United States Patent [19]

Kooi

[11] **3,908,276**

[45] **Sept. 30, 1975**

[54] **DRAFTING MACHINE BRAKING SYSTEM**

[75] Inventor: **J. Peter E. Kooi,** Succasunna, N.J.

[73] Assignee: **Keuffel & Esser Company,** Morristown, N.J.

[22] Filed: **Feb. 25, 1974**

[21] Appl. No.: **445,709**

[52] **U.S. Cl.** ..... **33/76 R;** 33/79 R

[51] **Int. Cl.²** **B43L 13/02**

[58] **Field of Search** ..... 33/79, 76 R

[56] **References Cited**

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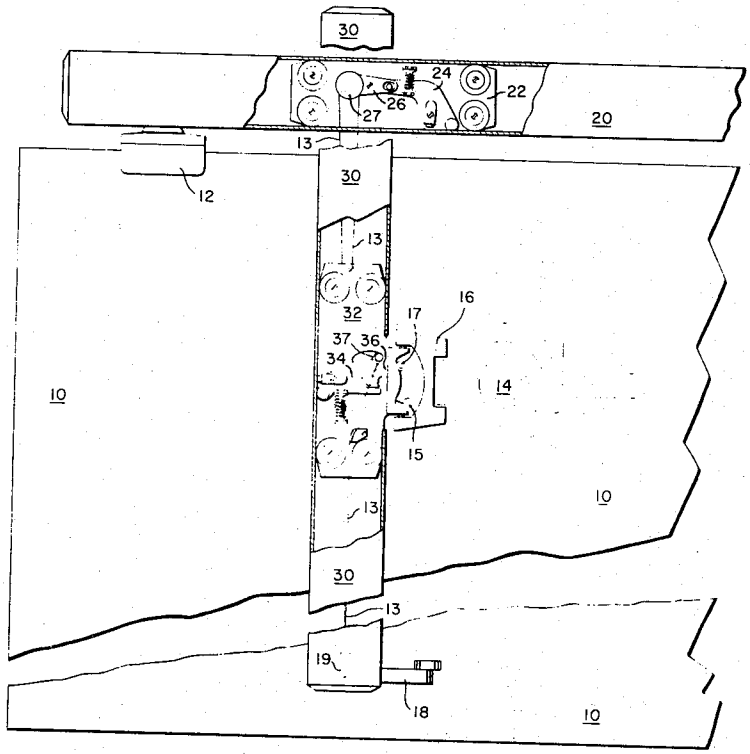
2,102,636	12/1937	McDonald	33/79 R
3,279,073	10/1966	Ardito et al.	33/79 R
3,400,461	9/1968	Faul	33/79 R
3,762,055	10/1973	Citrin	33/81
3,823,479	7/1974	Komabayashi et al.	33/76 R

Primary Examiner—Richard E. Aegerter
Assistant Examiner—John W. Shepperd
Attorney, Agent, or Firm—Lionel N. White, Esq.

[57] **ABSTRACT**

Operating levers for controlling the horizontal and vertical movement of a track-type drafting machine are mounted on the vertical motion carriage and are at all times within the functional span of the hand of a draftsman grasping the protractor drafting head. Actuation of the brake assembly carried by the horizontal motion carriage is effected by means of a cord loop extending between the carriages with movement of the operating lever drawing the cord through a dead center point of maximum tension, thus providing for the retention of the brake in the desired released or engaged condition.

