Feb. 10, 1942. L. R. WAGNER ET AL 2,272,491

PROTRACTOR

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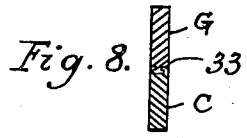


Fig. 8.

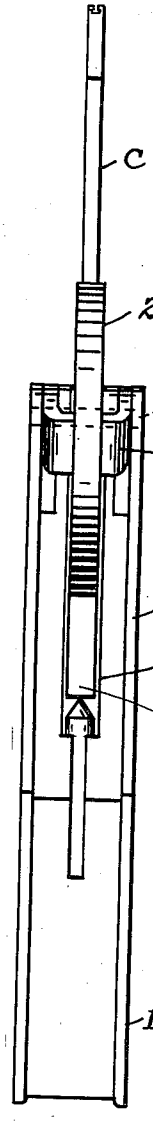


Fig. 2.

Fig. 1.

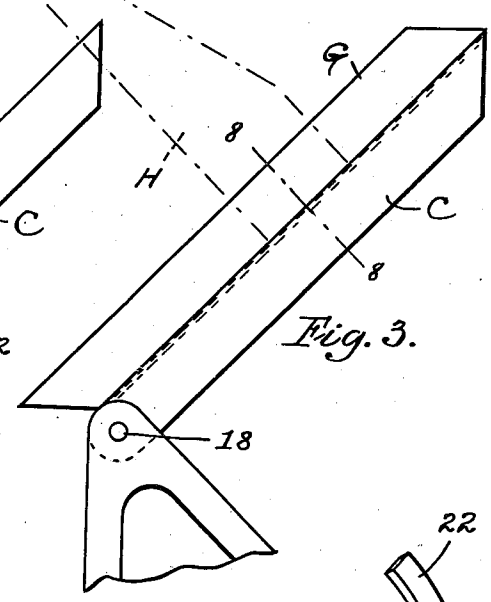


Fig. 3.

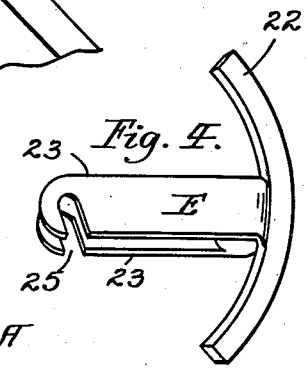


Fig. 4.

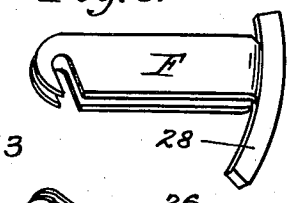


Fig. 5.

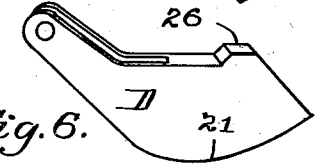


Fig. 6.

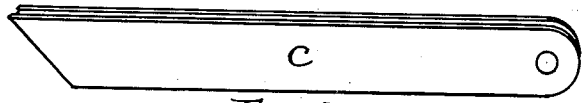


Fig. 7.

INVENTOR.
Lawrence R. Wagner
and Karl A. Olsen
BY
Attorney

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UNITED STATES PATENT OFFICE

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PROTRACTOR

Lawrence R. Wagner and Karl A. Olsen,
Los Angeles, Calif.

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9 Claims. (Cl. 33—75)

Our invention relates to improvements in instruments used to determine angularity in machine shop practice, drafting, surveying, navigation, etc. The primary object of our invention is the application of a principle to instruments mentioned above to determine angles quickly to a finer degree of accuracy than heretofore has been accomplished. A further object of our invention is the translation equably of the rotative angular movement of the variable degree member in the above instruments into a rectilinear movement, so that measurements of the latter movement with a micrometer graduated to read directly in degrees and subdivisions of a degree will indicate the relative rotative angular movement of the variable degree member. A further object of our invention is, in instruments used to determine angularity, the combination of the above principle and a system of spacing dividing the circumference of the rotative angular movement of the variable degree member of said instruments into progressive arcs, the angularity of the arcs in each progressive step being equal to the angular range of the above mentioned micrometer, which is applicable selectively to any arc in said system of arcs, to limit the size of the instrument as a whole to a practical working dimension, and at the same time obtain a finer degree of accuracy in determining any angle.

