

July 7, 1953

A. L. BAKER
DRAFTING MACHINE

2,644,238

Filed March 22, 1950

3 Sheets-Sheet 1

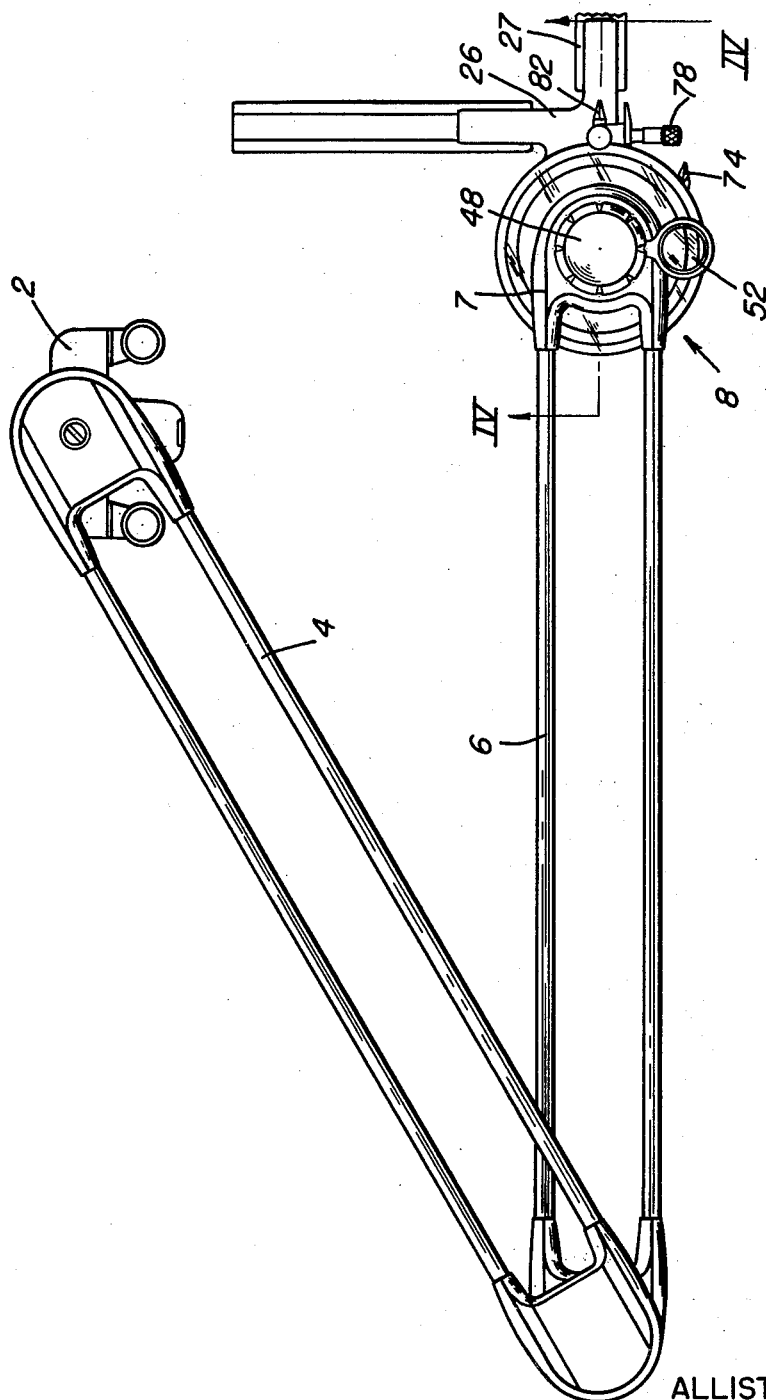


Fig. I

INVENTOR
ALLISTER L. BAKER

BY *J. Russell J. J. J.*
ATTORNEY

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3 Sheets-Sheet 2

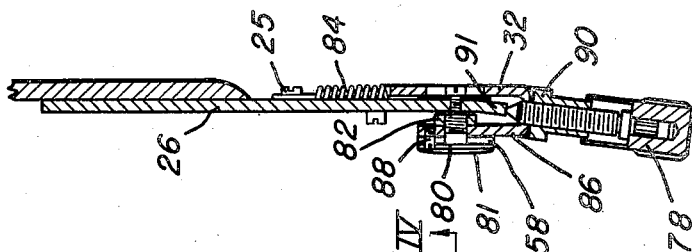


Fig. III

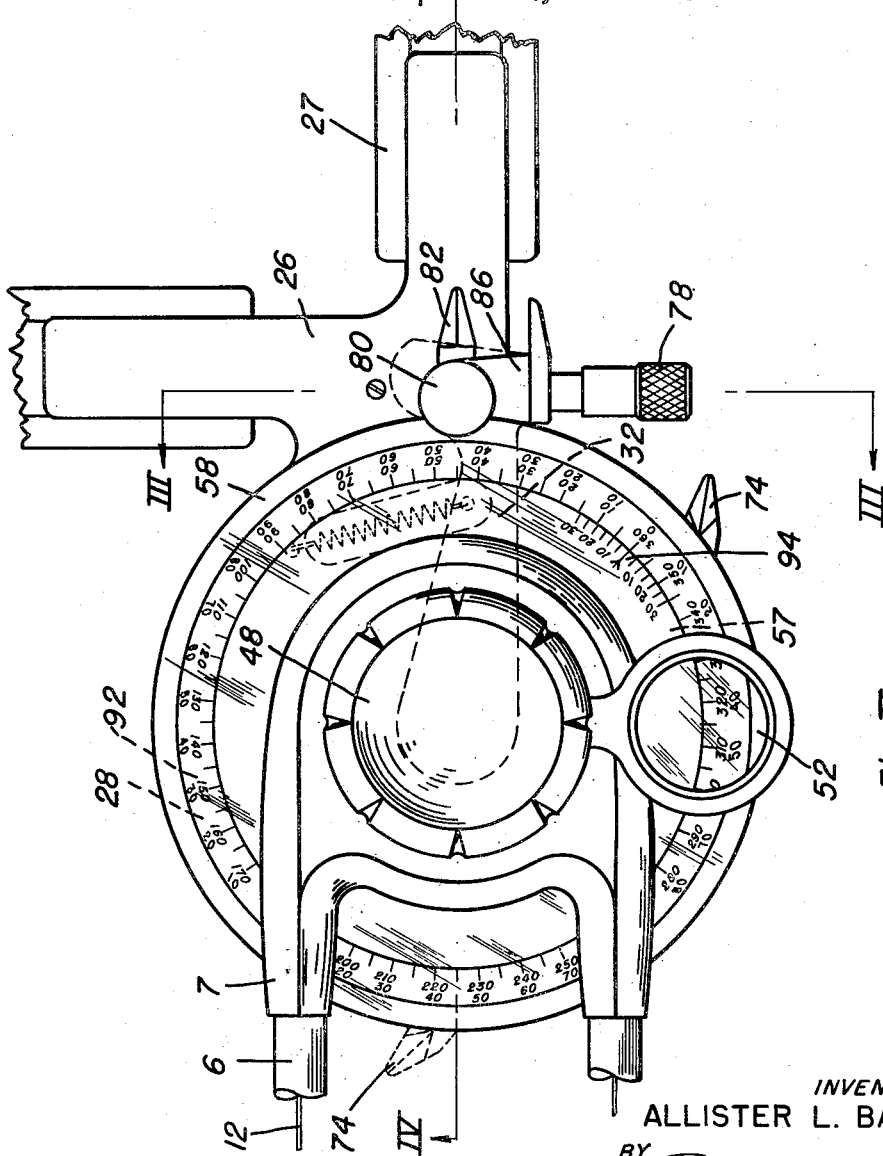


Fig. II

INVENTOR
ALLISTER L. BAKER

BY *J. Russell Juten*
ATTORNEY

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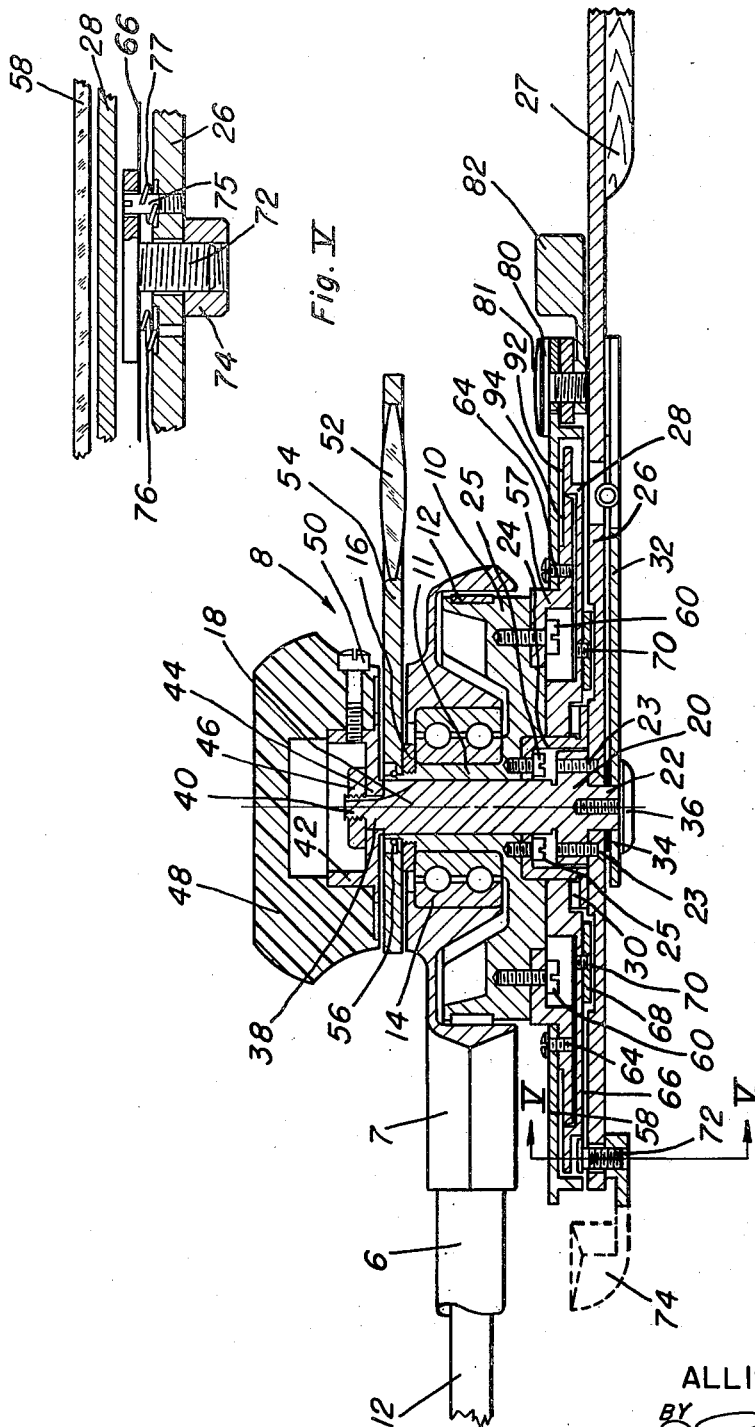


Fig. IV

INVENTOR
ALLISTER L. BAKER

BY *J. Russell Juntin*
ATTORNEY

UNITED STATES PATENT OFFICE

2,644,238

DRAFTING MACHINE

Allister L. Baker, Denville, N. J., assignor to
Keuffel & Esser Company, Hoboken, N. J., a
corporation of New Jersey

Application March 22, 1950, Serial No. 151,287

7 Claims. (Cl. 33—79)

