Feb. 5, 1946. V. B. WALLACE 2,394,344

DRAFTING MACHINE

Filed Jan. 4, 1943 2 Sheets-Sheet 1

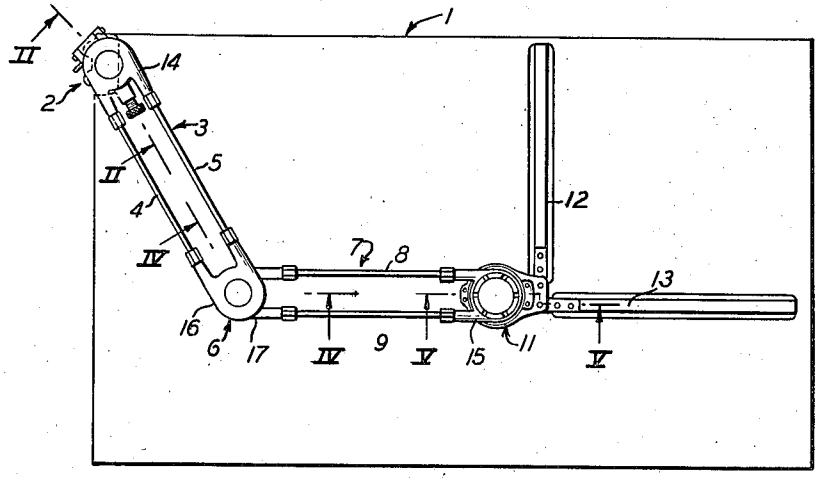


Fig. 1

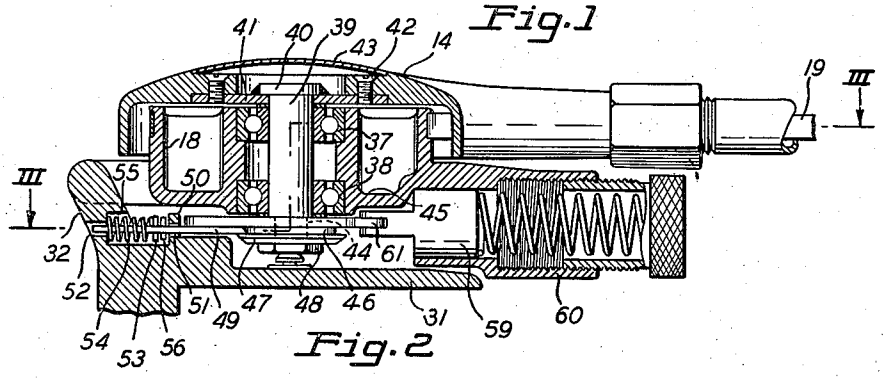


Fig. 2

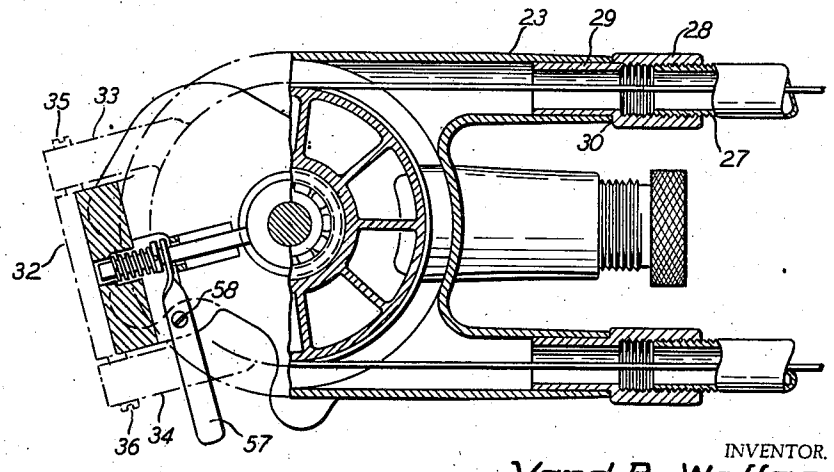


Fig. 3

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Feb. 5, 1946. V. B. WALLACE 2,394,344

