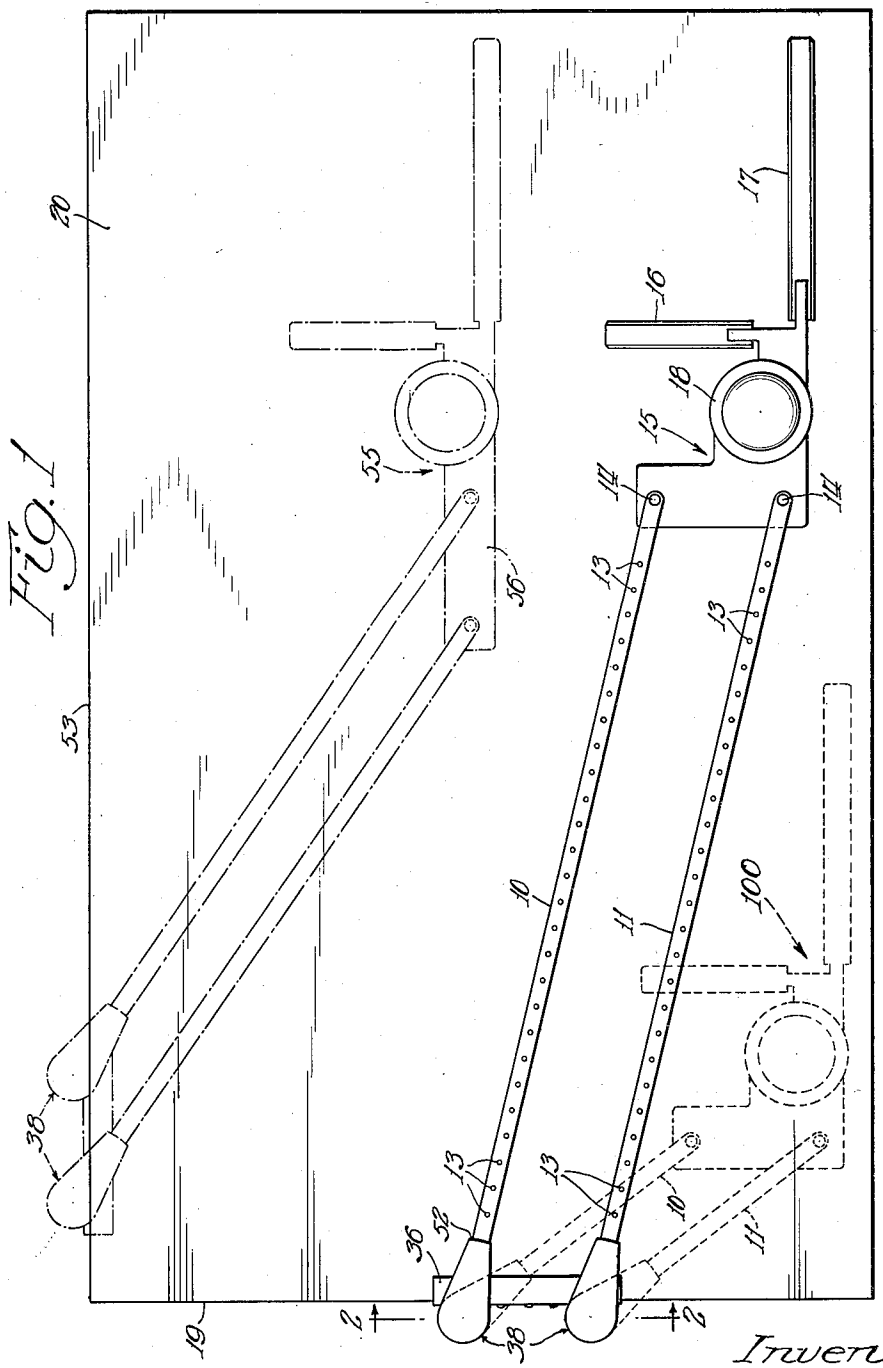
May 30, 1939. H. L. DE LISLE 2,160,130

DRAFTING MACHINE

Filed Sept. 25, 1936 3 Sheets-Sheet 1




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DRAFTING