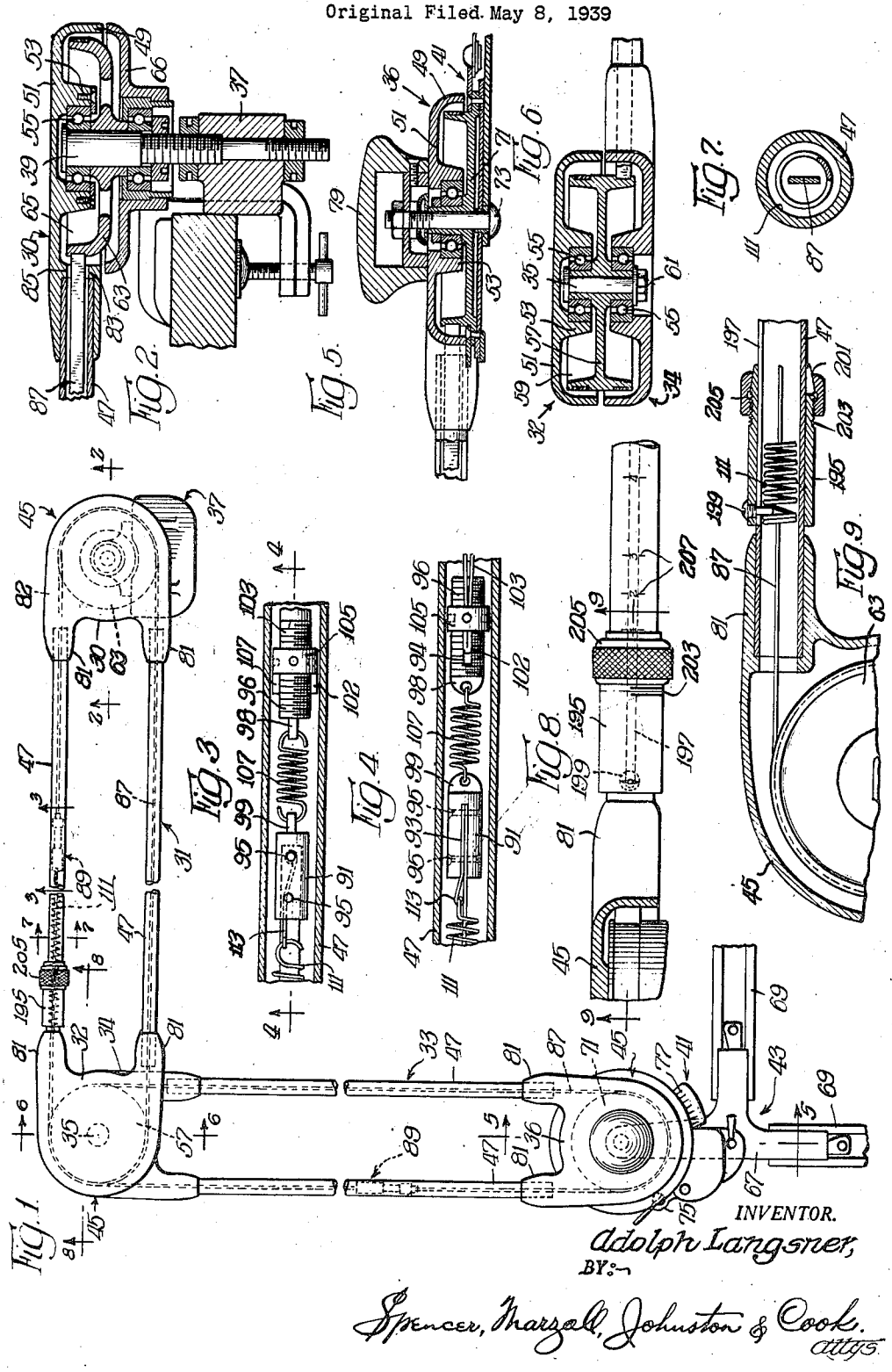
April 13, 1943. A. LANGSNER 2,316,485

DRAFTING APPARATUS

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## DRAFTING APPARATUS

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5 Claims. (Cl. 33—79)

My invention relates in general to parallel motion devices and more especially to drafting equipment embodying parallel motion mechanism, the invention relating more particularly to a device comprising pivoted arms adapted for attachment on a drawing board or table in order to support a ruling guide element, such as a straight edge, for free and unrestricted movement within a drafting area on the board or table, while maintaining the ruling element in an adjusted relative angular relation with respect to the board or table throughout the movement of the guide element within said drafting area. The present invention comprises subject matter divided from my copending application for United States Letters Patent Serial No. 272,335 filed May 8, 1939.