In the accompanying drawing, representing one form of our invention, Fig. 1 is a side elevation of our invention showing the variable degree blade adjusted at an angle of 45 degrees to the elevational side edge of the extended triangular frame; Fig. 2 is an edge elevational view of the structure shown in Fig. 1; Fig. 3 is a side elevational view of a detail showing an extension slide applied to the variable degree blade and an auxiliary blade indicated in broken lines applied at right angles to the variable degree blade; Figs. 4 and 5 are perspective views of the removable angular spacers; Fig. 6 is a perspective view of the cam used in the device; Fig. 7 is a perspective view of the variable degree blade used in the device, and Fig. 8 is a section taken on line 8—8 of Fig. 3.

In the drawing, A indicates an extended triangular frame, bounded by a vertical straight side edge 10, a horizontal lower side edge 11 at right angles to the elevational side edge; an angular side edge 12 substantially at 45 degrees representing the hypotenuse of a triangle, and a short vertical extension side edge 13 parallel with and opposite to the side edge 10. Within the boundary defined by said side edges and the lower portion of said frame is a connecting strengthening web 14, having a horizontal collar 15 in its upper portion and an open space in its lower portion, to receive and rigidly hold in said collar the upper end of the cylindrical barrel 17 of a micrometer B. Pivoted by the pin 18 through the apex of the triangle is a variable degree blade C. This blade is adapted to swing in the plane of the frame and is employed as a straight edge to true or plot a surface to assist in drawing or sighting a line at any definite angle or direction in relation to the side edges of the supporting frame. This variable degree blade is regulated in angularity to a small fractional degree by the use of the micrometer B which has the usual barrel 17 through which the coaxially and finely threaded stem 19 turns. One end of the stem carries the usual rotatable cap 20 by which it is turned by hand to regulate or gauge the angularity of the variable degree blade. The other end of the stem bears against the surface 21 of a cam D, which is pivoted to also swing in the plane of the frame by the pin 18. The cam is necessary to coordinate the rectilinear movement of the indicator stem with the rotative movement of the variable degree blade. The surface of the cam is a section of an equable spiral, laid out in proportion to the position of the micrometer in relation to the pivot 18, and expanding in each degree of rotation a distance equal to the rectilinear movement in one complete revolution of the micrometer stem.

An angular spacer E has an arcuate spacing member 22 interposed between the face 26 of the cam and the lower edge of the variable degree blade so that as the cam is swung upwardly by the micrometer stem the variable degree blade is also swung forwardly about its pivot support 18. The arcuate member is provided with a pair of radiating supporting arms 23 upon the outer ends of which it is mounted and by the inner ends of which the pivot 18 is separably engaged through the open slots 25, whereby the spacer may be easily removed or replaced as occasion arises.

The variable degree blade C may be used within a radius of zero to 45 degrees without using any spacer, in which event it rests directly upon the seat 26 which is formed on the upper edge of the cam. When thus used a slot 27 (see Fig. 2) in the frame permits the blade to recede into and rest in the frame with its working edge flush with the surface of the angular side edge thereof. To regulate the variable degree blade between the limit of 45 degrees and 90 degrees a spacer

such as F (see Fig. 5) having an arcuate member 28 of a length equal to 45 degrees is inserted on the pivot 18 between the blade and the cam, and to regulate the variable degree blade between the limits of 90 degrees and 135 degrees the spacer E is used in the same manner. A selective angular range is provided by the use of the spacers and the sliding extension blade G and the range of angular adjustment of the variable degree blade is increased.

A longitudinal scale 26, indicating degrees is inscribed upon the barrel of the micrometer. The forward edge 29 of the cap 20, when the latter is revolved cooperates with the scale 26 in indicating in degrees at which the variable degree blade is adjusted on the frame. The range of the scale is 45 degrees. The cap of the micrometer has inscribed upon its surface or circumference fractional scale 30 divided into sixty or any desired number of fractional parts. This fractional scale cooperates with an indicating pointer line 31 on the barrel so that as the cap is revolved to move the threaded stem 19, each degree of movement indicated by the scale 26 is indicated in sixtieths, thus affording a very minute adjustment and indicating to a very fine degree the angular position of the working edge 32 of the variable degree blade C, in relation to the side edges of the frame.

In use the straight edge 32 provided by the variable degree blade C is applicable for determing the angle of an object or a line drawn or sighted as compared with the side edges of the supporting frame A and the degree of this angle can be determined at any point up to one sixtieth of one degree by the micrometer adjustment which is provided by the device.

The removable spacers provide means for making minute adjustments in coordination with the micrometer through arcs in different positions circumferentially, whereas without such spacers the usefulness of the device would be confined to an arc of much less limitations.

In Fig. 5, we have shown an extension blade G slidably applied to the variable degree blade for increasing range of the instrument, the union between the extension blade and main blade being by means of a tongue and groove joint 33 (see Fig. 8). Also in Fig. 3 we have shown an extension blade H in broken lines slidable on the variable degree blade at right angles thereto by a similar tongue and groove joint.

