Aug. 22, 1961 A. L. BAKER 2,996,805

DRAFTING MACHINE

Filed March 25, 1957 2 Sheets-Sheet 1

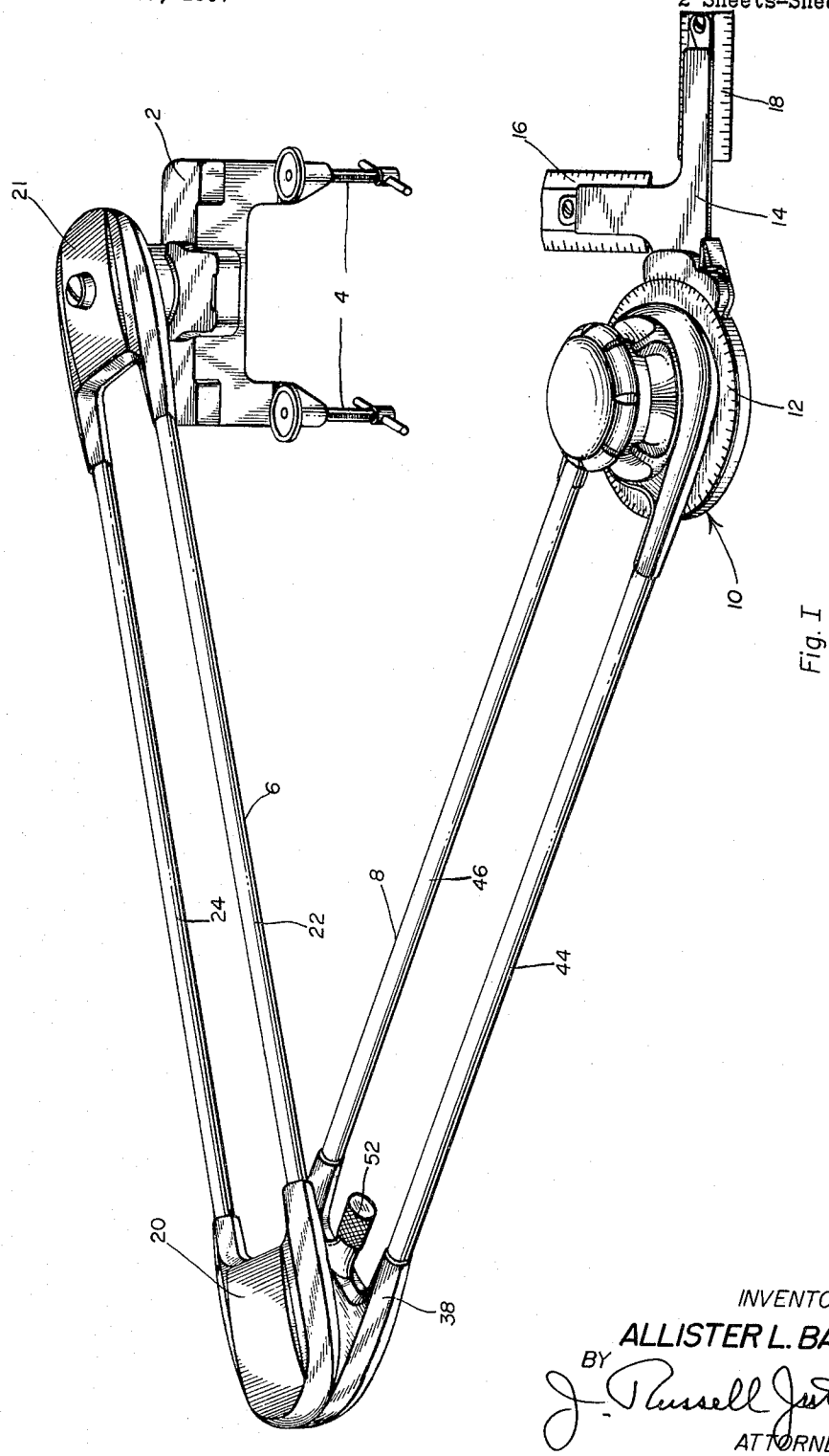


Fig. I

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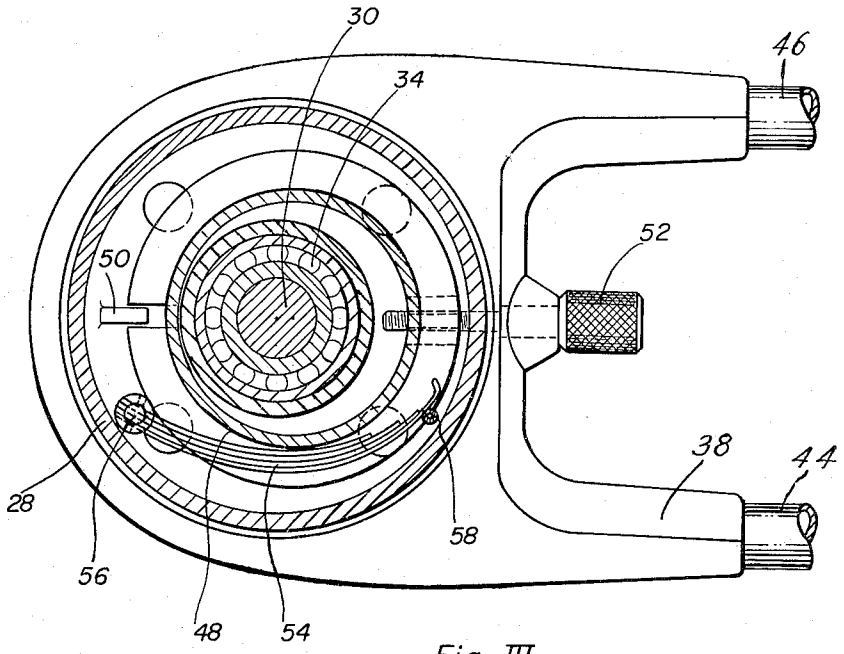


Fig. III

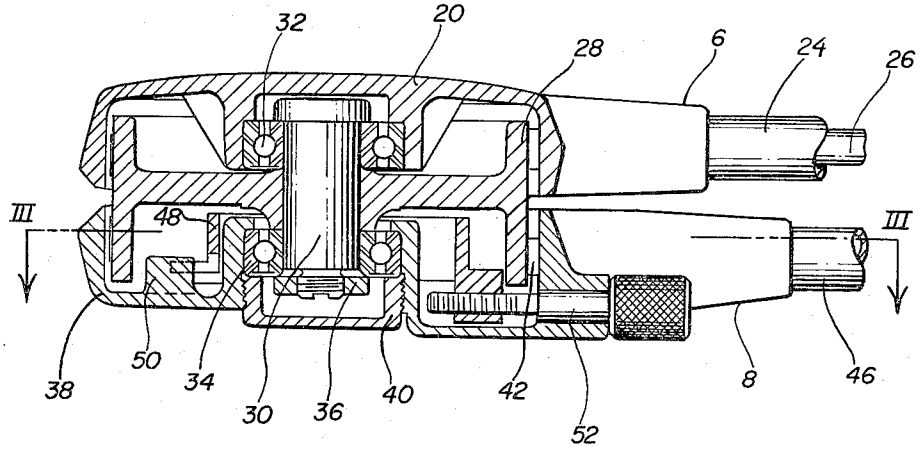


Fig. II

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DRAFTING MACHINE

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This invention relates to a counter-balance construction for a drafting machine. The invention may be used with a drafting machine of the pulley and band type. As is known in the art, this type of drafting machine includes a fixed member which may be 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 movable 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 some member of the drafting head is maintained in orientation by a combination of pulleys and bands or parallelograms or the like.

When such a drafting machine is used on an inclined drawing board, it is necessary to counter balance the movable parts so that the drafting head will remain in any position in which it is placed over the surface of the drawing board. Suitable means have already been devised for counter balancing the first movable arm so that it will not move under the action of gravity with respect to the member clamped to the drawing board. The present invention relates specifically to counter balancing means for the second movable arm which prevents it from moving under the action of gravity with respect to the first movable arm when the drafting machine is used on an inclined board.

