Aug. 27, 1957 J. C. BAKER 2,803,881

ROTARY PILOT PROTRACTOR

Filed April 9, 1954 2 Sheets-Sheet 1

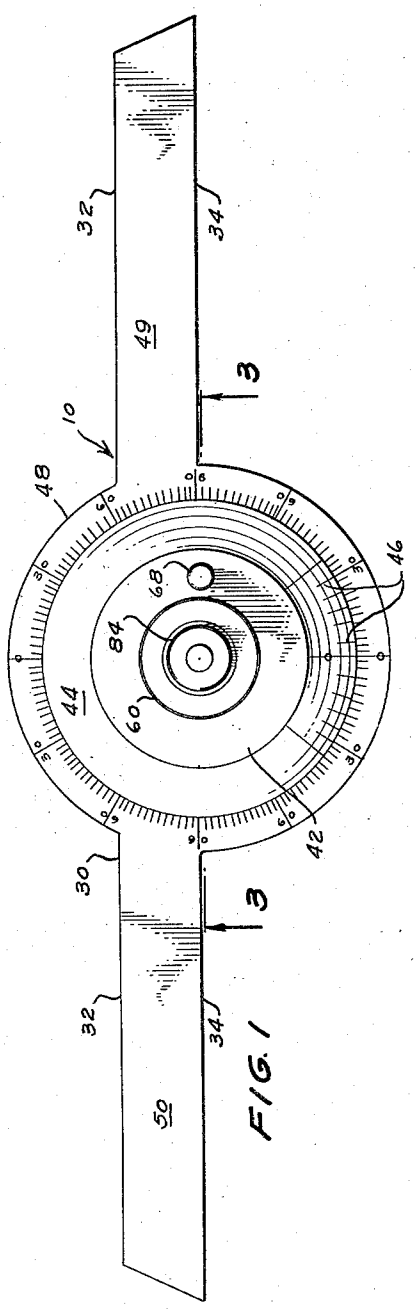


FIG. 1

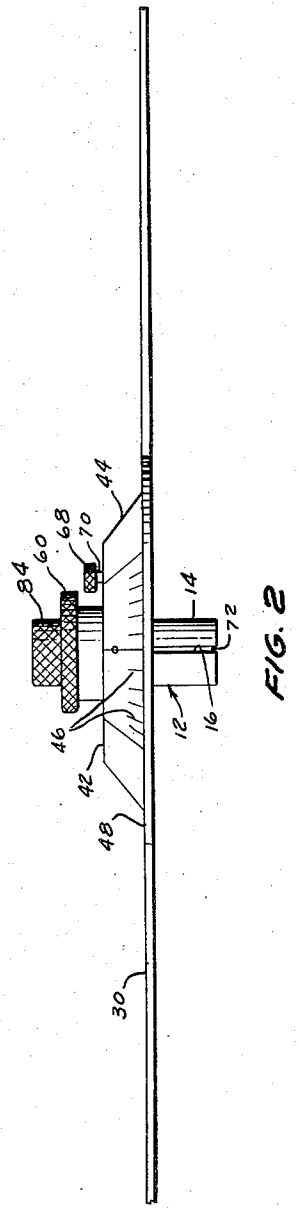


FIG. 2

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FIG. 3

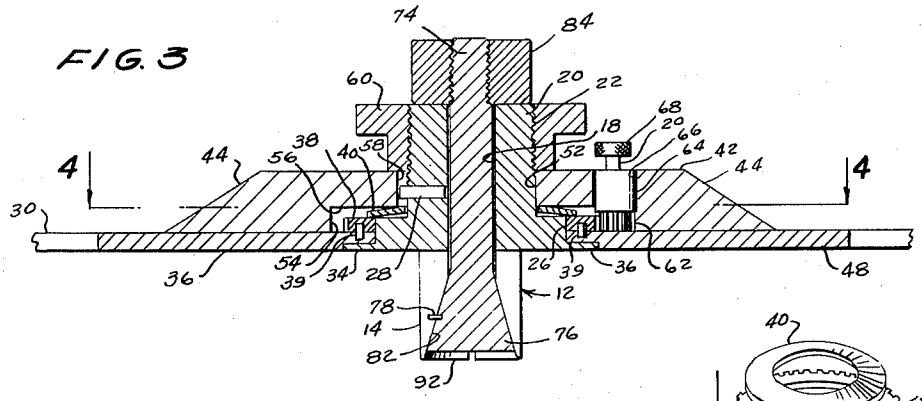
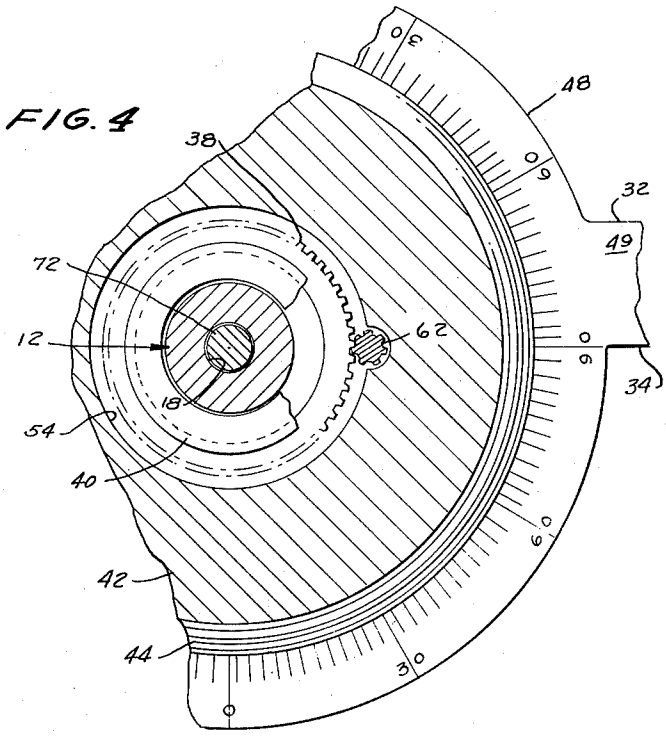


FIG. 4



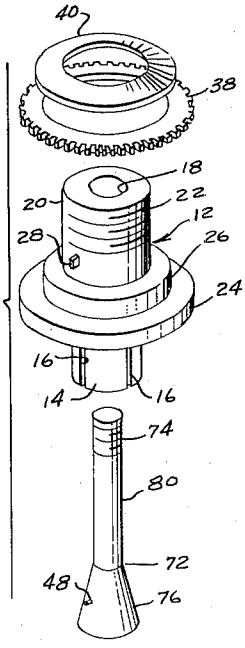


FIG. 5

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United States Patent Office 2,803,881
Patented Aug. 27, 1957

2,803,881

ROTARY PILOT PROTRACTOR

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Application April 9, 1954, Serial No. 422,112

4 Claims. (Cl. 33—75)

This invention relates to geometrical instruments and more particularly to a protractor of the type for use of tool and die makers as a scribing instrument.

It is an object of this invention to provide a protractor for use in conjunction with a pilot hole in any fixture, jig, tool, etc. where any number of holes, key slots, or grooves that need to be laid out for drilling, machining, inspection, etc. can be done in far less time than with prior instruments of this type.

It is a further object of this invention to provide a rotary pilot protractor in which layout or inspection is considerably speeded and made more rapid by use of a double-end straight edge.

It is a further object of this invention to provide a rotary pilot protractor which is accurate in its operation, simple in construction, capable of rugged extended use over long periods of working time without necessary readjustment, and which may be accurately set at any given reading.

