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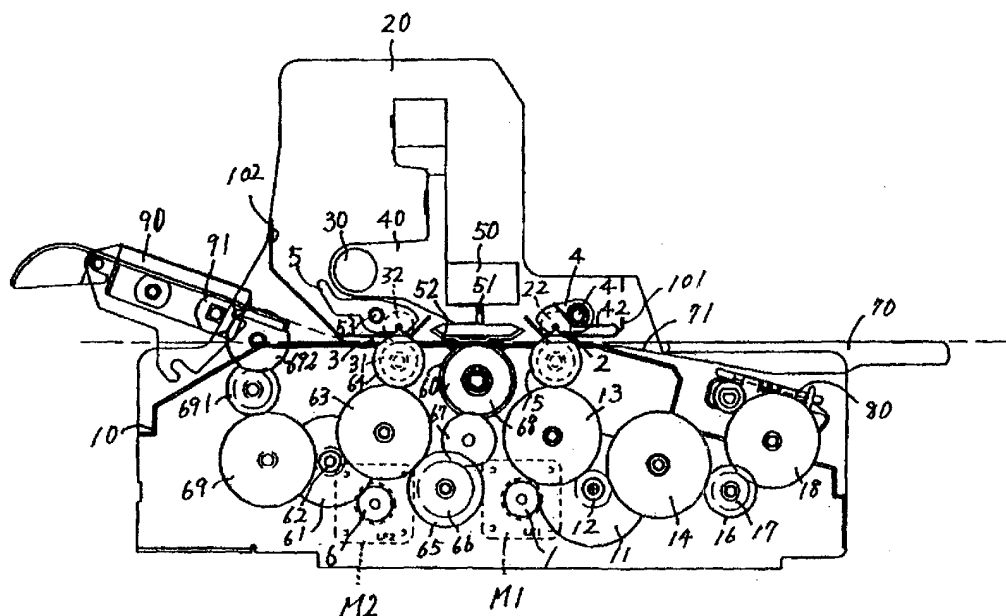
(54) **Printer**

(57) [Purpose] Ensuring that a suitable tension is always applied to paper fed from whichever side (front side or rear side) of a platen.

[Solution] A first conveyor roller assembly (2) (a drive roller (21), a pressure roller (22)) and a second conveyor roller assembly (3) (a drive roller (31), a pressure roller (32)) for clampingly conveying paper are disposed at respective places upstream from and downstream from a printing station including a print head (50)

and a platen (60). The paper may be conveyed via a first paper feeding passage extending from the first conveyor roller assembly (2) to the second conveyor roller assembly (3) or reversely via a second paper feeding passage extending from the second conveyor roller assembly (3) to the first conveyor roller assembly (2). The first and second conveyor roller assemblies are independently driven into rotation by separate drive motors (M1, M2) so that the circumferential speeds of these conveyor roller assemblies are readily adjusted.

FIG.2



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a printer.

[0002] Heretofore, there has been known a printer having an arrangement wherein a respective pair of conveyor rollers for clampingly conveying paper are disposed on opposite sides of a printing station or on an upstream side and a downstream side thereof and wherein the paper is fed from either selected one of a front side and a rear side of the printer to be discharged from the other side of the printer. The printer is also arranged such that the conveyor rollers on the paper discharging side are adapted to rotate at a higher circumferential speed than the conveyor rollers on the paper feeding side whereby the paper under a suitable tension is subjected to printing and then discharged. The printer of the conventional arrangement is adapted to rotate the conveyor rollers normally or reversely depending upon which side of the printer is used as a paper feeding site. A rotative drive mechanism for the conveyor rollers includes a single drive motor for paper conveyance which employs a speed changing gearing mechanism for transmitting its torque via two trains of transmission gears of different gear ratios thereby driving the conveyor rollers into rotation.

[0003] Unfortunately, the following problems are encountered by the mechanism wherein the torque of a single drive motor is transmitted via the two trains of gears for bringing the conveyor rollers on the opposite sides of the printing station into normal or reverse rotation depending upon which side of the printer is used as the paper feeding site, thereby accomplishing the paper feeding. That is, slack in, the paper is not eliminated if the conveyor roller on the paper feeding side is rotated at the same circumferential speed as the conveyor roller on the paper discharging side. On the other hand, the slack in the paper is eliminated if the conveyor roller on the paper discharging side is rotated at a slightly higher speed than the other. However, when the conveyor rollers are reversely rotated with reversely positioned paper feeding site and paper discharging site, need exists for inverting the prior circumferential speed ratio between the conveyor rollers. If a structure is made such that an additional train of gears is provided for meeting this need, a complicated structure naturally results. As another approach, there is proposed a mechanism wherein only the conveyor roller downstream from the printing station is driven into the rotation when the conveyor rollers are reversely rotated while the conveyor roller upstream from the printing station is brought out of operation by means of a one-way clutch so that the paper may not be broken due to an excessive tension thereon. However, this mechanism suffers disadvantages which include the necessity for the one-way clutch, a structure

extremely complicated by the provision of gears of different numbers of teeth, and inability to apply a suitable tension to the paper.