DRAFTING MACHINE

Filed Jan. 4, 1943 2 Sheets-Sheet 2

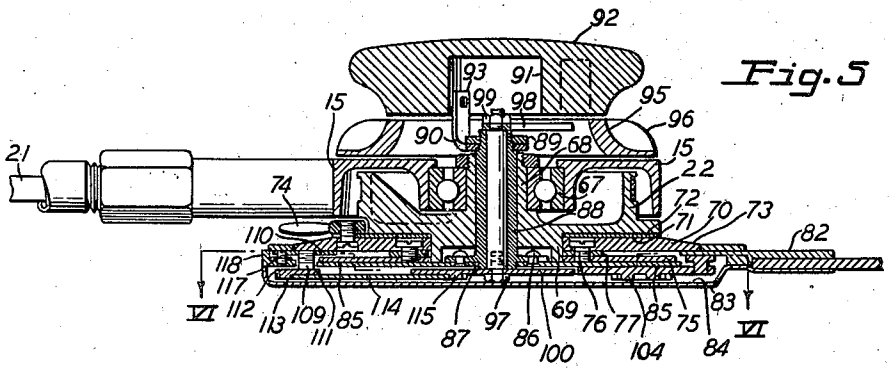


Fig. 5

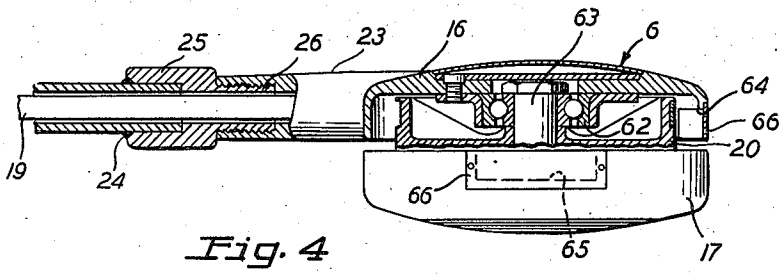


Fig. 4

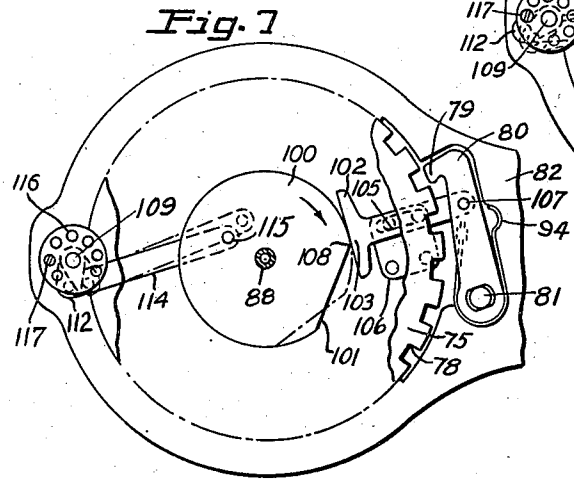


Fig. 7

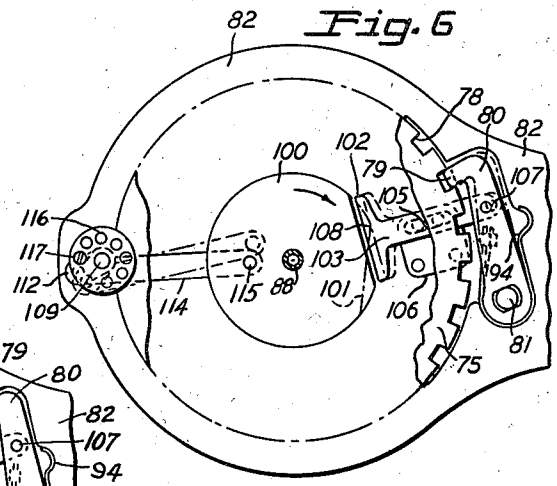


Fig. 6

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Patented Feb. 5, 1946 2,394,344

UNITED STATES PATENT OFFICE

2,394,344

DRAFTING MACHINE

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Application January 4, 1943, Serial No. 471,232

7 Claims. (Cl. 33—79)

My invention relates to drafting machines and has particular reference to an improved drafting machine of the endless band and pulley type which is characterized particularly by a novel strut and guard construction and an improved protractor head control mechanism.

Drafting machines of the endless band and pulley type to which this invention particularly relates are characterized by a jointed arm construction having pulleys mounted at the ends of the arms encircled by endless bands so arranged that when one end of one arm is pivotally secured to a drafting board or table by a suitable clamping device, the pulley at the other end of the other arm will be held fixed as regards angular orientation thereof but movable to various positions over the drawing board or table.

In order to maintain the required accuracy with which the angular orientation of the movable pulley is held, it is necessary to employ for the endless bands steel tapes or similar bands which are stretched very tightly. As a result there is created a danger of injury to the operator of the drafting machine in the event one of the bands should break as occasionally happens.

Prior attempts to overcome this difficulty have included the use of guards or auxiliary tubes extending about those portions of the bands which pass between adjacent pulleys. These devices have not been entirely satisfactory because of the difficulty of adjusting the tension of the individual bands and because of the additional weight which the guard construction adds to the mechanism. Furthermore, difficulty has been encountered in manufacturing parallel motion mechanisms of the type wherein the endless bands are completely enclosed because of the difficulty of enclosing the band within the guards and making up the joint between meeting ends of each band which must of a necessity be made in order to make the band endless as is required.

