April 17, 1945. L. KETTING 2,374,020

DRAFTING MACHINE

Filed June 12, 1941

FIG.2.

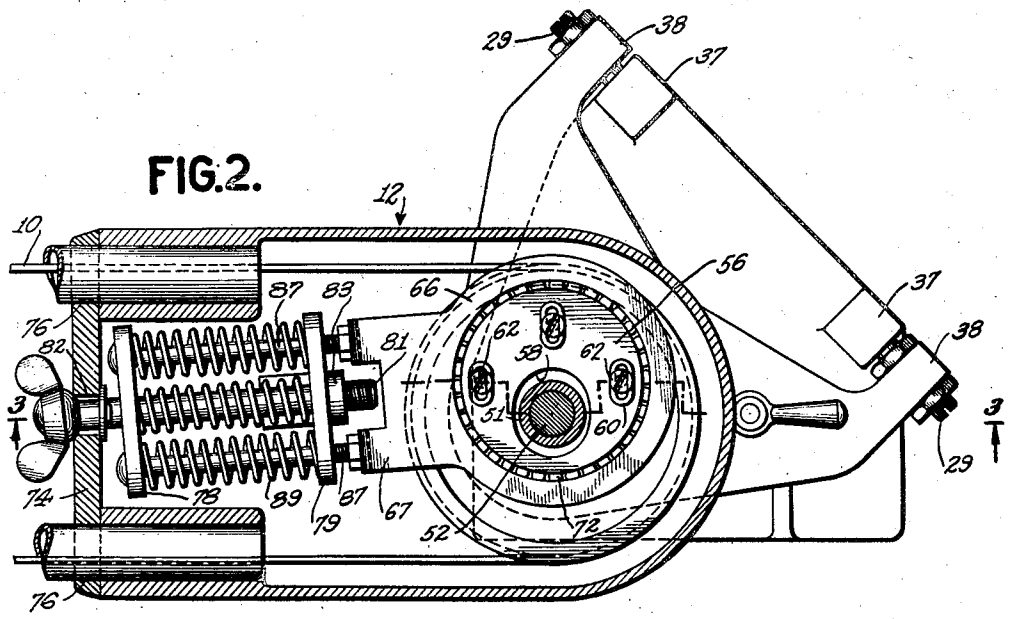


FIG.3.

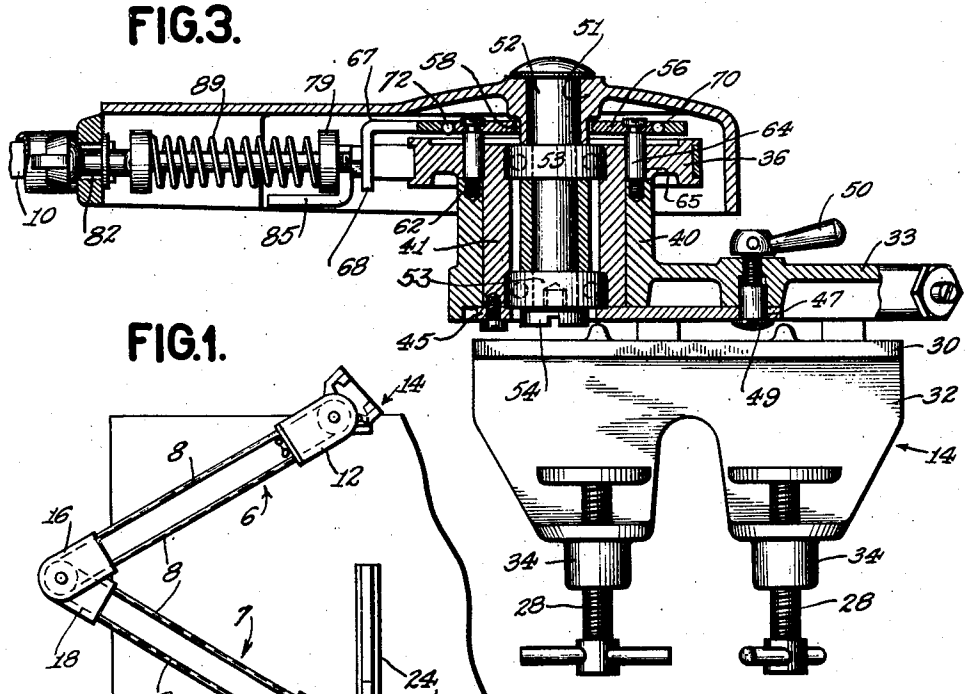


FIG.1.