2 Claims, 3 Drawing Figures



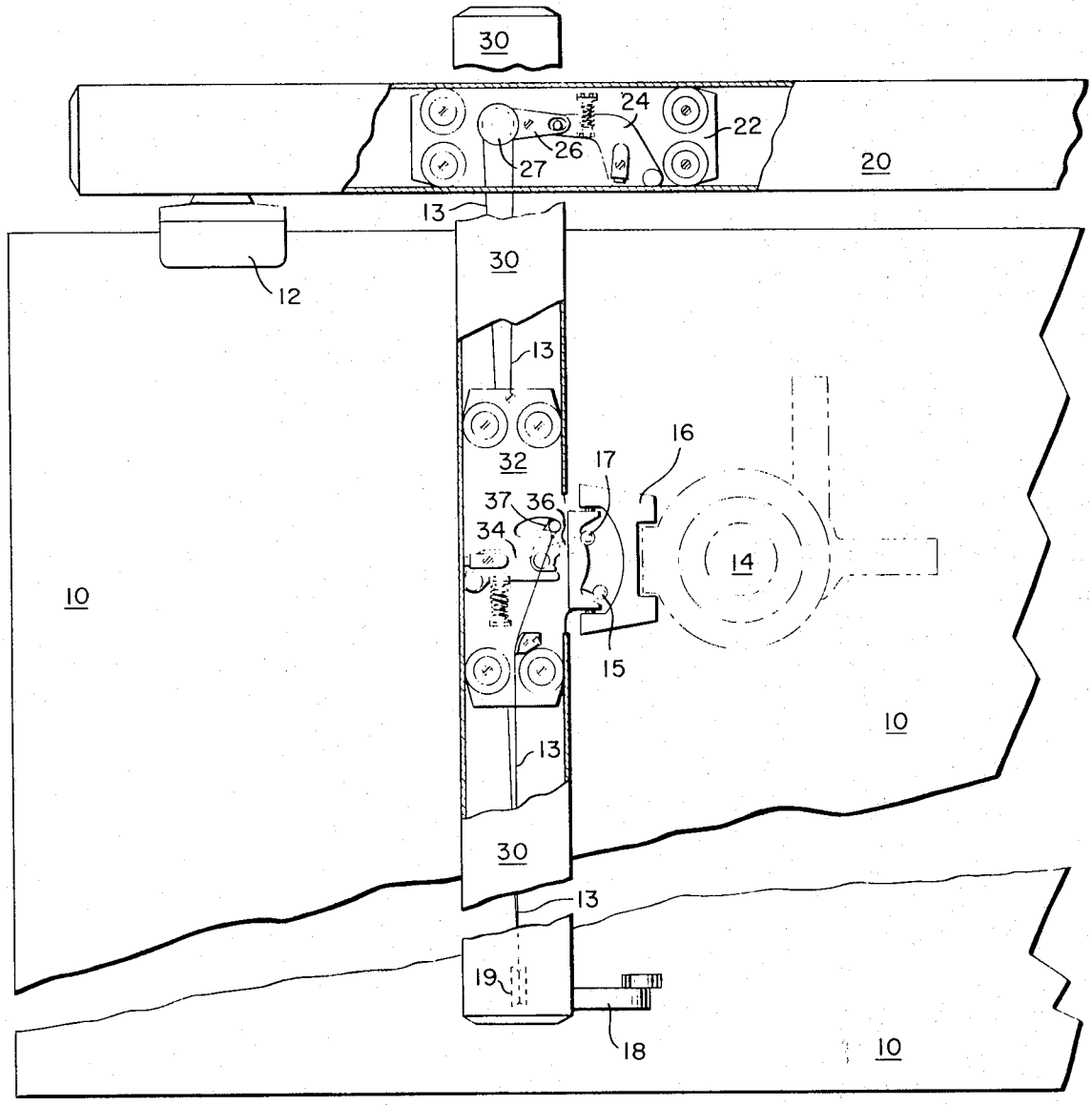

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FIG. 1

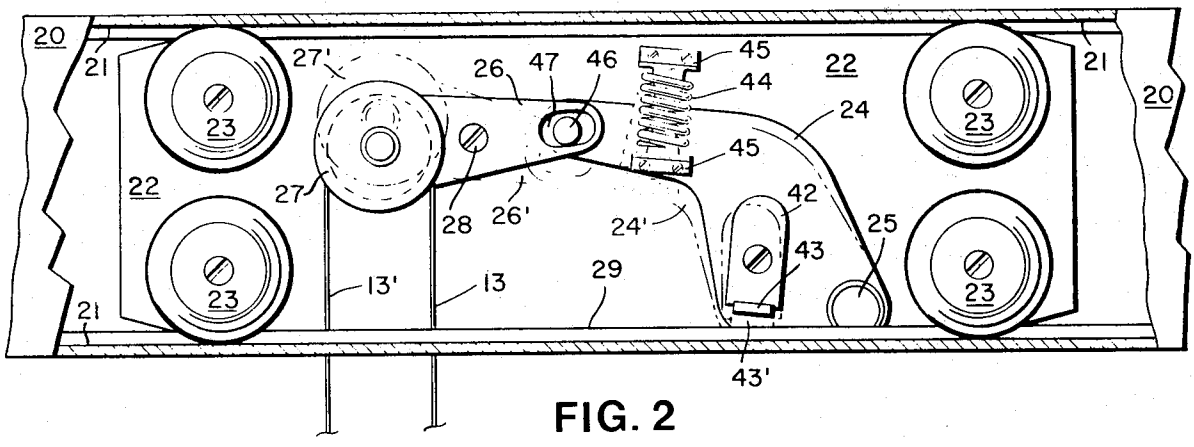
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FIG. 2

