June 27, 1939. C. H. LITTLE 2,164,215

DRAFTING MACHINE

Filed Oct. 12, 1935 6 Sheets-Sheet 1

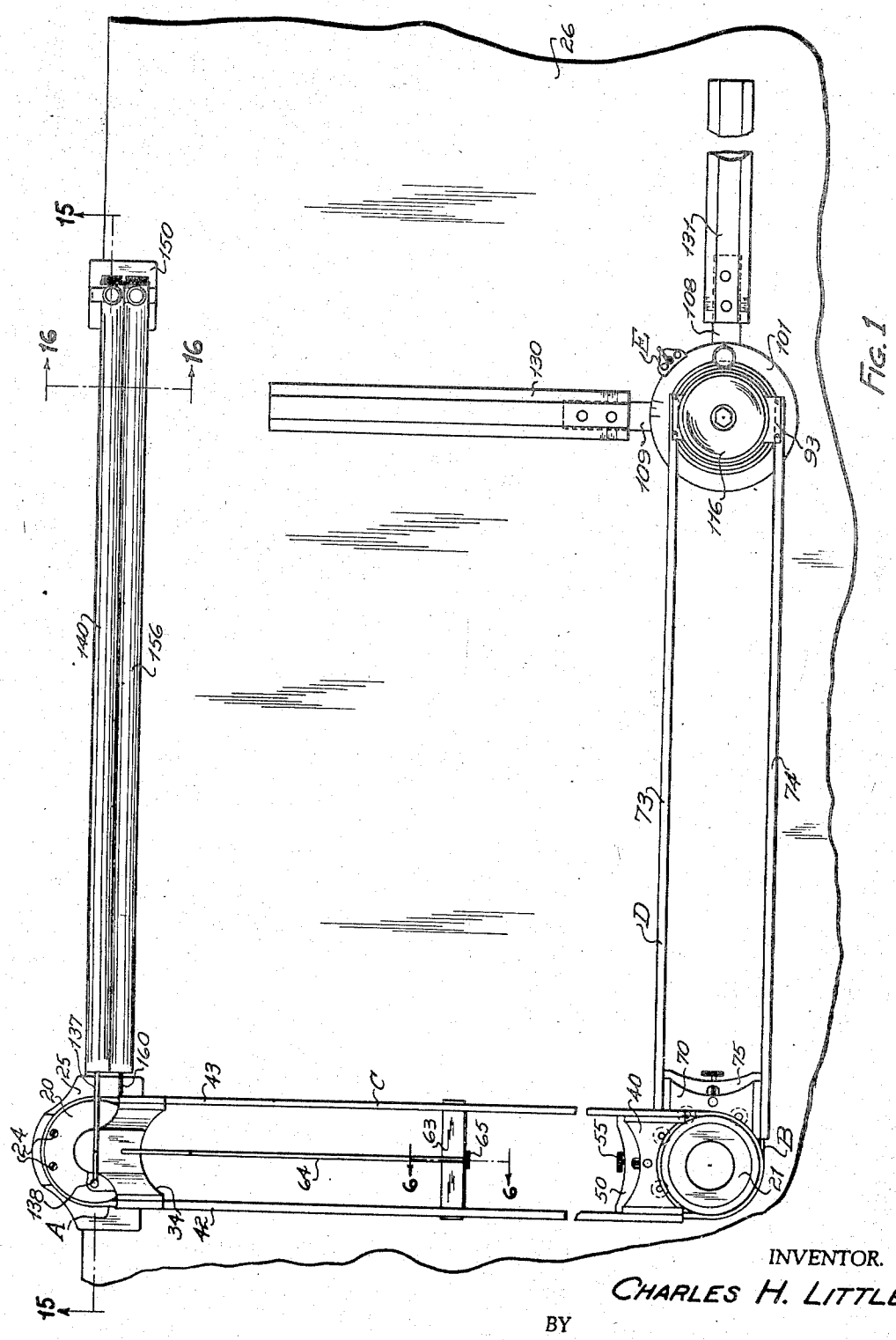

FIG. 1

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June 27, 1939. C. H. LITTLE 2,164,215

DRAFTING MACHINE

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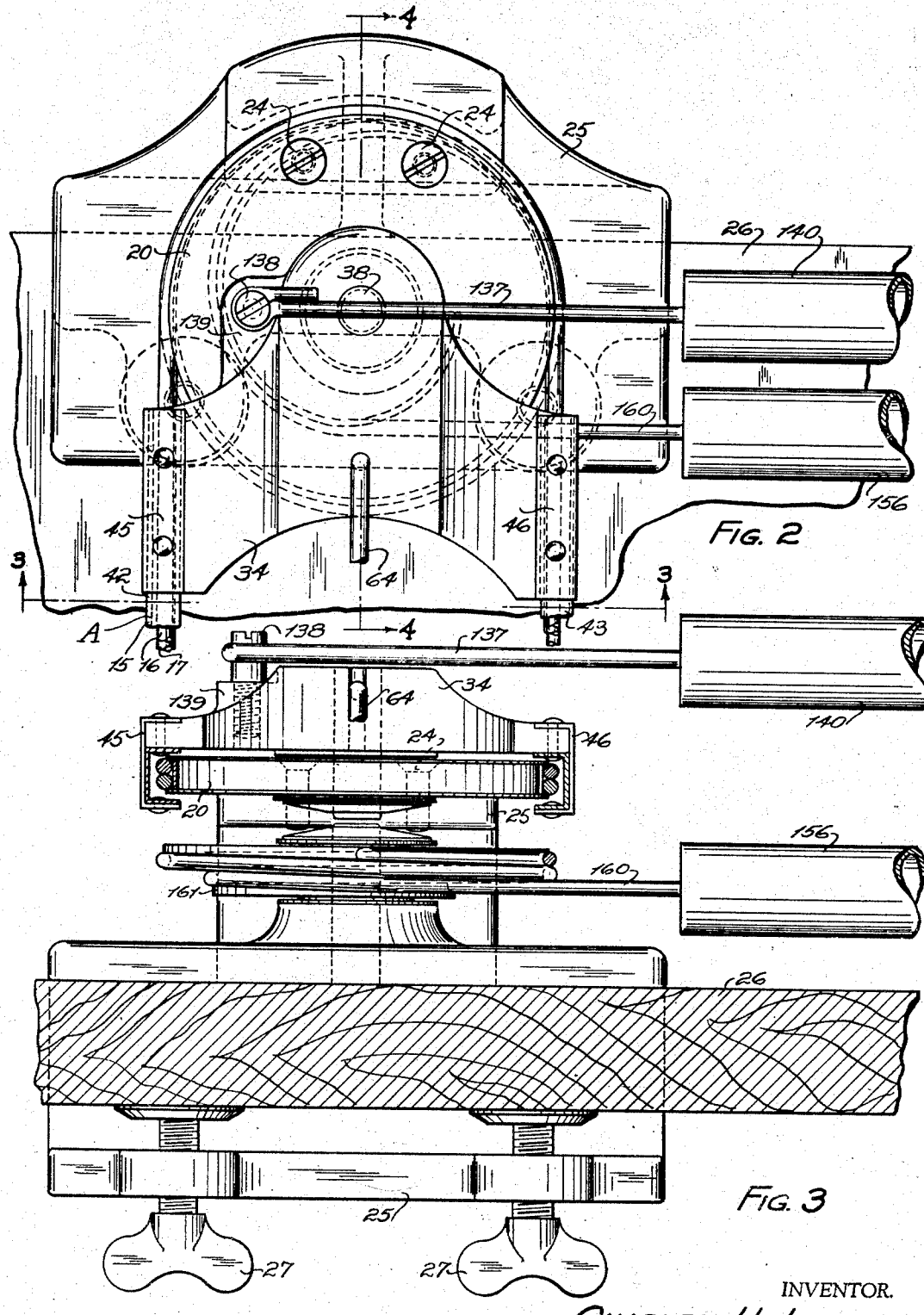

