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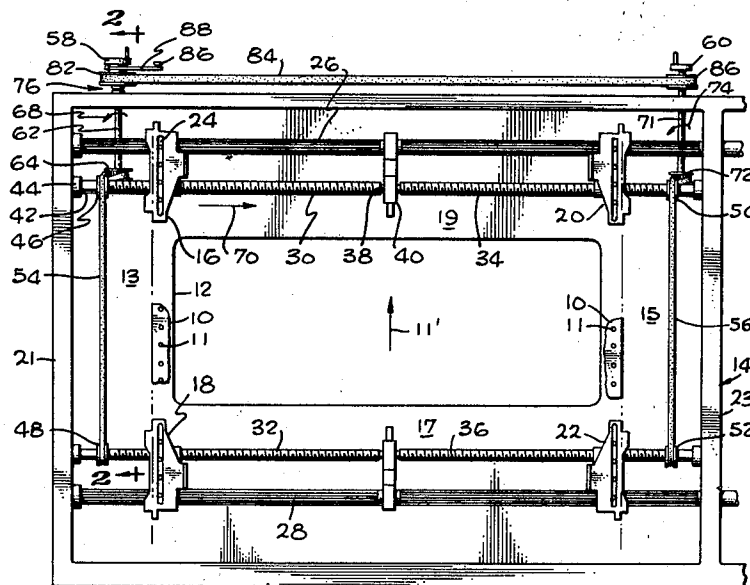
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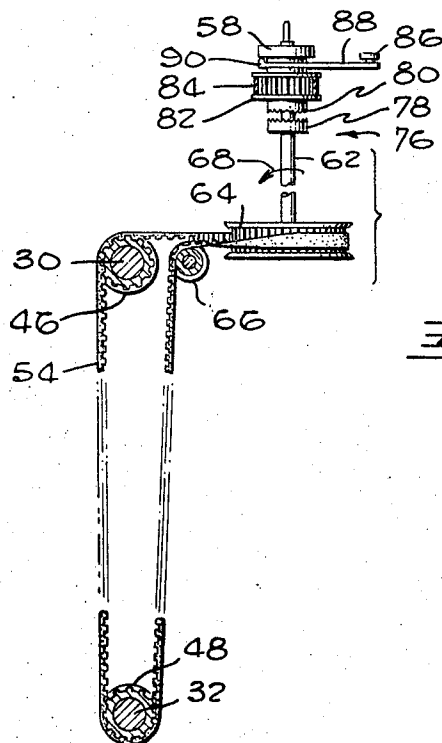
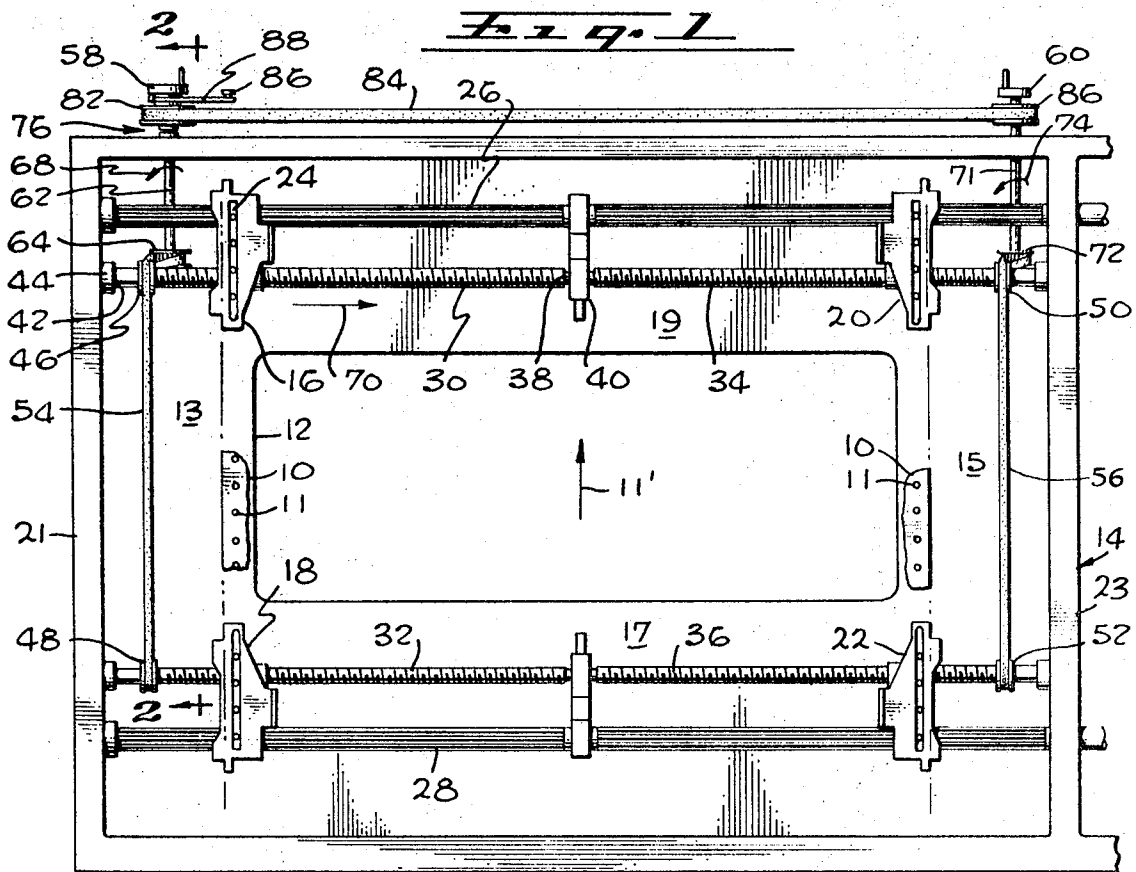
[54] **PAPER ADJUSTING MECHANISM**
1 Claim, 2 Drawing Figs.

