June 6, 1944. C. W. KEUFFEL 2,350,358

DRAFTING MACHINE

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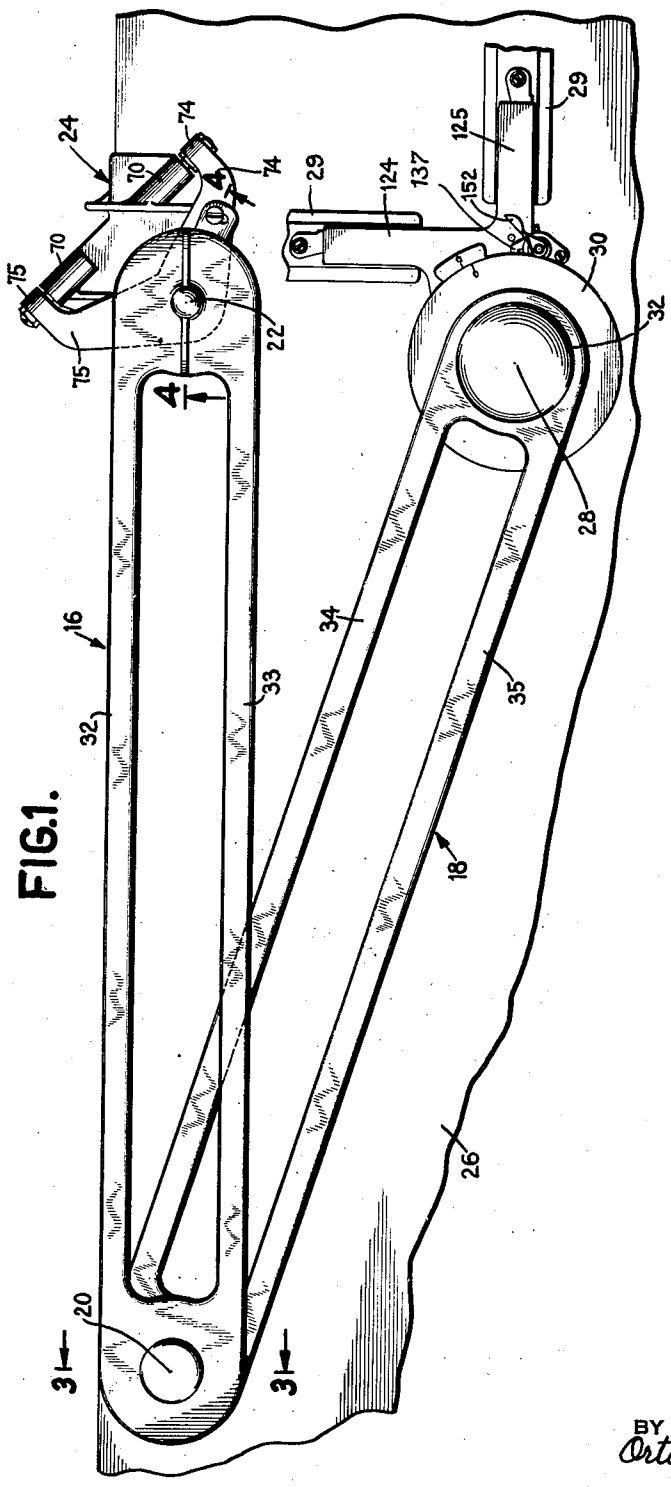


FIG.1.

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FIG. 4.

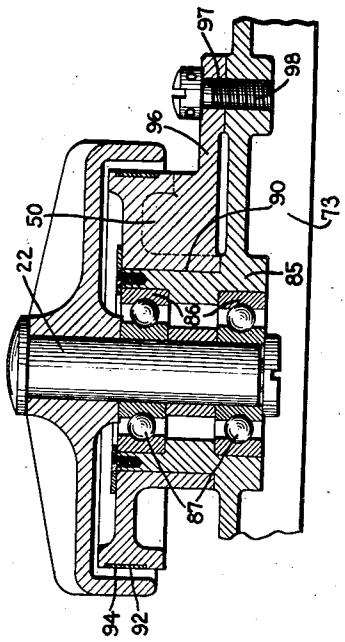


FIG. 2.