FIG. 2

FIG. 3

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June 27, 1939. C. H. LITTLE 2,164,215

DRAFTING MACHIN E

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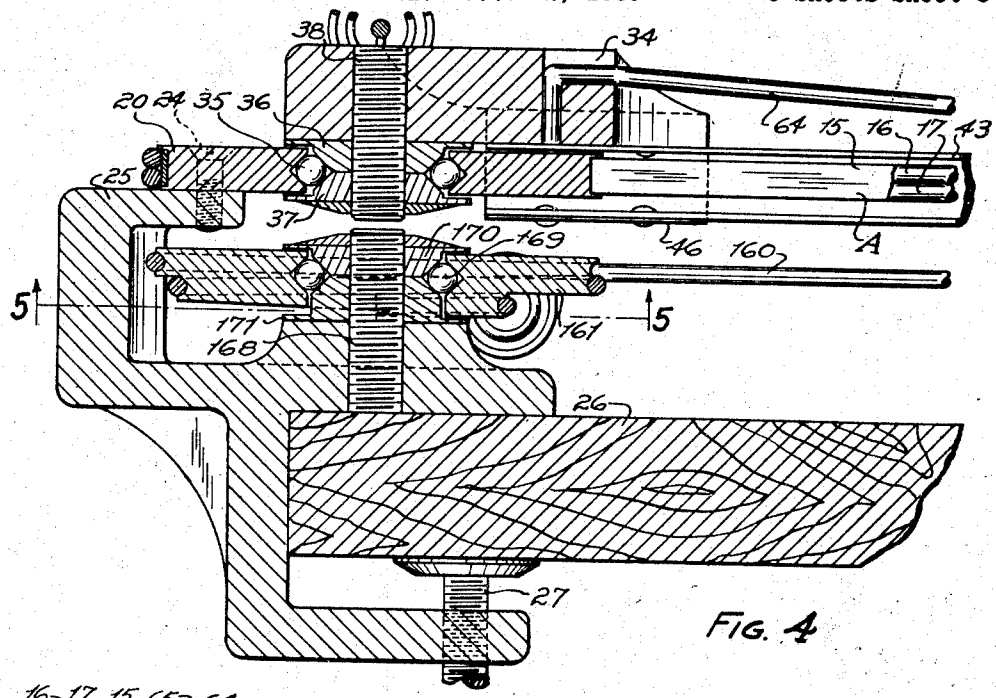

FIG. 4

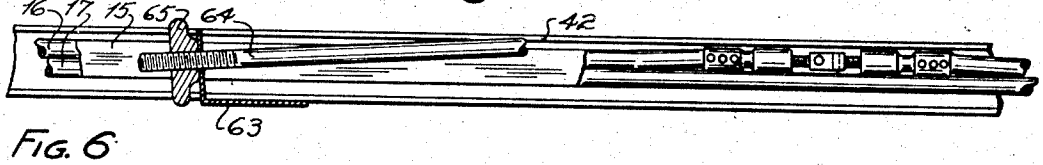

FIG. 6

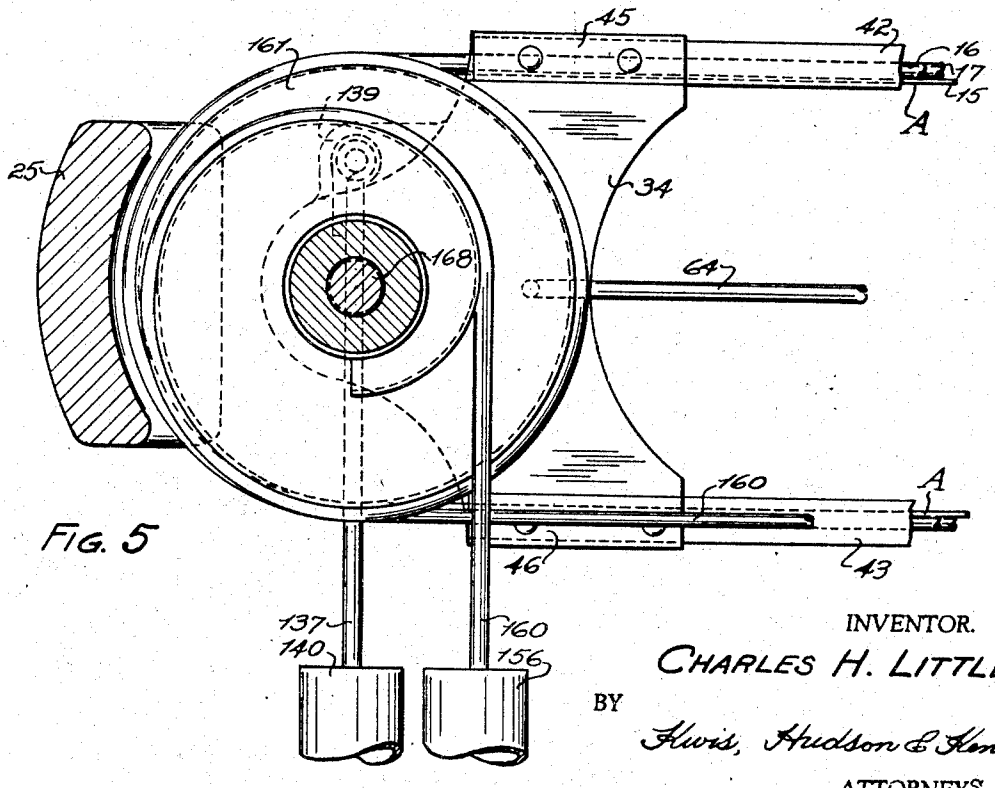

FIG. 5

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June 27, 1939. C. H. LITTLE 2,164,215