INVENTOR

BY LEENDERT KETTING.

Orton and Griswold

ATTORNEYS

Patented Apr. 17, 1945

2,374,020

UNITED STATES PATENT OFFICE

2,374,020

DRAFTING MACHINE

Leendert Ketting, Secaucus, N. J., assignor to Keuffel & Esser Company, Hoboken, N. J., a corporation of New Jersey

Application June 12, 1941, Serial No. 397,665

17 Claims. (Cl. 33—79)

This invention relates to parallel motion drafting devices of the kind in which the several tools the draftsman handles most frequently are embodied in principle in one unit to obviate the necessity of the draftsman reaching about for a required tool, thereby enabling the draftsman to keep his attention concentrated directly upon the drawing. Drafting devices of this character have heretofore been proposed in which adjacent ends of two arms are pivoted together, the free end of one arm being secured to the remote side of the drafting board while the free end of the other arm is provided with a head comprising a protractor and straight-edges which are in fixed angular relation to move about the center of the protractor as an axis. Such drafting machines have been of two general kinds one of which comprises parallel motion mechanism in the form of a jointed arm composed of two parallelograms. In another form, the arms have pulleys, spaced apart thereon with flexible driving means between the pulleys, one pulley at the joint between the two arms being common to the flexible driving means or tension members, such as belts, of both arms.

Drafting devices of this character are frequently used upon drafting boards which are inclined at an angle to the horizontal. Since the arms of the drafting machine have considerable weight and the head at the free end of the articulated arm is also of considerable weight, there is frequently a tendency toward accidental movement due to forces of gravity when the arms are positioned on one side or the other of a vertical plane passing through the anchor and perpendicular to the remote edge of the board. Many attempts have been made to counterbalance the weight of the arms to thereby prevent their accidental displacement.

One object of the present invention is counterbalancing means for the weight of the arms which may be readily contained within an arm.

Another object of the invention is counterbalancing means, the effect of which is applied directly to the angularly movable members or supports which are relatively angularly movable with respect to the frame of the arm and about which the flexible driving means pass and between which they extend and drivingly interconnect.

A further object of the invention is counterbalancing means which will not interfere with the adjustment of the fixed pulley by which the proper angularity of the straight-edges is originally set to a base line.

Still another object of the invention is to adjust the counter-balancing means.

In carrying the invention into effect, tensioning means is provided which extends between an arm and an angularly movable member.

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 drawing illustrating one embodiment by which the invention may be realized and in which:

Figure 1 is a view showing a drafting machine mounted on a drafting table;

Figure 2 is a view on an enlarged scale of the counterbalancing means, the upper portion of the casing being removed to show details of construction; and

Figure 3 is a vertical sectional view taken in the planes indicated by the broken lines 3—3 of Figure 2 and looking in the direction of the arrows.

Referring to the drawing, there is illustrated in Figure 1 a typical endless band type of drafting machine which includes a pair of arms or struts 6, 7, each of which is constructed to include an end member at each of its ends held apart by tubes 8, 8 extending into the end members and through which the endless bands 10 pass. The upper arm 6 includes a pivot end member 12 which is pivotally mounted on the anchor 14 and at the other end a pivot end member 16 which in turn carries the pivot end member 18 of the so-called lower arm 7. The end member 20 at the free end of the arm 7 carries the head 22 on which are mounted the straight-edges 24. In the illustrated embodiment, the anchor 14 comprises a frame adapted to engage the drawing table 25 and be clamped thereto by the clamp screws 28. The bracket consists of a flat surface member 30, Figure 3, to rest on the top face of the drawing board and with a downwardly depending positioning wall 32 lying in a plane at right angles to the surface member 30 so that it can be placed on a drawing board and fit against the side with relative accuracy. This bracket is formed at its lowermost portion with threaded bosses 34 though which pass the clamp screws 28 by which the bracket may be rigidly mounted on the drawing board or drawing table 25 which is firmly clamped between the surface member 30 and the heads of the clamp screws. Above the table member lies two spaced bearing members 37 to which are pivotally mounted the adjustable plate 33 which pivotally supports the upper end of the arm 6. This plate 33 is a bifurcated member

having spaced arms 38 provided with pivots 29 mounted in the two spaced bearings 37. The plate 33 is formed on the side remote from the pivots with a tubular portion 40 within which is rotatably mounted a sleeve 41 carrying the pulley 36 on its upper end. The pulley 36 rests on the tubular portion 40 of the frame or plate 33. The sleeve 41 is adjustable radially to adjust the pulley and band 10 in arm 6, as will be understood. This is accomplished by securing an arm 45 to the lower end of the pulley sleeve 41. The free end of arm 45 is formed with an arcuate slot 47 receiving a bolt 49 mounted in the frame. Upon loosening the bolt 49 by means of the handle 50, the arm may be moved as desired to adjust the pulley in orientation with respect to the anchoring means and then locked in adjusted position.