MACHINE

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Fig. 2

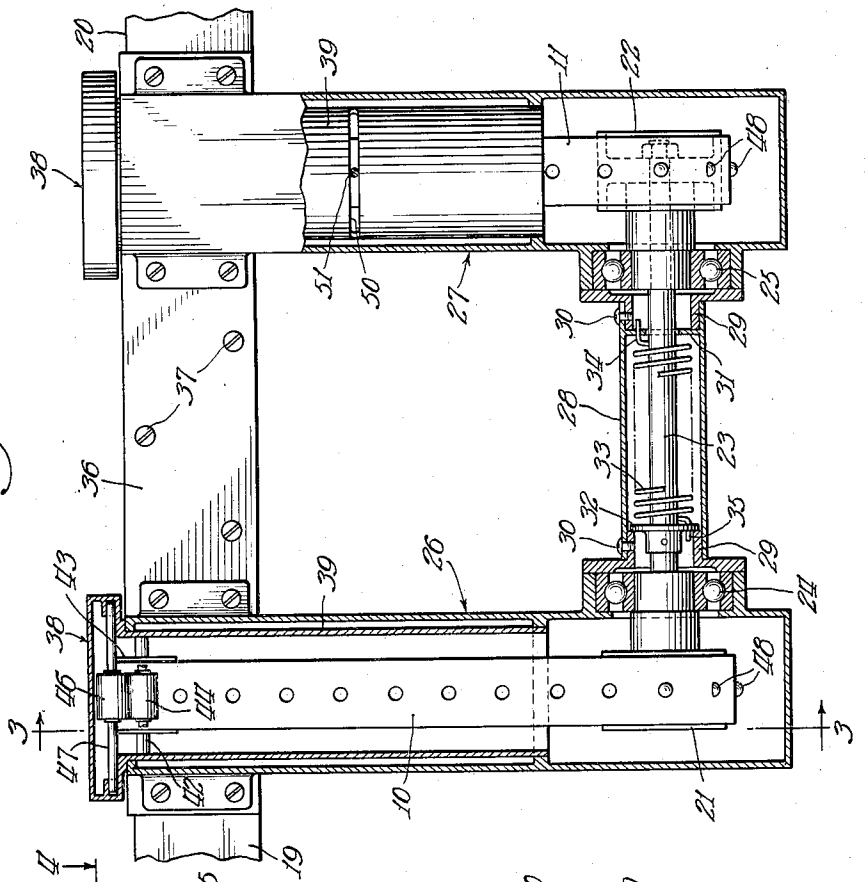
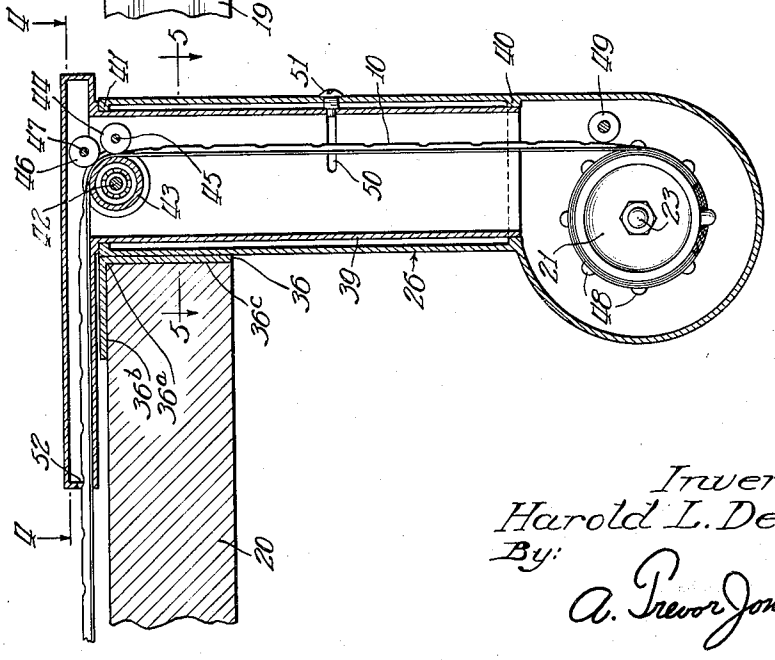