In using a drafting machine it is often necessary to lift the parallel motion mechanism and the drafting tools carried thereby from the surface of the drawing board in order to permit drawings to be removed therefrom or placed thereon. Prior drafting machine constructions have employed a horiontally extending pivot at the anchor or fixed end of the parallel motion mechanism to permit the entire mechanism to be lifted from the surface of the board. These mechanisms have, however, introduced the likelihood of injury and breakage to the mechanism since in certain positions of the parts of the parallel motion mechanism, the structure is overbalanced with respect to the horizontal pivot and consequently flips over, with the result that the drafting machine head and parts of the parallel motion mechanism strike the floor or the drafting table a severe and damaging blow.

It is the conventional practice in drafting machine constructions to mount the straight edges or scales on a protractor head assembly so arranged that the scales can be turned to any desired angular position relative to the fixed pulley carried by the head end of the parallel motion mechanism. There is usually included also a notch plate or similar structure which permits the automatic indexing of the scales at certain frequently used angular positions such as 0° and 90° and intermediate angular positions such as 30° and 45°. Provision is also made for manually locking the protractor head assembly in odd or unusual angles of orientation.

Such a structure requires a control mechanism by means of which the notch plate may be brought into operation or taken out of operation as desired and requires also some means for securing the protractor head assembly in the odd angular positions. This is usually accomplished by means of two or more separate control devices, adding to the complications of construction and operation of the device and tending toward increased wear, maintenance and loss of accuracy.

It is an object of the present invention to provide a drafting machine in which the various operations relating to the control of the angular orientation of the protractor head assembly are consolidated in a single control device mounted upon the drafting machine head in a convenient and accessible location.

It is also an object to provide a drafting machine head construction of the character set forth in the preceding paragraph in which a single control member is mounted upon the drafting machine head and above the scales and protractor plate portion thereof in a position to be readily accessible to an operator of the machine and which is arranged to be moved in either direction to perform the various locking and unlocking functions relating to the protractor assembly.

It is a still further object of my invention to provide a drafting machine head of the character set forth in the preceding paragraph in which the control device is arranged to selectively engage or disengage the protractor notch plate assembly, provide for the automatic spring return of the notch plate mechanism to protractor locking position, provide for the permanent unlocking of the protractor notch plate mechanism, and provide for the clamping of the protractor and scale assembly in odd angular positions.

It is additionally an object of my invention to provide a drafting machine head construction of the character set forth in the preceding paragraph in which the control mechanism is so arranged that the determination of one of the above noted functions which is performed by the mechanism is determined by the extent to which the control

member is moved in either direction from its normal or neutral position.

It is additionally an object of my invention to provide a drafting machine employing a parallel motion mechanism of the endless band and pulley type in which guard members are provided for completely enclosing the endless bands and in which the guard members themselves serve as struts to hold the pulleys in the desired spaced relation to each other.

It is also an object of my invention to provide a drafting machine of the character set forth hereinbefore which includes a novel mechanism for adjusting the effective length of the band guards to thereby provide for the tightening or loosening adjustment of the endless bands.

It is also an object of my invention to provide a drafting machine in which the parallel motion mechanism is mounted for pivotal movement about a horizontal axis relative to the anchor or fixed portion of the machine and which includes also a manually operable mechanism for selectively locking the drafting machine against pivotal movement about the horizontal pivot or releasing the machine to permit such pivotal movement.

In connection with a drafting machine of the character referred to in the preceding paragraphs, it is another object of my invention to provide a novel method of assembling the endless bands within their enclosing guards by means of permanent welded joints between the meeting ends of the bands which consists in so adjusting the effective length of the adjustable struts as to provide considerable slack in the endless band, bringing the adjacent ends of the endless band through an aperture in the guard for permanent welding of the ends to each other, restoring the length of the struts to place the band in its normal stressed condition, and employing a name plate or other functional part of the apparatus as a cover for closing the aperture.

Other objects and advantages of my invention will be apparent from a study of the following specifications, read in connection with the accompanying drawings, wherein:

Fig. 1 is a plan view illustrating the general form and appearance of a drafting machine constructed in accordance with my invention;

Fig. 2 is a longitudinal sectional view taken substantially along the line II—II of Fig. 1 to illustrate the details of construction of the anchor portion of the drafting machine of my invention;

Fig. 3 is an elevational view with parts broken away and parts shown in section taken substantially along the line III—III of Fig. 2 of the anchor portion of the drafting machine and illustrating the details of construction of a manually releasable locking member controlling the pivotal movement of the drating machine about a horizontally disposed axis;

Fig. 4 is an elevational view of the elbow portion of the drafting machine of my invention with parts shown in section as indicated by the line IV—IV in Fig. 1;

Fig. 5 is a longuitudinal vertical sectional view of the protractor head assembly portion of the drafting machine of my invention, Fig. 5 being taken substantially along the line V—V of Fig. 1;

Fig. 6 is a horizontal sectional view taken substantially along the line VI—VI of Fig. 5 and illustrating by means of dotted and solid lines two positions of the protractor notch plate mechanism; and

Fig. 7 is a view similar to Fig. 6 but illustrating by means of dotted and solid lines two additional positions of the protractor notch plate mechanism.

