

Oct. 29, 1968

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3,407,981

CONTROL APPARATUS FOR WEB FEEDING DEVICES

Filed March 31, 1967

3 Sheets-Sheet 1

FIG. 1

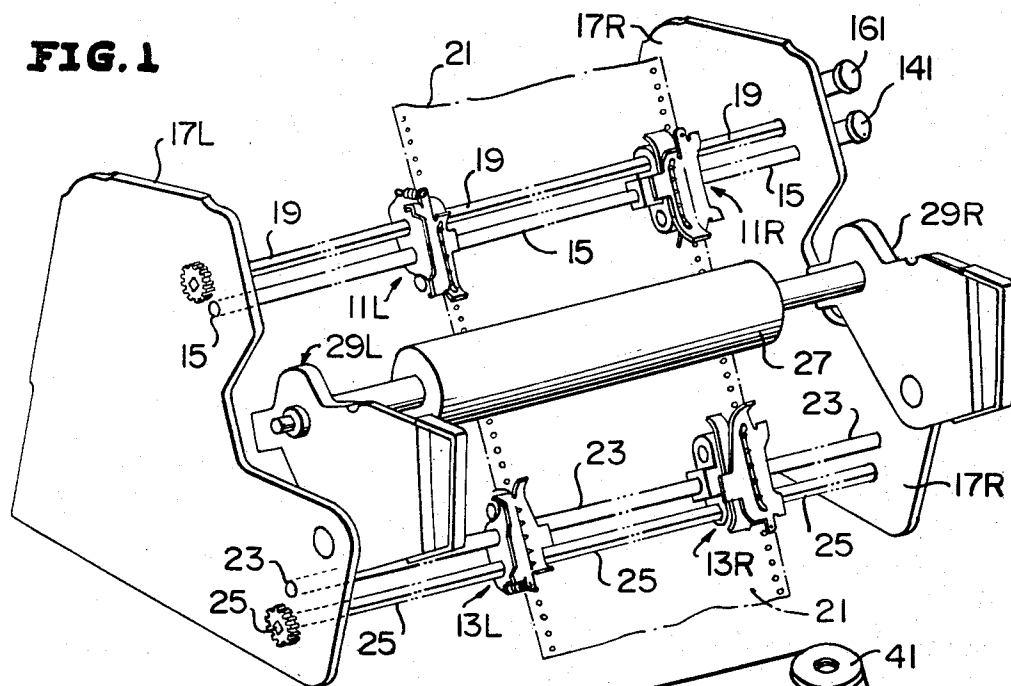
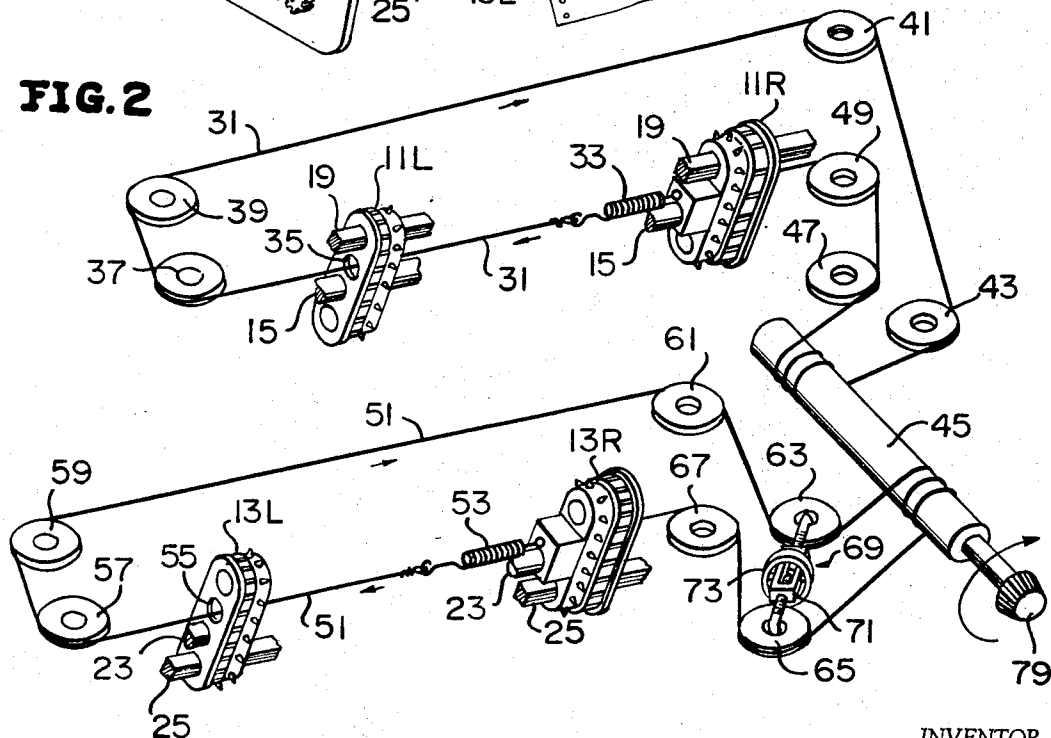