An important object of the invention is to provide apparatus of the character mentioned having counter-balancing means operable to balance the turning tendency of the arms on their support pivots when mounted on a tilted board or table; a further object being to provide adjustable counter-balancing means in parallel motion apparatus comprising pivotally connected frames and flexible belt means operating on pulleys at the opposite ends of the frames; a still further important object being to provide adjustable counter-balancing means in apparatus wherein the relatively pivoted frames comprise arms of simplified construction each having tubular connecting members extending between spaced heads forming houses in which the pulleys are mounted.

Another important object is to provide yielding means neatly and compactly arranged to normally urge the flexible driving element in one direction on said pulleys; a further object being to utilize a helical spring extending within one of the tubular spacing and enclosing members, with the flexible driving element extending axially through said helical spring, whereby to conserve space and permit the spring and driving element to be snugly enclosed while freely operable within the tubular element.

Another important object is to provide means readily operable to adjust the tension applied on the driving element by the helical spring, it being understood that the spring, in urging the driving member in one direction on the pulleys, tends to rotate the arm about the supported end thereof in one direction whereby to counterbalance the weight of said arm, particularly when the device is mounted on a support for movement in a plane tilted from the horizontal; a further important object being to utilize, as tension adjusting means, a manually operable tensioning slide operating in a way on the pulley housing; a further object being to utilize frictional clamping means to secure the slide in adjusted position.

Another important object is to form the manually operable adjusting means as a slide member movable on the tubular spacing member which surrounds the driving element.

Among the numerous other objects and advantages of my present invention is the provision of neat, compact and attractive parallel motion mechanism wherein the weight of moving parts is reduced to a minimum, all of the parts being entirely enclosed and housed against mechanical damage from outside forces and from deterioration through exposure to the atmosphere, the novel structural features of the apparatus, in addition, lending themselves to the provision of an attractive streamlined appearance in the finished article.

The foregoing and numerous other objects, advantages and inherent functions of my present invention will become apparent as the same is more fully understood from the following description which, taken in connection with the accompanying drawing, discloses a preferred embodiment of the invention.

Referring to the drawing:

Figure 1 is a top plan view of parallel motion embodying my present invention;

Figures 2, 3, 4, 5, 6, 7, 8 and 9 are sectional views taken substantially along the lines 2—2, 3—3, 4—4, 5—5, 6—6, 7—7, 8—8 and 9—9 in Figures 1, 3 and 8.

To illustrate my invention, I have shown on the drawing parallel motion mechanism comprising means forming a pair of arm elements 31 and 33 connected together for relative rotation about an axis 35 adjacent an end of each arm, means 37 being provided at the opposite end of the arm 31 for anchoring it on a drafting board or table for relative rotation about a stationary axis preferably formed by a stationary pin 39. The end of arm 33, opposite from the pivot 35, carries means 41 for supporting an element 43 for parallel movement, said element, in the illustrated embodiment, comprising drafting guide means adapted to be moved throughout a drafting area on the drawing board or table on which the mechanism is or may be attached.

The arms 31 and 33 are preferably of substantially identical construction and may comprise each a pair of housing elements 45 and a pair of hollow, tubular spacers 47, the opposite ends of which are secured to the housing elements 45 to support the same in spaced-apart relationship. The housing elements of the arm 31 are individually identified by the numerals 30 and 32, while the corresponding elements of the arm 33 are identified by the numerals 34 and 36.