The invention and the means for its attainment will be more fully understood after reading the following description taken in conjunction with the drawing in which:

FIG. I is a view in perspective showing the complete drafting machine.

FIG. II is a view in sectional elevation taken through the elbow between the first and second movable arms, the two arms having been pivoted with respect to each other at the elbow from the position shown in FIG. I to a position in which the second movable arm lies directly under the first movable arm.

FIG. III is a view in plan which is partly in section; the section being along the line III—III of FIG. II and looking in the direction of the arrows.

Referring to FIG. I, the anchor **2** or member which may be fastened to the drawing board is provided with suitable clamp screws **4** for clamping it on a drawing board. The first movable arm **6** is pivoted to the anchor **2** at one end as shown. The second movable arm **8** is pivoted to the other end of the first movable arm **6** at the elbow which is shown in greater detail FIGS. II and III. The drafting head **10** is mounted at the free end of the second movable arm **8**. The drafting head **10** includes a protractor **12** which may be secured to a member within the drafting head **10** which member is maintained in orientation with respect to the drawing board by means of bands passing within the tubular portions of the arm **6** and **8**. The protractor arm **14** is pivoted about the center of the drafting head **10** so that the protractor arm **14** may be adjusted to any angular position as indicated by the protractor **12**. In the embodiment shown, the protractor arm **14** carries two scales **16** and **18** which are detachably secured to the protractor arm **14** by conventional means.

Referring to FIG. II the end bracket **20** of the first movable arm **6** is secured to the tubes **22** and **24** within which the band **26** is free to move. The band **26** passes around the elbow pulley **28** and thereby maintains the elbow pulley **28** in orientation with respect to a fixed pulley which is secured to the anchor **2** and is mounted within the end bracket **21** FIG. I at the opposite end of the first movable arm **6**. The elbow pulley **28** carries a shaft **30** to which are secured the inner races of the ball bearings **32** and **34** by means of the nut **36**. The pulley **28** is provided with a recess formed between the rim of the pulley and the hub of the pulley. The outer race of the ball bearing **32** is pressed into the end bracket **20** of the first movable arm **6** so that the arm **6** can pivot with respect to the pulley **28**. Similarly, the outer race of the ball bearing **34** is secured to the end bracket **38** of the second movable arm **8**. The button **40** which helps to hold the outer race of the ball bearing **34** in the bracket **38** may also act as a slide for the elbow of the drafting machine as it moves over the surface of the drawing board. The band **42** passes around the pulley **28** and through the tubes **44** and **46** of the second movable arm **8**. This band **42** also passes around a pulley within the drafting head and maintains that pulley in orientation with respect to the drawing board.

An eccentric drum or cam **48** is mounted within the end bracket **38** under the pulley **28** and partially extending into the recess formed between the hub and rim of the pulley as shown. This eccentric drum **48** is provided with an integral lower flange which is slotted to receive the key **50** which is formed integrally with the end bracket **38**. An integrally cast lug projects downward from the flange on the eccentric drum **48** in the diametrically opposite position. This lug is internally threaded as shown to receive the adjusting screw **52**. The adjusting screw **52** therefore serves to adjust the eccentricity of the eccentric drum **48** with respect to the axis of the pulley **28**.