Yet another object of this invention is to provide a rotary pilot protractor which when once set in a desired position of adjustment will leave both hands of the operator free for subsequent scribing operations in the layout of the work to be accomplished.

Other objects and advantages will become apparent from the following detailed description, forming the specification, and taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a top plan view of a protractor embodying this invention;

Figure 2 is a side elevational view thereof;

Figure 3 is a vertical cross sectional view taken on line 3—3 of Figure 1;

Figure 4 is a horizontal cross sectional view taken on a greatly enlarged scale, taken on line 4—4 of Figure 3, and shown fragmentarily; and

Figure 5 is an exploded view of the central portion of the protractor indicating the relation of the elements on the central shaft thereof.

With continued reference to the drawings, there is shown the protractor of this invention, generally indicated at **10** and which comprises an upstanding shaft, generally indicated at **12** having the lower end **14** thereof provided with spaced longitudinal slots **16** extending through the lower edge of the shaft and in communication with the central longitudinal bore **18** through the shaft, the lower end **14** being adapted to be received in a pilot hole of a workpiece (not shown) upon which work is to be laid out, to define an anchoring means.

The shaft **12** has at its upper end **20** external screw threads **22** and is formed intermediate its upper and lower ends with an annular flange **24** having an undercut portion **26** defining a second flange of lesser diameter, and between the screw threads **22** and the annular flange **26** of smaller diameter there is provided an outwardly extending key **28**.