The arm 6 is free to turn about a pivot pin 52 journalled within bearings 53 mounted inside the pulley sleeve 41. The pivot pin 52 is held against accidental removal by a locking screw 54 bearing against the lower bearing 53.

To counterbalance the weight of the arms, a counterbalancing device is disposed within the upper end member of the respective arms. In the illustrated embodiment, only the counterbalance of arm 6 is shown but it will be understood that the pertinent structure therein is illustrative of structure which may be incorporated in both arms. Briefly described, the counterbalancing device comprises an eccentric on the pulley about which a strap from the arm extends, the strap including a tensioning device. As shown, a disc 56 is mounted eccentrically on the pulley 36. The disc 56 is formed, preferably on one diameter, with an elliptical aperture 58 permitting the passage of the pivot pin 52 and the socket portion 51 in which the pivot pin 52 is mounted in the arm member 12. The aperture 58 is sufficiently oversize for this purpose in all positions of adjustment of the disc 56. As shown, the disc 56 is adjustably mounted on the pulley 36. To this end, the disc 56 is formed with slots 60 through which screws 62 pass through arcuate slots 65 in the pulley 36 into the relatively fixed tubular portion 40 of the plate 33. The axes of the slots are preferably parallel to the major axis of the elliptical opening 58. Bushings 64 are shown as mounted on the screws 62 to support the disc above the surface of the pulley.

Surrounding the eccentric disc 56 is a strap shown as a circular frame member or ring 66 provided with a radially extending arm 67 formed at its end with spaced downwardly extending ears 68. The strap member 66 is made freely rotatable about the eccentric member 56 by providing the opposing edges of the two members with raceways 70 containing anti-friction members, such as the balls 72.

Across the open end of the end member is a frame member 74 apertured as at 76, 76 for the passage of the tubes 8 and by which the end 74 is fixed against displacement. The member 74 serves as an abutment to which is secured one end of a tension device to which is secured the strap 66, 67.

The tension device is composed of two spaced frame members 78 and 79, each provided with three spaced apertures. A bolt 81 passes through an aperture 82 in the fixed frame member 74 and passes through both frame members 78 and 79 and is threaded into a nut 83 on the side of the member 79 nearest the pulley 36. It is thus fixed to the frame member nearest the pulley 36. This nut has an arm 85 extending beneath the frame member 78 to prevent the nut 83 from turning. Bolts 87 extend through the apertures in both frame members 78, 79 on each side of the apertures for bolt 81. Bolts 87 are secured in the respective ears 68 and their heads are on the side of the frame member 78 most remote from pulley 36. Compression springs 89 encircle each of the bolts 87 and 81 between the frame members 78 and 79 to urge the frame members away from one another. The compression springs are placed under the desired torsion by rotating the bolt 81 and to this end, a wing nut-like head is mounted on the bolt 81 on the outside of the frame member 74. Thus as the bolt 81 is rotated, the frame members 78 and 79 are drawn together until the proper degree of tension is placed upon the frame members 66, 67.

As viewed in Figure 2, the normal tendency of the arm 6 is to rotate, due to the weight of the arms and head, in a counter-clockwise direction about the axis of the pivot pin 52. Since the disc 56 is eccentric with respect to the pivot pin 52 and pulley thereon, as the arm tends to swing in a counter-clockwise direction, the distance between the frame 74 and the eccentric disc increases thereby placing compression upon the compression springs. In resisting the compression, the springs oppose the tendency of the arm to rotate in a counter-clockwise direction. At the same time the arm may be normally moved to any position on the drawing board against the action of the springs. By suitable selection of the springs and correctly positioning the eccentric disc and placing the springs under the requisite compression, the tension on the arms may be adjusted to counterbalance the weight of the arms.

It will be readily appreciated that the same counterbalancing device may be provided, if found desirable, in the end member 18 on arm 7 although in many situations, this may not be found necessary in view of the fact that the normal action of the belts and pulleys restrained by the counterbalance in the upper arm may be sufficient for the purpose at hand.

