

Sept. 10, 1968

N. McMILLAN ET AL

3,400,800

PRINTING RIBBON SUPPORT APPARATUS INCLUDING RIBBON GUIDE MEANS

Filed Aug. 16, 1965

2 Sheets-Sheet 1

Fig. 1

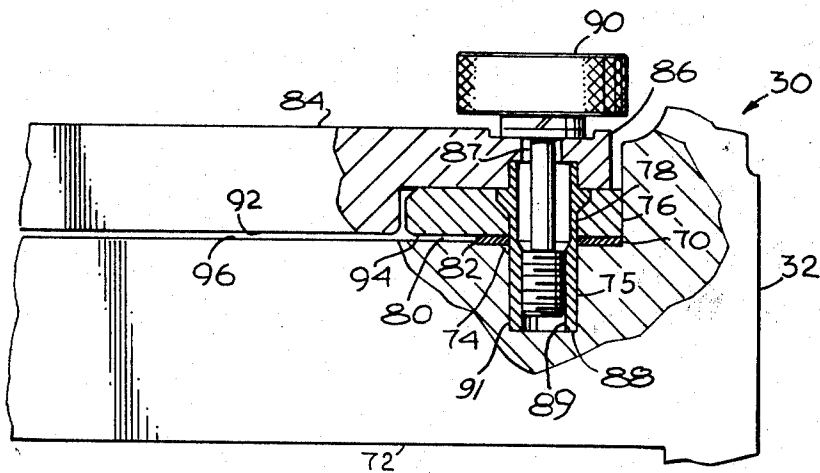
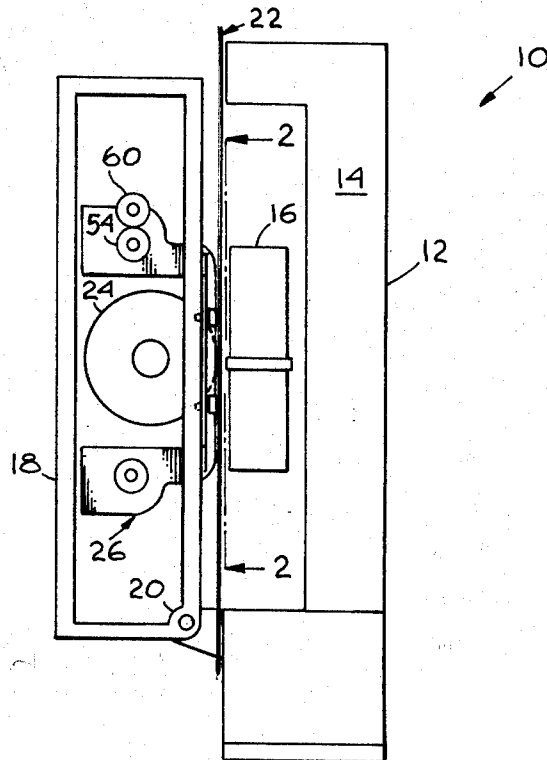


Fig. 4

INVENTORS
NORMAN McMILLAN
CLAUDE H FORET
BY *Samuel Lindenberg*
Arthur Freilich
ATTORNEYS