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ABSTRACT: Apparatus for use with a high speed printer which has four tractors that engage sprocket holes in the paper, to adjust for different paper widths or to adjust the lateral position of the paper. The apparatus comprises a pair of lead screws on each side of the printer, each lead screw coupled to one tractor. A pair of timing belts couple together the two lead screws on each side of the printer so that the tractors on each side move laterally together. A handwheel on the printer can be engaged either with only one belt to laterally move only the pair of tractors on one side of the printer, or with both belts to move all four tractors together.





PAPER ADJUSTING MECHANISM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to printing apparatus, and more particularly to paper transports therefor.

2. Description of the Prior Art

Modern high speed printers are capable of printing at speeds in excess of 1,000 lines per minute. In order to facilitate accurate advancement of the paper, many printers use paper with sprocket holes along the edges. The printer uses four tractors for holding the paper taut during printing thereon, and for advancing the paper after each line is printed. One pair of tractors lies at each edge of the paper, with one tractor of each pair positioned behind the area at which characters are printed and the other in front of this area.

The printers generally require the provision of means for moving the tractors laterally. The lateral tension of the paper can be adjusted by laterally moving only the pair of tractors on one edge of the paper. Such lateral movement of only one pair of tractors can also be used to adjust for different widths of paper. On the other hand, the lateral position of the paper can be adjusted without changing the tension by lateral movement of both pairs of tractors simultaneously. The printers generally require means for easily accomplishing either of these types of adjustments.

Relatively uncomplicated mechanisms could be devised for moving two tractors together. However, the design of mechanisms for moving all four tractors in either of two modes, to adjust for either tension or position, is not easily accomplished. The difficulty is especially great in high speed printers because of the need for high accuracy in alignment of the tractors. Various cable systems have been proposed for simultaneous lateral tractor movement, with special tensioning devices to assure maintenance of tractor position. However, the great complexity of these systems resulted in high cost and reduced reliability.

OBJECTS AND SUMMARY OF THE INVENTION

One object of the present invention is to provide apparatus for facilitating the adjustment of paper holding tractors in a printer.

Another object is to provide apparatus for enabling the adjustment of lateral paper tension and width, or of paper position, from a single location on a printer.

In accordance with the present invention, apparatus is provided which enables the adjustment of the four paper-holding tractors on a printer transport. The tractors can be moved to change lateral paper tension and width, or to change the position of the paper without affecting tension. The apparatus comprises four lead screws, each coupled to one of the paper-holding tractors to move it laterally. Each pair of lead screws on one side of the paper path are connected together by a chain drive, or cogged belt which is often referred to as a timing belt. This assures that the two tractors on each side of the paper path move laterally by the same amount, to avoid skewing of the paper.

The two pairs of lead screw drives are coupled together through a clutch. Engagement of the clutch assures that all four lead screws rotate the same amount, so that the lateral separation of the pairs of tractors is constant and lateral paper tension is not changed. Disengagement of the clutch enables only one pair of tractors to move while the other pair remains stationary, thereby changing lateral paper tension or effective paper width without changing the position of one edge of the paper.