Fig. 3



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Fig. 4

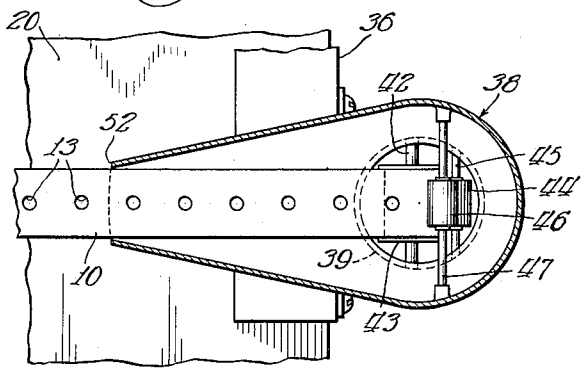



Fig. 5

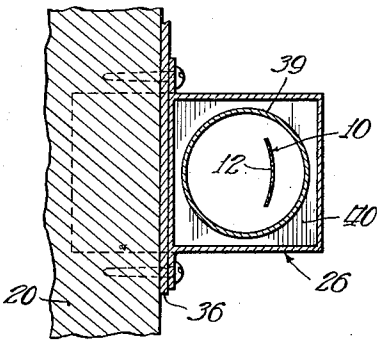



Fig. 7

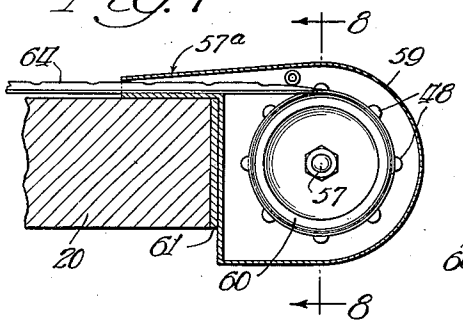



Fig. 8

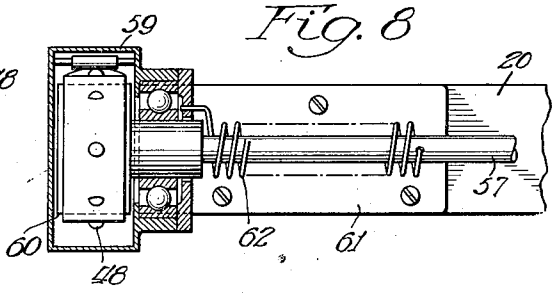
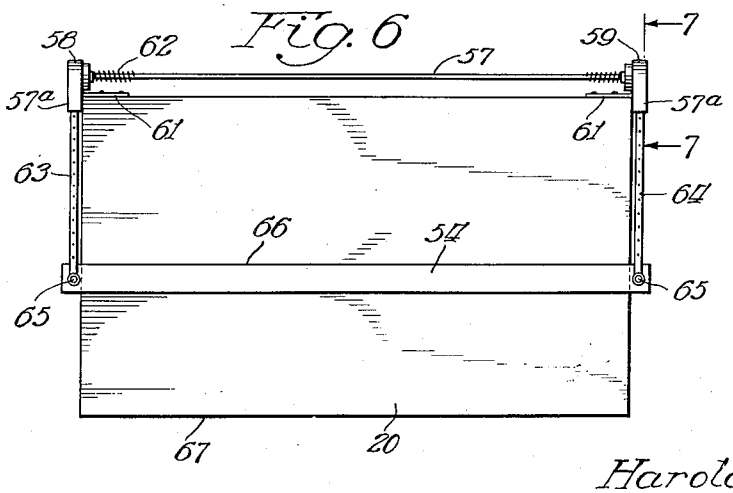



Fig. 6




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# UNITED STATES PATENT OFFICE

2,160,130

## DRAFTING MACHINE

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Application September 25, 1936, Serial No. 102,453

15 Claims. (Cl. 33—79)

This invention relates to drafting machines in which a drafting tool is maintained parallel with an edge of a drafting board.