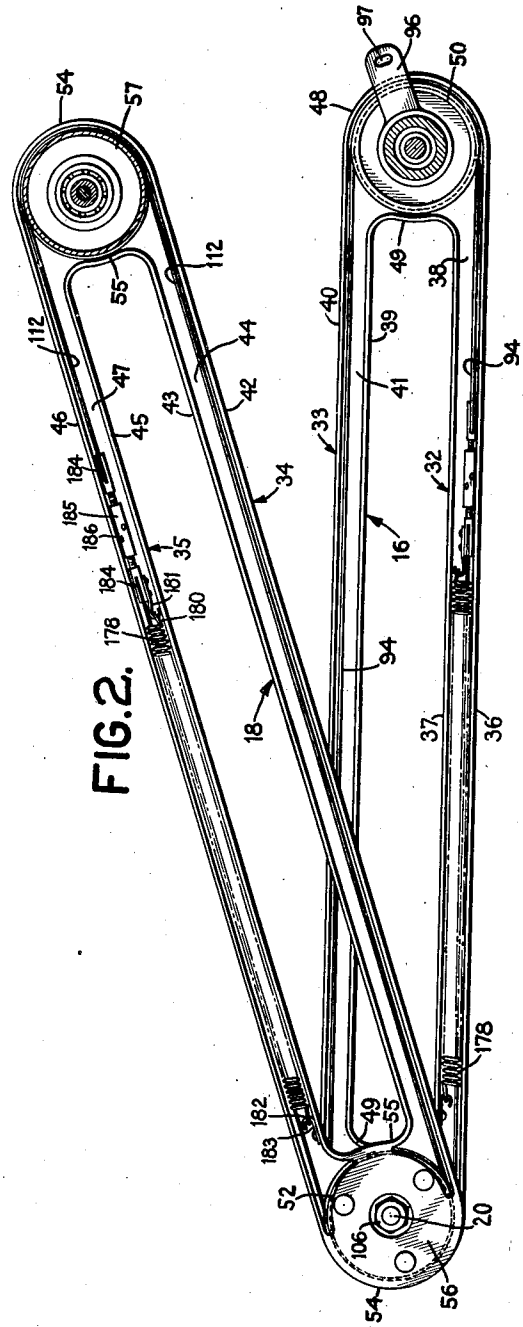
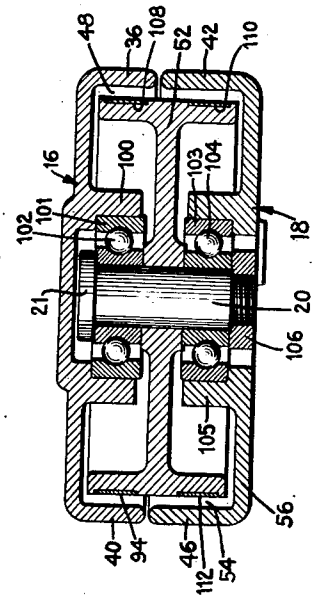


FIG. 3.



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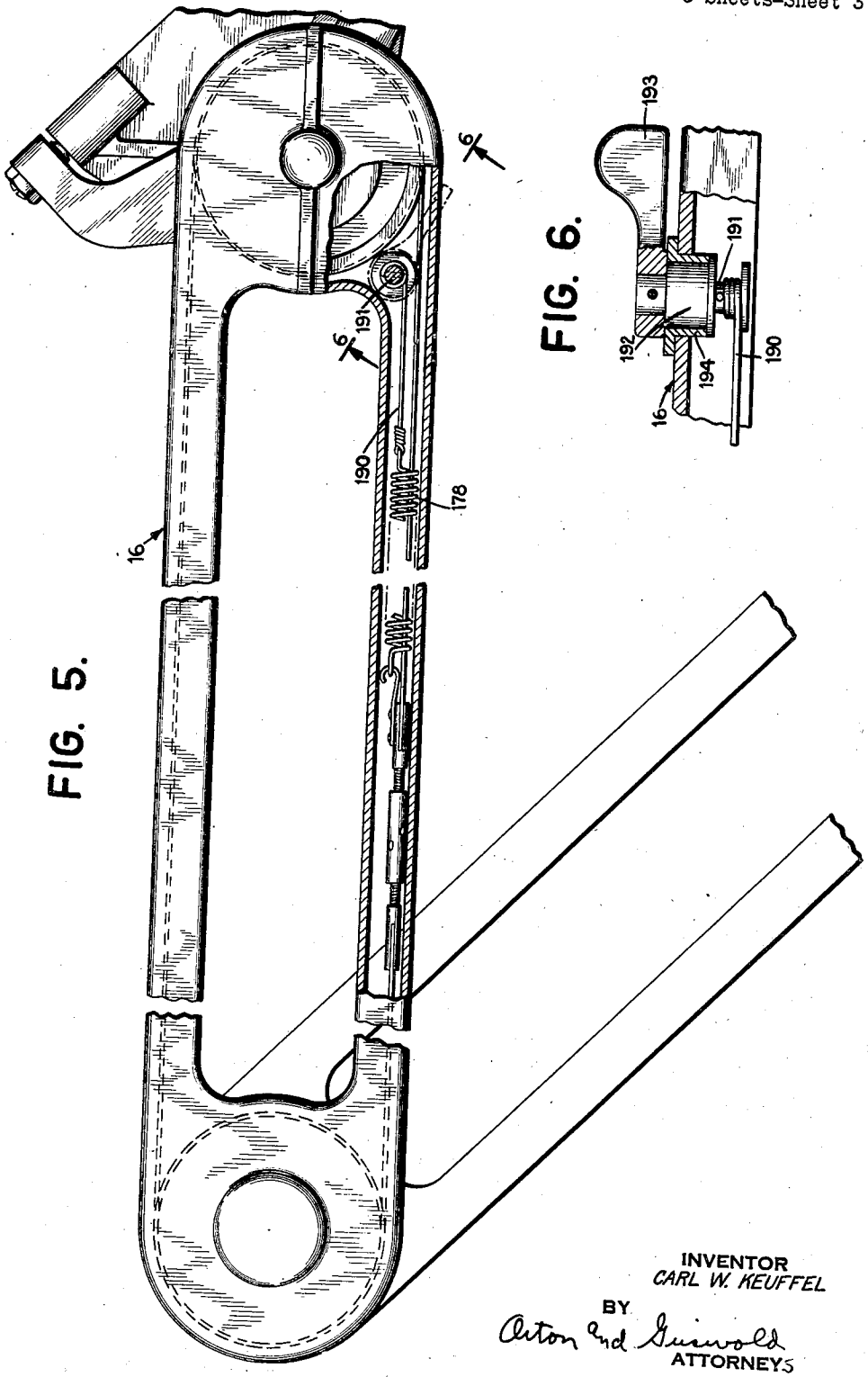