The housing elements 45 preferably are of substantially identical construction for convenient and inexpensive fabrication, and they preferably comprise, generally, shallow casings, each

having a rim 49 and a closed end wall 51, the opposite end being open. The end wall 51, within the rim 49, carries an annular flange 53 preferably formed integral with the wall 51 and extending inwardly of said wall in position to form a seat for a bearing 55 of any suitable or preferred construction, and which, as shown on the drawing, may be a roller or ball bearing.

The casings 30 and 32, which are at the opposite ends of the arm 31, as well as the casing 36, which is at the free end of the arm 33, are arranged with their open ends facing downwardly toward the surface on which the device is mounted. The casing 34 at the end of the arm 33, which is secured to the arm 31, is arranged with its open end facing upwardly, opposite the open end of the casing 32, so that the casings 32 and 34 cooperate to form a housing. This housing encloses a pulley 57 having a rim 59 extending in the peripheral portions of the compartment formed by the cooperating casings 32 and 34. The pulley is mounted on a pin 61 and journalled for rotation in the bearings 55 of the casings 32 and 34, the pin 61 serving to hold the casings together by cooperation with said bearings.

It will be noted that the pin 61 has a nut threaded thereon at one end, and that the end wall 51 of the casing 34 is formed with a central opening through which access may be had to said nut.

At the anchored end of the arm 11 the arm is preferably pivotally mounted upon a shaft or pin 39, said shaft being preferably fixed on and forming a part of the clamp means 37 by which the device is or may be fastened upon the drawing board or table. The housing element 30 is journalled on the pin 39 by means of its bearing 35. The pin 39 also carries a pulley 63 extending within the housing element 30 and having a rim 65 extending adjacent and within the rim 49 of the casing. The pulley 63 has a hub fixed on the pin or shaft 39 so that the pulley is held from rotation with respect to the mounting means 39 and the table on which the device is or may be attached.

The open end of the housing 45 may be and preferably is enclosed by suitable cover means 66 supported on the shaft 39, and while such cover means may take any suitable or convenient form and may be formed on or carried by the pulley 63, if desired, I prefer to mount the cover for free rotational movement on the pin 39 so that the casing 30 and cover 66 may form a closed casing around the pulley 63.

In the illustrated embodiment, the device or element 43 supported for parallel movement comprises a bracket 67 supporting straight edge elements 69 at right-angles, one with respect to the other, although it is, of course, apparent that the invention is not necessarily limited to the specific character of the supported element 43. Means 41 is provided to mount the supported element 43 upon the casing 36 at the free or swinging end of the arm 33, the means 41 comprising a pulley 71 carried on a pin 73 and journalled for rotation on the housing element 36 by means of the bearing 55 in said housing.

It will be noted that the pin 73 is fast with the pulley 71, the pin having a head extending downwardly of and projecting from the lower, open end of the housing in position to support the bracket 67 which forms a part of the supported element 43. The bracket 67 is carried by the pin 73, and means, including the clamp 75, is provided for adjusting the relative angular relationship of the supported device 43 with respect to the pulley 71 and for locking the parts in a desired adjusted relationship, the angularity of which may be determined on a scale 77 carried by the pulley 71. At its end opposite the head 73, the pin projects upwardly of the bearing through a central opening formed in the wall 51 of the housing 36, and this end is provided with means for attaching a knob or hand piece 79 to aid in the manipulation of the device. In the illustrated embodiment the hand piece 79 is fastened on the pin 73 against turning movement.

The rim 49 of each of the castings 30, 32, 34 and 36 is or may be formed with a pair of preferably integral projections 81 extending tangentially of the rim 49, said projections on each casing being parallel and spaced apart on opposite sides of the casing. The projections 81 are each formed with a preferably accurately defined seat 83 adapted to snugly receive the end of a spacer tube 47. The bottom of each seat is connected with the interior of the casing on which it is formed, by means of an opening 85 so that when the end of a tube 47 is assembled in the seat 83 the interior of the tube is connected with the interior of the casing in tangential alignment with the rim of the pulley therein.

The arms 31 and 33 are assembled readily by press-fitting the ends of the tubular members 47 into the sockets or seats 85, the tubes forming adequately rigid connection between the casings and serving to maintain the casings in accurately spaced-apart relationship, at the same time providing an extremely light weight arm structure.