In one embodiment of the invention, a handcrank is mounted on each side of the printer. Each handcrank is coupled to the timing belt which rotates the two lead screws on the same side of the printer. A third timing belt extends laterally across the printer to couple the two handcranks together through a clutch. When the clutch is engaged, rotation of either handcrank rotates all four lead screws, and when

it is disengaged, rotation of one handcrank rotates only one pair of lead screws. The clutch is mounted adjacent to one of the handcranks, so complete control of adjustment can be made from that position on the printer.

The novel features of the invention are set forth with particularity in the appended claims. The invention will best be understood from the following description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial front elevation view of a printer, showing the paper adjusting apparatus of the invention; and FIG. 2 is a partial view taken on the line 2-2 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 illustrates a portion of a high speed line printer which utilizes a paper strip, indicated at 10, which has sprocket holes 11 at opposite edges. The paper is removed from a folded stack and advanced in the direction of arrow 11' past an opening 12 in a frame 14, where a bank of hammers strike the paper against an inked ribbon and character drum to print characters on the paper. The opening 12 defines the printing area which has laterally spaced sides 13 and 15, and up-path and down-path ends 17 and 19, respectively. The area of paper being printed upon is held taut by four tractors 16, 18, 20 and 22, which form the corners of a rectangle. The printing hammer apparatus and character drum apparatus are well known in the art and therefore are not shown.

Each tractor has a sprocket chain 24 which has sprockets engaged with the sprocket holes 11 in the paper. The sprocket chains 24 are engaged with a pair of splined shafts 26 and 28 which are driven by a motor (not shown). After each line of characters is printed, the splined shafts 26, 28 are rotated a predetermined amount and stopped. This advanced the sprocket chains 24 and therefore the paper strip 10 by one or more lines.

The printer is designed to vary the margins along the sides of the paper. This is most easily accomplished by moving all four tractors laterally in synchronism. The printer is also designed for use with a variety of paper widths. The printer can be set to receive a different width of paper while maintaining the same margin at one edge of the paper, by moving only the pair of tractors on the other edge of the paper. Thus, positioning apparatus is desired which can selectively move either all four tractors in synchronism, or only one pair of tractors at one edge of the paper. After any tractor movement, the tractors must remain stationary until it is desired to effect a further movement.

In accordance with the invention, tractor positioning apparatus is provided comprising four lead screws 30, 32, 34 and 36. Each lead screw has one end 38 rotatably mounted on a center bearing 40 which is fixed to the machine frame 14, and an opposite end 42 rotatably supported on an end bearing 44 on the frame. Sprocket wheels or pulleys 46, 48, 50 and 52 are fixed to each lead screw 30, 32, 34 and 36 to enable turning of the screw. A timing belt 54 extends between the two sprocket wheels 46 and 48 on one side of the frame, to rotate the lead screws 30 and 32 by the same amount at all times. The timing belt is a bed with cogs at uniform intervals along its length to prevent slippage. Another timing belt 56 extends between the other two sprocket wheels 50 and 52 to assure rotation of the other two lead screws 34 and 36 by the same amount. The two timing belts 54 and 56 assure that the pairs of tractors on each side of the printer move laterally in synchronism, to prevent skewing of the paper. Instead of cogged or timing belts, chain belts or other elongated flexible power transmission members can be used which have sprockets or the like along their length to prevent slippage, any of which may be referred to as timing belt means.

Power for laterally moving the tractors is applied through two handcranks 58 and 60 that are mounted on either side of the frame to provide knobs for hand turning. The crank 58 is

fixed to one end of a shaft 62 which is rotatably mounted on the frame. The opposite end of the shaft is fixed to a driving sprocket wheel 64. As shown in FIG. 2, the timing belt 54 extends around a guide roller 66 to the sprocket wheel 64. The cogs or sprockets on the timing belt 54 are engaged with the three sprocket wheels 46, 48, and 64. Rotation of the handcrank 58 in the direction of the arrow 68 rotates the sprocket wheels 46 and 48 in the clockwise direction, as seen in FIG. 2. The two lead screws 30 and 32 then rotate synchronously and move the tractors 16 and 18 inwardly in the direction of the arrow 70 shown in FIG. 1. Of course, instead of using handcranks as the driving means, electric motors or the like can be used.

The other crank 60 on the other side of the frame is fixed to a shaft 71 which is fixed to a sprocket wheel 72. The wheel 72 is coupled to the two wheels 50 and 52 on the lead screws 34 and 36 through the timing belt 56, which extends over another guide roller (not shown) in the same manner as the apparatus shown in FIG. 2. The pitch of each of the lead screws 34 and 36 is in a direction such that rotation of the handcrank shaft 71 in the direction of the arrow 74 causes the tractors 20 and 22 to move in the direction of the arrow 70.