Such machines as are now on the market for this purpose are expensive and cumbersome. The present invention aims to provide a simple and relatively inexpensive machine of this type, with enhanced flexibility of structure and operation and improved efficiency and usefulness.

Heretofore it has been assumed that such a machine must be constructed of rigid material, somewhat on the arms and elbow principle, necessitating a number of joints and an excess of material. In contrast, the present invention employs a pair of flexible members, such as steel tapes, and depends solely upon the principle of the natural tendency of the tapes to remain parallel if the distance apart of the tapes at two or more places at a given time is maintained the same even though this difference may vary at different times.

The invention will be understood by reference to the accompanying drawings in which:

Figure 1 shows in full lines a drafting board with my invention applied thereto and in broken lines an alternative application;

Figure 2 is an enlarged vertical section taken on the line 2—2 of Fig. 1 and showing the tape controlling means;

Figure 3 is a cross-section taken on the line 3—3 of Fig. 2;

Figure 4 is a partial plan section taken on the line 4—4 of Fig. 3;

Figure 5 is a cross-section taken on the line 5—5 of Fig. 3;

Figure 6 is still another application of the invention;

Figure 7 is an enlarged section taken on the line 7—7 of Fig. 6; and

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

In the illustrative construction shown in the drawings, the members 10, 11 are resilient steel tapes of the type which are commonly used in measuring instruments and which normally have a slight concavo-convex curvature transversely as shown at 12 (Fig. 5). The tapes are somewhat rigid in their own plane by reason of their material and by reason of the concavo-convex curvature they have substantial rigidity in the direction of their lengths, although they may be wound upon a spool or reel in which event the curvature may be flattened out so that the tapes occupy a minimum of space.

I provide means for causing the amount of the tapes projected to be uniformly equal. In accordance with my invention as here shown, these tapes 10, 11 have registering indentations therein such as the perforations 13, at uniformly spaced-apart intervals therealong to register with projections on spools for the tapes, as presently described. The perforations 13 in the tape 10 are all alined with the perforations 13 in the tape 11 so that a geometrical diagram formed by a return-bent line connecting four adjacent perforations is a parallelogram, and so that a line forming the centers of two oppositely-disposed perforations is parallel with an edge of the drafting board as presently described.

The free ends 14 of each of the tapes 10, 11 are pivotally secured (to pivot in their own plane) by any suitable means to a drafting tool, which, for example, as shown in Fig. 1, may be the conventional protractor head 15 which includes a pair of right-angularly related straight edges 16, 17, secured thereto by a swivel device 18, as is well known in drafting practice. The object of my invention is the improved means including the tapes 10 and 11 for maintaining the edges of the straight edges 16 and 17 parallel and perpendicular respectively with one edge, say the edge 19 of the drafting board 20. It will be understood also that a return-bent line connecting the pivot points of the free ends 14 on the tool 15 with the adjacent perforations 13 of the tapes 10 and 11, also defines a parallelogram.

To maintain the parallelogram line connecting the two pivot points 14 parallel with the drawing board edge 19, it is thus necessary to maintain the tapes 10, 11, an equal distance apart at all times at any two places between them even though this distance may vary from time to time, depending upon the angle of the tapes. It is further necessary to cause the tapes to advance or retract an equal distance. For this purpose, I have shown the tapes mounted upon spools fixed the same distance apart as the points 14 and rotatable on a common axle, or rotatable shaft. The tapes are thus secured at fixed equal distances apart both to the board and to the drafting tool, lines joining said places of securement on the board and on the drafting tool respectively being parallel with a line joining the surface and an edge of the board.