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This invention relates to a drafting head for a drafting machine. Reference is made to co-pending application Serial No. 6,789, filed February 6, 1948, now Patent 2,611,184, granted September 23, 1952, of which this is a continuation in part. A fuller disclosure of one of the embodiments mentioned in the parent case is given herein. Much of the structure shown in the parent case can also be used in the present embodiment. However, the embodiment described herein has an advantage over the embodiment shown in the drawings of the parent application for some applications because the protractor is clamped positively to the protractor arm when laying off an angle.

Various forms of drafting machines are well known in the art, such as, the pulley and band type, in connection with which this invention is useful. The usual type comprises a fixed member clamped to a drawing board, a first movable arm pivoted at one end to the fixed member, a second movable arm pivoted at one end to the moving end of the first arm, and a drafting head carried at the free end of the second movable arm and movable over the drawing board. The drafting head includes a protractor and a protractor arm with means for holding one or more scales, rulers, or straightedges, which can be rotated about the protractor. As the drafting head is moved over the drawing board, orientation of some member of the protractor or drafting head is held constant by a combination of pulleys and bands, parallelograms or the like. The present invention relates only to the drafting head and it should be understood that the form of the other parts of the machine in no way affects the invention.

Specifically, the invention relates to an improved type of drafting head which may be combined in any suitable manner, known in the art, with other parts necessary to form a drafting machine.