FIG. 5.

FIG. 6.

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UNITED STATES PATENT OFFICE

2,350,358

DRAFTING MACHINE

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Application April 24, 1937, Serial No. 138,759

6 Claims. (Cl. 33—79)

This invention relates to parallel motion drafting devices of the kind in which the several tools which the draftsman handles most frequently are embodied, in principle, in one unit to obviate the necessity of a 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 a drafting board while the free end of the other arm is provided with a protractor and straight edges which are in fixed angular relation to move about the center of the protractor as an axis. Such straight edges have heretofore been so associated with the protractor as to be set and locked at any angle of the protractor or to be automatically stopped at predetermined intervals. The straight edges of drafting devices of this type have been maintained in the desired relation to the drawing board irrespective of the angularity of the arms by means of endless bands embracing pulleys of the three movable joints of the construction.

Still another object of the invention is to counterbalance the arms to prevent accidental movement thereof, due to gravity, for any angle of inclination of the board, within limits.

Yet another object of the invention is to provide for adjustment of the counterbalance.

A further object of the invention is to adjust the counterbalance, particularly where tensioning devices are utilized, whereby the adjustment of the position of the straight edges is facilitated.

The invention also resides in the details of construction by which a drafting device is provided which is practical from the standpoint of ease and convenience in manufacture and durability and facility in use.

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

Figure 1 is a view showing the drafting device of this invention, in plan;

Figure 2 is a view showing the drafting device, looking from below in Figure 1 and illustrating, particularly, the counterbalance device which, in this instance, takes the form of a tension spring;

Figure 3 is a transverse vertical sectional view taken in the plane indicated by the line 3—3 of Figure 1, looking in the direction of the arrows and showing the pulley for the tension band and the details of construction thereof at the movable joint;

Figure 4 is a transverse vertical sectional view, taken in the planes indicated by the broken line 4—4 of Figure 1, and looking in the direction of the arrows,

Figure 5 is a view showing a device to adjust the counterbalancing of the drafting machine of this invention; and

Figure 6 is a vertical transverse, sectional view taken in the plane indicated by the line 6—6 of Figure 5.

Referring first to Figure 1, it will be noted that the drafting device of this invention comprises two arms indicated generally at 16 and 18, respectively, whereof the adjacent ends of the respective arms are pivoted as at the point 20. The arm 16 is also pivoted, as at 22, at its free end to a fixed anchor member indicated generally at 24, by which the device is mounted on the drawing board, a fragmentary portion of which drawing board is indicated by the numeral 26. Mounted on the free end of the arm 18, as at 28, is the protractor 30. A knob 32 is turnable relative to the end of the arm 18 about the pivot 28 to adjust the position of straight edges 29 with respect thereto.