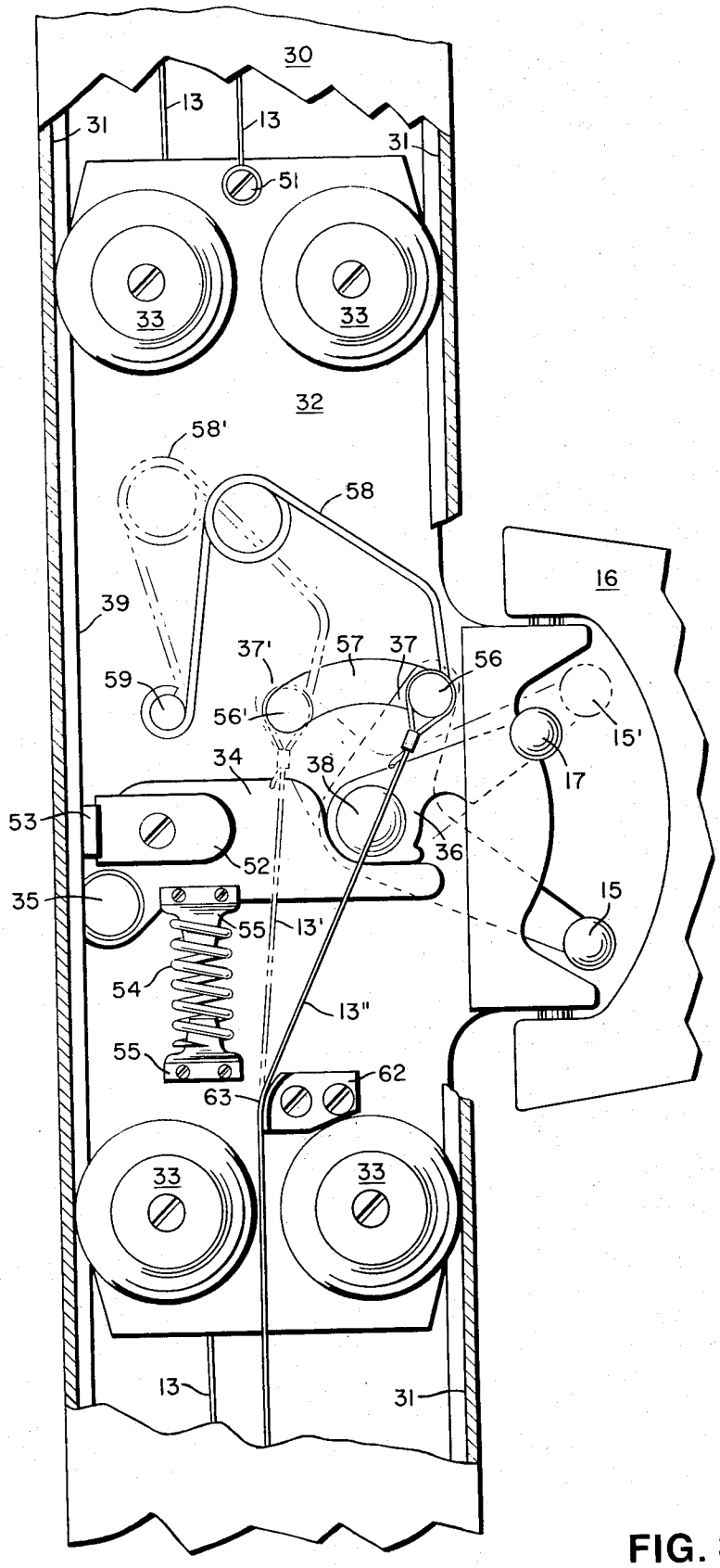
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FIG. 3

DRAFTING MACHINE BRAKING SYSTEM

BACKGROUND

In recent years, track-type drafting machines have found increasing acceptance in the engineering drawing field. Such devices generally comprise a stationary horizontal track affixed to the top edge of a drafting board or table and along which a wheeled carriage is guided to provide a freedom of movement across the board in the horizontal direction.