FIG. 2



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FIG. 4

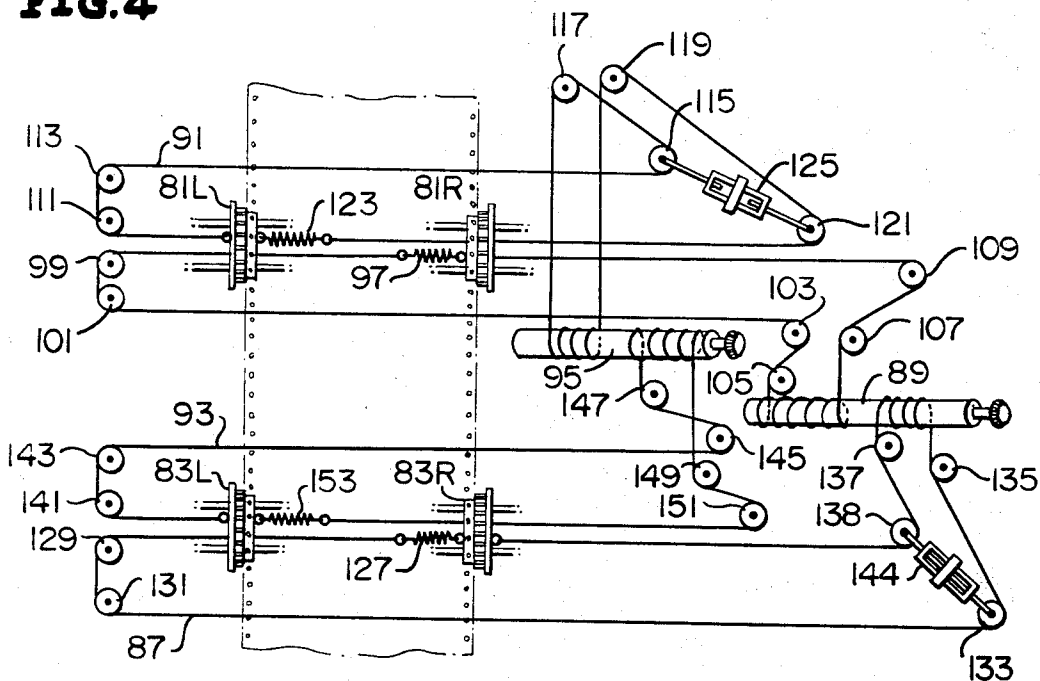
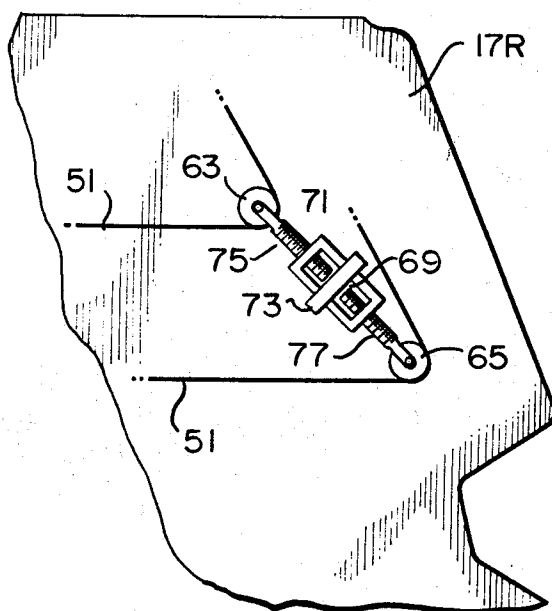