A straight edge **30** of elongated, generally rectangular

shape and of flat bar material is provided with parallel opposite side edges **32** and **34** extending longitudinally thereof to define the edges along which straight lines may be scribed using these edges as guides, and further provided with a central circular scale plate **48** having a central opening therethrough to receive the annular flange **26** therein and provided with an annular recess **36** concentric with the opening centrally therethrough to receive therein the annular flange **24** with the annular flange **24** having its lower surface coplanar with the lower or bottom surface of the straight edge or protractor **30** so that the smooth, continuous surface is provided on the bottom of the straight edge or protractor, and this lower surface **36** is adapted to overlie the workpiece in which the lower end **14** of the shaft **12** is received in a pilot hole therein so that the lower face or surface **36** is in face to face relation with the workpiece.

The straight edge or protractor **30** is thus carried by the shaft **12** intermediate its ends for movement in an arcuate path perpendicular to the shaft and adapted to overlie a workpiece in face to face relation thereto.

As clearly shown in Figure 3, the annular flange **26** is of considerably greater width than the flange **24** and extends beyond the top surface of the straight edge or protractor **30** to receive thereon the central opening through a gear **38** so that the gear **38** is in overlying relation to the straight edge or protractor **30** and in face to face relation thereto and fixed thereto by a plurality of small dial pins **39**. The gear **38** is rotatable on the flange **26** of the shaft **12** so as to cause rotation of the protractor **30**.

A spring washer **40** is carried by the shaft **12**. The spring washer **40** is of concavo-convex formation and has its concave side extending toward the flange **26** and the gear **38** so that the circumferential edge of the washer is in contact with the gear **38**.

A protractor body **42** which forms a vernier plate or ring is of generally a truncated cone formation having a beveled peripheral side wall **44** on which is inscribed an arcuate vernier scale **46** adapted to register with the circular scale plate **48** on the protractor **30** between the arms **49** and **50**. The scale is marked off in major increments of thirty degrees with the scale being repetitious consecutively in increments of thirty degrees after each ninety degrees of the three hundred and sixty degrees of the circle has been marked off. As will be readily appreciated, the circular scale plate **48** is formed integrally with the protractor or straight edge **30** and disposed centrally intermediate its ends so that the arms **49** and **50** extend equidistantly from either side of the circular scale plate **48** and perpendicularly to the center line of the shaft **12** with the straight edge **34** being disposed along the diameter of the circular scale plate **48**. A central opening is provided transversely through the vernier ring **42** so as to be received on the shaft **12** and this opening **52** has an enlarged annular recess **54** concentric therewith to provide a space wherein the gear **38** and spring washer **40** may be received as the side wall **44** of the ring **42** overlies the top surface of the circular scale plate **48**, but can be moved longitudinally of the shaft to thereby permit the circular scale **48** to have its markings register with the scale **46** formed on the tapered circular side wall **44** of the plate. Also, the wall **56** of the recess **54** remote from the end of the recess which opens to the lower end of the vernier ring **42** is in engagement with the convex side of the spring washer **40**.

The protractor body or vernier ring **42** is operatively connected to the shaft **12** by the key **28** which extends into a keyway **58** formed in the protractor body **42**. Hence, the protractor body is carried by the shaft **12**

against rotation thereabout and overlies the protractor circular scale plate **48**.

To secure the protractor **30** in a selected position in its arcuate path of movement with respect to the ring **42**, a lock nut **60** is threadingly carried on the threaded upper end portion **20** of the shaft **12** so that it will contact the upper surface of the vernier ring **42** and when tightened thereagainst will cause the plate **48** to move longitudinally of the shaft toward the plate **42** and resiliently urge the spring washer **40** against the gear **38** to lock the gear against rotation. This will prevent further movement of the protractor **30** since the gear **38** will frictionally be engaged at the upper surface of the plate **48** so as to be locked and lock the protractor in a selected position.

The gear **38** is one element of the means whereby the protractor **30** may be moved in its arcuate path. The other element of the means to move the protractor **30** in its arcuate path is the vernier gear **62** which is in mesh with the gear **38** and is carried at the lower end of a vernier knob shaft **64** rotatably carried in an opening **66** in the vernier ring **42** with the gear **62** disposed within the recess **56**, and a knurled vernier operating knob **68** extends upwardly therefrom along the longitudinal center line of the shaft **64** and preferably formed integrally therewith by the stem **70**. By rotating the vernier knob **68**, the gear **62** will impart rotation to the gear **38** which in turn will cause the protractor **30** to move in its arcuate path about the shaft as a vertical axis.