Sept. 10, 1968

N. McMILLAN ETAL

3,400,800

PRINTING RIBBON SUPPORT APPARATUS INCLUDING RIBBON GUIDE MEANS

Filed Aug. 16, 1965

2 Sheets-Sheet 2

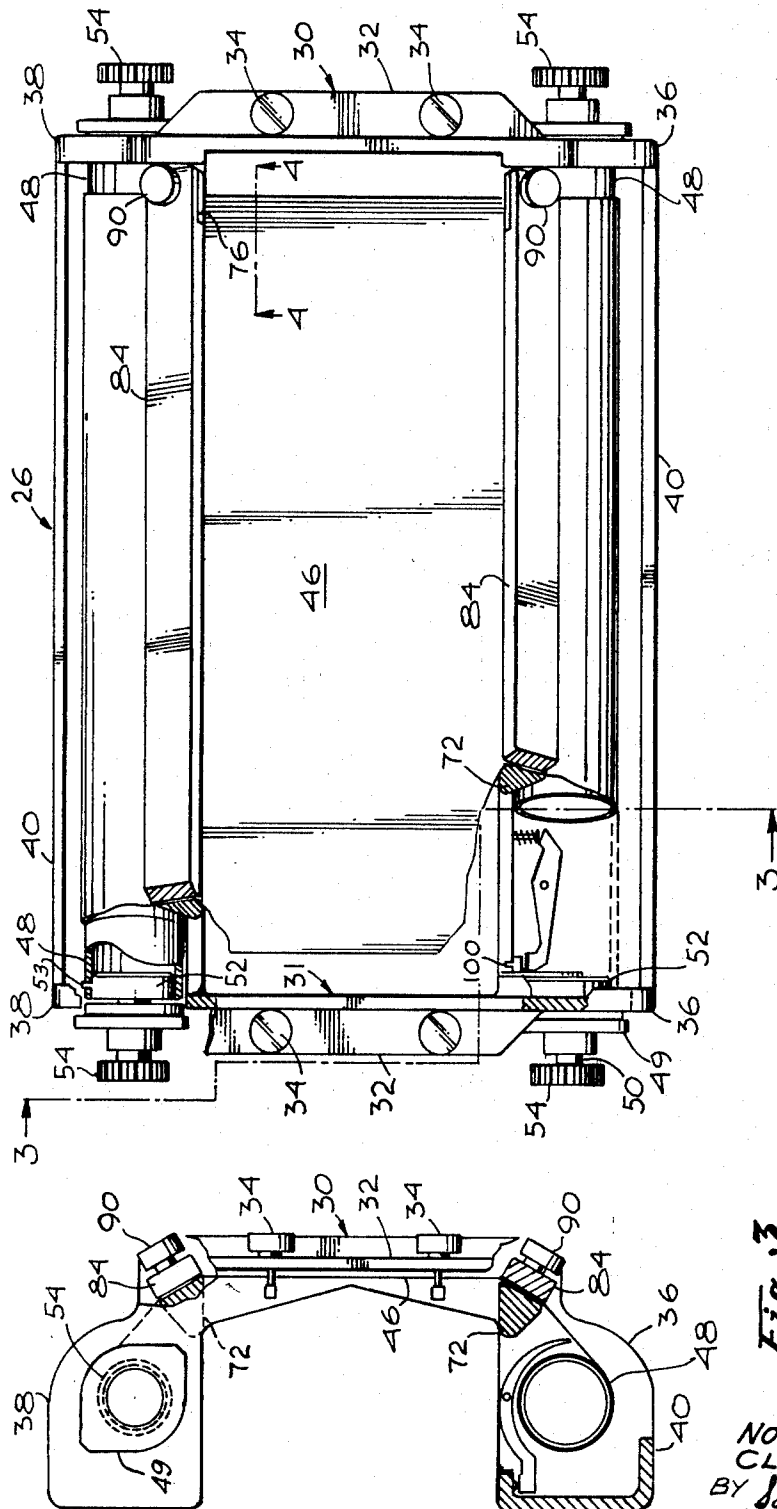


Fig. 2

Fig. 3

INVENTORS
NORMAN McMILLAN
CLAUDE H. FORET
BY *Samuel Lindenberg*
Arthur Fredrich
ATTORNEYS

1

2

3,400,800

PRINTING RIBBON SUPPORT APPARATUS INCLUDING RIBBON GUIDE MEANS

Norman McMillan, Santa Monica, Calif., and Claude H. Foret, Toulon, France, assignors to Data Products Corporation, Culver City, Calif., a corporation of Delaware
Filed Aug. 16, 1965, Ser. No. 479,707
3 Claims. (Cl. 197—151)

ABSTRACT OF THE DISCLOSURE

An apparatus for supporting a printing ribbon for use in a high speed printing system in which the ribbon is moved between a hammer bank and a rotatable character drum. The apparatus includes first and second spaced rotatably mounted mandrels for respectively carrying first and second tubes to which opposite ends of a wide printing ribbon are secured. Guide means are provided adjacent the ribbon edge for preventing lateral ribbon movement. Additionally, closely spaced guide bars are disposed adjacent opposite surfaces of the ribbon for preventing the ribbon from folding upon itself as a reaction to the restricted lateral movement.

This invention relates generally to high speed printing apparatus and more particularly to means for mounting and controlling a printing ribbon used therein.