For example, by reference to Fig. 2 it will be seen how the tapes 10, 11 are mounted respectively on the spools 21, 22 which are keyed to the common axle 23, this axle being desirably rotatably mounted on anti-friction bearings such as the ball bearings 24, 25 carried by a two-part

housing 26, 27. The axle 23 may itself pass through the axle housing 28 which is a tubular member secured to the hubs 29 on the housings 26, 27 respectively. Set screws 30 may hold these parts in fixed relationship. The axle housing 28 may have a transverse wall 31 and the axle may have keyed thereto a flanged collar 32. A coil spring 33 may have one end anchored as at 34 to the transverse wall 31 and its other end attached as at 35 to the flanged collar 32. So constructed and arranged the axle constitutes a spring roller and rotation of the axle to extend the tapes 10, 11 causes the spring to be wound and thus retract the tapes when the latter are released.

The spools 21, 22 are housed respectively by the housing portions 26, 27 which are in turn secured to an angular plate 36 which may be secured to an edge such as the edge 19 of the drafting board as by screws 37. The line 36*a* (Fig. 3) at the junction of the portion 36*b* and 36*c* of the plate 36 is thus parallel to both the surface of the board 20 and its edge 19.

At their upper ends the housing sections 26, 27 desirably are provided with guides 38 through which the tapes 10, 11 pass. As here shown these guides are integral with a depending cylindrical portion 39 for each guide which passes downwardly into the housing section 26 or 27 as the case may be, for rotation therein. While the housing sections 26, 27 may be of square formation they may have transverse walls 40 and 41 which provide circular bearings for the depending guide portions 39. Thus the guides 38 with their depending portions 39 may pivot in the housings 26, 27. At their upper ends the depending portions 39 carry a transverse pin 42 upon which is mounted, desirably by antifriction means, an idler roller 43. Also adjacent this idler roller 43 is another roller 44 carried by a transverse pin 45 in the depending portion 39 and a third roller 46 carried by a transverse pin 47 in the guide 38. The rollers 44 and 46 are placed sufficiently close to the roller 43 so that the tape passes frictionally between all three of these rollers and a tension is maintained on the tape at this point. From thence the tape passes down to be wound upon the spool 21 or 22 as the case may be.

Each of these spools has a series of circumferentially uniformly spaced-apart registering means such as the buttons 48 which register with and pass through the indentations 13 in the tapes, thus further ensuring that the tapes will move uniformly to project an equal distance upon any given rotation of the axle 23. Oppositely-disposed buttons on the two spools are aligned, when the spools are secured to the axle, to be parallel with the line 36*a* formed by the junction 36*a* of the attachment portions 36*b* and 36*c* of the plate 36. A line forming the pivot points 14 is also initially caused to be parallel with the line 36*a*.

Another roller 49 carried within the lower part of the housings adjacent each of the spools 21 and 22 desirably presses the tape against the spool to ensure registration of the perforations and abutments; and also to flatten out the tape to occupy a minimum of space. The rotation of the depending guide portions 39 to a single plane may be ensured and the area of rotation limited by slots 50 in the guide portions in which set screws 51 in the housings may oscillate. The mouths of the guides 38 are desirably reduced as at 52 to be no larger substantially than the cross-section of the tape itself, thus reducing play between the guide and the tape.

It will be understood that the flexibility of the tapes permits the twist put upon them by the swiveling of the guides 38 so that the protractor head may be moved to any position on the board, as for example that shown in dotted lines at 100 (Fig. 1). In each case the length of the tapes 10, 11 extended is the same at any given time.

As shown in broken lines in Fig. 1, the device may be similarly selectively secured to an edge of the drafting board other than the edge 19 or, for example, the upper edge 53 of the board, the drafting tool 55 in this instance being similar in function and operation to the device 15 but having a slightly different attachment portion 56 for the tapes 10 and 11, the function and operation being similar.

In this case the spring 33 may be strong enough to support the tool 15 by means of the tapes even though the board is tilted toward the vertical as in what is known as vertical drafting. Unlike the usual spring roller, the axle 23 is desirably always under the influence of the spring 33, and the force of the spring may be such as to just balance the resistance of the drafting tool so that if the drafting tool is moved toward the reel means, the spring will rapidly take up the tapes, while at all times the drafting tool will remain in the position placed against the force of the spring 33.