Attached to and moving with the horizontal track carriage is a vertical track member along which is guided a second wheeled carriage to provide vertical motion over the drafting surface. The usual protractor drafting head is attached to the vertical track carriage and as a result of the orthoganal movements provided by the carriages is enabled to move to any point on the drafting surface.

During the course of the preparation of an engineering drawing, however, it is generally required that the two degrees of freedom of movement of the drafting head be individually or jointly arrested to enable the draftsman to complete various drafting operations. Such arresting of movement has for the most part simply been accomplished by individual braking members carried by each of the carriages and which may be actuated to engage the respective track members, thereby immobilizing the head with respect to the relevant direction of movement.

Of particular concern to the draftsman is the capability of actuating the respective braking members with the least interruption to his drafting procedure, and thus it is most desirable that brake-actuating controls be available to the hand of the draftsman which engages the protractor head during normal drafting operations.

Little problem exists in providing such an arrangement for actuating the vertical motion braking means, since the protractor head is physically associated with and moves in the same direction as the vertical motion carriage. The vertical brake control is, as a result, at all times within the ready grasp of the draftsman's hand. Actuation of the brake on the horizontal motion carriage, on the other hand, has continuously presented a problem due to the varying distance between the horizontal motion carriage and the protractor head during vertical movement of the head.

Designers of earlier track-type drafting machines have attempted in numerous ways to satisfy the noted requirement of convenience in the actuation of the horizontal carriage brake.

The ultimate convenience of an electrical system for operating the brakes of a drafting machine, as described in U.S. Pat. No. **3,153,284** is quite apparent; however, the added cost, complexity, and power requirement limitations of such an arrangement were found to outweigh the advantage of convenience.

The greater simplicity and lower expense of mechanical means thus prompted the designers of the machines described in U.S. Pat. No. **3,074,173**; U.S. Pat. No. **3,279,073**; and U.S. Pat. No. **3,400,461** to employ an elongated horizontal brake actuation control member extending generally over the length of the vertical track to provide manual accessibility to the draftsman of that control member regardless of the distance of the protractor head from the horizontal track. Although these

devices provided some satisfaction of the demand for convenience, the fact that the brake control member, while accessible, was not capable of moving with the vertical motion carriage caused draftsmen to find that in actual practice horizontal brake actuation required movement of the protractor operating hand from that station.

A brake-actuating system described in U.S. Pat. No. **2,102,636** embodied the desirable feature wherein movement of a horizontal brake control member was, in fact, associated with the movement of the vertical motion carriage. That system, however, did not entirely satisfy the demands of the draftsman, since the critical actuating elements were so arranged as to require the removal of the draftsman's hand from the arena of the protractor head, thus rendering horizontal motion braking during drafting activity a two-handed operation.

The present invention provides an improvement in the device generally described in U.S. Pat. No. **2,102,636** whereby either or both of the horizontal and vertical track carriage brake may be actuated by the draftsman from any location on a drafting board without a need for his moving the operating hand from the protractor head of the drafting machine.

SUMMARY

In accordance with the present invention, a drafting machine braking system is provided which includes a running cord loop anchored to the vertical carriage and encompassing brake actuating means situated at the horizontal motion carriage and manually accessible control means situated at the vertical motion carriage. As a result of the cord loop feature, the control means is constantly in communication with the horizontal motion braking assembly regardless of the distance between the horizontal and vertical carriages.

The horizontal brake control means carried by the vertical carriage comprises a pivoted lever to the proximal arm of which is attached the terminal end of the cord forming the control loop. A control member at the end of the distal lever arm is movable through a short arc within the span of the draftsman's hand from the protractor head and by such movement causes the lever to apply tension to the control cord during a portion of the arcuate sweep of the lever arm. Such tension results in a shortening of the loop and thus transfers the draftsman's effort to the brake assembly of the horizontal carriage.

The proximal arm of the brake control lever is so disposed, however, with respect to the attitude of the terminal reach of the cord to which it is attached that completion of the arcuate sweep of the lever carries the arm through a dead center point of maximum cord tension and into a position which is thereafter maintained by the reactive tension of the cord upon the lever arm. By virtue of the arrangement of the control lever assembly, the noted dead center point is located at a distance from the center of the arcuate sweep of the lever and thereby results in a difference between the cord tensions at the arc termini. Such cord tension difference establishes the respective engaged and released conditions of the horizontal brake.