High speed line printers are now employed in most data processing systems for providing hard copy output. Most of these printers employ a rotating drum having a plurality of tracks thereon, each track including an identical set of raised characters. A hammer bank including one hammer for each track is usually positioned opposite to the drum. The hammers are selectively actuatable so that any hammer can be caused to strike any one of the characters in the track opposite thereto. Paper which is to be printed upon is disposed between the hammer bank and the drum and a printing ribbon is usually disposed between the paper and the drum. In operation, the paper is usually moved one line at a time past the hammer bank. At each line position, a full line is printed by actuating each hammer at the appropriate time depending upon the character desired to be printed. Since a full character set will pass each hammer during each drum revolution, a single revolution is all that is required to print a full line. The ribbon of course should also be moved in order to maximize the ribbon life.

In some printers, a narrow ribbon similar to a typewriter ribbon, is moved parallel to the drum axis or in other words perpendicular to the paper movement. It has been found however that ribbons of this sort have a very short life in high speed printers, oftentimes having to be changed once for every hour of operation. In order to extend the time between ribbon changes, efforts have been made to use wide ribbons which are incrementally moved in the same direction as the paper. Although wide ribbons can have a much greater area than narrow ribbons and thus a much longer life, it has in the past been difficult to properly roll the ribbon between two cylindrical mandrels to which the ribbon ends are secured. More particularly, because of unevenly distributed pounding on the ribbon by the hammers, the ribbon tends to deform and perhaps roll up in a skewed, rather than even, manner on the mandrels. In order to avoid this, it has been common practice to employ sensors which detect the position of the ribbon edge and a servo system for moving the axis of at least one of the mandrels to correct improper rolling. The use of such a servo system introduces undesired complexity and costs.

In view of the foregoing, it is an object of the present

invention to provide apparatus for evenly rolling a printing ribbon or the like onto a rotating mandrel. Although the invention finds primary utility in high speed printing apparatus, it is also useful for evenly rolling any compliant material; e.g. the invention may be useful in textile manufacturing machines.

Briefly, the invention is based upon the recognition that a ribbon can be pulled evenly onto a rotating mandrel if both its lateral and vertical movement are restricted. That is, by providing a guide surface at the ribbon edge, the ribbon will be prevented from moving laterally. As a reaction thereto, the ribbon will normally tend to fold upon itself at some point spaced from the edge. However, in accordance with the present invention, a pair of guide bars are provided which are spaced from one another by slightly more than the ribbon thickness thus preventing the ribbon from folding upon itself. In other words, the full width of the ribbon is prevented from moving substantially perpendicularly to a plane which is substantially tangential to the mandrels.

In accordance with a further aspect of the present invention, the ribbon is carried by a frame or cassette which can be easily mounted on and removed from a door of the printer apparatus. When the ribbon frame is locked in position on the door, driving means will be coupled to the empty mandrel to cause it to pull the ribbon thereon from the full mandrel. When the door is in a closed position, the ribbon frame will properly position the ribbon between the hammer bank and character drum.

The novel features that are considered characteristic of this invention are set forth with particularity in the appended claims. The invention itself both as to its organization and method of operation, as well as additional objects and advantages thereof, will best be understood from the following description when read in connection with the accompanying drawing, in which:

FIGURE 1 is a side sectional view of a printer apparatus employing the teachings of the present invention;

FIGURE 2 is a vertical sectional view taken substantially along the plane 2—2 of FIGURE 1;

FIGURE 3 is a vertical sectional view taken substantially along the plane 3—3 of FIGURE 2; and

FIGURE 4 is an enlarged vertical sectional view taken substantially along the plane 4—4 of FIGURE 2.

Attention is now called to FIGURE 1 of the drawing which illustrates a high speed printer apparatus 10 constructed in accordance with the present invention. The apparatus 10 includes a main frame 12 defining a compartment 14 therein in which is mounted a bank 16 of individually actuatable hammers. The hammer bank 16 is supported near the open end of the compartment 14 opposite to a door 18 hinged to the frame 12 at 20. The door 18 is movable between the closed or vertical operative position illustrated in FIGURE 1 and an open or horizontal inoperative position.