In either case it will be noted that the drafting tool 15 or 55 may be moved not only upwardly and downwardly of the board 20 but also to the left or to the right on this board, the straight edges 16, 17 being maintained parallel at all times to the edges 19 and 53 respectively of the board 20 by reason of the operation of the tapes just described, assuming that the original relation of the straight edges 16, 17 is not altered by the conventional device 18.

Referring now to Figs. 6 to 8 inclusive, my invention may be used with a somewhat different drafting tool, in this case a straight-edge 54 extending entirely across the board 20 and intended to be moved only upwardly and downwardly of the board. In this case the tapes need only be advanced and retracted and the guides 57*a* do not need to be arranged to swivel as the guide 38 in Figs. 1 to 5 inclusive. Also for this purpose, the axle 57 may extend the entire width of the board, the housing portions 58 and 59 for the spools 60 being thus more widely separated and located at each of the upper corners of the board as by brackets 61 secured to the board at these corners. The spools 60 are keyed to the common axle 57 the same as before. In this case there may be a coiled spring 62 associated with each of the brackets but keyed to the common axle 57 for retracting the tapes 63, 64. The tapes are secured as at 65 to each end respectively of the straight-edge 54, thus maintaining the straight-edge proper 66, for example, parallel at all times with the lower edge 67 of the board 20 by reason of the principle already described with reference to Figs. 1 to 5.

It will be noted that in each case, as the drafting tool is moved away from the edge of the board to which the tape spools are secured an equal length of the tapes 10, 11, 63, 64 is extended from the said edge and thus since the tapes are an equal distance apart at all times, a line connecting the attachment points 14 or 65, as the case may be, must necessarily be parallel at all times to the said edge of the board, regardless

of the length of the tapes which are extended or the angle of said tapes. Thus by means of this simple but unique provision of maintaining a parallelogram, the position of the particular drafting tool attached to the tapes is assured with respect to the edges of the board. When the drafting tool is moved toward the edge to which the spools are secured, the energy stored in the springs by extension of the tapes is used to wind up the spools and thus take in the amount of tape which is not needed when the distance from the said edge to the drafting tool is diminished.

By reason of the flexibility of the expedients here disclosed, including the resilient steel tapes, the drafting tool 15 or 54 may be lifted above the surface of the board, for example, to pass by another tool on the board without disturbing the position of the latter and without changing the relationship of the drafting tool 15 or 54 to the edge of the board as described.

The invention is not limited to details of construction shown for purposes of illustration, and such changes may be made as fall within the scope of the appended claims without departing from the invention.

Having described my invention, I claim:

1. In a drafting machine, the combination with a drafting board, of a drafting device movable on said board, a pair of flexible tapes having free ends connected to the device at their free ends, the tapes being connected to the board at one end of the tapes only opposite their free ends whereby the device may be lifted from the board, a pair of spools for winding said tapes thereon, means causing said spools to act in unison, and uniformly spaced registering means on the tapes and spools jointly.

2. In a drafting machine, the combination of a rotatable shaft, a pair of spools keyed thereto, a flexible tape having a free end wound on each spool, uniformly spaced apart projections on the spools and means on the tapes registering with the projections to guard against slippage of the tapes with respect to the spools, while extending or retracting the free ends of the tapes, and a drafting device, the free ends of the tapes being pivotally secured to the said device.

3. In a drafting machine, the combination of a rotatable shaft, a pair of spools keyed thereto, a steel tape wound on each spool having a free end, uniformly spaced apart projections on the spool, the projections on both spools being aligned to be on lines parallel with the axis of the shaft, and perforations in the tapes registering with the said projection on the spools respectively to guard against slippage of the tapes with respect to the spools, while extending or retracting the free ends of the tapes, and a drafting device, the free ends of the tape being pivotally secured to the drafting device.

4. The structure of claim 3 wherein a spring is provided for winding the shaft, the shaft being at all times under the influence of the spring.

5. The structure of claim 3 wherein means is provided immediately adjacent each spool for pressing the tape against the spool to ensure registration of the projections and perforations.