An expansion bolt **72** has one end **74** thereof externally threaded remote from the tapered conical head **76** which carries thereon and extending outwardly therefrom the guide pin **78**. The shank **80** of the expansion bolt extends through the bore **18** of the shaft **12** with the externally threaded end **74** extending beyond the upper end of the shaft and the guide pin **78** received in one of the slots **16** in the lower end **14** of the shaft so that the head **76** is in engagement with the outwardly tapering lower end **82** of the bore **18** and the bolt is held against rotation relative to the shaft. A lock nut **84** is threadingly received on the end **74** of the expansion bolt and extending beyond the upper end of the shaft **12** and may be tightened thereon so as to engage the upper end surface of the shaft and when tightened thereon will draw the expansion bolt within the bore **18** and cause the lower slotted end **14** of the shaft **12** to expand against the side walls of the pilot hole in which it is placed on the workpiece to define an anchor whereby the anchoring means **14** of the shaft can be expanded and secured in such pilot hole. This leaves the hands of the operator free for subsequent laying out and scribing operations in connection with the workpiece upon which the protractor device **10** has been mounted.

With the lower end **14** of the shaft **12** tightened in the pilot hole of the workpiece, and the lock nut **60** tightened down against the top of the vernier ring **42** to move the ring toward the plate **48** so as to cause the spring washer **40** to lock the protractor or straight edge **30** in a selected position, the lock nut **60** may then be backed off so as to permit movement of the straight edge or protractor **30** in its arcuate path. It is contemplated that the "zero" setting or marking on the arcuate scale **46** of the vernier ring **42** will be in register with a "zero" mark on the protractor circular scale plate **48** and in line with the center line of a workpiece. With the lock nut **60** loosened, the straight edge or protractor can be moved to any desired setting in degrees and minutes over the entire three hundred and sixty degrees of the circle without danger of error in use due to the similar readings which would be obtained on diametrically opposite sides of the scale **48** with reference to the guide edge **34**. As the desired setting is obtained, the lock nut **60** is then tightened to secure the straight edge or protractor **30** in this selected position in its path of movement.

Since the lower end of the shaft **12** will be tightened by the lock means, lock nut **84**, carried by the bolt **72** to be anchored in the pilot hole of the workpiece, both hands of the operator will be free as contrasted to the ordinary type of protractor where one hand of the operator is required to hold the protractor device against a make-shift straight edge or scale after locating the exact center line of the job and making sure that the scale and protractor square is on the exact center where the center line comes tangent thereto and then must use a scribe to mark the desired line. With the present protractor device, it is merely necessary to get the easily read desired setting in degrees and minutes, lock the setting by the lock nut **60** which defines means carried by the shaft for moving the ring **42** longitudinally of the shaft **12** and toward the plate **48** against the inherent resilience of the washer **40** for locking the protractor or straight edge in a desired position in its path of movement, and scribing the desired line along the selected angle.

From the foregoing, it will be apparent that there has been provided a rotary pilot protractor which comprises an upstanding shaft **12** having the lower end **14** provided with spaced longitudinal slots defining the anchoring means to be received in a pilot hole of a workpiece, a straight edge or protractor **30** carried by the shaft **12** for movement in an arcuate path perpendicular to the shaft and disposed intermediate the ends of the shaft, the straight edge **30** adapted to overlie the workpiece, a protractor body or vernier ring **42** carried by the shaft **12** against rotation thereabout and movable longitudinally thereof toward and away from and in overlying relation to the plate **42** of the straight edge **30**, the shaft **12** being provided with a central bore **18** longitudinally therethrough to receive therein an expansion bolt **72** extending therethrough, lock nut **84** carried by the bolt to tighten the anchoring means of the shaft **12** in the pilot hole, means in the form of the gear **38** and vernier gear **62** for rotating the straight edge in its arcuate path, and lock means **60** carried by the shaft **12** for securing the straight edge in a selected position in its arcuate path of movement by causing the ring to move longitudinally of the shaft toward the plate **48** and against the resilience of the washer **40**.

It will be appreciated that the vernier arrangement will be used to get an exact reading in minutes and fractions thereof after the straight edge has been rotated to the approximate reading.

While there are shown and described the preferred embodiment of the invention, it is to be understood that the structure is susceptible to change and modification within the practicability of the invenion and therefore should be limited only by the scope of the claims appended hereto.