DRAFTING MACHINE

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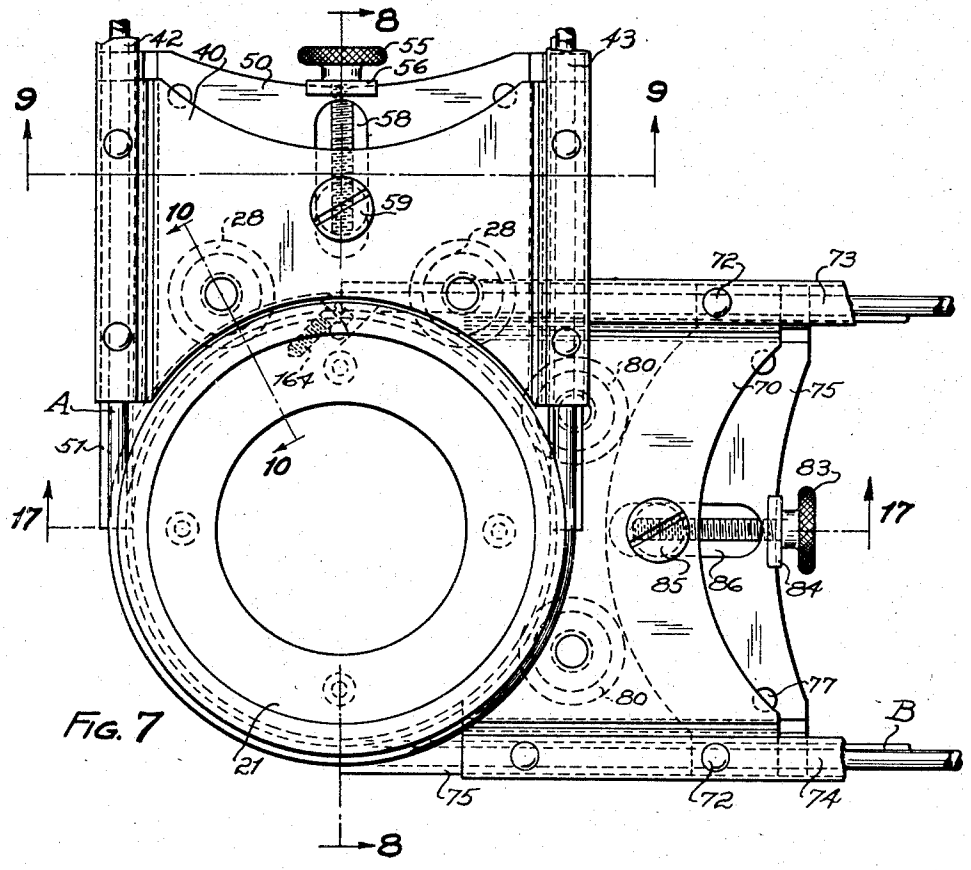