Referring to the drawings, I have illustrated in Fig. 1 one form of drafting machine constructed in accordance with the preferred embodiment of my invention as being secured to a drawing board or table indicated generally by the reference character 1. The drafting machine includes an anchor member indicated generally at 2 upon which one arm 3 including struts 4 and 5 is pivoted. The arm 3 is pivotally connected as by means of an elbow 6 to a second arm 7 which includes struts 8 and 9. The other end of the arm 7 carries a protractor head assembly 11 to which is affixed scales 12 and 13 or other conventional drafting tools.

The anchor 2 and the protractor head assembly 11 include, respectively, pulley guards or enclosures 14 and 15, and the elbow 6 similarly includes a pair of pulley guards or enclosures 16 and 17. Within the guard 14 there is enclosed a pulley 18 about which extends an endless band 19 (see Fig. 2).

As will be later described, the pulley 18 is fixed by the anchor mechanism 2 with respect to the drafting board 1 and the band 19 is extended about a pulley 20 secured within the pulley guards 16 and 17 (see Fig. 4). The pulley 20 is pivotally supported, as will be hereinafter described, upon both of the guards 16 and 17 and is encircled additionally by a second endless band 21 which passes also around a pulley 22 pivotally supported within the guard 15 associated with the protractor head assembly 11 (see Fig. 5).

By this construction the arms 3 and 7 may be so moved as to permit the protractor head assembly 11 to be moved to substantially any desired position over the surface of the drafting board 1 and the interconnection of the head pulley 22 with the fixed pulley 18 through the medium of the bands 21 and 19 and the elbow pulley 20 serves to hold the protractor head assembly in fixed angular orientation relative to the drawing board 1.

As is best shown in Figs. 2, 3 and 4, the strut members 4—5 and 8—9 associated with the arms 3 and 7 serve the duel purpose of acting as struts to hold the respective pulleys in their proper spaced relation to each other and as guards completely enclosing the endless bands 19 and 21.

Each of the pulley housings 14—17 is provided with outwardly extending tubular extensions 23 disposed parallel to each other and positioned substantially tangentially with respect to the pulley with which they are associated. Each of the strut members 4—5, 8—9 are at one end, as for example at the elbow end, secured as by means of welding 24 (see Fig. 4) or other suitable means of attachment to a nut member 25 which may be provided with a hexagonal cross section to permit ready application of a wrench or similar tool thereto.

The nut members 25 each include a reduced diameter shank portion 26 which is externally threaded to coact with internal threads provided in the bore within the tubular portions 23 associated with the elbow 6. By this means the four strut members may each be immovably and nonrotatably secured to the pulley guards 16 and 17.

The opposite ends of each of the trusts 4—5, 8—9 are threaded externally as indicated at 27 in Fig. 3 to coact with similar internal threads formed on the interior of a tubular nut 28. The nut 28 is provided with a hexagonal cross section

permitting the application of a wrench or similar tool thereto and includes also a tubular portion 29 of reduced diameter adapted to be closely received within the interior of the tubular members 23 associated with the anchor 2 and protractor head 11.

The reduced diameter portion 29 defines a radial thrust shoulder 30 adapted to be brought into pressure engagement with the outermost ends of the corresponding tubular portions 23. Thus by turning the tubular nuts 28, the strut members 4—5, 8—9 may be caused to move inwardly or outwardly relative to the anchor 2 or the protractor head assembly 11 to thereby reduce or increase the spacing between the pulleys carried by the arms 3 and 7 to provide for the tightening or loosening of the bands 19 and 21 as desired.

The anchor construction 2 is illustrated in detail in Figs. 2 and 3 and includes a bed plate portion 31 adapted to engage the upper surface of the drawing board 1 and be secured thereto by means of suitable clamps (not shown) adapted to engage the under surface of the drawing board. The bed plate 31 supports or has formed integrally therewith an upstanding lug or ear 32 which is adapted to be received between a pair of arms 33 and 34 formed integrally with or secured to the pulley 18. The arms 33 and 34 each carry pivot screws 35 and 36 adapted to engage suitable seats formed in the side surfaces of the lug 32 to thereby secure the pulley 18 to the bed plate 31 for pivotal movement about a horizontally extending axis while holding the pulley 18 against pivotal movement about its own vertical axis.

The pulley 18 is, as is shown in Fig. 2, fitted with suitable anti-friction bearings 37 and 38 which in turn support a central shaft 39. The shaft 39 may be headed as indicated at 40 and secured as by means of welding to an upper plate 41 which is in turn secured to the pulley housing or enclosure 14 as by means of screws 42 or like attaching means. Access to the screws 42 may be had through a removable cover plate 43.