Each of the arms 16 and 18 consists generally of a pair of spaced channeled shaped connecting members 32, 33, 34 and 35, respectively, and, as shown in Figures 2 and 3 as comprised of the side walls or flanges 36, 37, 38, 39; flanges 36 and 37 being connected by a top wall 38 and flanges 39 and 40 being connected by a top wall 41. Channel member 34 is formed of the flanges 42 and 43 connected by the top wall 44 and channel member 35 is formed by the flanges 45, 46 connected by the top wall 47. The arm 16 is formed at the remote end from the joint 20 with a semi-cylindrical wall 48 connecting the two flanges 36 and 40, while the flanges 37 and 39 are connected at this end by a continuation flange 49, the flanges 48 and 49 defining a space therewithin for a so-called fixed pulley 50. The opposite end of the arm 16 at the joint 20 is similarly formed by a semi-cylindrical flange 48, Figure 3, connecting the flanges 36 and 40 and an inner flange 49 connecting the flanges 37 and 39, as shown in Figure 2, to receive its portion of a freely movable pulley indicated generally at 52 in Figure 3, which will hereinafter be described. The ends of the arm 18 are similarly formed with semi-cylindrical ends 54 and con-

necting flange 55 so that at the free end, as shown at the right in Figure 2, the space defined therein may receive a pulley 57 and at its connected ends, i. e., the joint 20, the space defined by these walls 54 and 55 receives the companion portion of the pulley 52. The only substantial difference between the two arms is that the bottom of the recess in the last named end of arm 18 is closed by a wall 56.

Referring now to the end of the member 16 containing the pulley 50, that is, the end of the arm 16 at the right in Figure 1. This structure is shown as mounted upon an anchor member with provision for movement about a vertical axis, the anchor member being indicated generally by the numeral 24. This anchor member is adapted to be clamped to the remote edge, preferably, of the drafting board 26, as shown in Figure 1.

The plate 73, Fig. 4, which may take any form so long as it has the desired strength and rigidity, is formed at a convenient point remote from the pivot ends 74 and 75 with a central bearing portion 85 receiving races 86 for anti-friction bearings 87 which support the pivot pin 22 about the axis of which arm 18 turns. The fixed pulley 50 turns, in adjustment, on a cylindrical surface 90 of the plate 73. The fixed pulley 50 is provided with a recessed surface 92 to receive the endless band 94 and therebelow has integral with it an arm 96 formed with an elongated arcuate slot 97 concentric with the axis of the pin 22 so that the pulley may be shifted about its axis with respect to the axis of the arm 18. Through the slot 97 passes a locking screw 98 whereby the angular position of the pulley may be adjusted within desired limits for moving the endless bands 94 longitudinally of the arm 18 for an adjustment which is translated to the straight edges. The end of the arm 16 opposite to the anchored end, i. e., at the joint, is provided centrally with an annular bearing 100 receiving the raceway 101 for an antifriction bearing member shown as the balls 102 and within which the pivot pin 20 turns, a similar bearing 103 being also provided with bearing members 104 within an annular portion 105 on the arm 18, the pin 20 serving as a support for a race member 103 for a similar bearing member 104 about which the ends of the arm 18 turns. The two arms 16, 18 are secured together with provision for angular displacements by the pin 20 between the head 21 of the pin and a nut or the equivalent 106. Between the bearings is disposed the idler pulley 52 so that the pulley and pin 20 may turn relative to the respective ends of the arms 16 and 18. As shown, the pulley 52 is formed with two recessed surfaces in its periphery 108 and 110, the recess 108 receiving the endless band 94 and the recess 110 receiving an endless band 112, which also extends about the pulley 57.

With the pivot 22 anchored on an edge of the board and where the board is level, any movement of the protractor to bring the straight edges to the desired position will effect angularity of the two arms 16 and 18 but by virtue of the endless band, the straight edges will, in known manner, be maintained at the desired inclination to a fixed line either indicated or imaginary on the drawing. If the board lies in a plane at an angle to the horizontal this condition of course may not obtain because of the weight of the free end of the instrument which will have a tendency to slide down the board somewhat and destroy the fixed angularity or fixed relative position of the straight edges. Counterbalancing devices may be provided. In the illustrated embodiment one said counterbalancing means is illustrated in Figure 2 where tension devices illustrated as springs 178 are secured at their one end 180 to the endless band and at their other end 182 to the wall of the housing. Conveniently each end of the spring 178 is in the form of a ring. The endless bands 112 or 94, as the case may be, passes through the helically coiled wire of the spring. A hook 181 carried on a turnbuckle, one element of a turnbuckle connecting the ends of the endless band together, while at the opposite end the ring is engaged by a hook 183 secured to the wall of the housing 18. The two ends of the endless band are provided with threaded members 184 forming elements of the turnbuckle, the threaded ends of which are received within an interiorly threaded sleeve 185 provided with suitable means such as the apertures 186 for the reception of means such as a pin to be inserted therein to turn the sleeve 185 to draw the ends 184 together or permit them to separate. Thus movement of the respective endless bands about the pivot is resisted by the tension of the spring and these endless bands, being thus under tension, will counterbalance the device for any angle of tilt of the drawing board up to approximately 12, 15 or 17 degrees, depending of course upon the proportion and selection of the parts.