FIG. 7

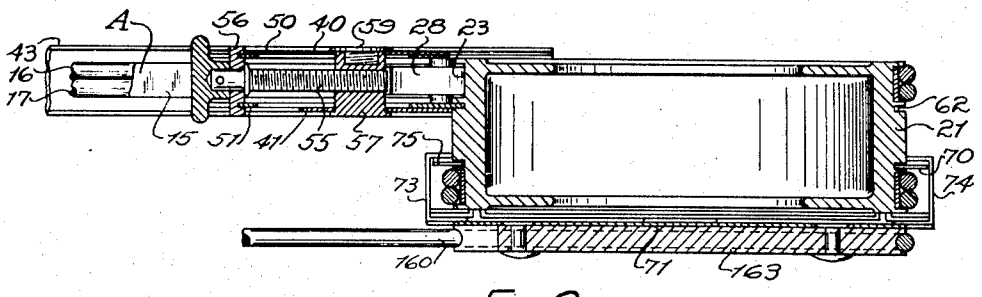

FIG. 8

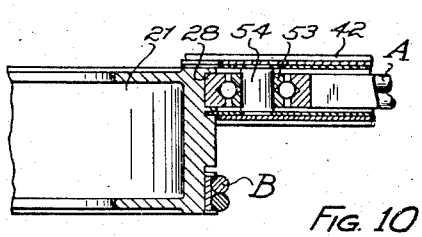

FIG. 10

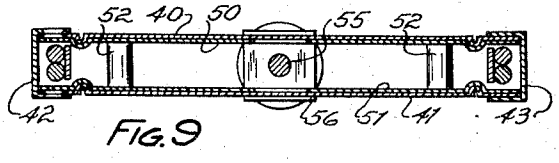

FIG. 9

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DRAFTING MACHINE

Filed Oct. 12, 1935 6 Sheets-Sheet 5

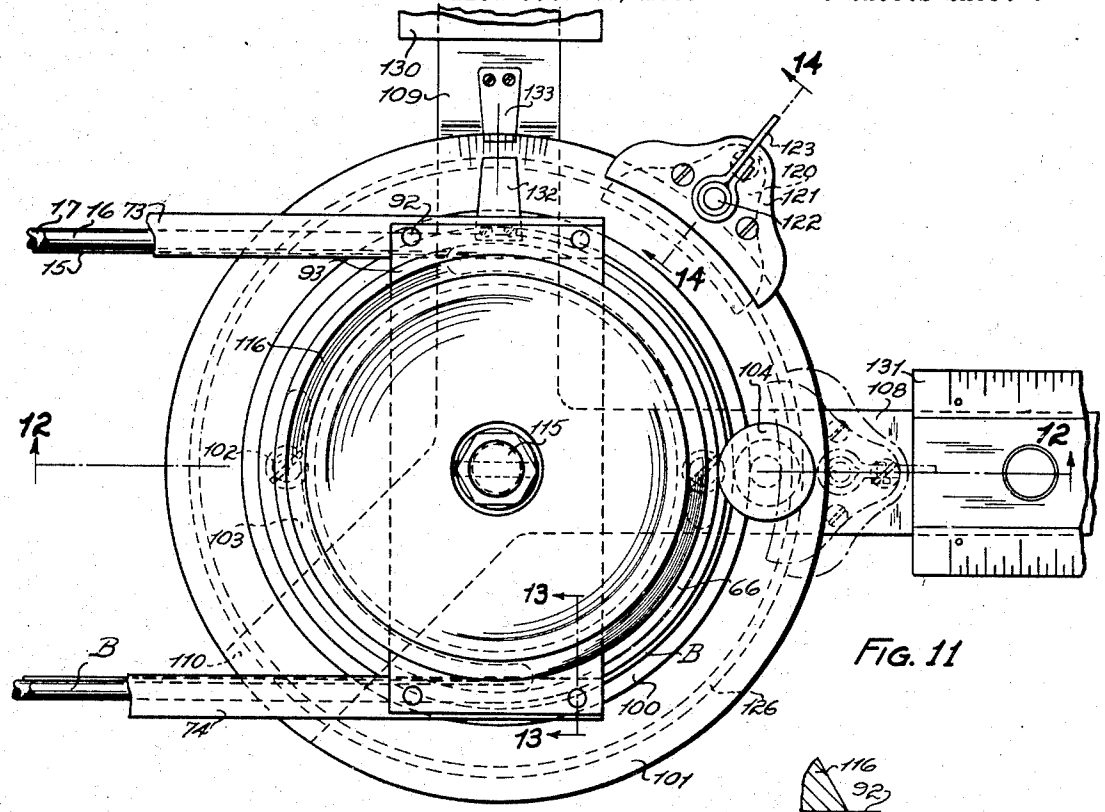

FIG. 11

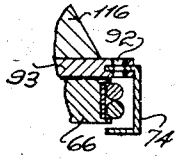

FIG. 13

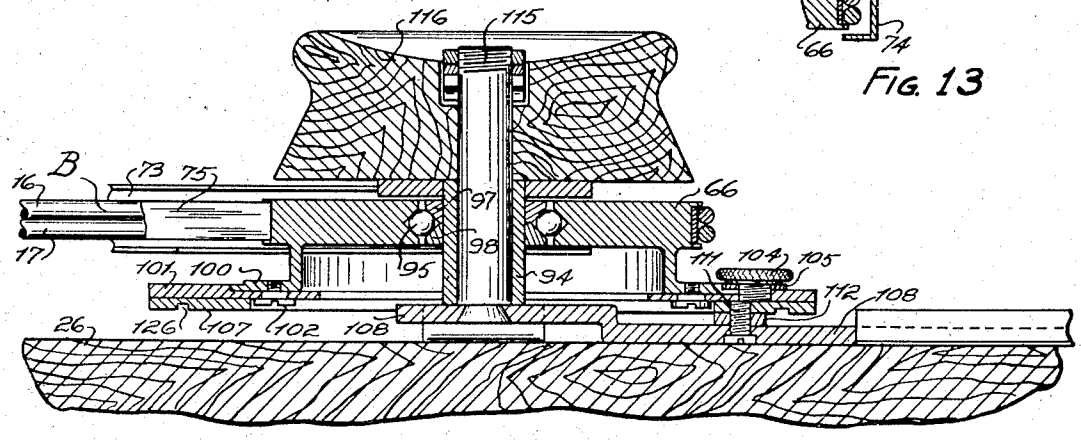

FIG. 12

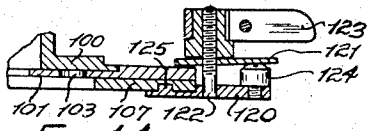

FIG. 14

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June 27, 1939. C. H. LITTLE 2,164,215

DRAFTING MACHINE

Filed Oct. 12, 1935 6 Sheets-Sheet 6

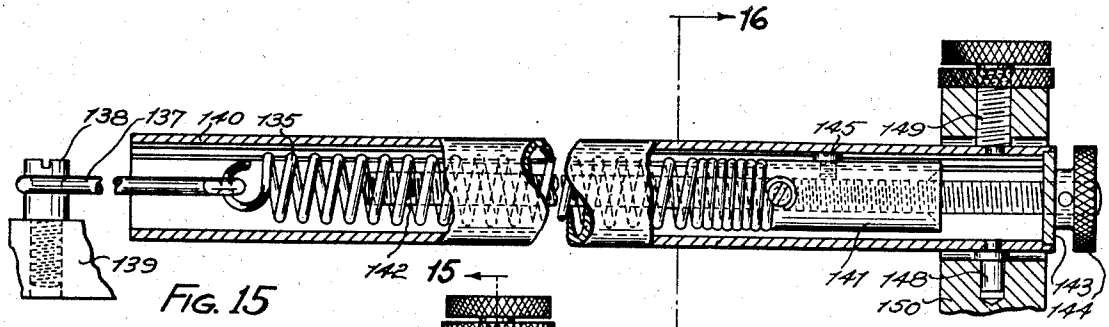

FIG. 15

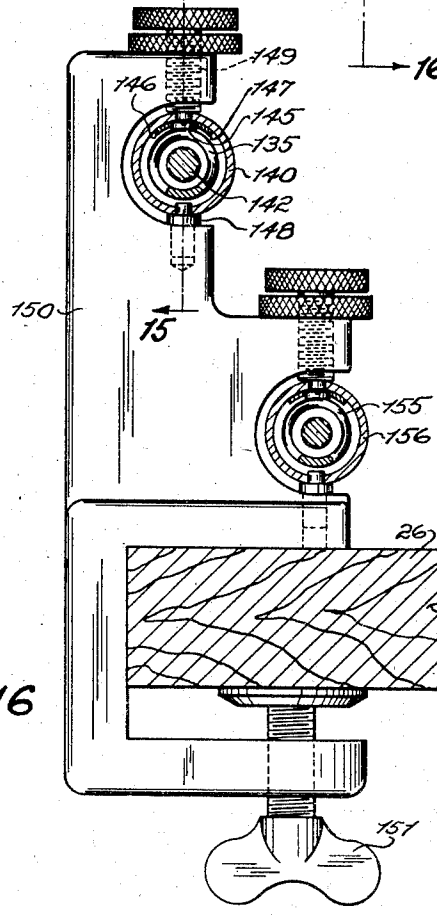

FIG. 16

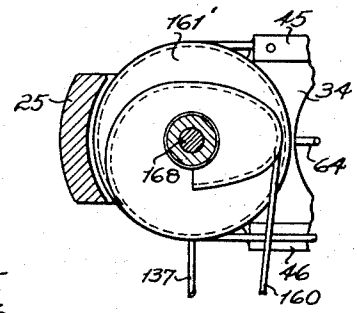

FIG. 18

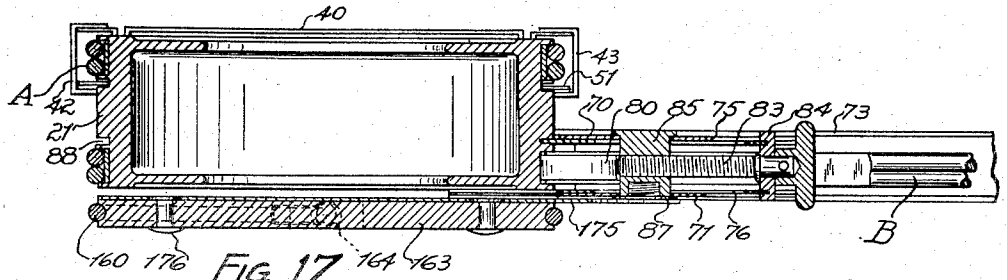

FIG. 17

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Patented June 27, 1939

2,164,215

UNITED STATES PATENT OFFICE

2,164,215

DRAFTING MACHINE

Charles H. Little, Cleveland Heights, Ohio, assignor of one-tenth to Charles Hubbard Little, Cleveland Heights, Ohio