FIG. 3



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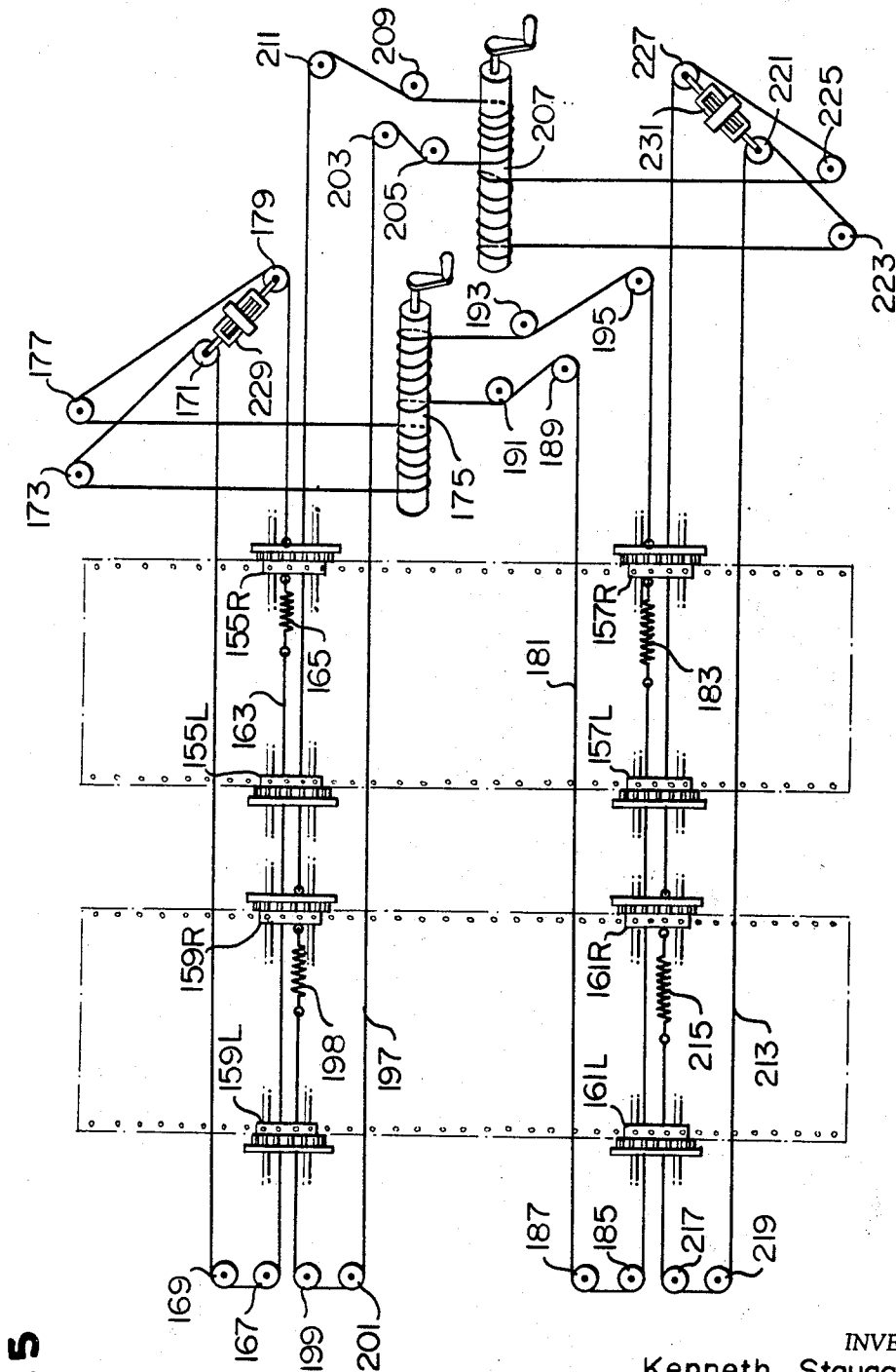