It will thus be seen that a drafting device has been provided which may be readily secured to the back of the drawing table by holding the vertical bearing surface of the anchor against the rear edge of the board and securely tightening the clamp screws. The straight edges may be rotated about the pivot 28.

Again the position of the protractor head may be adjusted if the straight edges do not lie parallel to the board. By means of an adjusting pin the turnbuckle 184, 186 is released under, say, the arm that carries the protractor; in this instance, the arm 18. This will release the tension of the steel belt 112. This protractor itself can then be turned by grasping it and rotating it independently of the tension belt while the straight edges are held in position and the protractor latch 137, controlled by lever 152 in any well known manner, in the released position. Having brought the zero of the protractor to the zero of the vernier while the straight edges are parallel to the edges of the board, the turnbuckle 185 may be tightened.

In Figure 6, there is shown a means of adjusting the tension of the spring 178 in the arm 32. In lieu of a fixed anchor 183, a flexible cable 190 is secured at one end to the end of the spring 178, the other end of the cable being wound about a shaft 191 on the upper end of which is a lever arm 192. A drum 193 is carried on the shaft 191 disposed in a bearing 194. As the diameter of the bearing is substantially two and one-half times that of the shaft, the device is self locking, so that even though considerable tension is exerted tangentially on the surface of the drum cylinder, yet the diameter of this cylinder is so much smaller than the diameter of the bearing that the mechanism is self-locking.

Various modifications will occur to those skilled in the art in the composition, configuration and disposition of the component elements going to make up the invention as a whole as well as in the selection and combination of selected features to accomplish the results sought, and no

limitation is intended by the phraseology of the foregoing description or illustrations in the accompanying drawings except as indicated in the appended claims.

What is claimed is:

1. In a parallel motion drafting device, in combination, an arm, a pulley at each end thereof, means permitting relative movement between the arm and the pulleys, respectively, an endless belt about the pulleys and tension means between the belt and the arm comprising a coil spring one end of which is anchored to the arm and the other end of which is anchored to the band.

2. In a parallel motion drafting device, in combination, an arm, a pulley at each end thereof, means permitting relative movement between the arm and the pulleys, respectively, an endless belt about the pulleys and tension means between the belt and the arm comprising a coil spring through which the belt passes, one end of which is anchored to the arm and the other end to the belt.

3. In a parallel motion drafting device, in combination, an arm, a pulley at each end thereof, means permitting relative movement between the arm and the pulleys, respectively, an endless belt comprising a turnbuckle and passing about the pulleys and tension means between the turnbuckle and the arm comprising a coil spring through which the belt passes one end of which is anchored to the arm and the other end is anchored to the turnbuckle.

4. In a parallel motion drafting device, in combination, an arm, a pulley at each end thereof, means permitting relative movement between the arm and the pulleys, respectively, an endless belt about the pulleys and tension means between the belt and the arm comprising a coil spring one end of which is anchored to the arm and the other end is connected to a flexible member, a drum carried with the arm and about which the flexible member is wound, means to turn the drum and locking means for the drum in various positions of adjustment.

5. A drafting machine comprising a fixed head, a work head, link mechanism connecting the fixed head and the work head, each link of said link mechanism comprising pulleys in spaced relation, a flexible band passing around the pulleys and a casing surrounding the flexible band, and means to counterbalance the weight of the links comprising springs housed within the casings surrounding the flexible bands and connected to counterbalance the weight of the links.

6. A drafting machine comprising a fixed head, a work head, link mechanism connecting the fixed head and the work head, each link of said link mechanism comprising pulleys in spaced relation, a flexible band passing around the pulleys, an arm means maintaining said pulleys in spaced relationship and formed with channels receiving portions of said flexible band between the pulleys, whereby said arm forms a guard for said portions in said channels, and means to counterbalance the weight of the links, comprising springs housed within the channels and surrounding the flexible bands, said springs being connected to counterbalance the weight of the links.

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