Application October 12, 1935, Serial No. 44,747

15 Claims. (Cl. 33—79)

The present invention relates to drafting machines, and particularly to drafting machines of the band type wherein the arm or parallel motion mechanism consists of a plurality of parallelograms made up of wheels and flexible bands operatively connected together.

An object of the present invention is the provision of a novel drafting machine comprising a light, strong, inexpensive arm or parallel motion mechanism of the band type that will give a higher degree of stability to the rulers forming part of the protractor assembly than was heretofore obtainable in the art.

Another object of the invention is the provision of a novel drafting machine comprising an arm or parallel motion mechanism of the band type, which can be readily assembled and disassembled for the purpose of repairs or replacement, and in which the bands are covered thereby enhancing the appearance of the machine as a whole and protecting both the bands and the operator against injury.

Another object of the present invention is the provision of a novel drafting machine comprising a compact, simple and reliable counterpoise for balancing the weight of the arm, protractor assembly, etc., so that the same will remain in any position to which it is moved irrespective of the inclination of the drawing board or table with which the machine is used.

The present invention resides in certain novel details of construction, combinations and arrangements of parts, and further objects and advantages thereof will be apparent from the following description of the preferred embodiment thereof described with reference to the accompanying drawings forming a part of the specification, in which similar reference characters designate corresponding parts throughout the several views, and in which:

Fig. 1 is a plan view of a drafting machine embodying the present invention;

Fig. 2 is an enlarged plan of the anchor end of the drafting machine;

Fig. 3 is a section on the line 3—3 of Fig. 2;

Fig. 4 is a section on the line 4—4 of Fig. 2;

Fig. 5 is a section on the line 5—5 of Fig. 4;

Fig. 6 is a section on the line 6—6 of Fig. 1;

Fig. 7 is an enlarged plan of the elbow portion of the arm of the drafting machine;

Fig. 8 is a section on the line 8—8 of Fig. 7;

Fig. 9 is a section on the line 9—9 of Fig. 7;

Fig. 10 is a section on the line 10—10 of Fig. 7;

Fig. 11 is an enlarged plan of the protractor end of the drafting machine;

Fig. 12 is a section on the line 12—12 of Fig. 11;

Fig. 13 is a section on the line 13—13 of Fig. 11;

Fig. 14 is a section on the line 14—14 of Fig. 11;

Fig. 15 is a section on the line 15—15 of Figs. 1 and 16;

Fig. 16 is a section on the line 16—16 of Figs. 1 and 15;

Fig. 17 is a section on the line 17—17 of Fig. 7; and

Fig. 18 is a view similar to Fig. 5 but showing a modified construction.

The drafting machine shown in the drawings is the preferred embodiment of the present invention but it is to be understood that the invention can be otherwise embodied, that changes and modifications may be made within the scope of the present invention, and that the particular drafting machine shown is merely illustrative of the invention.

Briefly stated, the present drafting machine comprises an arm or parallel motion mechanism of the wheel and band type made up of sections angularly movable relative to each other, carrying at one end thereof a protractor assembly and adapted at the other end for attachment to a drafting board or table. In general, the arm or parallel motion mechanism comprises two or more flexible compound bands encircling three or more grooved wheels of equal diameter held apart or in spaced relation by suitable struts. The preferred embodiment illustrated also includes a counterpoise for balancing the weight of the arm, protractor assembly, etc., so that the same will remain stationary in any position to which it is moved irrespective of the inclination of the drawing board or table with which the same is used. In this respect the machine shown is admirably suited for use with vertical boards or tables or those inclined at a substantial angle. But it will be understood that the counterpoise may be omitted as will be hereinafter apparent, if desired, and preferably so where the instrument is to be used with a horizontal or substantially horizontal board or table as the omission of the counterpoise reduces the cost of the machine materially.

The flexible compound bands designated generally by the reference characters A and B are of identical construction and each comprises a flexible flat metal band 15, the ends of which are welded or otherwise secured together to form a continuous band, and a plurality of flexible cable bands 16 and 17, the ends of which are connected together by turnbuckles or takeups of suitable construction. The turnbuckles or takeups are provided for the purpose of adjusting the length of the cable bands with respect to the flat band 15 and provide means for adjusting the distribution of the load therebetween. The two cable bands 16 and 17 may be replaced by a single cable band encircling the wheels twice or other arrangements may be employed if desired.

The band A which encircles wheels 20 and 21 engages the same within suitable band receiving grooves formed therein. The band may prefer-

ably be attached to the wheel under some circumstances to prevent slipping but such a construction limits the movement of the parallelograms to 180° or less. The upper wheel 20 which in some respects forms a part of the anchor mechanism is fixed as by screws 24 to an anchor member 25 adapted to be attached or clamped to the edge of the drafting board or table 26 in any convenient manner as by the thumb screws 27. The wheel 21 is held in spaced relation to the wheel 20 for the purpose of keeping the band A taut, etc., by the strut designated generally by the reference character C, the lower end of which is provided with rollers 28 adapted to engage the periphery of the wheel 21 within the band groove and against which the wheel 21 rolls in operation. The upper end of the strut C comprises a cross member 34 rotatably supported concentric with the wheel 20 by anti-friction bearings in the form of balls 35 retained between outside races formed on the inside of an aperture extending through the wheel 20, and inside races 36 and 37 adjustably threaded on a stud 38 fixed to the cross member.