Various modifications will occur to those skilled in the art in the composition, configuration and disposition of the various component elements going to make up the invention as a whole and particularly the composition of the compressible members and the manner in which the strap is affixed and formed and no limitation is intended by the phraseology of the foregoing specification or illustrations in the accompanying drawing except as indicated in the appended claims.

What is claimed is:

1. A parallel motion drafting device of the pulley and band type including anchoring means adapted to be attached to a drawing board and comprising arms pivoted at adjacent ends, one of said arms being pivoted at a free end to the anchoring means, a pair of spaced pulleys in each arm, an endless band passing around each pair of pulleys, eccentric means carried by a pulley, a strap around the eccentric means and tension means one end of which is connected to the arm and the other end of which is connected to the strap.

2. A parallel motion drafting device of the pulley and band type including anchoring means adapted to be attached to a drawing board and comprising arms pivoted at adjacent ends, one of said arms being pivoted at a free end to the anchoring means, a pair of spaced pulleys in each arm, an endless band passing around each pair of pulleys, a disc eccentrically mounted on

a pulley, a strap around the eccentric means and tension means between the arm and the strap.

3. A parallel motion drafting device of the pulley and band type including anchoring means adapted to be attached to a drawing board and comprising arms pivoted at adjacent ends, one of said arms being pivoted at a free end to the anchoring means, a pair of spaced pulleys in each arm, an endless band passing around each pair of pulleys, a disc eccentrically mounted on a pulley, a ring surrounding the disc and formed with an arm and tension means between the end of the arm on the ring and the arm of the drafting device.

4. A parallel motion drafting device of the pulley and band type including anchoring means adapted to be attached to a drawing board and comprising arms pivoted at adjacent ends, one of said arms being pivoted at a free end to the anchoring means, a pair of spaced pulleys in each arm, an endless band passing around each pair of pulleys, a disc eccentrically mounted on a pulley, a ring surrounding the disc, anti-friction means between the ring and the disc, said ring being formed with an arm and tension means between the end of the arm on the ring and the arm of the drafting device.

5. A parallel motion drafting device of the pulley and band type including anchoring means adapted to be attached to a drawing board and comprising arms pivoted at adjacent ends, one of said arms being pivoted at a free end to the anchoring means, a pair of spaced pulleys in each arm, an endless band passing around each air of pulleys, a disc eccentrically mounted on a pulley, a ring surrounding the disc, the proximate faces of the ring and disc being formed with raceways and ball bearings between the raceways, said ring being formed with an arm and tension means between the end of the arm on the ring and the arm of the drafting device.

6. A parallel motion drafting device of the pulley and band type including anchoring means adapted to be attached to a drawing board and comprising arms pivoted at adjacent ends, one of said arms being pivoted at a free end to the anchoring means, a pair of spaced pulleys in each arm, an endless band passing around each pair of pulleys, eccentric means carried by a pulley, a strap around the eccentric means and tension means between the arm and the strap comprising spaced members, compression means between the members and means connecting the member nearest the pulley to the arm and the member remote from the pulley to the strap.

7. A parallel motion drafting device of the pulley and band type including anchoring means adapted to be attached to a drawing board and comprising arms pivoted at adjacent ends, one of said arms being pivoted at a free end to the anchoring means, a pair of spaced pulleys in each arm, an endless band passing around each pair of pulleys, eccentric means carried by a pulley, a strap around the eccentric means formed with a pair of circumferentially spaced ears and tension means between the arm and the strap comprising a pair of spaced frame members, bolts passing through the frame members and the ears and connecting the frame member remote from the pulley to the strap, a bracket member carried by the arm, a bolt passing through the frame members and the bracket member and connecting the frame member nearest the pulley to the arm, and coil springs surrounding the bolts between the frame members.

8. A parallel motion drafting device of the pulley and band type including anchoring means adapted to be attached to a drawing board and comprising arms pivoted at adjacent ends, one of said arms being pivoted at a free end to the anchoring means, a pair of spaced pulleys in each arm, an endless band passing around each pair of pulleys, eccentric means carried by a pulley, a strap around the eccentric means formed with a pair of circumferentially spaced ears and tension means between the arm and the strap comprising a pair of spaced frame members, bolts passing through the frame members and the ears and connecting the frame member remote from the pulley to the strap, a bracket member carried by the arm, a bolt passing through the frame members and the bracket member and connecting the frame member nearest the pulley to the arm, coil springs surrounding the bolts between the frame members and means to adjust the compression on the springs.

