Sept. 6, 1949. O. L. ANDERSON 2,481,062

PROTRACTOR

Filed Sept. 25, 1943

Fig. 1

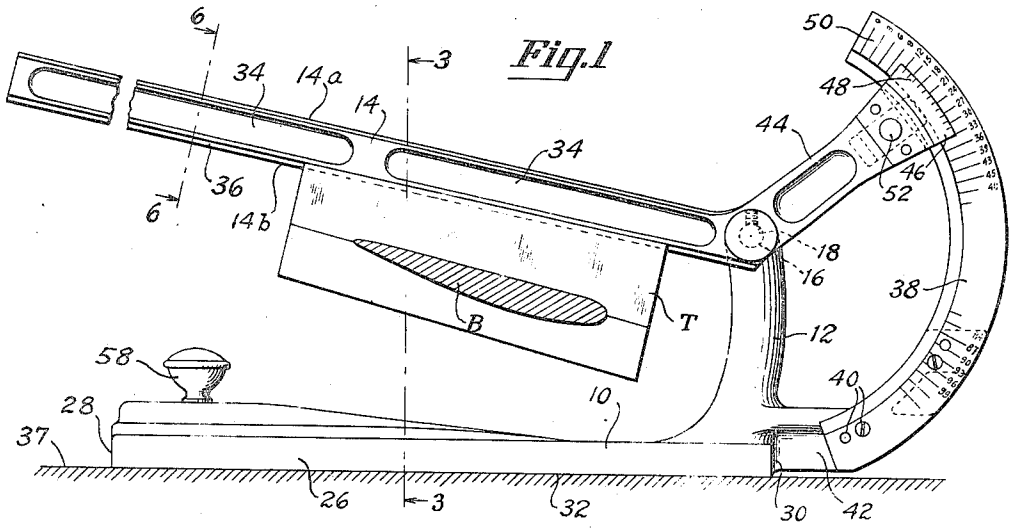


Fig. 2

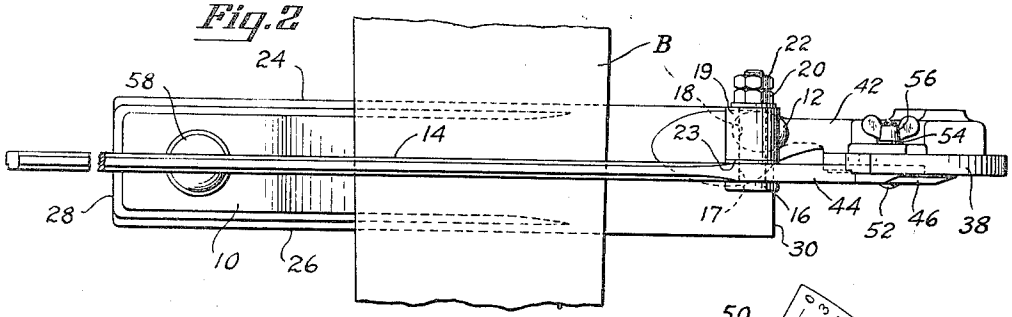


Fig. 4

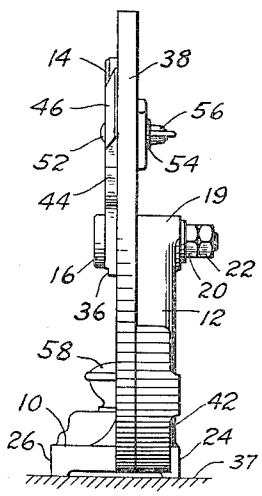


Fig. 3

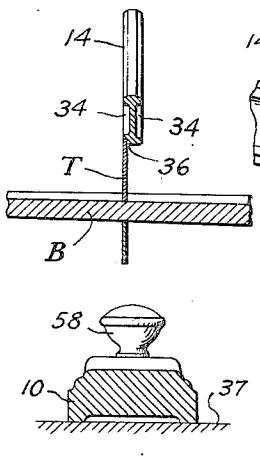


Fig. 5

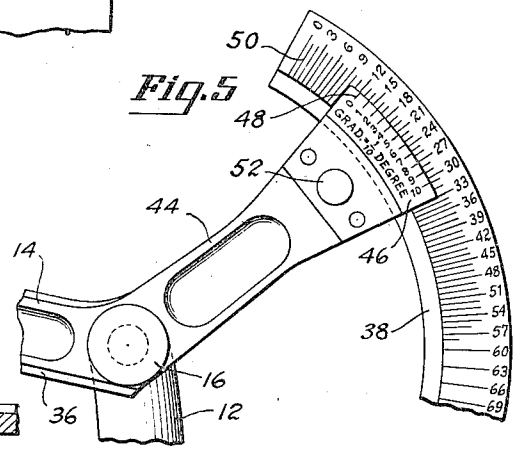
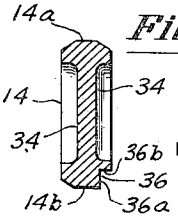


Fig. 6



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PROTRACTOR

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6 Claims. (Cl. 33—75)

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This invention relates to protractors and particularly to an improved protractor for use in the inspection of propeller blades of the type used in aircraft.