FIG. 5

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CONTROL APPARATUS FOR WEB FEEDING DEVICES

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ABSTRACT OF THE DISCLOSURE

The lateral position and separation of web feeding tractors such as those used in high speed printers is controlled by flexible cables attached to the tractors which cooperate with one side of the web and wrapped around rotatable cylinders. The rotation of the cylinder translates the attached tractors in the same direction and at the same rate.

Background of the invention

This invention relates generally to improvements in web feeding devices for high speed printers, and more particularly to improvements in means for controlling the positioning of paper feeding tractors on high speed printers.

In printers of the type commonly referred to as drum printers, the printing apparatus often includes a wide drum having rows of type fonts disposed thereabout. Solenoid actuated hammers are selectively energized during rotation of the drum to cause printing to occur on a paper web disposed between the drum and the hammers. Endless or continuous webs having perforated feed holes along the edges thereof are commonly used in such printers. Two sets of feed devices referred to in the art as tractors are used to control the advance of the web, one set being disposed below the type drum to serve as the "in-feed" tractors and the other pair being disposed above the type drum to serve as the "out-feed" tractors.

United States Patent No. 3,006,520 to House illustrates one type of tractor, as well as apparatus used for driving tractors in a drum printer. In drum printers such as that illustrated in the House patent, the spread of the tractors to accommodate webs of various widths is controlled by means of a threaded shaft assembly. In a similar manner, the lateral position of the four tractors is controlled by the selective rotation of threaded shafts appropriately coupled with the tractors. While such apparatus can be used to control the position of the tractors, it is found that the cost thereof is relatively high and the apparatus has certain drawbacks in regards the manner in which the spread and lateral position of the tractors are controlled.

Another system for controlling the positioning of tractors in a drum printer is disclosed in U.S. Patent No. 3,114,491 to Wright. This method uses flexible cables attached to the tractors and strung over pulleys. The cables are controlled by hand positioners which allow the tractors to be moved either simultaneously apart or together or to be translated simultaneously either to the left or the right. A serious disadvantage of this system is the impossibility of keeping one margin fixed while adjusting the separation of the tractors to accept webs of different widths. Every time an adjustment is made in the separation of the tractors, their movement changes the location of the margins. In order that the printing be properly positioned on the paper, the operator must then translate the tractors to the right or left to correct the position of the left-hand margin. Thus, two adjustments are required each time a different width paper is used. A second serious disadvantage of Wright is the impossibility of moving either the right or left tractor across the center position of the printer, due to the center post requirement.

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Objectives and summary of invention

It is therefore an object of my invention to improve control apparatus for web feed devices.

It is a further object of my invention to provide a tractor positioning system for a high speed printer which allows the tractors to be translated over the full width of the carriage.

It is a further object of my invention to provide a tractor control system for a high speed drum printer which allows one margin to remain fixed while the tractor separation is adjusted to accept paper of different widths.

In accordance with these and other objects of my invention, I provide a mechanism for positioning the upper and lower tractors on one side of the carriage of a high speed printer independently of the tractors on the other side of the carriage. The tractor positioning mechanism comprises a pair of flexible coupling devices, such as cables, connected one each, to the upper and lower tractors on one side of the carriage and not coupled to the tractors on the other side of the carriage. The cables pass over idler pulleys on either side of the carriage so that each tractor may be translated over the entire carriage width. Means are provided for winding said cables in the same direction and at the same rate for translating said tractors connected to said cables. Winding means and pairs of cables may be added for independently controlling the tractors on the other side of the carriage or for controlling the tractors of separate paper webs.