It will be noted that the casings 32 and 34 cooperate to form a substantially closed housing for the pulley 57; that the housing 30, in conjunction with the cover means 66, likewise forms a substantial enclosure for the pulley 63; and that the pulley 71 has a portion carrying an outstanding flange that cooperates with the open end of the casing 36 to form an enclosure for the tape carrying portions of the pulley 71.

The rims of the pulleys 63 and 71 are each formed preferably with a single, peripheral groove, while the pulley 57 at the pivotally connected ends of the arms 31 and 33 is formed with a pair of grooves in its rim. The grooves in all of the pulleys 57, 63 and 71, however, are of like width and depth, and are adapted to receive flexible driving means 87 preferably comprising an endless belt in each of the arms 31 and 33. These belts may conveniently comprise lengths of metal tape, the opposite ends of each tape being connected together by fastening means 89 allowing for adjustment so that the flexible driving means may be drawn up to a desired tension on the carrying pulleys.

The tape-like elements forming the flexible driving means may be applied on the pulleys in each arm by threading the same endwise through the open side of the housing element 39, in the case of arm 31, and through the open side of the housing element 36, in the case of the arm 33, before the pulleys 63 and 71 are assembled in place. The tape is passed through one of the tubes 47 toward and around the pulley 57. The flexible elements of both arms 31 and 33 may thus be drawn around the pulley 57 and returned, one through the remaining tube of the arm 31, and the other through the remaining tube of the arm 33, back to the starting point. It will be noted that the pulley chamber in each casing extends into the base portions of the projections 81,

thereby providing openings accessible from the under side of the arm assembly to facilitate drawing the flexible members through the tubes 47 and around the pulleys in applying the same. In addition, openings 82 may, if desired, be formed in the top of the housings for this purpose. After the flexible driving means have thus been assembled in each of the arms 31 and 33, the abutting ends of each may be connected together by the connectors 89. Then the pulleys 63 and 71 may be assembled in place.

The connectors 89 may be of any suitable or preferred construction, but, as shown in the drawing, the same may each comprise a stem 91 having a diametral slot 93 at one end adapted to receive an end of the flexible driving member 87 which is secured in the slot 93 by rivets 95 or other suitable fastening. The stem 91 has a lug 99 formed with an opening to receive one end of a spring 101, the opposite end of which is connected on a lug 98 formed in the end of a threaded stem 96 formed with a diametral slot 94 to receive an adjustable connector piece 102. This piece is of plate-like form adapted to slidingly fit the slot 94 and it has a necked portion 103 of width not greater than the diameter of the stem 96 so that a nut 105 on the stem 96 may encircle the necked portion 103. The connecting piece 102 has a head 107 extending outwardly of the slot 96 on opposite sides of the stem in position to bear upon one end of the nut 105. Consequently, after the driving bands 87 have been assembled in the arms 31 and 33, as heretofore described, the abutting ends of the bands may be connected together simply by attaching one of said ends in the slot 93 and attaching the other end on the connector piece 102. This done, it is merely necessary to thread the nut 105 on the stem 96 and draw the same down until a desired tension is obtained in the driving element, and the nut 105 may have radial sockets therein adapted to receive a tool to facilitate the tightening of the nut on the stem. Tightening of the nut may be readily accomplished through the opening at the base of the projections 81.

It will be seen that as the nut is tightened, the spring 101 will be placed in tension to any desired degree within limits determined by the length of the stem 96 and the position of the nut 105 thereon. The spring 101 will substantially maintain the band 87 under resilient tension at all times and will automatically compensate for any slight stretching of the band 87 that may occur while the device is in service.