[0004] In view of the foregoing, it is an object of the invention to provide a printer providing an easy adjustment of the circumferential speeds of the conveyor rollers on the opposite sides of the printing station, thereby achieving a proper circumferential speed ratio of the conveyor rollers for applying a suitable tension to the paper fed from whichever side of the printer.

SUMMARY OF THE INVENTION

[0005] A printer according to the invention comprises a first conveyor roller and a second conveyor roller disposed at respective places upstream and downstream from a printing station for clampingly conveying paper, and is adapted to feed the paper via a first paper feeding passage extending from the first conveyor roller through the printing station to the second conveyor roller, or via a second paper feeding passage extending from the second conveyor roller through the printing station to the first conveyor roller, the printer characterized in that the first conveyor roller and the second conveyor roller are independently controllably driven into rotation by separate drive means.

[0006] This provides for an easy control such that the second conveyor roller is rotated at a higher circumferential speed than the first conveyor roller when the paper is fed via the first paper feeding passage or that the first conveyor roller is rotated at a higher circumferential speed than the second conveyor roller when the paper is fed via the second paper feeding passage.

BRIEF DESCRIPTION OF THE DRAWING

[0007]

Fig. 1 A front view showing a state where a cut sheet or continuous paper is conveyed via a first paper feeding passage; and

Fig. 2 A front view showing a state where a cut sheet or continuous paper is fed via a second paper feeding passage.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0008] A preferred embodiment of the invention will hereinbelow be described with reference to the accompanying drawings. Fig. 1 schematically illustrates a serial printer adapted to receive cut sheets or continuous paper from a right-hand or left-hand side as seen in the figure for printing thereon. At an upward place from a paper guide 10, two guide shafts (only one of them is shown) 30 are bridged between opposite side walls 20. A carriage 40 is carried on the guide shafts in a manner to reciprocate transversely (a perpendicular direction

with respect to the drawing surface in Fig. 1) as guided by the guide shafts. The print head 50 has a carriage 40 mounted thereto, whereas a nose portion 51 of the print head depends from a lower surface of the print head. A paper guide 52 extends around the nose portion so that a print wire inserted in the nose portion strikes a platen 60 so as to print on a sheet.

[0009] A printing operation is performed by conveying the cut sheet or continuous paper along a paper feeding direction (the transverse direction as seen in Fig. 1) and reciprocating the print head 50 perpendicularly with respect to the drawing surface of Fig. 1. On the right-hand side as seen in Fig. 1, there are disposed a sheet feeding tray 70 for feeding cut sheets, and a tractor 80 for feeding continuous paper. A top surface of the sheet feeding tray is flush with the paper guide 10.

[0010] A first conveyor roller assembly 2 and a second conveyor roller assembly 3 are disposed at respective places upstream from and downstream from a printing station of the serial printer, the printing station including the print head 50 and the platen 60. The first and second conveyor roller assemblies each include a drive roller 21 or 31, and a pressure roller 22 or 32 pressingly brought into rotation by the corresponding drive roller. The sheet is clampingly conveyed by the first conveyor roller assembly 2 via a passage extended from the first conveyor roller assembly 2 through space between the print head 50 and the platen 60 of the printing station to the second conveyor roller assembly 3 (hereinafter referred to as a first paper feeding passage) and then is discharged from a discharge part (on the left-hand side as seen in the figure). Conversely, the sheet may be clampingly conveyed by the second conveyor roller assembly 3 via a passage extended from the second conveyor roller assembly 3 through space between the print head 50 and the platen 60 of the printing station to the first conveyor roller assembly 2 (hereinafter referred to as a second paper feeding passage) and then is discharged from a discharge part (on the right-hand side as seen in the figure).

[0011] Pressure means for the pressure roller 22 of the first conveyor roller assembly 2 has an arrangement wherein a pressure arm 4 engages with a shaft portion 22a of the pressure roller and is rotatably supported by a pin 41. A helical torsion coil spring 42 has one end thereof anchored to the pressure arm 4 for imparting friction (resilient force) thereto. The torsion coil spring is wound about the pin 41 and has the other end thereof in resilient contact with a paper guide 101. Pressure means for the pressure roller 32 of the second conveyor roller assembly 3 is substantially constructed the same way as the aforesaid pressure means for the pressure roller 22. That is, a pressure arm 5 is rotatably supported by a pin 53 and is imparted with spring force by a helical torsion coil spring (not shown). It is noted that a reference numeral 102 denotes a paper guide.