Various other objects, advantages, and features of my invention will become more fully apparent in the following specification with its appended claims and accompanying drawings, in which:

Brief description of drawings

FIG. 1 is a perspective view from the front of a high speed drum printer having upper and lower sets of paper feed devices;

FIG. 2 is a perspective view of a cable tractor position control system in accordance with my invention;

FIG. 3 shows a turnbuckle used to adjust the vertical alignment of the tractors;

FIG. 4 shows a cable tractor position control system embodying my invention, in which the left and right sets of tractors are controlled independently; and

FIG. 5 is a cable tractor position control system embodying my invention, in which right-hand tractors for two paper webs are controlled independently.

Detailed description

My invention can best be understood by referring to the following detailed description of the illustrated embodiments. In this description the terms right and left, up and down, and top and bottom are used with reference to the parts in the machine as seen by a person viewing the machine from the front.

Referring to FIG. 1 of the drawings, there is illustrated a portion of a high speed drum printer similar to the one illustrated in U.S. Patent No. 3,114,491 to Wright. The printer includes an upper set of paper web feeding devices referred to as tractors 11R and 11L, as well as a lower set of tractors 13R and 13L. The tractors 11R and 13R and the tractors 11L and 13L together form sets which may be referred to as right and left sets, respectively. The tractors 11R and 11L are supported for independent lateral movement on a shaft 15, which is supported by and extends between the main machine frames 17R and 17L. A rectangular drive shaft 19 passes through the upper tractor assemblies and is drivingly coupled therewith in a manner similar to that illustrated in the above-identified Wright patent, so that when the shaft 19 is rotated, the

tractor assemblies 11R and 11L serve to advance the paper web 21 with which the tractors are engaged.

In a similar manner lower tractors 13L and 13R are supported for independent lateral movement by a shaft 23, which is supported by and extends between the main machine frames 17L and 17R. A second rectangular drive shaft 25 is drivingly coupled with the lower tractor assemblies and serves to drive said lower tractors. As described in U.S. Patent No. 3,006,502, and as is well known in the art, the drive shafts 19 and 25 are supported for rotation by the frames 17R and 17L and are simultaneously rotated to act through the tractor assemblies to advance the web 21. A type drum or printing cylinder 27 is rotatably supported by a pair of frames 29L and 29R carried by the main support frames 17L and 17R in a manner such that drum 27 can be rocked away from the web 21 to facilitate the loading of a web into the machine. Further details of the drum 27 and the drive apparatus therefor, as well as details of the actual printing apparatus and the drives for shafts 19 and 25, are not illustrated herein, since such apparatus is well known in the art and forms no part of the present invention.

A cable control system in accordance with a preferred embodiment of my invention, which controls the position of the right-hand set of tractors independently of the left-hand set of tractors, is illustrated in FIG. 2 of the drawings. The cabling and tractors are shown without including the other structural portions of the machine for simplicity and clarity of description. Upper cable 31 is connected to the left-hand side of tractor 11R through spring 33 and passes through hole 35 in tractor 11L. Cable 31 is next passed over stationary pulleys 37 and 39, which are mounted by any convenient fashion on the left-hand main machine frame 17L, is returned over the full width of the carriage, and is passed over stationary pulleys 41 and 43, which are mounted in any convenient fashion on the right-hand main machine frame 17R. The cable 31 is then wrapped several times around rotatable cylinder 45 and passed over stationary pulleys 47 and 49. The end of the cable 31 is connected to the right-hand side of tractor 11R.