The two shafts 62 and 71 which are fixed to the handcranks can be coupled together through a clutch 76 which is mounted on the shaft 62. The clutch includes a lower clutch element 78 which is fixed to the shaft 62, and an upper clutch element 80 which is rotatably mounted on the shaft. A sprocket wheel 82 is fixed to the upper clutch element and it drives a timing belt 84. The timing belt 84 extends to the opposite side of the frame, where it is engaged with another sprocket wheel 86 which is fixed to the other handcrank shaft 71.

When the clutch elements 78 and 80 are engaged and the crank 58 is turned in the direction of arrow 68, the side of bed 84 which is shown in FIG. 1 moves opposite to the direction of arrow 70, and all four tractors 16 through 22 move in the direction of arrow 70. Engagement of the clutch elements is accomplished by pressing down the end of a clutch engaging lever 88. An inner end 90 of the lever bears against the lower surface of the handcrank 58, while the center of the lever is engaged with the sprocket wheel 82. Pressing down the end of the lever 88 moves down the sprocket wheel 82 and upper clutch element 80, and results in engagement of the clutch.

If it is desired to adjust the tension of the paper strip 10, either one of the handcranks 58 or 60 may be turned, to move only the pair of tractors on one side of the frame. In this case, the clutch elements are not engaged. Similarly, in order to alter the separation of the tractors so as to accept a different width of paper in the printer, only one handcrank is turned while the clutch is disengaged. If it is desired to maintain the margin at side 21 of the printer constant, then only crank 60 is turned. Conversely, rotation of crank 58 changes the lateral tractor separation while maintaining the margin at side 23 constant.

If it is desired to shift both sets of tractors in either direction, then the clutch 76 is engaged during all handwheel rotations. This can be performed easily by rotating the handcrank 58 while the end of the clutch engaging lever 88 is pressed down. The fact that the clutch and handwheel are at the same position on the printer facilitates such operation. The lead screws hold the tractors in position after any adjust-

ment. Movement of the pair of tractors on either side of the frame, and of both pairs of tractors together is accomplished with high precision because of the use of the timing belts and lead screws. The timing belts assure that all lead screws rotate by the same amount within less than a few degrees of each other. For standard coarse pitch lead screws, rotation of all screws by the same amount within several degrees of each other assures that lateral translation of the tractors is synchronized within several thousandths of an inch. Thus, high accuracy is realized with a relatively simple and reliable tractor adjusting apparatus, and yet, the apparatus is highly versatile in allowing shifting of either or both pairs of tractors.

Although particular embodiments of the invention have been described and illustrated herein, it is recognized that modifications and variations may readily occur to those skilled in the art, and, consequently, it is intended that the claims be interpreted to cover such modifications and equivalents.

I claim:

1. Apparatus for adjusting the position of paper-holding tractors in a printer comprising:

- a frame with first and second sides, defining a printing area having first and second laterally displaced sides nearest said first and second sides of said frame, respectively, and having up-path and down-path ends;
- a first pair of tractors disposed on said first side of said frame, one at said up-path end and the other at said down-path end thereof;
- a second pair of tractors disposed on said second side of said path, one at said up-path end and the other at said down-path end;
- a first pair of lead screws rotatably mounted on said frame and extending laterally thereon, each threadably engaged with one of said tractors of said first pair of tractors;
- a second pair of lead screws rotatably mounted on said frame and extending laterally thereon, each threadably engaged with one of said tractors of said second pair of tractors;
- first driving means located on said first side of said printing area including a shaft rotatably mounted on said frame about an axis substantially perpendicular to the axes of rotation of said first pair of lead screws, a first sprocket wheel mounted on said shaft, and means for receiving hand-turning forces to rotate said shaft by an operator who is positioned at said first side of said frame;
- second and third sprocket wheels, each fixed to one of said lead screws of said first pair of lead screws;
- a timing belt with sprockets spaced therealong, said belt constructed to permit twisting at least about 90° about its length, and said belt extending about said first, second and third sprocket wheels;
- second timing belt means coupled to each of said lead screws of said second pair of lead screws;
- second manually operable driving means located on said second side of said printing area for driving said second timing belt means, to enable shifting of said second pair of tractors by an operator at said second side of said frame; and
- clutch means for selectively engaging said first and second driving means.