The lower end of the strut C or the end thereof adjacent the elbow of the arm, comprises two plates 40 and 41 held in predetermined spaced relation to each other and to the cross member 34 by side members 42 and 43 preferably of channel section and enclosing the flexible band A. The ends of the side members 42 and 43 may be connected to the cross member 34 and the plates 40 and 41 in any convenient manner. As illustrated, the upper ends thereof are riveted to the member 34 and to short channel members 45 and 46, which, in turn, are riveted to the member 34 along with the side members 42 and 43, and the plates 40 and 41 at the lower end of the strut are riveted to the lower ends of the side members. The plates 40 and 41, together with the side channel members 42 and 43, form a box section within which a member comprising a plurality of plates 50 and 51 is slidably supported. The plates 50 and 51 are secured together and held in predetermined spaced relation by a plurality of members 52 to which they are suitably riveted, and carry the rollers 28 supported by means of anti-friction bearings in the form of balls 53 on pins 54 riveted or otherwise secured thereto. As previously stated, the rollers 28 engage within the upper band groove of the wheel 21 and retain the same in spaced relation to the wheel 20.

For the purpose of facilitating assembly and adjusting the tension of the band A the plates 50 and 51 which form a section telescoped within the lower end of the strut proper, are adapted to be moved within the box section formed by the plates 40 and 41 and the side channel members 42 and 43, by a thumb screw 55 rotatably supported in a member 56 fixed to the plates 50 and 51 and threaded into a headed member 57 projecting through elongated slots 58 in the plates 50 and 51 and secured in aligned apertures in the plates 40 and 41 by a screw 59. As illustrated, cooperating projections and grooves formed in the plates 40 and 50, and 41 and 51, respectively, assist in guiding the plates 50 and 51 within the plates 40 and 41. The lower edge of the plate 50 is rounded or concave to conform with the wheel as shown in Fig. 7, and terminates short of the edge of the wheel, but may project slightly over the wheel if desired. The lower edge of the plate 51 is also concave or rounded and engages within a groove 62 formed in the wheel 21 below the upper band groove 23, which construction helps to maintain the axis of the wheel 21 normal to the longitudinal axis of the strut and assists in guiding the wheel during its rotation.

Because of the additional stress to which the anchor strut C is subject in operation, the channel members 42 and 43 are braced midway between their ends by a cross member 63 secured thereto in any convenient manner, and a tension member or rod 64. The upper end of the rod 64 is bent at right angles and projects into a suitable aperture formed in the cross member 34, and the lower end thereof projects through an aperture in the cross member 63 beyond which it is provided with an adjusting nut 65 threaded thereon.

The wheel 21 which is approximately three times the thickness of the wheel 20, is common to both parallelograms, and together with the wheel 66 at the protractor end of the arm is encircled by the band B which engages within suitable grooves formed on the wheels 21 and 66. The wheels 21 and 66 are held in spaced relation by a strut D, the left hand end of which is similar in construction to the lower end of the strut C and comprises upper and lower plates 70 and 71 secured as by rivets 72 to side members 73 and 74 of channel section which enclose the band B. Plates 75 and 76 secured together and held in spaced relation by members 77 riveted thereto, are slidably supported within the box section formed by the plates 70 and 71 and the channel members 73 and 74 and guided therein by cooperating projections and depressions formed in the plates 70 and 75, and 71 and 76, respectively. The member comprising the plates 75 and 76 is provided with rollers 80, similar to the rollers 28, adapted to engage in the lower band groove in the wheel 21, and is adapted to be moved within the box section comprising the plates 70 and 71 for the purpose of adjusting the tension of the band B, by a thumb screw 83 rotatably supported in a member 84 fixed to the plates 75 and 76, and threaded into a headed member 85 projecting through slots 86 in the plates 75 and 76 and secured in aligned apertures in the plates 70 and 71 by a screw 87. The lefthand end of the upper plate 75 is concave, similar to the lower end of the plate 51, and projects into a groove 88 formed in the wheel 21 above the lower band groove, and the lower plate 76 is similarly shaped but terminates short of the wheel 21.

The right hand ends of the side channel members 73 and 74 are secured as by rivets 92 to a rectangularly shaped member 93 provided with a downwardly projecting boss in the form of a tubular member or bushing 94 fixed thereto in any convenient manner. The protractor assembly including wheel 66 of the parallel motion mechanism is rotatably supported on the tubular member 94 through the medium of the wheel 66 and anti-friction bearings in the form of balls 95 retained between inside races 97 and 98 secured to the bushing 94 and outside races in the wheel. The wheel 66 is provided with a downwardly and outwardly extending flange 100 formed integrally therewith to which the protractor plate 101 provided with suitable graduation is secured for limited rotational movement by screws 102 projecting through arcuate slots 103 in the protractor plate and threaded into suitable tapped holes in the flange 100. The screws 102 are provided with shoulders which engage the flange 100, leaving sufficient clearance to provide for free movement of the protractor plate. The protractor plate 101 is adapted to be clamped in any

adjusted position with reference to the flange 100 by a thumb screw 104 threaded in a suitable tapped aperture in the protractor plate and provided with a clamping member or washer 105, which engages the edge of the flange 100 and clamps the same therebetween and a portion of the protractor plate which extends underneath the flange 100.

The chuck plate 107 which, in the present instance, is in the form of an annular ring has the chuck arms 108 and 109 which are formed integral with a somewhat similar member 110, attached thereto by means of screws 111. The screws 111 project through the chuck arms 108 and 109, and the member 110 and are threaded into the chuck plate 107. In the present instance spacer members 112 are interposed between the chuck arms and the member 110, and the chuck plate, but this construction is merely incidental. The chuck plate 107 is rotatably supported concentric with the wheel 66 and the protractor plate 101 through the medium of the chuck arms 108 and 109 and the member 110 to which it is secured, as previously explained, by a vertical pin or shaft 115 fixed to the chuck arms and projecting through the bushing 94. The pin 115 is rotatable within the bushing 94 and is provided at its upper end with a hand grasp 116 secured thereto in any convenient manner, and which retains the parts in their assembled relationship.

The upper surface of the chuck plate 107 engages the undersurface of the protractor plate 101 and the two plates are adapted to be clamped together in any desired position by a floating clamp designated generally by the reference character E. The clamp E comprises two members 120 and 121 adapted to extend over the edge of the protractor and chuck plates and clamp the same together. The lower member 120 has a stud 122 fixed therein which projects through a suitable aperture in the upper member 121 above which it is provided with a winged nut 123 for manual operation of the clamp. A screw 124 carried by the lower member 120 to the outside of the stud 122 forms a fulcrum for the upper member 121. The lower member 120 has an arcuately shaped ridge or projection 125 on the upper side thereof which engages in an annular groove 126 formed in the underside of the chuck plate and retains the clamp E in assembled position therewith. The annular groove 126 also permits the clamp E to be shifted to different positions about the circumference of the protractor and chuck plates. This construction is especially advantageous when the protractor, etc., are located underneath the arm, as is the case in the preferred construction illustrated, since it permits a low, compact construction without limiting the arc through which the protractor and chuck plate can be moved.