Lower cable 51 is connected to the left-hand side of tractor 13R through spring 53 and passes through hole 55 in tractor 13L. Cable 51 is then passed over stationary pulleys 57 and 59, which are mounted in any convenient fashion onto machine frame 17L, returned to the right side of the carriage, and is passed over stationary pulley 61, which is mounted in any convenient fashion on right machine frame 17R. Cable 51 is then passed over movable pulley 63, wrapped around the rotatable cylinder 45, passed over movable pulley 65 and stationary pulley 67 and connected to the right side of tractor 13R. Movable pulleys 63 and 65 may be coupled to each other by means of turnbuckle 69, the sleeve 71 of which is rotatably mounted on the right-hand machine frame 17R by any convenient fashion, for instance, by collar 73, as shown in FIG. 3. Cables 31 and 51 must be wound on rotatable cylinder 45 in such a direction that tractors 11R and 13R are pulled in the same direction when cylinder 45 is rotated.

In operation, when cylinder 45 is rotated in a counter-clockwise direction, right-hand tractors 11R and 13R are pulled to the right at the same rate by cables 31 and 51, respectively. Left-hand tractors 11L and 13L, however, remain stationary, since the cables 31 and 51 pass through holes 35 and 55, respectively. To translate the right-hand tractors 11R and 13R to the left, the cylinder 45 is rotated in a clockwise direction. Thus, it is possible to position the right-hand set of tractors independently of the left-hand side.

Minor adjustments in the vertical alignment of the right-hand tractors 11R and 13R may be made by means of turnbuckle 69, which is best illustrated in FIG. 3. To adjust the vertical position of the tractors, sleeve 71 of turnbuckle 69 is rotated in collar 73. When sleeve 71 is

rotated, screw pieces 75 and 77 are simultaneously either extended or drawn into the sleeve 71. If screw pieces 75 and 77 are extended, the portion of the cable 51 wrapped around pulley 63 is loosened and the portion of cable 51 wrapped around pulley 65 is tightened, thereby keeping the same tension on the cable 51 but adjusting the position of the tractor 13R to the right. If the screw pieces 75 and 77 are drawn into sleeve 71, the tractor 13R is moved to the left. In the embodiment illustrated, the threads of the screw pieces 75 and 77 should be in opposite directions, that is, one must be a right-hand thread and the other a left-hand thread. Collar 73 holds sleeve 71 against axial motion.

The control knob 79 on rotatable cylinder 45 is shown for illustration purposes only, and any driving system may be used, another example being the belt drive shown in the above-mentioned patent to Wright. The spring 33 and 53, connected between the cables 31 and 51 and the tractors 11R and 13R, respectively, ensure that the cables are kept under tension so that they do not become slack with use.

FIG. 4 illustrates an embodiment of my invention in which the left and the right-hand sets of tractors are independently controlled by separate cable control systems. The operation of the system is substantially identical to that of the embodiment shown in FIG. 2, with the right-hand set of tractors 81R and 83R being controlled by cables 85 and 87, respectively, and rotatable cylinder 89, and the left-hand set of tractors 81L and 83L being controlled by cables 91 and 93, respectively, and rotatable cylinder 95. Cable 85 is connected to the left-hand side of tractor 81R through spring 97, is passed through a hole in tractor 81L, is then passed over fixed pulleys 99 and 101, which are mounted on the left machine frame (not shown) and returned to the right side of the carriage, where it is passed around stationary pulleys 103 and 105 and is wrapped around rotatable cylinder 89. Then it is passed over stationary pulleys 107 and 109, and is attached to the right-hand side of tractor 81R.

Cable 91 is attached to the left side of the upper left-hand tractor 81L, is passed around stationary pulleys 111 and 113, which are mounted on the left machine frame 17L and around movable pulley 115 and stationary pulley 117 on the right-hand side of the carriage. It is then wrapped around rotatable cylinder 95, passed over stationary pulley 119 and movable pulley 121, passed through a hole in tractor 81R, and is connected to the right-hand side of the tractor 81 through spring 123. Movable pulleys 115 and 121 are coupled by turnbuckle 125, which is used to adjust the vertical alignment of the left-hand set of tractors 81L and 83L in exactly the same manner described for turnbuckle 69 in FIGS. 2 and 3.