A paper drive means (not shown) is provided for driving paper 22 to be printed upon past the hammer bank 16. A rotatable character drum 24 is carried by the door 18. When the door 18 is closed, the horizontal diameter of the drum 24 is substantially in alignment with all of the hammers in the bank 16. A printing ribbon frame or cassette 26 is also carried by the door 18 for the purpose of moving an inked printing ribbon between the drum 24 and the paper 22. In the operation of the apparatus of FIGURE 1, the paper 22 is incrementally moved past the hammer bank 16 one line at a time. At each line position, each of the hammers in the bank corresponding to a character to be printed on that line is actuated at the appropriate time to propel the hammer against the paper which in turn pushes the ribbon against the selected character to thus form an impression on the ribbon side of the paper.

The printing ribbon frame 26 preferably comprises an integrated casting including a pair of U-shaped end pieces 30, 31. Each of the end pieces 30, 31 includes a bight portion 32 carrying a pair of captive bolts 34. Each of the end pieces 30, 31 in addition has a pair of depending ears 36 and 38. The end pieces 30, 31 are connected by cross bars 40.

Wide printing ribbons 46 of the type shown in FIGURE 2 are commercially available and are usually provided with each of their ends secured to a hollow tube or mandrel 48. The tubes 48 are oftentimes made of cardboard or some other inexpensive and disposable material.

Each of the ears 36 and 38 defines an aperture extending therethrough. A flange plate 49 is secured to the outer surface of each of the ears in alignment with the aperture. A shaft 50 extends through the plate 49 and ear aperture and is mounted for rotation therein. A core 52 is secured to the inner end of each shaft 50 and a drive gear 54 is secured to the outer end thereof. The cores 52 are adapted to extend into the hollow tubes 48. Each of the cores 52 is provided with one or more teeth 53 engageable with slots (not shown) formed in the tube ends. Spring means (not shown) are provided for normally urging the cores 52 inwardly away from end pieces 30, 31. The spring means permit the shafts 50 to be pulled outwardly to withdraw cores 52 from tubes 48.

The printing ribbon frame 26 is adapted to be secured to the door 18 by the captive bolts 34 which are received within captive nuts secured to structural members (not shown) retained on the door 18. When the printing ribbon frame 26 is so secured, the gears 54 on one of the tubes 48 will be engaged with a gear 60 coupled to a source of drive power (not shown). Thus, one of the tubes 48 can be driven in a direction to pull the ribbon 46 off of the other tube and onto itself.

It is to be noted that a gear 54 is provided on each of the four cores even though only one gear need be used at any one time and only two gears need be employed as long as the ribbon frame remains in one position, one gear for driving the ribbon in each of two opposite directions. The four gears 54 are provided, however in order to make the ribbon frame symmetric such that it can be properly installed in either of two opposite positions. As a consequence, if printing is primarily along one side of the paper, the ribbon frame can be reversed after a period in order to more evenly wear the ribbon.

In order to assure that the ribbon rolls squarely onto the pulling tube, a guide surface is provided for guiding the ribbon edge. More particularly, a shim 70 (FIGURE 4) is secured to the upper surface of each of the two lower guide bars 72 at the ends thereof. The guide bars 72 extend between the end pieces 30, 31. The shim 70 defines a central aperture 74 which is aligned with an aperture 75 formed in the bar 72. A plate 76 is secured to the shim 70 and also defines an aperture 78 aligned with apertures 74 and 75.

The plate 76, shim 70 and lower guide bar 72 effectively form a U-shaped structure defining a central trough space 80. The shim 70 therefore comprises the bight portion of the defined U-shaped structure and defines an inner bight surface 82 which functions to guide the edge of the ribbon. It is significant that no crevices are defined between the plate 76 and shim 70 or between the shim 70 and lower guide bar 72. Thus, the edge of the ribbon 46 is restrained from moving laterally.

In prior art arrangements where edge guides have been employed to cause a material to roll evenly, the material usually reacts by folding over upon itself at some point spaced from the ribbon edge. In order to prevent this from occurring, a pair of upper guide bars 84 are provided. Each of the upper guide bars 84 has a reduced end 86 which defines an aperture 87 therein which is adapted to be seated over the aperture 78 in plate 76. An insert 88 which has an internally threaded lower end 89 is received in the aligned apertures 74, 75, 78, 87. A

captive bolt 90 is carried by the end 86 of each upper guide bar 84 and is adapted to be threaded into the lower end 89 of the insert 88. The upper end of the aperture 87 is reduced to prevent the enlarged end 91 of the bolt 90 from being withdrawn therethrough.