The flexible driving belts 87 are tightened sufficiently to provide appreciable frictional grip upon the pulleys. Since the pulley 63 is held against rotation with respect to the drawing board or table, it will hold the flexible connector 87 of the arm 31 because of the frictional driving engagement between said pulley 63 and the flexible connector. As the arm 31 is swung about the pivot pin 39, however, the driving connection between the flexible connector of the arm 31 and the pulley 57 will cause said pulley to rotate in the casing 32 through an angular displacement equal at all times to the angular movement of the arm 31 about the pivot pin 39. In like fashion, the flexible connector 87 of the arm 33, through its frictional driving engagement on the pulley 57 and on the pulley 71, insures that the angular movement of the pulley 71 with respect to the housing 36 is at all times equal to the angular movement of the housing 34 with respect to the pulley 59, thereby insuring that the supported element 43 is at all times maintained in an adjusted, angular relationship with respect to the board or table on which the device is mounted, regardless of the movement of the arms 31 and 33. The desired angular relationship, of course, may be adjusted by manipulating the means 41, including the clamp 75, as is well understood in parallel motion mechanism.

The device of my present invention is adapted for use on drawing boards and tables which may be inclined or tilted more or less from horizontal position. When used on a tilting board, a device of the character described will have a tendency to slide, under the influence of gravity, downwardly on the board, the arm 31, as shown in Figure 1, tending to rotate in counterclockwise direction about the anchored pivot 39, and the arm 33 tending to rotate in clockwise direction, as shown in Figure 1, about the pivot 81. In order to counterbalance this tendency to slide, I provide resilient counterbalancing means cooperatively connected between one or both of the belts 87 and the frame on which mounted. The counterbalancing means is arranged to apply a yielding and adjustable bias upon the frames 31 or 33 or both, whereby to resist the turning movement of the arms, under the influence of gravity, on a tilted support.

To this end, I prefer to provide a resilient spring 111 connected at one end on the belt 87, as by means of a hook 113 carried by the tightening device 89, the hook 113 being preferably secured in the slot 93 of the stem 91. The other end of the spring 111 is adjustably secured on the tilting frame, preferably at one of the housings 45 at an end of the frame, and I provide manually operable adjusting means 119 for varying the tension of the counterbalancing means 111, whereby readily to condition the device to counterbalance the slipping tendency of the arms when mounted on a tilted support.

An important feature of my present invention is the arrangement of the resilient tensioning means neatly and compactly within the tubular members 47. To this end, the resilient tensioning means may comprise a helical spring 111, on the arm 31, and, if desired, a similar spring may also be applied in the arm 33. The helical spring preferably has an internal diameter appreciably greater than the largest cross-sectional dimension of the flexible driving element 87 so that said spring may be assembled in position encircling a portion of the driving element, without, however, binding upon the element or interfering in its operation. The spring 111 also is of a size to fit freely within one of the spacing tubes 47 without binding.

The counterbalancing spring means 111 may be arranged in either or both of the arms 47 of said frame, providing, however, that the spring is arranged to exert tension on the band 87 in a direction to urge rotation of the arm opposite to that in which it tends to turn under the influence of gravity on a tilted support.

As shown in Figure 1, the spring 111 may be arranged in the upper arm 47 and connected with adjusting means on the pulley housing 45 at the swinging end of the arm 31. The spring means 111, however, may equally well be arranged in the lower arm 47 of the frame 31 and attached on the housing 45 at the pivoted end of the frame 31. Likewise, if desired, counterbalancing spring means may be applied in the arm 33, although the necessity for counterbalancing the swinging arm 33 is not as great as the need for balancing

the arm 31, and consequently counterbalancing means will ordinarily be omitted from the arm 33.

To adjust the tension of the spring 111 I have shown slidable means 195 on the frame, including screw threaded clamping means for securing the slidable means in adjusted position. In this connection tubular member 47 itself is utilized as a slideway for the slide means which comprises a cylindrical sleeve 195 on the tubular member 47 adjacent the end of the housing portion 81. The member 47 is provided with a longitudinal slot 197, and the sleeve 195 carries a pin 199 thereon in position extending inwardly through the slot 197, the spring 111 being secured on the inwardly projecting end of the pin 199.

One end of the sleeve 195 is tapered and split, as at 201, and is threaded, as at 203, to receive a clamping gland 205, the outer surfaces of which may be knurled, if desired, so that, by screwing the gland on the threaded portions of the sleeve 195, its split end may be clamped upon the tubular member 47. The tubular member also may be provided with numbered gauge marks 207 to indicate the adjusted position of the slide clamp.