By means of the construction just described, the pulley housing or bracket 14 is journaled for pivotal movement about the axis of the pulley 18 and for pivotal movement along with the pulley 18 about the horizontal axis defined by the pivot screws 35 and 36. To normally hold the drafting machine against pivotal movement about such horizontal axis, the shaft 39 is extended downwardly below the pulley 18 and is provided with a squared portion 44 upon which is positioned in succession a cam plate 45, a spacer 46 and a latch plate 47, these three members being clamped against a shoulder provided on the shaft 39 as by means of a clamping nut 48.

The spacer 46 is provided with a diameter somewhat less than the diameter of the latching plate 47 so that a horizontally positioned latch member 49 may extend into the space between the latch plate 47 and the cam plate 45. The latch member 49 is slidably mounted upon a suitable lug 50 and in apertures 51 and 52 formed upon and in the base plate 31. The latch member 49 carries a collar 53 against which bears a compression spring 54 surrounding the latch member 49 and bearing also against the bottom of a spring receiving socket 55 formed in the lug 32.

Forwardly of the collar 53; that is, toward the shaft 39 from the collar 53, there is positioned a latch operator 56 which may, as is illustrated in Fig. 3, comprise a lever 57 pivoted to the base plate 31 as at 58 and provided with a bifurcated portion extending above and below the latch member 49.

With this construction pivotal movement of the lever 57 through engagement of the bifurcated end thereof with the collar 53 serves to move the latch member 49 axially away from the shaft 39 and against the force of the spring 54 to position the latch member 49 a distance away from the shaft 39 sufficient to permit the bracket 14 and pulley 18 to be moved upwardly in a pivotal fashion about the horizontal pivot axis. This operation is, of course, prevented when the latch member 49 is in the engaged position which is illustrated in Fig. 2.

In order to provide for automatic relatching of the mechanism when the bracket 14 is pivotally moved from a displaced position to the normal position illustrated in Fig. 2, the upper surface of the latch member 49 and the lower surface of the latch plate 47 are preferably beveled as illustrated in Fig. 2.

The cam plate 45 hereinbefore referred to comprises one element of a spring counterbalancing mechanism of the type described and claimed in a copending application Serial No. 410,996, filed by Russell H. Cole et al. on September 16, 1941, and entitled "Spring counterbalance for drafting machines." The other part of this mechanism comprises a spring pressed follower 59 mounted within a tubular member 60 secured to the pulley 18 and carrying a cam engaging element 61 in a position to engage the cam 45, which cam may be of circular form and positioned eccentrically relative to the axis of the pulley 18.

Referring now to Fig. 4, it will be noted that the pulley guards 16 and 17 included in the elbow 6 are each pivotally supported as by means of anti-friction bearings 62 upon an elbow shaft 63 to which the elbow pulley 20 is secured. As is shown in Fig. 4, each of the guards 16 and 17 is provided with apertures 64 through which the bands 19 and 21 may be passed when the effective length of the struts 4—5, 8—9 are reduced to a minimum.

In assembling the drafting machine, the strut and pulley assemblies are made up as hereinbefore described and sufficient lengths of flat tape-like material are selected to form the endless bands 19 and 21. These are passed through the struts 4—5, 8—9, respectively, and about the pulleys 18 and 22. The ends of the pieces which must be secured to each other to form an endless band are brought out through the apertures 64 and 65 and are then butt or flash welded to each other to form a permanent joint and provide truly endless bands for the bands 19 and 21. The loops which protrude through the apertures 64 and 65 are then pushed back into the interior of the housings 16 and 17 and the effective lengths of the struts are increased by manipulation of the adjusting nuts 28 to tighten the bands about the pulleys. The apertures 64 and 65 may then be covered by means of name plates or similar functional covers 66.

The drafting machine construction of my invention also includes a novel protractor head assembly. This mechanism is illustrated in detail in Figs. 5–7. As is shown in the enumerated figures, the housing or bracket 15 carries an anti-friction bearing 67 which is in turn mounted upon a central column-like structure 68 forming a part of the pulley 22.

The underside of the pulley 22 is cut away and turned to provide a downwardly extending cylindrical portion 69 upon which is journaled for ro-

tation a protractor plate 70. Between the protractor plate 70 and an under radial surface 71 of the pulley 22 there may be placed a thin layer of cushion or friction material 72 to provide for smooth and somewhat restrained movement of the protractor ring 70 relative to the pulley 22.

The protractor ring 70 has inscribed on a sloping upper surface 73 thereof the customary angular graduations so that by virtue of the rotary mounting of the plate 70 upon the cylindrical portion 69 the plate 70 may be turned to any desired position of the zero or index of the angular scale with respect to the drawing board 1. A clamping nut and screw arrangement 74 is provided for locking the protractor plate 70 in any adjusted position in which it may be placed.