What is claimed is:

1. A rotary pilot protractor for use on a workpiece having a pilot hole therein, comprising an upstanding shaft having a central bore longitudinally therethrough and provided at its lower end with expandable means for anchoring said shaft in the pilot hole, a protractor straight edge having a central plate, said plate carried on said shaft for movement of said straight edge in an arcuate path about the axis of said shaft in overlying relation to the workpiece, a protractor ring carried by said shaft against rotation relative thereto and for movement longitudinally thereof in overlying relation to said plate, means carried in said shaft bore for expanding said means at the lower end of the shaft to anchor the shaft in the pilot hole, resilient means carried by said shaft interposed between said ring and said plate and movable into locking relation with said plate upon movement of said ring toward said plate to secure said straight edge in a selected position in its arcuate path of movement, and means carried by said shaft for moving said ring longitudinally of said shaft.

2. A rotary pilot protractor for use on a workpiece having a pilot hole therein, comprising an upstanding shaft having a central bore longitudinally therethrough

and provided at its lower end with expandable means for anchoring said shaft in the pilot hole, a protractor straight edge having a central plate, said plate carried on said shaft for movement of said straight edge in an arcuate path about the axis of said shaft in overlying relation to the workpiece, a protractor ring carried by said shaft against rotation realtive thereto and for movement longitudinally thereof in overlying relation to said plate, means carried in said shaft bore for expanding said means at the lower end of the shaft to anchor the shaft in the pilot hole, resilient means carried by said shaft interposed between said ring and said plate and movable into locking relation with said plate upon movement of said ring toward said plate to secure said straight edge in a selected position in its arcuate path of movement, and means carried by said shaft for moving said ring longitudinally of said shaft, means for moving said straight edge comprising a gear rotatably mounted on said shaft and secured upon said plate, a gear carried by said ring and rotatable about an axis parallel to the axis of said shaft and in mesh with said first-mentioned gear to impart rotation thereto for moving said straight edge in its arcuate path.

3. A rotary pilot protractor for use on a workpiece having a pilot hole therein, comprising an upstanding shaft having a central bore longitudinally therethrough and provided at its lower end with expandable means for anchoring said shaft in the pilot hole, a protractor straight edge having a central plate, said plate carried on said shaft for movement of said straight edge in an arcuate path about the axis of said shaft in overlying relation to the workpiece, a protractor ring carried by said shaft against rotation relative thereto and for movement longitudinally thereof in overlying relation to said plate, means carried in said shaft bore for expanding said means at the lower end of the shaft to anchor the shaft in the pilot hole, resilient means carried by said shaft interposed between said ring and said plate and movable into locking relation with said plate upon movement of said ring toward said plate to secure said straight edge in a selected position in its arcuate path of movement, and means carried by said shaft for moving said ring longitudinally of said shaft, said expandable means having longitudinally extending, angularly spaced slots opening into said bore and through the lower edge of said shaft to define a slotted lower end, said means for expanding the slotted lower end of said shaft including an expansion bolt disposed within said bore with its head disposed within said lower end and a portion of its shank extending outwardly from the upper edge of said shaft, and a nut carried by said bolt on its outwardly extending shank portion bearing against the upper end of said shaft to draw the bolt head into said slotted lower end and causing it to expand.

4. A rotary pilot protractor for use on a workpiece having a pilot hole therein, comprising an upstanding shaft having a central bore longitudinally therethrough and provided at its lower end with expandable means for anchoring said shaft in the pilot hole, a protractor straight edge having a central plate, said plate carried on said shaft for movement of said straight edge in an arcuate path about the axis of said shaft in overlying relation to the workpiece, a protractor ring carried by said shaft against rotation relative thereto and for movement longitudinally thereof in overlying relation to said plate, means carried in said shaft bore for expanding said means at the lower end of the shaft to anchor the shaft in the pilot hole, resilient means carried by said shaft interposed between said ring and said plate and movable into locking relation with said plate upon movement of said ring toward said plate to secure said straight edge in a selected position in its arcuate path of movement, and means carried by said shaft for moving said ring longitudinally of said shaft, means for moving said straight edge comprising a gear rotatably mounted on said shaft and secured upon said plate, a gear carried by said ring and rotatable about an axis parallel to the axis of said shaft and in mesh with said first-mentioned gear to impart rotation thereto for moving said straight edge in its arcuate path, said expandable means having longitudinally extending angularly spaced slots opening into said bore and through the lower edge of said shaft to define a slotted lower end, said means for expanding the slotted lower end of said shaft including an expansion bolt disposed within said bore with its head disposed within said lower end and a portion of its shank extending outwardly from the upper edge of said shaft, and a nut carried by said bolt on its outwardly extending shank portion bearing against the upper end of said shaft to draw the bolt head into said slotted lower end and causing it to expand.

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