The rulers 130 and 131 may be of any conventional construction and chucked to the chuck arm in any convenient manner, and the construction shown in United States application Serial No. 526,912 is, which has matured into Patent 2,049,302, suitable for the present purpose. Members 132 and 133 attached to the flange 100 and the chuck arm 109, respectively, and provided with reference marks facilitate the setting of the protractor and rulers, etc.

The drafting machine thus far described is the preferred embodiment of the invention less the counterpoise, and is the preferred construction when the counterpoise is not employed, as is often the case as previously pointed out. The preferred embodiment of the counterpoise of the present invention comprises two enclosed springs operatively connected to the arm in such a manner as to balance the weight thereof and that of the protractor assembly, etc., in any position to which the same is moved.

The weight of the anchor portion of the arm is balanced about its pivotal connection with the anchor by a tension spring 135 extending along the upper edge of the board or table, operatively connected to the cross member 34 through the medium of a rod 137 pivotally connected to a screw 138 carried by a projection 139 formed on the cross member. The screw 138 is so positioned on the cross member 34 that it is on the opposite side of the axis about which the arm rotates from that of the spring when the anchor parallelogram is in a vertical position or at right angles to the upper edge of the board. In other words, the spring is attached to the anchor parallelogram in such a manner that when the anchor parallelogram is in a vertical position it does not exert any force thereon tending to rotate the same, since the force exerted by the spring is directly across the axis about which the arm rotates. As the upper parallelogram is moved in either direction from the vertical position, the spring 135 exerts a force thereon sufficient to balance the weight thereof.

The spring 135 is preferably enclosed and provision made for adjusting the tension thereof. As shown the spring 135 is enclosed within a tubular member 140 and the right hand end thereof is connected to a tubular member 141 threaded onto a long rod 142 projecting through the center of the member 140. The rod 142 is rotatably supported in a member 143 secured to and forming a closure for the end of the tubular member 140. The rod 142 projects through the member 140 and to the right thereof is provided with a knurled knob 144 for manual operation. From the foregoing it will be apparent that the tension of the spring 135 can be readily adjusted by rotating the threaded rod 142 by means of the knob 144. The member 141 is prevented from rotating with the rod 142 by a screw 145 carried thereby, the head of which engages within a slot formed by two members 146 and 147 secured in the interior of the tubular member 140 in any convenient manner. The right hand end of the tubular member 140 is pivotally supported through the medium of a pin 148 and a screw 149, in an aperture formed in a bracket 150 clamped to the board or table 26 by a thumb screw 151. The principal object of the tubular member 140 is to enclose the spring and present a neat appearance, but it may be omitted altogether or a member of different shape such as a channel member positioned with the channel opening toward the board or the rear, may be substituted therefor.

The weight of the protractor portion of the arm and that of the protractor assembly is balanced by a spring 155, enclosed within a tubular member 156, similar to the tubular member 140, pivotally supported within a suitable aperture in the bracket 150. The spring 155 is similar to the spring 135 and is adjustably secured within the tubular member 156 in a manner similar to that in which the spring 135 is secured within the tubular member 140, and will not be described in detail. The left hand end of the spring 155 is connected to one end of a cable 160 which after making two turns about a helical or spiral cam 161 extends down along one side of the

upper parallelogram underneath the side member 43 of the strut C to the elbow of the arm where it is attached to a wheel 163 by a screw 164, after being wrapped partly thereabout. The cam 161 is rotatably supported on a stud 168 in axial alignment with the stud 38, by an anti-friction bearing in the form of balls 169 retained between the outside races formed in the aperture in the cam through which the stud 168 projects and inside races 170 and 171 adjustably threaded on the stud. The wheel 163 is secured to a plate or member 175 as by rivets 176, which, in turn, are secured to the side members 73 and 74 of the strut D.

The wheel 163 is fixed to the strut D and turns in unison therewith about the center of the wheel 21 as an axis. The lead of the spiral cam 161 is such that the effective moment arm of the spring 155 varies in such a manner that the weight of the protractor parallelogram is balanced, and can be readily determined by anyone skilled in the art to meet the requirements of the particular problem at hand. The cable 160 with the cam 161 forms a bell-crank connection at the anchor end of the arm, from which it will be understood that the cam 161 could be replaced by a conventional bell-crank lever, although the effective moment arm of the spring 155 could not be so readily controlled. A conventional sheave could also be employed in place of the cam 161 at the anchor end of the arm and the end of the cable 160 attached to the strut D either directly or through the medium of a cam similar to the cam 161 with varying results.

One modification of the cam 161 is illustrated in Fig. 18. As shown in this figure the maximum moment arm at which the spring 155 operates occurs when the protractor parallelogram is horizontal and the anchor parallelogram vertical. The cam in this instance is designated by the reference character 161'. The cams shown are merely illustrative and, as previously stated, may be varied as desired, and the shape which gives the best results for the specific application at hand can be readily determined.

From the foregoing description of the preferred embodiment of the present invention it will be apparent that a novel drafting machine and counterpoise therefor has been provided. The parallel motion mechanism or arm is light, strong, readily assembled and disassembled and gives a high degree of stability to the rulers. The side members of the struts through which the straight portions of the bands extend not only serve as guards to protect the draftsman from injury in case a band should snap under the tension imposed in it, but as the bands are guarded by channel-shaped members not only is the application or removal of the bands facilitated but, what is of equal or greater importance, though guarded the straight portions between the wheels are accessible to the operator or draftsman. This is of considerable importance in enabling the draftsman to test the tension of the band from time to time by pulling the band inwardly with a tool or with his finger and then releasing it, and, by the tone resulting from the vibration, gauge its tension. This may be aptly termed "tuning" and is made possible only by reason of the fact that the nature of the guard for the band is such that the band is accessible and in this instance the guard flanks the band only on its outer side, leaving its inner side free or uncovered for this purpose. Accordingly, the band may be said to be tunably guarded in the sense or for the purpose described above. The counterpoise is compact, reliable and free from exposed springs, and on the whole the machine presents a very neat and pleasing appearance. While the preferred embodiment illustrated and described incorporates a counterpoise, it will be readily apparent that the counterpoise could be omitted and such is within the contemplation of the present invention.