Below the protractor ring 70 there is positioned a notch plate 75 secured to the protractor ring 70 as by means of screws 76, the notch plate 75 being held spaced from the under side of the protractor ring 70 as by means of interposed spacers 77. The notch plate 75 is provided with a series of peripherally spaced notches 78 (see Fig. 6) adapted to be engaged by the nose portion 79 of a pawl member 80 which is pivotally mounted as by means of a pivot 81 upon a scale supporting plate 82 to which the scale or drafting tools 12 and 13 are secured.

The plate 82 completely surrounds the protractor plate 70 as is illustrated in Figs. 6 and 7 and carries an under side cover plate 83 defining a housing space 84 within which certain control mechanism to be described hereinafter is positioned. The plate 82, though cut away at the location of the plane along which the section of Fig. 5 is taken, extends inwardly into the interior space 84 and beneath the notch plate 75, that portion of the plate 82 being identified in Fig. 5 by the reference character 85. The inner portion of the plate part 85 is secured as by means of screws or rivets 86 to a radially extending flange 87 formed on the lower end of a tubular member 88 which is passed upwardly through a suitable aperture formed in the column 68.

To the upper end of the sleeve 88 there is secured as by means of a clamping nut 89 a U-shaped yoke member 90. The upstanding arms of the yoke 90 are received within a central interior recess 91 formed in a knob or handle 92 and are secured to the handle 92 as by means of pins, screws or rivets 93 so that the sleeve 88 and the scale supporting plate 82 secured thereto may be rotated by merely rotating the knob 92. This rotation of the scale supporting plate 82 is, of course, normally arrested and prevented by the engagement of the nose 79 of the pawl 80 with one of the notches 78, into which notches it is resiliently urged as by means of a hairpin spring 94.

To provide for the proper control of the operation of the latching pawl 80, I provide a circular control member 95 which is interposed between the knob 92 and the upper surface of the pulley guard 15. The member 95 is wheel-like in form and contoured to conform to the external contour of the knob 92 and may, if desired, be provided with a series of radial spoke-like webs 96 to assist the operator of the machine in turning the control member 95. The control member 95 is secured to a pivot shaft 97 which is extended upwardly through the interior of the tubular member 88, the attachment to the shaft 97 being effected as by means of a cross-bar 98 secured to or molded into the control member 95 and affixed to the upper end of the shaft 97 as by means of a clamping nut 99.

The lower end of the shaft 97 carries a cam plate 100, the form of which is best illustrated in Figs. 6 and 7. The cam plate 100 may be of substantially circular form but is provided with one flat side 101 adapted to be normally engaged by a relatively wide cam engaging shoe portion 102 of a sliding link 103. The sliding link 103 is mounted upon the plate portion 85 and supported for sliding movement as by means of suitable projections 104 formed on the link 103 and received within guiding slots 105 formed in a lower guide member 106 which is in turn secured to the plate portion 85. The outer end of the link 103 is pivotally attached as indicated at 107 to the pawl 80 so that sliding movement of the link 103 may result in so moving the pawl 80 as to disengage the nose 79 thereof from the notches 78.

The normal position of the parts is shown by solid lines in Fig. 6, in which position it will be noted the shoe 102 engages the flat face 101 of the cam member 100 and the pawl 80 is in its inwardmost or notch engaging position.

A slight angular movement of the control member 95 and the cam plate 100 in either direction, as for example in a clockwise direction through an angle of approximately 20° as is illustrated in Fig. 6, will cause the sliding link 103 to be moved outwardly from the center of the mechanism a distance sufficient to remove the nose of the pawl 79 from the notch 78, such positions of the parts being illustrated by dotted lines in Fig. 6.

It is to be noted that in this position, the device is automatically restoring since the pawl spring 94 acting upon the pawl and through the pivotal connection 107 serves to urge the sliding link 103 inwardly and since the point of engagement of the shoe 102 with the heel 108 of the cam plate 100 is to one side of the central thrust line extending from the center of the shaft 97 to the pivot 107. Thus the operator if he desires to change the angular orientation of the scales from one frequently used position to another, as for example from 0° to 15°, may by turning the control member 95 through a slight angle release the scale supporting plate 82 so that the knob 92 may be turned to shift the scales 12 and 13 to a new angular position.

This operation accompanied by the release of the control member 95 will result in the nose of the pawl 80 riding along the peripheral surface of the notch plate 75 until it registers with the next notch 78, at which time the spring 94 will impel the pawl 80 to a notch engaging position and rotate the control member 95 back to its original position.

In the event it is desired to prevent this automatic re-engagement of the pawl 80 with the notch plate 75, it is only necessary to turn the control member 95 through a somewhat greater angle, as for example 40°, to dispose the parts in the positions illustrated by solid lines in Fig. 7.