A similar control lever actuating arrangement is provided with respect to the vertical motion brake; however, since both the actuating and braking means are located at the vertical carriage, the need for a control

cord is eliminated and the lever action is applied directly. The control member for this second braking assembly is situated closely adjacent that of the horizontal brake control lever, thereby placing all braking controls and the protractor head within a single span of the draftsman's hand.

DRAWINGS

In the accompanying drawings:

FIG. 1 depicts a track-type drafting machine mounted upon a drawing board and reveals, in partial cut-away, carriage assemblies embodying a braking system according to the present invention;

FIG. 2 shows in greater detail a drafting machine horizontal motion carriage with braking means according to the present invention; and

FIG. 3 shows in greater detail a drafting machine vertical motion carriage with braking means according to the present invention.

DESCRIPTION

The present improvement in track-type drafting machine braking means may be particularly described by reference to the accompanying drawings which depict a simple embodiment of the invention whereby a cord loop trained about a horizontal motion arresting mechanism and attached to a control member mounted upon the vertical motion carriage provides positive and self-sustained braking actuable from any location of the drafting machine head on a drafting board surface.

In FIG. 1 there is mounted along the upper edge of drafting board **10** by means of mounting brackets **12** (one of which is shown) the horizontal track member **20** of a track-type drafting machine. In a manner well known from previous similar drafting machines as above-noted, a wheeled horizontal motion carriage **22** is arranged to move along parallel tracks associated with track member **20** to thereby provide the horizontal degree of motion freedom to the drafting machine.

Mounted on carriage **22** is a braking assembly, shown generally at **24** and to be described later in more detail, comprising a pivotted lever arm mounting a brake shoe with spring means biasing the lever arm to movement in a direction to engage the brake shoe with a surface of track member **20.**

Additionally affixed to horizontal carriage **22** by well-known means not shown is a vertically disposed track member **30.** Mounted at the lower end of vertical member **30** is wheel assembly **18** which provides track member **30** with support for its movement with carriage **22** across the width of drawing board **10.**

Arranged for movement along vertical member **30** in the manner previously described with respect to the horizontal carriage is a generally similar vertical carriage **32** to which is pivotally mounted through a yoke **16** the protractor drafting head assembly **14** of the drafting machine.

A braking assembly **34** similar to assembly **24** of carriage **22** is pivotally mounted on vertical motion carriage **32** and provides the means for arresting motion of carriage **32** and drafting head **14** in the vertical direction. Brake actuating controls **15, 17** located at the respective distal ends of lever arms **37, 36** pivotally mounted on vertical carriage **32** are positioned within the span of a draftsman's hand stationed at drafting head **14.** Means for actuating vertical motion brake assembly **34** to govern movement of carriage **32** may be seen to generally comprise lever **36** which, upon movement of control member **17,** effects withdrawal of the vertical brake shoe from engagement with track member **30.** Further detail in the operation of this brake actuating means will be given with reference to FIG. **3.**

Actuating means for horizontal brake assembly **24** to control movement of carriage **22** along track member **20** is simply and schematically represented in the drawings by a lever **26** pivotally mounted to horizontal carriage **22** and communicating between vertical brake lever arm **24** and pulley member **27.** Such a schematic representation should not detract from a complete understanding of the present invention; however, since it will be readily understood by those familiar with track-type drafting machines, such as are described in the aforementioned patent specifications, that the additional elements of the present embodiment of the invention may be employed as well to actuate complex lever train brake mechanisms housed in bridging assemblies often used to mount the vertical track member upon the horizontal carriage. Thus, by considering the response and effect of brake actuating lever **26** in the actions described below, one will derive no less a complete description of the instant invention.

Means for transferring brake-actuating effort from the draftsman's fingertip to braking assembly **24** comprises a cord or cable **13** which is anchored at one end to vertical carriage **32,** trained about actuating lever pulley **27** and a stationary pulley **19** mounted on vertical track member **30** near its lower end, and affixed at its terminal end to lever arm **37,** thereby forming of the cord a running loop extending substantially the entire length of track member **30.** Thus it will be seen that the loop of cord will trail the vertical movement of carriage **32** and that tension applied to the cable at its mobile end by movement of lever arm **37** will effect a shortening of the cord loop and cause a downward movement of pulley **27** with resulting actuation of brake assembly **24** to disengage the horizontal carriage brake from track member **20.** In drafting machines which employ a counterweight (not shown here) for the vertical carriage/drafting head assembly, cord **13** may serve a dual function as both brake control loop and counterweight cord.