The preferred embodiment of the invention has been illustrated and described in detail, but I do not wish to be limited to the particular construction shown, which may be varied within the scope of this invention. It is my intention to cover all variations, adaptations, and uses thereof that come within the customary practice and skill of those skilled in the art to which the invention pertains, and I particularly point out and claim as my invention the following:

1. A drafting machine comprising a parallel motion arm, said parallel motion arm comprising a plurality of wheels, a flexible compound band encircling said wheels, said compound band comprising an endless flat band and an endless cable band encircling said flat band, and a strut operatively connected to said wheels for maintaining said wheels in spaced relation, said strut comprising a plurality of side members of channel section partly enclosing said compound band between the wheels.

2. A drafting machine comprising an anchor, a plurality of wheels, means for operatively connecting one of said wheels to said anchor, a flexible band encircling said wheels, a strut operatively connected to said wheels for maintaining said wheels in spaced relation, said strut comprising two spaced side members surrounding said band, a cross member connecting said side members intermediate the ends thereof, a supporting member operatively connected to said anchor above the plane of said side members, and means for connecting said supporting member to said cross member.

3. A drafting machine comprising a parallel motion mechanism, said parallel motion mechanism comprising a plurality of wheels, a flexible band encircling said wheels, and a strut operatively connected to said wheels for maintaining the same in spaced relation, said strut comprising two sections telescoped together, one of said sections comprising side members partly enclosing said band and a plurality of spaced plates connected to said side members at one end thereof, the other of said sections being slidably supported between said spaced plates.

4. A drafting machine comprising a parallel motion arm, said parallel motion arm comprising a plurality of wheels, a flexible band encircling said wheels, and a strut operatively connected to said wheels for maintaining the same in spaced relation, said strut comprising: two side members partly enclosing said band, a plurality of spaced plates connected to said side members at one end, a member slidably supported between said spaced plates, a plurality of rollers carried by said member and adapted to engage the periphery of one of said wheels, and means for moving said member relative to said plates.

5. In a drafting machine the combination of, an arm comprising sections angularly movable relative to each other, means for operatively connecting one end of said arm to a drafting table, resilient means adapted to be operatively connected at one end to the drafting table, means for operatively connecting the other end of said

resilient means to one section of said arm, a second resilient means adapted to be operatively connected at one end to the drafting table, and means for operatively connecting the other end of said second resilient means to another of the sections of said arm.

6. In a drafting machine the combination of, an arm comprising sections angularly movable relative to each other, means for operatively connecting one end of said arm to a drafting table, a plurality of tubular members adapted to be pivotally connected to the drafting table, tension springs positioned within said tubular members, means for operatively connecting one of said springs with one section of said arm for balancing the same, and means for operatively connecting another of said springs with another of the sections of said arm for balancing the same.

7. In a drafting machine the combination of, an arm comprising two sections angularly movable relative to each other, an anchor operatively connected to one end of said arm for connecting the same to a drawing table, resilient means operatively connected to said board, and means for operatively connecting said resilient means to a section of said arm other than the section thereof adjacent the anchor, said last mentioned means comprising a member pivotally supported adjacent said anchor.

8. In a drafting machine the combination of, an arm comprising sections angularly movable relative to each other, an anchor operatively connected to one end of said arm for connecting the same to a drafting table, resilient means operatively connected to said table, and means for operatively connecting said resilient means to a section of said arm other than the section thereof adjacent the anchor, said last mentioned means comprising a bell crank connection adjacent said anchor.

9. In a drafting machine the combination of, an arm comprising sections angularly movable relative to each other, an anchor for operatively connecting one end of said arm to a drafting table, a plurality of tubular members adapted to be pivotally connected to the drafting table, tension springs positioned within said tubular members, means for operatively connecting one of said springs with one section of said arm for balancing the same, and means for operatively connecting another of said springs with another of the sections of said arm for balancing the same, said last mentioned means comprising a member rotatably connected to said anchor.

10. A drafting machine comprising a parallel motion arm composed of sections angularly movable relative to each other, means for operatively connecting one end of said arm to a drafting board, means for counterbalancing a section of said arm, said means extending generally along the upper edge of the drafting board in all operative positions of said arm, and means for operatively connecting said means to one of said sections of said arm.

11. A drafting machine comprising a parallel motion arm composed of sections angularly movable relative to each other, means for operatively connecting one end of said arm to a drafting board, a spring for counterbalancing a section of said arm, said spring extending generally along the upper edge of the board in all operative positions of said arm, and means for operatively connecting said spring to one of said sections of said arm.

12. A drafting machine comprising a parallel motion arm composed of sections angularly movable relative to each other, means for operatively connecting one end of said arm to a drafting board, resilient means for counterbalancing a section of said arm, said resilient means extending generally along the upper edge of the drafting board in all operative positions of said arm, means for operatively connecting said resilient means to one of said sections of said arm, a second resilient means for counterbalancing another section of said arm, said means extending generally along the upper edge of the drafting board in all operative positions of said arm, and means for operatively connecting said second resilient means with another of said sections of said arm.

13. A drafting machine comprising a parallel motion arm composed of sections angularly movable relative to each other, means for operatively connecting one end of said arm to a drafting board, counterpoise mechanism, a wheel rotatably supported adjacent the end of the arm adapted to be connected to the drawing board, a second wheel the diameter of which is equal to that of the first mentioned wheel connected to a section of said arm other than the section adapted to be connected to the drawing board, and means for connecting said counterpoise mechanism with said section of said arm other than the section adapted to be connected to the drawing board including a flexible cable encircling said wheels.

14. A drafting machine comprising a parallel motion arm composed of sections angularly movable relative to each other, each of said sections including a pair of wheels, bands encircling said wheels, struts for maintaining said wheels in spaced relation, an anchor for operatively connecting one end of said arm to a drafting board, counterpoise mechanism, a wheel rotatably supported coaxially with the wheel of said arm adjacent said anchor, a second wheel connected to a section of said arm remote from the section thereof connected to the anchor concentric with a wheel of said section, and means for operatively connecting said counterpoise mechanism with said section of said arm other than the section thereof connected to the anchor including a flexible cable extending about said wheels.

15. A drafting machine comprising a parallel motion arm composed of sections angularly movable relative to each other, each of said sections comprising a pair of wheels, bands encircling said wheels, struts operatively connected to said wheels for holding the same in spaced relation, anchor mechanism for operatively connecting one end of said arm to a drafting board, resilient means extending generally along the upper edge of the drafting board in all operative positions of said arm, means for operatively connecting said resilient means to the section of said arm connected to the anchor, resilient means extending generally along the upper edge of the drafting board in all operative positions of said arm, a wheel rotatably supported coaxially with the wheel of said arm at the anchor end thereof, a second wheel connected to a section of said arm other than the section thereof connected to the anchor, and means including a flexible band extending about said wheels for operatively connecting said second resilient means with said section of said arm other than the section thereof connected to said anchor.

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