Cable 87 is connected to the left-hand side of the right lower tractor 83R through spring 127, is passed through a hole or slot in the left-hand tractor 83L, is wrapped over stationary pulleys 129 and 131, which are mounted on the left-hand machine frame, and is returned to the right-hand side of the carriage, where it is passed over movable pulley 133 and stationary pulley 135. It is then wrapped around the rotatable cylinder 89 and passed over stationary pulley 137, movable pulley 139, and attached to the right side of tractor 83R.

Cable 93 is connected to the left-hand side of the left lower tractor 83L, strung over stationary pulleys 141 and 143, which are mounted on the left machine frame. It is then passed over stationary pulleys 145 and 147, which are mounted on the right-hand machine frame 17R, is wrapped around rotatable cylinder 95, and is passed around stationary pulleys 149 and 151. Cable 93 is then passed through a hole or slot in tractor 83R and is connected to the right-hand side of tractor 83L, through spring 153. Movable pulleys 133 and 139 are coupled by turnbuckle 144, which is used to adjust the vertical alignment of right-hand tractors 81R and 83R.

In this embodiment, the clockwise rotation of cylinder

87 pulls right-hand tractors 81R and 83R to the right, by means of cables 85 and 87, respectively, and the counter-clockwise rotation of cylinder 89 pulls them to the left. The clockwise rotation of cylinder 95 pulls the left-hand set of tractors to the right by means of cables 91 and 93. Movement of the left-hand set of tractors is independent of that of the right-hand set, and vice versa, since the cables connected to one set of tractors are not coupled to the other set of tractors.

FIG. 5 illustrates an embodiment of my invention in which two webs of paper may be controlled in the same machine. The operation of the embodiment is essentially identical to that of the embodiment shown in FIG. 2, with tractors 155L, 155R, 157L, and 157R driving the right-hand paper web and the tractors 159L, 159R, 161L, and 161R driving the left-hand paper web. Cable 163, which controls the upper right-hand tractor for the right-hand web is connected to the left side of tractor 155R through spring 165, passed through holes in tractors 155L, 159R, and 159L, and is passed around stationary pulleys 167 and 169, movable pulley 171, stationary pulley 173, and rotatable cylinder 175. It is then passed over stationary pulley 177 and movable pulley 179, and is connected to the right-hand side of tractor 155R. Cable 181, which controls the lower right-hand tractor for the right-hand web is connected to the left-hand side of tractor 157R through spring 183, passed through holes in tractors 157L, 161R, and 161L, passed over stationary pulleys 185, 187, 189, and 191, and is wrapped around rotatable cylinder 175. The cable 181 is then passed over stationary pulleys 193 and 195 and is connected to the left-hand side of right-hand tractor 157R.

Cable 197 controls the upper right-hand tractor for the left paper web and is connected to the left-hand side of tractor 159R through spring 198, passed through a hole in tractor 159L, passed over stationary pulleys 199, 201, 203, and 205, and is wrapped around rotatable cylinder 207. Cable 197 is then passed over stationary pulleys 209 and 211, through holes in tractors 155R and 155L, and is connected to the right-hand side of tractor 159R. Cable 213 controls the lower right-hand side of tractor 161R for the left-hand web and is connected to the left side of tractor 161L, is passed over stationary pulleys 217 and 219, movable pulley 221, stationary pulley 223, and is wrapped around rotatable cylinder 207. The cable is then passed over stationary pulley 225, movable pulley 227, through holes in tractors 157R and 157L, and is connected to the right-hand side of tractor 161R.

Movable pulleys 171 and 179 for the upper set of tractors, and movable pulleys 221 and 227 for the lower set of tractors are connected by turnbuckles 229 and 231, respectively. These turnbuckles function in the same fashion as was described in connection with FIGS. 2 and 3 and are used to adjust the vertical alignment of the right-hand tractors for each web. Rotatable cylinders 175 and 207 may be controlled by any convenient drive means, for example, the belt system shown in simplified form. Stationary pulleys 167, 169, 185, 187, 199, 201, 217, and 219 are mounted on the left-hand machine frame in any convenient fashion. Stationary pulleys 173, 177, 189, 191, 193, 195, 203, 205, 209, 211, 223, and 225 are mounted on the right-hand machine frame in any convenient fashion. Turnbuckles 229 and 231 are mounted by means of collars (not shown) to the right-hand machine frame in exactly the same manner as described for FIG. 3. Rotatable cylinder 207, cables 197 and 213, control the right-hand set of tractors for the left-hand web and rotatable cylinder 175, cables 163 and 181 control the right-hand set of tractors for the right-hand web.