[0012] By the way, the invention is arranged such that the first and second conveyor roller assemblies 2, 3 are

independently driven into rotation by respective separate drive means therefor, whereby the respective rotational speeds of the conveyor roller assemblies may be controllably regulated.

[0013] Now a specific arrangement of the invention is described. There are provided two drive motors M1, M2. One M1 of the drive motors has an arrangement wherein a drive pivot 1 of the drive motor M1 is meshed with a reduction gear 11, to which a gear 12 is coaxially pivotally mounted. The gear 12 is meshed with two intermediate gears 13, 14, one gear 13 of which is meshed with a gear 15. The gear 15 drives into rotation the drive roller 21 of the first conveyor roller assembly 2, the drive roller 21 coaxially secured to the gear 15. On the other hand, the other intermediate gear 14 is meshed with a gear 16, to which a pinion 17 is coaxially pivotally mounted. The pinion 17 is meshed with a gear 18 which drives into rotation the tractor 80 for feeding continuous paper, thereby delivering the continuous paper to place between the print head 50 and the platen 60 of the printing station. On the other hand, a cover plate 71 is disposed at a leading end (a left end as seen in the figure) of the cut-sheet feeding tray 70 as allowed to pivot upwardly by means of a pin. Thus, the cover plate 71 is pivotally moved upwardly when the continuous paper is fed by the tractor 80 to place between the print head 50 and the platen 60 of the printing station.

[0014] A drive pivot 6 of the other motor M2 is meshed with a reduction gear 61, to which a pinion 62 is coaxially pivotally mounted. The pinion 62 is meshed with an intermediate gear 63, which is meshed with two gears 64, 65. One gear 64 of these gears drives into rotation the drive roller 31 of the second conveyor roller assembly 3, the drive roller coaxially secured to the gear 64. On the other hand, the other gear 65 has a pinion 66 coaxially pivotally mounted thereto. The pinion 66 is meshed with a gear 67, which is meshed with a gear 68 which drives into rotation the platen 60 coaxially pivotally secured thereto.

[0015] The invention is arranged such that the cut sheets or continuous paper may also be fed through the second paper feeding passage or from a rear side (the left side as seen in the figure) of the printer. The arrangement is described with reference to Fig. 2. As mentioned supra, the drive pivot 6 of the drive motor M2 is meshed with the reduction gear 61, to which the pinion 62 is coaxially pivotally mounted. The pinion 62 is meshed with a reduction gear 61, which is geared to drive into rotation a drive gear 692 via an intermediate gear 691. Mounting a rear tractor 90 to a rear sheet feed port establishes a meshing engagement between a gear 91 of the tractor and the drive gear 692. Thus, the tractor is driven by a driving torque of the drive motor M2 thereby feeding the continuous paper.

[0016] Next, operations of the invention are described. In a case where cut sheets are fed via the first paper feeding passage, an unillustrated switches provided at the printer are set to positions indicating "for-

ward feeding" and "cut sheets" and the cut sheets are loaded on a top surface of the cut-sheet feeding tray 70. Changing the positions of the switches permit the drive motors M1, M2 to rotate in a normal direction. When the drive motors M1, M2 are energized, the driving torque of the drive motor M1 is transmitted via a train of the transmission gears 1, 12, 13, 15 to the drive roller 21 of the first conveyor roller assembly 2, which is driven into rotation. Since the pressure roller 22 is driven into rotation by the drive roller 21 as held in resilient contact therewith by the torsion helical coil spring 42, a cut sheet fed from the sheet feeding tray 70 is clamped between the drive roller 21 and the pressure roller 22 so as to be delivered to place between the print head 50 and the platen 60 of the printing station, where the cut sheet is printed. The printed cut sheet is further conveyed as clamped between the drive roller 31 and the pressure roller 32 of the second conveyor roller assembly 3, so as to be discharged from a discharge port. In this case, the drive motor M2 is adapted to rotate at a slightly higher rotational speed than the drive motor M1, so that the drive roller 31 on the downstream side of the printing station has a slightly higher circumferential speed than the drive roller 21 on the upstream side of the printing station. Therefore, a suitable tension is applied to the cut sheet while the sheet is subjected to a printing process at place in the course of the first paper feeding passage.

[0017] In a case where continuous paper is fed via the first paper feeding passage, the switches provided at the printer are set to positions indicating "forward feeding" and "continuous paper" and continuous paper is loaded on the tractor 80. When the drive motors M1, M2 are energized, the torque of the drive motor M1 is transmitted via a train of transmission gears 11, 12, 14, 16, 17, 18 to drive the tractor 80. Accordingly, the continuous paper is conveyed to place between the print head 50 and the platen 60 of the printing station as pushing open the cover plate 71 at the leading end of the sheet feeding tray 70. The other operations are the same as those performed in the feeding of cut sheets.