9. A parallel motion drafting device of the pulley and band type including anchoring means adapted to be attached to a drawing board and comprising arms pivoted at adjacent ends, one of said arms being pivoted at a free end to the anchoring means, a pair of spaced pulleys in each arm, an endless band passing around each pair of pulleys, eccentric means carried by a pulley, a strap around the eccentric means formed with a pair of circumferentially spaced ears and tension means between the arm and the strap comprising a pair of spaced frame members, bolts passing through the frame members and the ears and connecting the frame member remote from the pulley to the strap, a bracket member carried by the arm, a bolt passing through the frame members and the bracket member and connecting the frame member nearest the pulley to the arm, and coil springs surrounding the bolts between the frame members, said frame members being formed with seats for the springs.

10. A parallel motion drafting device of the pulley and band type including anchoring means adapted to be attached to a drawing board and comprising arms pivoted at adjacent ends, each arm comprising end members and spaced tubular members extending therebetween, one of said arms being pivoted at a free end to the anchoring means, a pulley in the member of each arm, an endless band in the tubular members and passing around the pulleys in each arm, a transverse member carried by the tubular members proximate the end member, eccentric means carried by a pulley, a strip around the eccentric means and tension means between the arm and the strap comprising spaced members, compression means between the members and means connecting the member nearest the pulley to the transverse member and means connecting the member remote from the pulley to the strap.

11. A parallel motion drafting device of the pulley and band type including anchoring means adapted to be attached to a drawing board and comprising arms pivoted at adjacent ends, each arm comprising an end member and spaced tubular members extending therebetween, one of said arms being pivoted at a free end to the anchoring means, a pulley in the member of each arm, an endless band in the tubular members

and passing around the pulleys in each arm, a transverse member carried by the tubular members proximate the end member, eccentric means carried by a pulley, a strap around the eccentric means and tension means between the arm and the strap comprising spaced members, compression means between the members and adjustable means connecting the member nearest the pulley to the transverse member and means connecting the member remote from the pulley to the strap.

12. A parallel motion drafting device of the pulley and band type including anchoring means adapted to be attached to a drawing board and comprising arms pivoted at adjacent ends, one of said arms being pivoted at a free end to the anchoring means, a pair of spaced pulleys in each arm, an endless band passing around each pair of pulleys, a disc eccentrically mounted on a pulley, means to adjust the eccentricity of the disc, a strap around the eccentric means and tension means between the arm and the strap.

13. A parallel motion drafting device of the pulley and band type including anchoring means adapted to be attached to a drawing board and comprising arms pivoted at adjacent ends, one of said arms being pivoted at a free end to the anchoring means, a pair of spaced pulleys in each arm, an endless band passing around each pair of pulleys, eccentric means carried by a pulley in an arm, a strap around the eccentric means and tension means between said arm and the strap.

14. A parallel motion drafting device of the pulley and band type including anchoring means adapted to be attached to a drawing board and comprising a pivotally movable arm, a pulley carried thereby and fixed in orientation with respect to the anchoring means, means having a cam surface relatively fixed eccentrically with reference to the pulley and spring means between the arm and the eccentric means to engage various portions of the said cam surface to counterbalance the weight of the arm.

15. In a spring counterbalance for a drafting machine including an anchor member defining a fixed axis pivotally supporting an arm member of a parallel motion mechanism, the combination of: a cam member secured to said anchor member and defining a circular cam surface eccentrically disposed relative to said fixed axis; means on said member defining a housing directed toward said cam surface; cam engaging means slidably mounted in said housing and engaging said cam surface; and compression spring means in said housing for urging said cam engaging means into pressure engagement with said cam surface.

16. In a spring counterbalance for a drafting machine including an anchor member defining a fixed axis pivotally supporting an arm member of a parallel motion mechanism, the combination of a cam member fixed with respect to said anchor member and defining a cam surface eccentrically disposed relative to said fixed axis, spring means carried by the arm member and cam engaging means actuated by said spring means to engage with the cam member to counterbalance the arm member.

17. In a spring counterbalance for a drafting machine including an anchor member defining a fixed axis pivotally supporting an arm member of a parallel motion mechanism, the combination of a cam member fixed with respect to said anchor member and defining a cam surface eccentrically disposed relative to said fixed axis, said arm member including a housing at least partially surrounding said cam member, spring means carried by the said housing of said arm member and cam engaging means actuated by said spring means to engage with said cam member to counterbalance the arm member.

LEENDERT KETTING.