The device of my present invention has several advantages, including simplicity of construction of the arms 31 and 33, lightness in weight of moving parts; the provision of simple, easily operated means for tensioning the flexible driving belts 67 and the housing thereof within the spacing tubes 47, thereby effectively enclosing the same and improving the appearance of the apparatus; the provision of counterbalancing springs 111 and the neat, compact arrangement thereof around the flexible driving belts within the spacing tubes 27; and also the simplified arrangements for adjusting the tension of the counterbalancing springs.

It is thought that the invention and numerous of its attendant advantages will be understood from the foregoing description, and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the form herein described being a preferred embodiment for the purpose of illustrating the invention; and I do not herein claim any of the broad features of invention which form the subject matter of my copending application for United States Letters Patent No. 179,832 filed December 15, 1937, for Drafting apparatus.

The invention is hereby claimed as follows:

1. A parallel motion apparatus comprising an arm having spaced pulleys thereon, flexible driving means on said pulleys, a spring connected to said flexible driving means and adjustably anchored on said arm under tension to urge said driving means in one direction on said pulleys, manually operable means to adjust the tension of said spring comprising a sleeve connected to said spring and having contractible portions encircling and having longitudinal sliding relationship on a slide supporting portion of said arm, and means comprising a collar threaded on the sleeve, said collar and sleeve having co-operable cam portions whereby the collar is operable to squeeze said contractible portions of said sleeve into gripping engagement with said slide supporting portion to anchor the sleeve in adjusted position thereto.

2. A parallel motion apparatus comprising an arm having spaced pulleys thereon, flexible driving means on said pulleys, a tubular member on said arm and enclosing the flexible driving means between said pulleys, a spring connected to said flexible driving means within said tubular member and adjustably anchored on said arm under tension to urge said driving means in one direction on said pulleys, manually operable means to adjust the tension of said spring comprising a sleeve connected to said spring and having contractible portions encircling and longitudinally slidable on said tubular member, and clamp means manually operable to secure said sleeve in longitudinally adjusted position on said tubular member.

3. A parallel motion apparatus comprising an arm having spaced pulleys thereon, flexible driving means on said pulleys, a tubular member on said arm and enclosing the flexible driving means between said pulleys, a spring connected to said flexible driving means within said tubular member and adjustably anchored on said arm under tension to urge said driving means in one direction on said pulleys, manually operable means to adjust the tension of said spring comprising a sleeve connected to said spring and having contractible portions encircling and longitudinally slidable on said tubular member, and clamp means manually operable to secure said sleeve in longitudinally adjusted position on said tubular member, said clamp means comprising a collar threaded on said sleeve having cam portions whereby to squeeze said contractible portions of the sleeve into gripping engagement with said tubular member.

4. A parallel motion apparatus comprising an arm having spaced pulleys thereon, flexible driving means on said pulleys, a tubular member on said arm and enclosing the flexible driving means between said pulleys, a spring connected to said flexible driving means within said tubular member and adjustably anchored on said arm under tension to urge said driving means in one direction on said pulleys, manually operable means to adjust the tension of said spring comprising a sleeve connected to said spring and having contractible portions encircling and longitudinally slidable on said tubular member, clamp means manually operable to secure said sleeve in longitudinally adjusted position on said tubular member, and an index scale graduated on said tubular member to indicate the tension of said spring in terms of the adjustably anchored position of said sleeve.

5. A parallel motion apparatus comprising an arm having spaced pulleys thereon, flexible driving means on said pulleys, a tubular member on said arm and enclosing the flexible driving means between said pulleys, a spring connected to said flexible driving means within said tubular member and adjustably anchored on said arm under tension to urge said driving means in one direction on said pulleys, manually operable means to adjust the tension of said spring comprising a sleeve connected to said spring and having contractible portions encircling and longitudinally slidable on said tubular member, said tubular member being formed with a longitudinal slot and said sleeve having a spring connected portion extending in said slot, and clamp means manually operable to secure said sleeve in longitudinally adjusted position on said tubular member.

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