In accordance with the patent statutes, we have described the principles of operation of our invention together with the construction thereof which we now consider to represent the best embodiment thereof, but we desire to have it understood that the structure shown is only illustrative and that the invention can be carried out by other means and applied to uses other than those above set forth within the scope of the following claims.

We claim:

1. In an instrument for determining angularity, a frame, a variable degree member swung about a pivot upon said frame, a segment of predetermined length removably swung about said pivot, and a measuring means upon said frame having a screw actuated rectilinearly movable stem, and a cam swung about said pivot, having a cam surface against which said stem bears, said cam surface conforming with a spiral in which the radial distance of a point moving on the spiral from the center thereof increases regularly as said point moves, whereby the rectilinear movement of the micrometer shaft is converted in direct ratio into the rotary movement of said cam, said segment being interposed between said cam and said variable degree member and transmitting the motion of said cam to said variable degree member.

2. In an instrument for determining angularity, the combination of a micrometer having a rectilinearly movable stem and a protractor having a movable angular member, an intermediate rotary member between and in contact with said stem and angular member, said rotary member having a cam surface in contact with said stem, said cam surface conforming with a spiral in which the radial distance of a point moving thereon from the center thereof increases regularly as said point moves, whereby as said stem moves motion in direct ratio to the movement of the stem is transmitted to said angular member

3. An instrument for determining angularity, comprising, a frame, a variable degree member pivoted to swing upon said frame, a micrometer mounted upon said frame having a movable stem for transmitting rectilinear motion, and a cam concentrically swung about said pivot connection having a cam surface cooperating with said stem and conforming with a spiral on which the radial distance of a point moving upon the spiral from the center thereof increases regularly as said point moves, whereby as said stem moves motion in direct ratio to the movement of the stem is transmitted to said variable degree member, and an extension blade slidably mounted upon said variable degree member.

4. An instrument for determining angularity, comprising, a frame, a variable degree member axially swung upon said frame, a micrometer fixed upon said frame having a rotatable shaft which is rectilinearly movable by the rotation thereof, a cam element rotatable on said frame about the axis of said variable degree member having a cam surface bearing against the end of said shaft, and a removable spacer supported upon said axis and interposed between said cam and said variable degree member, said cam surface resembling a spiral in which the radial distance of a point moving thereon from the center thereof increases as said point moves, whereby the rectilinear movement of the micrometer shaft is transmitted in direct ratio thereto into the angular movement of said variable degree member.

5. An instrument for determining angularity, comprising, a frame, a variable degree member swung upon said frame, a micrometer mounted upon said frame having a rotatable and rectilinearly movable shaft, a cam element rotatable about an axis on said frame having a cam surface with which said shaft cooperates, said cam surface being an equable spiral having its center on the axis of the cam and in which the radial distance of a point moving on the spiral from the center thereof increases at a constant rate in coordination with the rectilinear movement of said shaft, and a spacer interposed between said cam and said variable degree element adapted to transmit motion of the cam to said variable degree member.

6. In an instrument for plotting and determining angularity, a stationary element, a variable degree element pivotally mounted to vary its angle upon said stationary element, a mechanical indicating device between said elements having a scale indicating degrees and a rectilinearly movable and rotatable stem coacting with said scale, a rotary cam interposed between the varia-

ble degree element and said stem having a cam surface resembling a spiral having a constant rate of expansion in coordination with the rotary and rectilinear movement of said stem and the angular movement of said variable degree element, and arcuate spacers removably insertable between the variable degree element and said cam, adapted to increase the angular range of the variable degree member.

7. In an instrument defined in claim 6, each arcuate spacer consisting of a segment removably mounted upon said pivot connection between the stationary and variable degree element.

8. In an instrument for plotting and determining angularity, a stationary element, a variable degree element tiltingly mounted about an axis on said stationary element to indicate angularity, a micrometer interposed between said elements having a rotatable and rectilinearly movable stem and a scale indicating movement of said variable degree element in degrees and fractional portions thereof, a cam rotatable about said axis on said stationary element having a cam surface conforming with a spiral, said spiral having a constant rate of expansion radially from said axis and coordinating with said stem, whereby the revolving motion of the latter is transmitted proportionately to the angular movement of said variable degree member.

9. In an instrument defined in claim 8, the micrometer having its stem operating longitudinally against the cam surface and adapted by its movement to cause the tilting of the variable degree element.

LAWRENCE R. WAGNER.
KARL A. OLSEN.