The principal object of the invention is to provide a drafting machine head which is particularly useful for performing the operations required in making maps and the like.

Another object of the invention is to provide in a drafting head means for making extremely fine adjustments when setting the protractor arm to selected angles or to a selected base line.

Another object of the invention is to provide a vernier or index mark plainly visible at all positions of the protractor arm.

A further object of the invention is to provide a fully covered and protected protractor scale.

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These and other objects of the invention and the means for their attainment will be more apparent from the following detailed description taken in connection with the accompanying drawings illustrating the invention, and in which:

Fig. I is a view in plan of a drafting machine provided with the new head.

Fig. II is an enlarged view in plan of the drafting head.

Fig. III is a view in sectional elevation of the scale frame and tangent screw arm taken along the line III—III of Fig. II and looking in the direction of the arrows.

Fig. IV is a view in sectional elevation taken along the line IV—IV in Figs. I and II looking in the direction of the arrows but showing the magnifying lens rotated 90° from its position in Figs. I and II and showing the clamp 74 in the dotted position of Fig. II for purposes of illustration only.

Fig. V is a view in enlarged sectional elevation taken along the line V—V of Fig. IV and looking in the direction of the arrows.

In Fig. I, the fixed member or anchor 2 is provided with means for clamping it to the drawing board. The first movable arm 4 is pivoted to this member 2 at one end and to the second movable arm 6 at its other end. The drafting head 8 is at the free end of the second movable arm 6.

As shown in Fig. IV, the band 12 passes around the drafting head pulley 10. A ball bearing 14 provides frictionless rotation means between the drafting head pulley 10 and the head bracket 7 of the second movable arm 6, so that the arm may rotate with respect to the pulley which is held in orientation by the band 12. The inner race of the ball bearing 14 is held onto the sleeve 11 of the drafting head pulley 10 as by the nut 16. The outer race is attached to the head bracket 7 in this embodiment by a press fit.

The center stud or pivot pin 18 is free to turn inside the drafting head pulley 10 and is accurately centered therewith being in close bearing contact with an internal bearing surface of the sleeve 11 of the drafting head pulley 10. The lower end of the center stud 18 has two portions 20 and 22 of different outside diameter. The protractor arm 26 fits over the portion 22 of center stud 18 and is fastened to the portion 20 as by the screws 23. The protractor arm 26 may be provided with chucks or other means to receive one or more rulers, scales, or straightedges 27. The tangent screw arm 32 also fits over the portion 22 and is separated from the protractor arm by the washer 34. The center screw 36 engages

threads in the portion 22 to hold the tangent screw arm 32 on the stud in such a manner that it is free to rotate about the stud. The center screw 36 also acts as a glider on which the drafting head rests as it is moved over the drawing board.

A holding member 24 is secured to the drafting head pulley 10 by the screws 25. The annular member or limb plate 28 provided with a protractor scale 92 fits over an outer cylindrical surface on member 24 and is held in frictional contact with the lower surface of the drafting head pulley 10. The spring washer 30 acts between an upper surface on the member 24 and a lower surface on the annular member or limb plate 28 to increase the friction between the annular member 28 and the lower surface of the drafting head pulley 10.

The upper end of the center stud 18 is provided with a portion 38 of smaller outside diameter and a threaded portion 40 of still smaller outside diameter. The knob support 42 fits over the portion 38 of the stud 18 and is keyed thereto by the key 44. The center nut 46 engages the threaded portion 40 of the center stud 18 to hold the knob support 42 and the center stud rigidly together. The knob 48 fits over the knob support 42 and is held rigidly thereto as by the screw 50.

A magnifying lens 52 is held by the magnifying lens arm 54 which is provided with a hole fitting over the sleeve 11 which is an integral part of the drafting head pulley 10. The magnifying lens arm 54 is held in place on the sleeve 11 by means of the retaining ring 56. The action of the retaining ring 56 is such that the magnifying lens arm 54 remains oriented with the drafting head pulley 10 and remains over the index mark or vernier 94 in normal use of the drafting machine. The magnifying lens arm 54 may be turned by hand about the sleeve 11 if it is desired to change it from a reading to a non-reading position.

The annular cover plate 58 is fixed to the drafting head pulley 10 to which it may be fastened directly or through the ring 57 as by screws 60 and 64. The annular cover plate 58 is preferably of a transparent non-fragile material such as a plastic but it may also be constructed of an opaque material having a cut out or transparent portion at the position of the vernier 94. The vernier or index mark 94 is provided on the ring 57 which is held in orientation by the drafting head pulley.