The invention has for one of its objects the provision of an improved universal propeller blade protractor which is capable of performing all inspection, production and service work on all types of propeller blades where a protractor is required.

Another object of the invention is to provide a protractor of this type having an improved movable arm enabling blade checking templates to be held accurately at right angles to the center line of the blade and parallel with the arm.

A further object of the invention is to provide an offset arm protractor especially adapted for bench use having a greater angle range, and having its graduations easily readable over the entire range.

A further object of the invention is to provide a protractor having a pivoted sine bar which is free at one end and which may be used on both its upper and its lower edges, thereby enabling both the high and low pitch angles of an assembled variable pitch propeller to be checked.

Another object of the invention is generally to improve the construction of propeller blade protractors.

Other objects will be pointed out hereinafter or will be apparent from the following description in connection with the accompanying drawing in which a preferred embodiment of the invention is shown for purposes of illustration.

In the drawing,

Fig. 1 is a side view of the improved protractor showing the same in position to check the camber side of a propeller blade, the latter being shown in section.

Fig. 2 is a plan view of Fig. 1, all but a fragment of the blade being broken away to facilitate illustration.

Fig. 3 is a sectional view taken on line 3—3 of Fig. 1.

Fig. 4 is an end view looking toward the right hand end of Fig. 1.

Fig. 5 is an enlarged detail showing the main and vernier scales.

Fig. 6 is a sectional view taken on line 6—6 of Fig. 1.

As herein shown, the improved protractor comprises a horizontal, generally rectangular base 10 provided adjacent one end and at one side of the longitudinal center line of the base with an upright support, or pedestal, 12 of oval

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cross-section and slightly curved to provide a convenient grasping portion. An arm, or sine bar, 14 of somewhat greater length than the base 10 is pivoted adjacent its right hand end, as viewed in Fig. 1, on a pivot pin 16 which extends through a transverse aperture 17 therein and through a corresponding transverse aperture 18 extending through an elongated boss 19 formed on the upper end of support 12 at right angles to the longitudinal axis of the base. Suitable adjusting and locking nuts 20 and 22, respectively, are provided on the pin to permit adjustment of the frictional restraint on said arm at its pivot provided by engagement of the arm with the end face 23 of the boss 19 which it will be observed is located so that the arm 14 lies in the longitudinal center line of base 10. The base member 10 has parallel side walls 24 and 26 and parallel end walls 28 and 30, all of these walls being accurately finished to provide a base having truly rectangularly related walls. These side and end walls are also formed accurately at right angles to the bottom 32 of the base.

The upper and lower edges 14*a* and 14*b* of arm 14 are parallel and arm 14 has recessed portions 34 in its opposite side walls suitably disposed along the length thereof which serve to lighten the arm while providing adequate rigidity. Arm 14 is further provided with a rectangular groove 36, shown most clearly in Fig. 6, which extends along the bottom edge thereof throughout the length of the arm for accurately positioning a template T as shown in Figs. 1 and 3. The side wall 36*a* of the groove being at right angles to the line of the base 32 and the bottom wall 36*b* of the groove being parallel with both the top and bottom edges of arm 14, it will be evident that a blade checking template T with its top edge positioned in the groove 36 will be accurately located at right angles to the longitudinal axis of a blade B being checked and will have its top edge parallel with arm 14 when the blade to be checked is supported at its hub end on the brench 37 in a fixture (not shown) with its longitudinal axis parallel to the bench.

Cooperating means are provided on the base and arm for indicating accurately the angular relationship of the arm 14 relative to the bottom 32 of the base. These means include an upstanding arcuate main scale carrying member 38 secured rigidly at its lower end by spaced fastening members 40 to an extended portion 42 of the base which is disposed generally in alignment with the support 12. The arcuate member 38 has its scale disposed in an arc struck about the

horizontal pivotal axis of arm 14 and cooperates with an extension 44, herein shown integral with the arm 14, which terminates in an arcuate beveled end portion 46 carrying a vernier scale 48 which overlies the main arcuate scale 50 on member 38. Preferably, as herein shown, the extension 44 is angularly related to arm 14, this extension projecting upwardly at an oblique angle to the arm when the latter is in a horizontal position. This permits the arm 14 to be swung through and beyond its vertical position before the extension 44 reaches a downwardly directed vertical position.

As shown in Fig. 4, the extension 44 closely overlies the graduated face of arcuate member 38 and means is provided for clamping the end portion 46 thereof to member 38 in any desired angular position of adjustment, said means including a bolt 52 which extends through the arm 44 and member 38 and is provided on the opposite side of the face 38 with a washer 54 and a wing nut 56.

The base member 10 is also preferably thicker at the end thereof remote from the member 38 and is provided with a knob 58 located on the top surface adjacent the end which provides a second handle.