It will be noted by having reference to Fig. 7 that when the control member 95 is so rotated, the cam engaging shoe 102 engages the circular surface of the cam member 100 at a point beyond the heel 108 so that the thrust line along which the force of the hairpin spring 94 acts is positioned precisely along the line of centers joining the shaft 97 with the pivot 107. The net result is, therefore, that no restoring force is applied to the cam 100 with the result that it will remain in the position in which it is placed until it is

manually returned toward its original position.

In order to provide for locking the protractor plate 82 at odd angular positions, I provide a clamping screw 109 which is journaled for rotation in a suitable aperture provided in the plate portion 85. The upper end of the screw 109 is threaded to receive a clamping nut 110 which overlies the notch plate 75 so that when the nut 110 and screw 109 are rotated with respect to each other, the notch plate 75 and the plate portion 85 will be clamped to each other between the nut 110 and a head-like portion 111 of the screw 109.

The head-like portion 111 is extended laterally to comprise a bell crank 112 which is connected as by means of a pivot projection 113 to one end of a drag link 114, the other end of which is pivotally secured as by means of a pivot projection 115 to the cam plate 100. The positions of the parts are so adjusted as by initially disposing them in the positions illustrated by solid lines in Fig. 6 that whenever the cam plate 100 is rotated from its neutral position in either direction, the clamping screw 109 will be pivotally moved in a counter-clockwise direction. With this adjustment of the parts, increasing angular displacement of the control member 95 from its neutral position will result in an increasing pivotal movement of the pivot screw 109.

The nut 110 which is associated with the screw 109 is provided with a series of holes 116, any one of which may receive a holding screw 117 threaded into a suitably disposed portion 118 of the scale supporting plate 82. By removing the screw 117 the nut 110 may be turned to substantially any desired position and then locked in that position against rotation by passing the screw 117 through the appropriate one of the holes 116 and re-engaging it with the adjacent portion 118 of the scale supporting plate 82.

This adjustment is so effected that angular displacement of the screw 109 to the extent indicated by the solid line positions of the parts in Fig. 7 will not result in clamping the notch plate 75 to the plate portion 85 but such that an appreciable increase in the angular displacement of the control knob 95, as for example to the dotted line position illustrated in Fig. 7, will result in the clamping of the notch plate 75 to the scale supporting plate 82.

Thus, whenever it is desired to turn the scale supporting plate 82 to an odd angular position and secure it in such position, it is only necessary for the operator to first rotate the control member 95 to a position corresponding to that illustrated by solid lines in Fig. 7 and then through use of the knob 92 to rotate the scale supporting plate 82 to the desired odd angular position. Thereafter further rotation of the control member 95 to move the cam plate 100 from the position illustrated in solid lines in Fig. 7 to that illustrated by dotted lines in Fig. 7 will result in the clamping of the notch plate 75 to the plate portion 85 of the scale supporting plate and so lock the scale supporting plate against displacement from the odd angular position in which it has been placed by the operator. To restore the scale supporting plate 82 to its original position, it is only necessary to reverse the above described operation.

From the foregoing it will be noted that I have provided a novel drafting machine construction and in that connection have provided a novel drafting machine head which is characterized by the employment of a single control member which is movable in either direction from a neutral position in which the scale supporting plate is held at an even and frequently used angular orientation to any one of three displaced positions in which the scale support is, respectively,

(a) released from the protractor assembly for adjustment to a new angular position but with an automatic return of the control member to its original position,

(b) released from the protractor assembly and held released until the control knob 95 is further manipulated, and

(c) locked in any odd angular position in which it may be placed.

It will be further noted that provision is made for adjusting the clamping assembly 109—110 to provide for the desired clamping action in response to substantially any amount of pivotal movement of the control member 95.

I have, in the foregoing, also disclosed a drafting machine construction which provides for the pivotal movement of the entire machine about a horizontally disposed axis, this construction being characterized particularly by the provision of a manually operable latch which will effectively resist such pivotal movement until such time as the operator of the machine intentionally releases the machine for lifting movement away from the surface of the drawing board, thus avoiding the danger of injury to the machine through inadvertent overturning of the machine when the parts thereof are so disposed as to overbalance the horizontal pivot.

Attention is directed to the employment of the strut members as guards for the endless bands and the arrangement which has been shown and described for adjusting the effective length of struts to provide for the tightening and loosening of the bands as may be desired.

I have also disclosed a novel arrangement of parts and methods by means of which a permanent welded connection between the adjacent ends of the bands may be made, though the entire band is arranged to be enclosed within a completely encompassing guard arrangement.

While I have shown and described the preferred embodiment of my invention, I do not desire to be limited to any of the details of construction shown or described herein, except as defined in the appended claims.