In FIG. **2** is shown the enlarged and more detailed view of horizontal motion carriage **22** and the horizontal motion braking assembly mounted thereon. On body plate **22** of the carriage are mounted wheels **23** which are in rolling engagement with parallel track surfaces **21** of horizontal track member **20.**

Mounted on body plate **22** at pivot stud **25** is horizontal brake lever arm **24** with affixed brake shoe bracket **42** carrying brake shoe **43.** To arm **24** is attached one of a pair of spring brackets **45, 45,** the other of which is affixed to body plate **22.** Extending between these spring brackets is compression spring **44** which biases lever arm **24** in a counter-clockwise direction about pivot **25** toward position **24'** at which brake shoe **43'** engages track inner edge surface **29** to arrest movement of the horizontal carriage along track member **20.**

Mounted on carriage body plate **22** at a pivot stud **28** is horizontal brake actuating lever **26,** the distal end of which pivotally supports a pulley **27.** At the proximal end of lever **26** is disposed a slot **47** which receives a stud **46** mounted at the distal end of brake lever arm **24.** Trained about pulley **27** is the upper reach of the loop of cord, leg **13** being anchored at its end to verti-

cal motion carriage **32** with leg **13'** being the tension leg as will be seen in later discussion. It will thus be apparent that downward tension at cord leg **13'** will displace actuating lever pulley to position **27** where lever movement through stud and receiver slot junction **46, 47**, overcoming the bias of spring **44**, moves the lever arm clockwise about pivot **25** to position **24** thereby lifting brake shoe **43** from track surface **29** to free the horizontal carriage for movement along track member **20.**

As shown in FIG. **3**, the vertical motion carriage comprises a similar arrangement of carriage body plate **32** mounting wheels **33** which engage parallel track surfaces **31** of vertical track member **30.** Braking of the vertical movement of carriage **32** along the vertical track member is effected in a manner similar to that earlier described with respect to the horizontal motion carriage. To this end, body plate **32** carries a braking assembly comprising brake lever arm **34** with brake shoe bracket **52** and brake shoe **53** pivotted at stud **35** for counter-clockwise movement under the biasing force of compression spring assembly **54, 55** to engage brake shoe **53** with track member edge surface **39** to arrest movement of the vertical carriage.

Release of the braking action of the vertical carriage brake assembly is effected by downward movement of control member **17** and its associated actuating lever **36** which is pivotally mounted upon body plate **32** at the stud **38.** Such movement rotates lever arm **34** in a clockwise direction against the bias of spring **54** to lift brake shoe **53** from engagement with track member surface **39.** In the interest of drawing clarity, the brake released position of the braking assembly and actuating lever **36** have not been shown; however, it will be noted that a complete depression of control member **17** will cause the proximal arm of lever **36** to pass through a dead center point of maximum displacement of lever arm **34**, thence to the terminal position in its arcuate movement, where it is retained by the biasing force of spring **54.** This self-maintaining provision of the present braking arrangements will be discussed later in greater detail with respect to the action of the horizontal brake actuating controls.

Mounted on pivot stud **38** at the underside of body plate **32** is horizontal brake actuating lever **37** at the end of the proximal lever arm of which is located stud **56.** Movement of actuating lever **37** is effected by fingertip effort of the draftsman applied to control member **15** affixed to the end of the distal arm of lever **37.** Located in body plate **32** is arcuate slot **57** through which lever arm stud **56** gains access to the upper side of body plate **32.** The termini of slot **57** provide positive stops for stud **56** to limit the arcuate sweep of control member **15.** Stops engaging lever **37** may be likewise employed.

The horizontal brake control loop is formed when cord **13**, anchored at stud **51** on vertical carriage body plate **32**, is trained upward and about horizontal brake actuating lever pulley **27**, thence downward and about stationary vertical track member pulley **19**, thence about guide **62**, and finally to attachment to brake control lever arm stud **56.**

It will be seen that slot **57** is so situated with respect to brake control lever arm **37** and pivot stud **38** that slot termini stud positions **56, 56'** are at different distances from a common cord tangent point **63** on guide **62.** Thus, movement of control member **15** between its terminal positions **15, 15'** effects a condition of greater or lesser tension upon cord **13**, the greater at **15** overcoming the biasing force of horizontal brake spring **44** with the resulting shortening of the cord loop to displace pulley **27** and disengage the horizontal brake as earlier described.