6. In a drafting machine, the combination with a drafting board of a spring controlled rotatable shaft carried by the board, a pair of sprocket wheels keyed to the shaft, perforated metallic tapes having free ends therein wound at one end on the sprocket wheels, and a drafting device attached to the free ends of the tapes, said tapes being normally inflexible in their own plane but being somewhat flexible in a direction normal to said plane whereby the free ends may be lifted from the board with said device.

7. In a drafting machine, the combination with a drafting board, of a spring controlled rotatable shaft journaled on the board, a pair of sprocket wheels keyed to the shaft, a metallic tape having a free end wound at one end on each sprocket wheel, and a drafting device attached to the free ends of the tapes, the sprockets of said wheels, perforations of the tapes, and points of attachment of the tapes to the drafting device being arranged on lines parallel with the axis of the shaft and with a line joining the surface and an edge of the board, whereby the free ends with said device may be lifted somewhat above the board but an edge of said device remains parallel with said line.

8. The structure of claim 7 including an upright housing for each tape carried by the board wherein the tapes each pass through one of said upright housings, the upper end of each housing being provided with a guide for the tape rotatable in a plane parallel with and just above the drafting board.

9. The structure of claim 7 including an upright housing for each tape carried by the board wherein the tapes each pass through one of said upright housings, the upper end of each housing being provided with a guide for the tape rotatable in a plane parallel with and just above the drafting board and wherein the guide has limited rotation with respect to the housing.

10. The structure of claim 7 including an upright housing for each tape carried by the board wherein the tapes each pass through one of said upright housings, the upper end of each housing being provided with a guide for the tape rotatable in a plane parallel with and just above the drafting board, said guide having a depending integral portion telescoped within the housing.

11. The structure of claim 7 including an upright housing for each tape carried by the board wherein the tapes each pass through one of said upright housings, the upper end of each housing being provided with a guide for the tape rotatable in a plane parallel with and just above the drafting board, said guide having a depending integral portion telescoped within the housing, and wherein the guide carries a system of idler rollers between which the tape passes for maintaining tension on the tape between said guide and said sprocket wheel.

12. In a drafting machine, the combination with a drafting board, of a straight edge, a pair of flexible members having free ends secured at one end to said board and at their free ends to said straight edge at fixed equal distances apart, lines joining said places of securement respectively being parallel with a line joining the surface and an edge of the board, and spring means including elements at uniformly spaced apart intervals for extending and contracting the members by equal increments of length while maintaining said parallelism, whereby the free ends of said device may be lifted somewhat above the board but an edge of said device remains parallel with said line.

13. In a drafting machine, the combination with a drafting board and a drafting tool movable on said board, of a pair of resilient tapes normally arcuate in cross-section connected in parallel relation at one end to an edge of the board and at their free ends to the drafting tool, said

connections providing for pivoting of the tapes at each point in the common plane of the tapes, and means for extending and retracting the free ends of the tapes an equal distance from or toward an edge of the board at all times while permitting said pivoting.

14. In a drafting machine, the combination with a drafting board and a drafting tool movable on said board, of a pair of resilient tapes normally arcuate in cross-section and having free ends, the tapes being connected in parallel relation both to the board at one end and at their free ends pivotally to the drafting tool, spring means carried by the board for reeling said tapes upon a common axle, and interengaging registering means between the tapes and reel means for ensuring that equal lengths of the tapes are extended or retracted from said reel means, said reeling means and registering means being under spring influence at all times tending to retract the tapes, whereby the free ends with said tool may be lifted above the board.

15. In a drafting machine, the combination with a drafting board and a drafting tool movable on the surface of said board, of a pair of resilient tapes normally arcuate in cross-section connected in parallel relation at one end at an edge of the board and at their free ends to the drafting tool, said connections providing for pivoting of the tapes at each point in the common plane of the tapes, the connection of the tapes to the board being by means of a rotatable shaft carried by the board parallel with a line joining the surface and edge of the board, spools keyed to said shaft upon which the tapes are wound, uniformly spaced registering means including projections on the spools and perforations in the tapes, a spring tending to retract the tapes onto said spools, the tape being normally constantly under the influence of said spring, and rollers adjacent the spools for flattening the tapes against their natural resilience while registering the said projections and perforations.

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