I claim:

1. In a drafting machine head including a rotatable support and a spring pressed pawl and notch plate mechanism for holding said support in a limited number of selected angular positions, the combination of: a control member mounted on said head for pivotal movement in either direction through three successive angular increments; coupling means connecting said control member to said pawl for disengaging said pawl in response to movement of said control member through the first of said angular increments, said coupling means being so arranged that said spring pressing said pawl will be effective to return said pawl to holding position when said control member is moved through the first of said angular increments and released and ineffective when said control member is moved through the first and second of said angular increments; clamping means for clamping said support against rotation regardless of the position of said support; and means coacting with said coupling means for operating said clamping means in response to angular movement of said

control means through all three of said angular increments.

2. In a drafting machine head including a rotatable support and a spring pressed pawl and notch plate mechanism for holding said support in a limited number of selected angular positions, the combination of: a control member pivotally mounted on said head; a cam member coupled to be rotated by said control member and defining a cam surface comprising a segment of a circle; and a sliding link engaging said pawl and having a straight line cam engaging surface disposed substantially at right angles to the length of said link and having a length substantially equal to the chord of said segment, said cam member being movable by said control member in either direction through a predetermined angle exceeding one-half of the central angle subtended by said chord.

3. In a drafting machine head including a rotatable support and a spring pressed pawl and notch plate mechanism for holding said support in a limited number of selected angular positions, the combination of: a control member pivotally mounted on said head; a cam member coupled to be rotated by said control member and defining a cam surface comprising a segment of a circle; a sliding link engaging said pawl and having a straight line cam engaging surface disposed substantially at right angles to the length of said link and having a length substantially equal to the chord of said segment, said cam member being movable by said control member in either direction through a predetermined angle exceeding one-half of the central angle subtended by said chord; clamping means for clamping said support against rotation regardless of the position of said support; and means interconnecting said clamping means with said cam member for operating said clamping means in response to movement of said cam member through said predetermined angle.

4. In a drafting machine head including a rotatable support, a spring pressed pawl and notch plate mechanism for holding said support in a limited number of selected angular positions and a pivoted control member for disengaging said pawl and movable through a predetermined angle greater than that required to disengage said pawl, the combination of: a screw and nut clamping means operable in response to relative rotation of said screw and nut to lock said support against rotation; a bell crank affixed to said screw; and a drag link interconnecting said bell crank with said control member, the length and angular disposition of said drag link being arranged to rotate said screw an amount sufficient to clamp said support in response to movement of said control member in either direction through said predetermined angle.

5. In a drafting machine head including a rotatable support and a spring pressed pawl and notch plate mechanism for holding said support in a limited number of selected angular positions, the combination of: a control member mounted on said head for pivotal movement in either direction from a normal position; coupling means interconnecting said control member with said pawl and notch plate mechanism and operable in response to a predetermined angular movement of said control member to shift said pawl and notch plate mechanism to a released position permitting pivotal movement of said support relative to said head; and means coacting with said coupling means and said spring pressed pawl and notch plate mechanism to return said control member to its normal position in response to movement of said pawl and notch plate mechanism to said engaged position when said control member is subjected to said predetermined angular movement and released, said last-named means being responsive to pivotal movement of said control member an amount exceeding said predetermined angular movement to render said pawl and notch plate mechanism ineffective to restore said control member to said normal position.

6. In a drafting machine head including a rotatable support and a spring pressed pawl and notch plate mechanism for holding said support in a limited number of selected angular positions, the combination of: a control member; a rotatable shaft pivotally mounted upon said head and coupled to be rotated by said control member; a cam member on said shaft defining a cam surface comprising a segment of a circle; a sliding link coupled to said pawl and notch plate mechanism for moving said mechanism from an engaged position to a released position in response to sliding movement of said link; a cam engaging member fixed on said sliding link and defining a straight line cam engaging surface disposed substantially at right angles to the length of said link and having a length substantialy equal to the chord of said segment; a clamping means for securing said head and said support against pivotal movement relative to each other and comprising a nut means disposed on one side of said head and support and a screw means engaging said nut means and disposed on the opposite side of said head and support, whereby relative rotation of said screw means and said nut means will immovably clamp said head and support to each other; a bell crank affixed to said screw means; a drag link interconnecting said bell crank with said cam member, the length and angular disposition of said drag link being arranged to rotate said screw means an amount sufficient to clamp said head and said support to each other in response to angular movement of said cam member in either direction from a neutral position an amount exceeding one-half of the central angle subtended by the chord of said segment; and adjustment means carried by said head for holding said nut means in any angular position in which it may be placed.

7. In a drafting machine head including a rotatable support and a spring pressed pawl and notch plate mechanism for holding said support in a limited number of selected angular positions, the combination of: a control member pivotally mounted on said head; coupling means connecting said control member to said pawl for disengaging said pawl in response to a predetermined angle of movement of said control member, said coupling means being so arranged that said spring pressing said pawl will be effective to return said pawl to holding position when said control member is moved to said predetermined angle and released; and means coacting with said coupling means and responsive to movement of said control member through an angle greater than said predetermined angle for holding said pawl disengaged against the pressure of said spring.

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