During movement from the brake-engaged position, as located by system elements **13', 15', 37', 56'**, to the brake-released position actually depicted, the proximal arm of lever **37** passes through a position at which the distance between stud **56** and the common tangent point **63** is the greatest and, thus, at which cord extension and tension are a maximum. In the embodiment here described, such a dead center point of maximum cord tension occurs when the terminal cable leg **13''** overlies the center of lever arm pivot **38** and is thus coicident coincident the proximal arm of control lever **37.** Further movement beyond this dead center point of maximum tension to the brake-released terminus of slot **57** allows the bias of spring **44**, through its reactive tension upon cord **13**, to retain lever **37** in that terminal position and effect the self-maintaining feature of the braking system of the present invention. In order to ensure the efficacy of brake actuation the dead center point must, of course, be displaced from a mid-arc location. A point set a short distance from one arc terminus is preferred.

To damp the motion of control member **15** subsequent to its passing the dead center point toward the brake-engaged positon, it is desirable to interpose a damping torsion spring **58** between stud **56** and an anchor stud **59** on body plate **32.** The torque of damping spring **58** is insufficient to cause any substantial decrease in the biasing force of horizontal brake actuating spring **44.**

What is claimed is:

1. In a drafting machine comprising a horizontally disposed track member, a horizontal motion carriage arranged to travel along the horizontal track, a vertically disposed track member carried by said horizontal carriage for movement therewith, a vertical motion carriage arranged to travel along the vertical track, a drafting head carried by said vertical carriage for movement therewith and with said vertical member, said drafting head thereby having two orthogonal degrees of freedom of movement over the surface of a drafting board, braking means for individually arresting the travel of each of said carriages to thereby limit the respective degrees of freedom of said drafting head, and means within reach of the hand of a draftsman grasping said drafting head for actuating vertical motion carriage braking means, the improvement in said braking means whereby actuation thereof to control the travel of both said carriages may at all times be effected by the hand of a draftsman stationed at said drafting head, said improvement comprising:

a. a braking member including a brake shoe mounted on said horizontal motion carriage for movement to and from carriage-arresting contact with said horizontal track member;

b. means carried by said horizontal motion carriage arranged to normally urge said brake shoe into said carriage-arresting contact with said horizontal track member;

c. lever means coupled to said braking member arranged to transfer to said braking member actuating force applied to a distal arm thereof to thereby

overcome said urging means and effect separation of said carriage-arresting contact between said brake shoe and horizontal track member;

d. a pair of pulleys, the first being mounted on said lever means distal arm for movement therewith and the second being mounted fixedly on said vertical track member, said pair of pulleys defining therebetween the path of travel of said vertical motion carriage;

e. a cord attached to said vertical motion carriage and trained about said pair of pulleys, thereby forming a loop including said vertical motion carriage;

f. control lever means pivotally mounted on said vertical motion carriage with a distal lever arm thereof within the reach of the hand of a draftsman grasping said drafting head and with a proximal lever arm thereof engaging said cord, whereby applied force displacing said distal lever arm with following displacement of said proximal lever arm effects a shortening of said loop through a minimum loop length, thereby displacing said lever arm-mounted pulley through a maximum with concurrent maximum displacement of said braking member and separation between said brake shoe and horizontal track member; and

g. stop means limiting the displacement of said control lever means beyond the position of said minimum loop length to a distance which is less than the displacement distance from the position of brake shoe engagement with said horizontal track member to said position of minimum loop length.

2. The invention according to claim **11** wherein said vertical motion carriage braking means comprises:

a. a braking member including a brake shoe mounted on said vertical motion carriage for movement to and from carriage-arresting contact with said vertical track member;

b. means carried by said vertical motion carriage arranged to normally urge said brake shoe into said carriage-arresting contact with said vertical track member; and

c. a second control lever means pivotally mounted on said vertical motion carriage with a distal lever arm thereof within the reach of the hand of a draftsman grasping said drafting head and arranged to transfer to said braking member actuating force applied to said distal arm thereof to thereby overcome said urging means and effect separation of said carriage-arresting contact between said brake shoe and vertical track member.

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