The protractor holding plate 66 is fastened to the limb plate 28 by means of the ring 68 and screws 70. The pin 72, the lever arm 74 and the springs 76 and 77 (see Fig. V) comprise a clamp for clamping the protractor holding plate 66 and thereby the annular member or limb plate 28 with its protractor scale 92 to the protractor arm 26. The pin 72 is slidably mounted in a hole in the protractor arm 26. The lower part of the pin 72 is threaded to fit a female thread in the lever arm 74. The springs 76 and 77 act between the protractor arm 26 and the pin 72 to hold the pin 72 up out of engagement with the protractor holding plate 66. The set screw 75 prevents rotation of the pin 72.

If the lever arm 74 is rotated in one direction it pulls the pin 72 downward against the action of springs 76 and 77 to clamp the protractor holding plate 66 against the protractor arm 26. If the lever arm is moved in the opposite direction the pin 72 is forced upward by springs 76 and 77

out of contact with the protractor holding plate 66.

In Figs. II, III and IV, the tangent screw 78, clamp screw 80, locking lever 82, tension spring 84, and other minor parts to be described form a clamp and tangent screw arrangement for fine adjustment of the protractor arm 26 or thereby the protractor 92. The locking lever 82 is provided with a female thread which engages with the clamp screw 80 so that when the locking lever 82 is pushed in one direction it pulls the clamp screw 80 downward against the annular cover plate 58, clamping it between the clamp screw 80 and the bracket 86 which is an integral part of the tangent screw arm 32. The clamp screw 80 is pinned to the bracket 86 by the set screw 88 to prevent its turning when the locking lever 82 is actuated. The head of the clamp screw 80 is provided with several holes spaced equally in a circle. The set screw 88 will fit each of these holes so that in the event that the clamping action becomes loose it may be tightened by turning the clamp screw 80 to tighten it and using the set screw 88 in another hole. A cap 91 is provided over the head of the clamp screw to hide these holes in the head of the clamp screw.

The female threaded member 90 (see Fig. II) is carried by the bracket 86 of the tangent screw arm 32. The tangent screw 78 operates in the female threaded member 90 against the projection 91 on the protractor arm 26. The point of the tangent screw is held in contact with the projection 90 of the protractor arm 26 by the tension spring 84 acting between the tangent screw arm 32 and the screw 25 on protractor arm 26. When the clamp is closed by the locking lever 82, the tangent screw gives a fine adjustment to the protractor arm either for adjusting the protractor arm 26 or the protractor 92 (if the latter is clamped to the protractor arm by clamp 74) relative to the drafting head pulley. The tension spring 84 holds the tangent screw arm 32 and the protractor arm 26 together so that they act as one except when the tangent screw is used to give a fine adjustment.

The tension spring 84 is so positioned that it cannot be extended when drawing lines due to pressure exerted against the straight edge 27 by the drawing instrument. Such pressure will only increase the pressure between the point of the tangent screw 78 and the projection 91 of the protractor arm 26.

When the locking lever 82 is closed it locks the tangent screw arm 32, by means of the bracket 86, to the annular cover plate 58. Since the annular cover plate is fastened to the drafting head pulley 10, the effect of the clamping action is to lock the tangent screw arm 32 and thereby the protractor arm 26 to the drafting head pulley 10.

The limb plate 28 is provided on its upper surface with a protractor scale 92 extending through the full 360°. The annular vernier plate 57 is provided on its upper surface with an index mark or preferably a vernier scale 94, one of the lines of which may be considered an index mark lining up with the protractor scale 92. The divisions of the protractor and vernier scales are chosen to read angles to any desired accuracy consistent with the inherent accuracy of the parts of the machine. In the preferred embodiment of the invention the protractor scale is divided to divisions representing 30 minutes and the vernier is divided to read the protractor scale to one minute, although a coarser arrangement is indicated

on the drawing. The scales may be viewed through the magnifier or not as desired.

Having described the interrelation of the various parts of the invention in detail, some of the ways in which a drafting machine provided with the new drafting head may be used will now be described.