The lower surface 92 of the upper guide bars 84 is in substantial alignment with the lower surface 94 of the plates 76. Both of these lower surfaces are spaced from the upper surface 96 of the lower guide bar 72 by a distance only slightly greater than the thickness of the ribbon 46. Accordingly, by defining a gap between the upper guide bar lower surface and the lower guide bar upper surface which is only slightly greater than the thickness of the ribbon, any movement of the ribbon in a direction other than in a plane substantially tangential to the tubes 48 is prevented.

From the foregoing, it should be appreciated that an apparatus has been shown herein which enables a printing ribbon or any other sheet material to be evenly or squarely rolled onto a tube or mandrel. Essentially even rolling is assured by providing both an edge guide surface 82 and upper and lower guide surfaces 92, 96 across the width of the ribbon which are spaced by a distance only slightly greater than the thickness of the ribbon. By utilizing a wide ribbon, longer ribbon life is assured. In order to maximize ribbon life however, means are also usually provided for reversing the ribbon drive after it is completely driven in one direction. Thus, a metal bar is usually sewn into a pocket a short distance from each end of the ribbon. When this metal bar is drawn off of the tube, it engages an actuator arm 100 (FIGURE 2) which in turn couples the driving means (not shown) to the gear 54 on the previously non-driven tube 48. After the ribbon has been run in each direction several times, it will of course become necessary to replace it. Inasmuch as the printing ribbon frame 26 can be easily removed from the door 18, replacement of the ribbon is very simple. That is, by loosening the captive bolts 34, the entire printing ribbon frame 30 can be detached from the door 18. The upper guide bar 84 can then be removed by unscrewing captive bolts 90 from insert 88. By then withdrawing the cores 52 from the tubes 48, the tubes 48 can merely be lifted from the frame 30 and thrown away. A new ribbon secured to a new pair of tubes 48 can then be inserted on the cores 52. Alternatively, inasmuch as the ribbon frame is symmetric, where printing primarily occurs on one side, e.g. the left side, of the ribbon, the frame can be removed from the door and then replaced in a reverse manner to permit subsequent printing primarily using the other side of the ribbon.

What is claimed is:

1. A high speed printing apparatus comprising:

a character drum having a longitudinal axis;
means supporting said drum for rotation about said longitudinal axis;

a hammer bank;

means supporting said hammer bank in spaced opposed relationship with respect to said character drum;
first and second spaced mandrels;

means supporting said mandrels for rotational movement about respective axes each extending substantially parallel to said drum longitudinal axis, each mandrel having a dimension along its axis substantially equal to the dimension of said drum along its longitudinal axis;

a printing ribbon having first and second ends respectively secured to said first and second mandrels, said printing ribbon having a width substantially equal to the dimension of said drum along its longitudinal axis;

first and second spaced guide bars each having a length at least equal to the width of said ribbon;

means supporting said guide bars substantially parallel to said drum longitudinal axis adjacent a first surface of said ribbon for directing said ribbon along a

5

path which extends between said hammer bank and said character drum substantially tangential to the surface of said drum;

third and fourth spaced guide bars each having a length at least equal to the width of said ribbon;

means releasably operatively connecting said third and fourth guide bars to said first and second guide bars respectively proximate to each end thereof adjacent to a second surface of said ribbon; and

means respectively disposed between said first and third guide bars and between said second and fourth guide bars for spacing said guide bars by a distance only slightly greater than the thickness of said ribbon and for defining a guide surface means adjacent each edge of said ribbon for preventing movement of said ribbon in a direction parallel to said drum longitudinal axis.

2. The apparatus of claim 1 wherein said guide surface means includes at least one structural element forming a U-shaped member defining a trough space; and

6

means supporting said U-shaped member adjacent said ribbon edge so that said ribbon extends into said trough space.

3. The apparatus of claim 1 wherein said printing apparatus includes a door mounted for movement toward and away from said hammer bank; and

means supporting at least said character drum and said first and second mandrels on said door.

References Cited

UNITED STATES PATENTS

1,849,921	3/1932	Green	101—96
2,725,819	12/1955	Floyd et al.	101—107
3,090,299	5/1963	Comstock	101—100
3,200,740	8/1965	Schaller et al.	101—96
3,313,391	4/1967	Hyjek	197—172

ROBERT E. PULFREY, *Primary Examiner.*

20 E. T. WRIGHT, *Assistant Examiner.*