In the use of the improved protractor the blade B is supported at its hub end in a usual fixture in spaced relation above the surface of the inspection bench 37 with its longitudinal axis parallel with the surface of the bench. The protractor can be readily moved about on the surface of the bench to bring the blade B into the position shown in Fig. 1 by grasping the support 12 in one hand and knob 58 in the other. In checking the blade, various templates T are used, each corresponding to a different station along the length of the blade; and by positioning the top edge of a template in the groove 36 the inspector is always sure that the template is located in a plane at right angles to the longitudinal axis of the blade B and also that the template is parallel with the length of the arm 14. The angle of the arm 14 relative to the base 32 is read on scales 48 and 50, these scales being of the usual type enabling the angle to be read directly to $\frac{1}{10}$ of a degree. Due to the fact that the space between the sine bar 14 and the base is open, it is not necessary to position the protractor by moving it lengthwise of the blade as with former protractors. Also by using both the top and bottom edges 14*a* and 14*b*, it is possible to check both the low and the high pitch angles of an assembled variable pitch propeller.

As a result of these improvements, it will be evident that a protractor has been provided which is simple in construction and which has a range enabling the elimination of special production setups on blade angles of over 60 degrees. It will further be evident that the improved protractor is reliable since the groove on the arm 14 for positioning the checking templates insures that the latter will be set squarely in relation to the center line of the blade. Further, due to the oblique position of the extension 44, relative to arm 14 the position of the gradations on the scales 48 and 50 enables readings to be easily made over a wide range of angularity of the arm 14. It will also be evident that as a result of these improvements a blade checking protractor has been provided which is of such universal application as to enable all required angular measurements to be made in production, inspection and service of variable pitch aircraft propellers.

While I have shown for purposes of illustration a preferred embodiment which the invention may assume in practice, it will be obvious that numerous changes in the construction and the arrangement of the parts may be made without departing from the scope of the invention as defined by the following claims.

What I claim and desire to secure by Letters Patent is as follows:

1. A bench protractor for indicating the angle of pitch of a propeller blade relative to the flat top surface of a test bench comprising, an elongated base member having a bottom reference surface adapted to rest upon the top surface of the bench and provide a stable support on which the protractor stands erect, a pedestal upstanding from said base adjacent one end thereof comprising a grasping portion, an arm pivotally mounted adjacent one of its ends on the upper end of said pedestal above said grasping portion and having a major portion of its length overlying said base, said arm having a reference surface on one of its longitudinal edges and being swingable from a position in which its reference surface is substantially at right angles to the reference surface on said base into a position in which its reference surface is disposed adjacent and parallel with said reference surface on said base and in vertically spaced relation to said base to provide a blade receiving space between said base and said reference surface on said arm, said arm having an extension on the other side of its pivot carrying indicating means, and a scale carrying member upstanding from said base member in laterally spaced relation to said pedestal and cooperating with said indicating means.

2. A propeller checking protractor comprising a horizontal base member having a bottom reference surface, an arm pivotally mounted adjacent one of its ends on said base member and adapted to overlie the latter in various angular positions relative to the reference surface thereon, the longitudinal edge of said arm which lies adjacent said base member comprising a second reference surface having means for positioning the upper edge of a checking template so that the plane of the template is located at right angles to the plane of said base reference surface.

3. A propeller protractor comprising a horizontal base, an upstanding support at one end of said base providing a generally vertical grasping portion, an arm pivotally mounted adjacent one of its ends on said support, said arm being offset from said base by the length of said support to receive a propeller blade which is disposed at right angles thereto in spaced relation between said base and arm, said arm having means for positioning the upper edge of a checking template thereon so that the plane of the template is at right angles to the plane of said base.

4. A propeller protractor comprising a horizontal base, an upstanding support at one end of said base providing a generally vertical grasping portion, an arm pivotally mounted adjacent one of its ends on said support, said arm being offset from said base by the length of said support to receive a propeller blade which is disposed at right angles thereto in spaced relation between said base and arm, said arm having a right angular groove along the bottom edge thereof for positioning the upper edge of a checking template thereon so that the plane of the template is at right angles to the plane of said base.

5. A propeller protractor comprising a base having a horizontal reference surface, and a sine

bar pivoted adjacent one end thereof on said base, said bar having angularly related surfaces extending along a bottom edge thereof for receiving the top edge and adjacent side edge portion respectively of a template in abutting relationship to position the latter, the surface for abutting the top edge being parallel with the longitudinal axis of said sine bar and the surface for abutting the side edge portion being perpendicular to the reference surface of said base.

6. A propeller protractor comprising an elongated base member having a bottom reference surface and a support upstanding therefrom at one end, an arm pivotally mounted at one end on said support and movable in vertical planes parallel with the length of the base and having a reference surface along the edge thereof which is adjacent said base and offset from said base by the length of said support when said arm is parallel with the reference surface thereof, said arm having an extension on the other side of its pivot projecting beyond said base and carrying

indicating means at its projecting end, a scale carrying member on said base projecting beyond the end thereof in position to cooperate with said indicating means, and means adjacent the other end of said base for increasing the weight of the base at said other end.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
996,901	Ball	July 4, 1911
1,018,790	Suddoth	Feb. 27, 1912
1,169,928	Commons	Feb. 8, 1916
2,000,926	Cox	May 14, 1935

FOREIGN PATENTS

Number	Country	Date
14,103	Great Britain	June 9, 1897