A line may be drawn to any angle with respect to the base line to which the protractor has been set as follows. With clamp 74 closed and clamp 82 open, the protractor arm 26 is turned until the desired angle on the protractor 92 is adjacent to the vernier scale 94. Since the vernier scale does not move with the protractor arm it is not necessary for the operator to move his head when finding the angle. The arm may be set more accurately to the desired angle, by clamping the tangent screw arm 32 to the drafting head pulley 10 with the locking lever 82 and making a fine adjustment of the protractor arm carrying the protractor 92 by means of the tangent screw 78. Having thus set the protractor arm to the desired angle, the drafting head 8 may be moved over the drawing board. The combination of bands and pulleys maintain the orientation or angle of the scale or straightedge 27 on the protractor arm 26. When a straightedge attached to the protractor arm passes through a desired point, the line is drawn at the selected angle through this point. By moving the drafting head again, lines may be drawn through any other desired points at the same selected angle. Lines may be so drawn through any desired points at any other desired angle to the same base line by resetting the protractor arm in the manner described.

If it is desired to change to another base or reference line and make the zero setting of the protractor correspond to this line on the drafting board, this may be accomplished as follows. With clamp 74 closed and clamp 82 open, the protractor arm is rotated until the protractor reading on the vernier 94 is close to zero. Then the locking lever 82 is pushed back to clamp the tangent screw arm 32 to the drafting head pulley 10 so that the protractor arm carrying the protractor may be adjusted to make the reading of the protractor and vernier scales exactly zero.

The clamp 74 is then opened. This fixes the limb plate 28 to the drafting head because of the action of spring washer 80 maintaining the zero setting of the protractor 92 to the vernier 94. The clamp 82 is opened and the protractor arm 26 is rotated and if necessary the drafting head is moved over the drawing board until the straightedge 27 is parallel to or in coincidence with the desired reference or base line. If the locking lever 82 is again closed to clamp the tangent screw to the drafting head pulley, the protractor arm 26 can be given a fine adjustment by means of the tangent screw 78, to set the straightedge exactly on or parallel to the desired reference line, without disturbing the zero setting of the protractor. The clamp 74 is then closed. The protractor then will be moved with the protractor arm 26. The clamp 82 is then released and the machine is ready for laying off angles from the new reference or base line as previously described.

The invention has been described as applied to the art of drafting machines. This art, as is understood, includes not only engineering or architectural drawing and the like but also mapping or surveying. In the latter fields a drafting machine or angle plotting machine of high accu-

racy and ease of operation such as described herein is of special value.

The invention has been described with reference to an embodiment having a protractor scale 32 on annular member 28 and an index mark 94 on member 57 carried by the member maintained in orientation or drafting pulley 10. It will be realized that an equally useful embodiment is obtained if the protractor scale is provided on member 57 carried by the drafting head pulley and the vernier or index mark is provided on annular member 28. The advantage of the former construction is that the index mark would never become hidden under the arm 6. The advantage of the latter construction is that the angular relations between objects drawn on maps and the like will be more readily apparent.

What is claimed is:

1. In a drafting machine for use on a drafting board, a drafting head comprising a member maintained in orientation on the drafting board, a protractor arm for carrying at least one straightedge rotatable with respect to said member maintained in orientation, an annular member also rotatable with respect to said member maintained in orientation but having a surface in frictional contact with a surface of said member maintained in orientation, resilient means applying constant frictional forces between said surfaces, said frictional forces being of sufficient magnitude so that said annular member will remain fixed to said member maintained in orientation during free rotation of said protractor arm, cooperating index mark and protractor scale means carried by said member maintained in orientation and said annular member, means for clamping said annular member to said protractor arm to move it with respect to said member maintained in orientation against friction and a clamp acting between said protractor arm and said member maintained in orientation to fix said protractor arm at any selected angle.

2. In a drafting machine for use on a drafting board, a drafting head comprising a member maintained in orientation on the drafting board carrying an index mark, a protractor arm for carrying at least one straightedge rotatable with respect to said member maintained in orientation, an annular member carrying a protractor scale cooperating with said index mark also rotatable with respect to said member maintained in orientation but having a surface in frictional contact with a surface of said member maintained in orientation, resilient means applying constant frictional forces between said surfaces, said frictional forces being of sufficient magnitude so that said annular member will remain fixed to said member maintained in orientation during free rotation of said protractor arm, means for clamping said annular member to said protractor arm to move it with respect to said member maintained in orientation against friction and a clamp acting between said protractor arm and said member maintained in orientation to fix the protractor arm at any selected angle.

