of varying extent with reference to the arm 27, the extent of the play being measurable in minutes.

Where composition instruments, such as my triangles, are secured to metal mountings it has been found that in course of time the composition often becomes warped or otherwise distorted. This may be due to differences in expansion and contraction, or it may be due to other causes. I have found, however, that by making a large hole in the composition between the rivets or eyelets by which the metal parts are secured to the composition, this trouble is avoided, or at least reduced to a very great extent. For this purpose I make a hole 50 in each of my triangles between the eyelets which secure the triangles to the metal supporting members. Obviously, these holes relieve the composition of direct stresses between the eyelets. The holes might be round, square, or other shape, but I prefer slots, placed with their longitudinal axes perpendicular to straight lines drawn from eyelet to eyelet.

Other modifications than those mentioned may be made without departing from the spirit or scope of my invention as defined by the appended claims. What I claim as my invention is as follows:

1. In a protractor, two supporting members pivotally connected, two triangles, each rigidly se-

secured to one of said members, whereby they are maintained in the same plane and adapted to move on the said pivotal connection to various angular positions with reference to each other, one of said supporting members being provided with a lug on which the other member impinges to limit the relative movement of the members in one direction, thereby setting the triangles in such position relative to each other that together they form a single triangle of a commonly used kind.

2. In a protractor, two supporting members pivotally connected, two triangles, each rigidly secured to one of said members, whereby they are maintained in the same plane and adapted to move on the said pivotal connection to various angular positions with reference to each other, one of said supporting members being provided with a lug on which the other member impinges to limit the relative movement of the members in one direction, thereby setting the triangles in such a position relative to each other that together they form a single triangle of a commonly used kind, the triangles being so positioned on said supporting members that when they combine to form said single triangle their edges are separated by a narrow space of uniform width, permitting said edges to be used for ruling.

3. In a protractor, two supporting members pivotally connected, two triangles, each rigidly secured to one of said members respectively, whereby they are maintained in the same plane and adapted to move on said pivotal connection to various angular positions with reference to each other, one of said members carrying a scale 10° in length divided into degrees, the other member carrying a scale 90° in length, divided into spaces 10° in length, said scales being concentric to the pivot which connects the members, in the same plane, and juxtaposed, the two scales combining to produce any even degree reading from 0° to 90° .

4. In a protractor, two supporting members pivotally connected, two triangles, each rigidly secured to one of said members respectively, whereby they are maintained in the same plane and adapted to move on said pivotal connection to various angular positions with reference to each other, one of said members carrying a scale 10° in length divided into degrees, the other member carrying a scale 90° in length, divided into spaces 10° in length, said scales being concentric to the pivot which connects the members, in the same plane, and juxtaposed, the two scales combining to produce any reading from 0° to 90° , the triangles being so positioned on the supporting members that when the scale reading is 90° two edges of the triangles are juxtaposition and separated by a narrow space of uniform width.

5. In a protractor, two supporting members pivotally connected, two triangles, each rigidly

secured to one of said members, whereby they are maintained in the same plane and adapted to move on said pivotal connection to various angular positions with reference to each other, one of said members carrying a scale 10° in length divided into degrees, the other member carrying a scale 90° in length, divided into spaces 10° in length, said scales being concentric to the pivot which connects the members, in the same plane, and juxtaposed, the two scales combining to produce any reading from 0° to 90° , one of said supporting members being provided with a lug on which the other member impinges to limit the relative movement of the members, the triangles being so positioned on the supporting members that when the relative movement of the members is arrested by said lug two edges of the triangles are in juxtaposition and separated by a narrow space of uniform width.

6. In a protractor, a base plate, a member superimposed thereon and pivoted thereto, said member carrying a segment concentric to the pivot and bearing a scale graduated in degrees, which scale is juxtaposed to a mark on the base plate, whereby to determine the relative angular position of the base plate and segment; and a mechanical vernier, comprising a stop-member lying on the base plate but movable with reference thereto by said segment-carrying member, with reference to which member it has a limited amount of play; said stop-member, when held in a fixed position on the base plate, at one extremity of said play, permitting movement of the segment-carrying member relative to the base plate to the extent of said play, and means for varying the extent of said play and for indicating its extent in minutes.

7. In a protractor, a base plate, a member superimposed thereon and pivoted thereto, said member carrying a segment concentric to the pivot and bearing a scale graduated in degrees, which scale is juxtaposed to a mark on the base plate, whereby to determine the relative angular position of the base plate and segment; a mechanical vernier, comprising a stop-member lying on the base plate but movable with reference thereto by said segment-carrying member, with reference to which it has a limited amount of play; said stop-member, when held in a fixed position on the base plate, at one extremity of said play, permitting movement of the segment-carrying member relative to the base plate to the extent of said play, and means comprising a graduated adjusting element, for varying the extent of play of said stop-member with reference to the segment-carrying member, from substantially none to that which will permit movement of the segment-carrying member equal to substantially sixty minutes on said scale.

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