The exact location and method of mounting the pulleys, turnbuckles, and rotatable cylinders onto the machine have not been shown, because they are matters of design only and would be obvious to one skilled in the art. Cables have been shown as passing through holes in the

tractors to which they are not coupled for ease of presentation only, and this should not be taken as a limitation on my invention. Obviously an arrangement could be made with the pulleys or by other means whereby the cables would pass around the tractors, rather than through holes or slots in them.

It is to be understood that the foregoing description of the illustrated embodiments of my invention is for purposes of illustration only, and as will be obvious to one skilled in the art, my invention might find uses in other systems and embodiments.

I claim:

1. In a high speed printer having pairs of paper feeding tractors slidably mounted on the carriage of said printer above and below the platen for feeding a web of paper through said printer, apparatus for varying the separation of said tractors to accept webs of varying widths comprising:

rotatable cylinder means,

first and second sets of pulley means, and

first and second flexible cables having their ends attached to opposite sides of the upper and lower tractors on one side of said carriage, respectively, and bypassing the tractors on the other side of said carriage, said cables passing over said first and second sets of pulley means respectively, and around said cylinder means for translating said tractors on said one side of said carriage along said carriage in the same direction and at the same rate by rotation of said cylinder means.

2. The apparatus of claim 1 further including means coupled to one of said sets of pulley means for vertically aligning the tractors on said one side of said carriage.

3. The apparatus of claim 1 wherein said sets of pulley means are disposed for allowing translation of the tractors on said one side of said carriage over substantially the entire width of said carriage.

4. The apparatus of claim 1 further including resilient tensioning means connecting one end of said cables to one side of said tractors on said one side of said carriage for preventing slackness in said cables.

5. The apparatus of claim 1 further including

second rotatable cylinder means,

third and fourth sets of pulley means, and

third and fourth flexible cables having their ends attached to opposite sides of the upper and lower tractors on the other side of said carriage respectively, and bypassing the tractors on the one side of said carriage, said third and fourth cables passing over said third and fourth sets of pulley means, respectively, and around said second rotatable cylinder means for translating said tractors on said other side of said carriage along said carriage in the same direction and at the same rate of rotation of said second cylinder means.

6. Apparatus for independently controlling the width of separation of a plurality of sets of paper feeding tractors, said sets of tractors being slidably mounted on the carriage of a high speed printer for feeding webs of paper independently and simultaneously through said printer, each of said sets including pairs of tractors arranged above and below the platen for cooperation with the edge portions of said paper webs comprising:

a rotatable cylinder for each of said sets of tractors, and

a pair of cables for each of said sets of tractors, the ends of said cables being attached to opposite sides of the upper and lower tractors which cooperate with one edge of a paper web, said cables being wrapped around the associated cylinder for translating said attached tractors along the carriage of said printer in the same direction and at the same rates upon rotation of said cylinder.

7. Apparatus for controlling the width of separation of a set of web feeding tractors, said set including an upper and a lower pair of tractors, each of said pairs being ar-

ranged for cooperation with the edge portions of said web, comprising:

- rotatable cylinder means,
- first flexible cable means having its ends attached to opposite sides of one of said upper pair of tractors, 5 and
- second flexible cable means having its ends attached to opposite sides of the one of the lower pair of tractors which cooperates with the same edge of said web as said attached upper tractor, said cable means by-passing the other tractors of their respective pairs 10

and being wrapped around said rotatable cylinder for translating said attached tractors in the same direction perpendicular to the path of said web and at the same rate upon rotation of said cylinder means.

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10 ALLEN N. KNOWLES, *Primary Examiner*.