3. In a drafting machine for use on a drafting board, a drafting head comprising a member maintained in orientation on the drafting board, a protractor arm for carrying at least one straightedge rotatable with respect to said member maintained in orientation, an annular member also rotatable with respect to said member maintained in orientation but having a surface in frictional contact with a surface of said

member maintained in orientation, resilient means holding said surfaces in frictional contact, cooperating index mark and protractor scale means carried by said member maintained in orientation and said annular member, means for clamping said annular member to said protractor arm to move it with respect to said member maintained in orientation against friction, a clamp acting between said protractor arm and said member maintained in orientation to fix said protractor arm at any selected angle and fine adjustment means for setting said protractor arm accurately with respect to said member maintained in orientation.

4. In a drafting machine for use on a drafting board, a drafting head comprising a member maintained in orientation on the drafting board, a protractor arm for carrying at least one straight-edge rotatable with respect to said member maintained in orientation, an annular member also rotatable with respect to said member maintained in orientation but having a surface in frictional contact with a surface of said member maintained in orientation, resilient means holding said surfaces in frictional contact, cooperating index mark and protractor scale means carried by said member maintained in orientation and said annular member, a knob centrally located above said annular member and fastened to said protractor arm for turning it to any selected angle, a transparent cover plate carried by said member maintained in orientation and covering said protractor scale and index mark, means for clamping said annular member to said protractor arm to move it with respect to said member maintained in orientation against friction, a clamp acting between said protractor arm and said member maintained in orientation to fix said protractor arm at any selected angle and fine adjustment means for setting said protractor arm accurately with respect to said member maintained in orientation.

5. In a drafting machine for use on a drafting board, a drafting head comprising a member maintained in orientation on the drafting board, a protractor arm for carrying at least one straight-edge rotatable with respect to said member maintained in orientation, an annular member also rotatable with respect to said member maintained in orientation but having a surface in frictional contact with a surface of said member maintained in orientation, resilient means applying constant frictional forces between said surfaces, said frictional forces being of sufficient magnitude so that said annular member will remain fixed to said member maintained in orientation during free rotation of said protractor arm, cooperating index mark and protractor scale means carried by said member maintained in orientation and said annular member, a thin flat annular plate secured to said annular member, a clamp means for bending said thin flat annular plate into contact with a surface of said protractor arm to clamp said annular member to said protractor arm so that it may be moved therewith against friction and a clamp acting between said protractor arm and said member maintained in orientation to fix said protractor arm at any selected angle.

6. In a drafting machine for use on a drafting board, a drafting head comprising a member maintained in orientation on the drafting board, a protractor arm for carrying at least one straight-

edge rotatable with respect to said member maintained in orientation, an annular member also rotatable with respect to said member maintained in orientation but having a surface in frictional contact with a surface of said member maintained in orientation, resilient means holding said surfaces in frictional contact, cooperating index mark and protractor scale means carried by said member maintained in orientation and said annular member, means for clamping said annular member to said protractor arm to move it with respect to said member maintained in orientation against friction, a tangent screw arm rotatable about the central axis of said drafting head, a female threaded member threaded in a direction tangent to a circle having its center on the central axis of the drafting head carried by said tangent screw arm, a tangent screw engaging said threaded member and projecting against said protractor arm, a spring in tension acting between said tangent screw arm and said protractor arm holding said tangent screw in contact with said protractor arm and a clamp for clamping said tangent screw arm to said member maintained in orientation to fix the protractor arm at any selected angle and so that when said clamp is closed said tangent screw will serve as fine adjustment means for setting said protractor arm accurately with respect to said member maintained in orientation.

7. In a drafting machine for use on a drafting board, a drafting head comprising a member maintained in orientation on the drafting board, a protractor arm for carrying at least one straight-edge rotatable with respect to said member maintained in orientation, an annular member mounted concentric to said member maintained in orientation, cooperating index mark and protractor scale means carried by said member maintained in orientation and said annular member, means for clamping said annular member to said protractor arm to move it with said protractor arm with respect to said member maintained in orientation, said annular member and said member maintained in orientation being in constant frictional engagement with each other, resilient means held by said members under a fixed predetermined unadjustable stress, said resilient means applying constant pressure between said annular member and said member maintained in orientation to produce constant frictional forces between said annular member and said member maintained in orientation, said frictional forces being of sufficient magnitude so that said annular member will remain fixed to said member maintained in orientation during rotation of said protractor arm when said clamping means are open.

ALLISTER L. BAKER.

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