A leaf spring **54** (FIG. III) which may be built up of several strips as shown is carried by the elbow pulley **28** (i.e., by the member maintained in orientation) and is always held thereby on the bottom side of the eccentric drum **48** (when the board is inclined) so that it always exerts a vertical upward force on the drum **48**. (Vertical as used in this paragraph means a direction parallel to the inclined drawing board in a vertical plane perpendicular to the surface of the drawing board.) One end of the leaf spring **54** is pivotally attached to the under side of the drum **28** by a pin **56** extending downward from the flange of the drum **28**. The other end of the leaf spring **54** is restrained by a pin **58** which is mounted similarly in the drum **28**. The central portion of the leaf spring **54** engages the eccentric drum **48**. The construction is such that the eccentricity of the eccentric drum is adjusted in the longitudinal direction of the second movable arm. Thus, when the second movable arm is vertical the eccentricity of the drum is in the vertical direction and when the second movable arm is horizontal, the eccentricity of the drum is in the horizontal direction. For intermediate inclined positions of the second movable arm, the eccentricity is in an inclined direction so that when the second movable arm is vertical the horizontal component of the eccentricity is zero and increases gradually to a maximum when the second movable arm is pivoted from the vertical to the horizontal position. The leaf spring **54** being carried by the member maintained in orientation exerts a force against the eccentric drum **48** which is always upward and substantially vertical and constant. The moment of this force about the elbow depends on the horizontal component of the eccentricity of the eccentric drum **48** and therefore varies with the eccentricity from zero to a maximum as

the second movable arm is pivoted from a vertical to a horizontal position.

The moment of force discussed above counterbalances the moment about the elbow of gravity acting on the second movable arm and the drafting head. Obviously, the moment arm of the force of gravity is also zero when the second movable arm is vertical and is a maximum when the second movable arm is horizontal. Thus the moment of the leaf spring acting on the eccentric drum can be made to counterbalance the moment of the force of gravity for all angles of the second movable arm pivoting about the elbow.

The magnitude of the effect produced by the force of gravity will also depend on the inclination of the drawing board. The eccentricity of the eccentric drum 43 may be adjusted to provide sufficient counterbalancing effect for the inclination of the drawing board within the limits of any particular construction. The counterbalancing effect will be assisted to some extent by forces of friction so that as a practical matter any construction according to the present invention will be operative over some range of board angles without readjustment.

Having thus described the invention, what is claimed is:

1. A counterbalance for the lower arm of a drafting machine having upper and lower arms pivoted together, the upper arm being pivoted to an anchor and the lower arm pivoted to the un-anchored end of the upper arm, an orienting member rotatably connected to the pivot between said upper and lower arms, a leaf spring mounted by at least one of its ends on said orienting member, a cam mounted on said lower arm and projecting into engagement with said leaf spring, said cam being mounted for movement relative to said lower arm and substantially in the plane of said lower arm so that said cam may be concentric with said pivot between said upper and lower arms or may be eccentric relative thereto, said leaf spring being biased into engagement with said cam, means connected to the cam and accessible from the exterior of said lower arm to control the degree of eccentric relation of said cam to said pivot, said counterbalance providing for adjusted balanced movement of said lower arm whereby the counterbalancing effect between said leaf spring and said cam will be a maximum when said lower arm is in a horizontal position and will be a minimum when said lower arm is in a vertical position, the counterbalancing effect of said spring and said cam and the friction between said spring and said cam always maintaining the lower arm in proper counterbalancing relation.

2. A counterbalance for a drafting machine having a first and second arm pivoted together and the first arm pivoted to an anchor, a pulley rotatably connected to the pivot between said first and second arms, said pulley having a circumferential recess in the side adjacent said second arm, a lead spring in said recess and mounted by at least one of its ends on the pulley adjacent the rim thereof, an eccentric mounted on said second arm and located in said recess in a radial plane including the pivot and said leaf spring and having the periphery of said eccentric engageable with an intermediate portion of said leaf spring deflecting said intermediate portion of said leaf spring radially from said pivot, said eccentric being mounted for movement relative to said second arm and substantially in the plane of said second arm so that said eccentric may be concentric with said pivot between said first and second arms or may be eccentric thereto, said leaf spring biased into engagement with said eccentric means connected to the eccentric and accessible from the exterior of said second arm to control the degree of eccentricity of said eccentric relative to said pivot, said counterbalance providing for adjusted balanced movement of said second arm whereby the counterbalancing effect between said leaf spring and said eccentric will be a maximum when said second arm is in a horizontal position and will be a minimum when the second arm is in a vertical position, the counterbalancing effect of said spring and said eccentric and the friction between said spring and said eccentric always maintaining the second arm in proper counterbalancing relation.

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