[0018] In a case where cut sheets are fed via the second paper feeding passage in an opposite way to the aforementioned feeding of cut sheets, the switches are set to positions indicating "rearward feeding" and "cut sheets". In this case, the same sheet feeding tray (not shown) as the aforesaid sheet feeding tray 70 is set to place. The changing of the switch positions permit the drive motors M1, M2 to rotate in the reverse direction. Energizing the drive motors M1, M2 drives the drive rollers 21, 31 into reverse rotation via a train of the aforesaid transmission gears 1, 11, 13 and a train of the transmission gears 1, 6, 61, 62, 63, 64. A cut sheet so fed in is clamped between the drive roller 31 and the pressure roller 32 of the second conveyor roller assembly 3 and delivered to the printing station including the print head 50 and the platen 60, where the sheet is printed. The printed cut sheet is further conveyed as clamped be-

tween the drive roller 21 and the pressure roller 22 of the first conveyor roller assembly 2 and then slidably discharged onto the top surface of the cut-sheet feeding tray 70.

[0019] In contrast to the aforementioned sheet feeding via the first paper feeding passage, the drive motor M1 is rotated at a slightly higher speed than the drive motor M2 so that the circumferential speed of the drive roller 21 of the first conveyor roller assembly 2 on the downstream side of the printing station is slightly higher than that of the drive roller 31 of the second conveyor roller assembly 3 on the upstream side of the printing station. Therefore, a suitable tension is applied to the cut sheet while the sheet is subjected to a printing process at place in the course of sheet conveyance.

[0020] In a case where continuous paper is fed from the rear side, the switches are set to positions indicating "rearward feeding" and "continuous paper". The changing of the switch positions permit the drive motors M1, M2 to rotate in the reverse direction and the same operations as in the rearward feeding of the cut sheets are performed. At this time, the torque of the drive motor M2 is transmitted via a train of the transmission gears 61, 62, 69, 691, 692 to drive into rotation the gear 91 of the rear tractor 90 thereby feeding the continuous paper. In this case, as well, the drive motor M1 is rotated at somewhat higher speed than the drive motor M2 so that the circumferential speed of the drive roller 21 of the first conveyor roller assembly 2 on the downstream side of the printing station is somewhat higher than that of the drive roller 31 of the second conveyor roller assembly 2 on the upstream side of the printing station. Therefore, the continuous paper is under a suitable tension while the paper is subjected to the printing process at place in the course of conveyance.

[0021] In this manner, the direction of rotation and the rotational speed of the two drive motors M1, M2 during the sheet feeding via the first paper feeding passage are changed from those of the motors during the sheet feeding via the second paper feeding passage. According to the invention, however, there are provided two independent drive motors which are readily adjusted for the respective rotational speeds thereof according to either selected one of the first and second paper feeding passages. Thus, the invention ensures that a suitable tension is always applied to the sheets or paper fed from whichever side of the printer.

[0022] In the above embodiment, the drive motor M2 is rotated at a slightly higher speed than the drive motor M1 when a cut sheet or continuous paper is fed via the first paper feeding passage, whereas the drive motor M1 is rotated at a slightly higher speed than the drive motor M2 when a cut sheet or continuous paper is fed via the second paper feeding passage. However, the rotational speed ratio between the drive motor M1 and the drive motor M2 is not limited to the above embodiment and any arrangement may be made such that the circumferential speed of the conveyor roller downstream from the

printing station is somewhat higher than that of the conveyor roller upstream from the printing station. The ratio of the circumferential speeds may be suitably changed by changing the diameters or gear ratio of the conveyor rollers.

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[0023] According to the invention, the two conveyor rollers are independently driven into rotation by the separate drive means, so that the circumferential speeds of the two conveyor rollers can be quite easily adjusted. Thus, the invention ensures that a suitable tension is always applied to the sheets or paper fed from whichever side of the printer.

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Claims

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1. A printer comprising a first conveyor roller and a second conveyor roller disposed at respective places upstream and downstream from a printing station for clampingly conveying paper and adapted to feed the paper via a first paper feeding passage extending from said first conveyor roller through said printing station to said second conveyor roller, or via a second paper feeding passage extending from said second conveyor roller through said printing station to said first conveyor roller,

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the printer **characterized in that** said first conveyor roller and said second conveyor roller are independently controllably driven into rotation by separate drive means in order that said second conveyor roller is rotated at a higher circumferential speed than said first conveyor roller when the paper is fed via said first paper feeding passage or that said first conveyor roller is rotated at a higher circumferential speed than said second conveyor roller when the paper is fed via said second paper feeding passage.

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FIG. 1

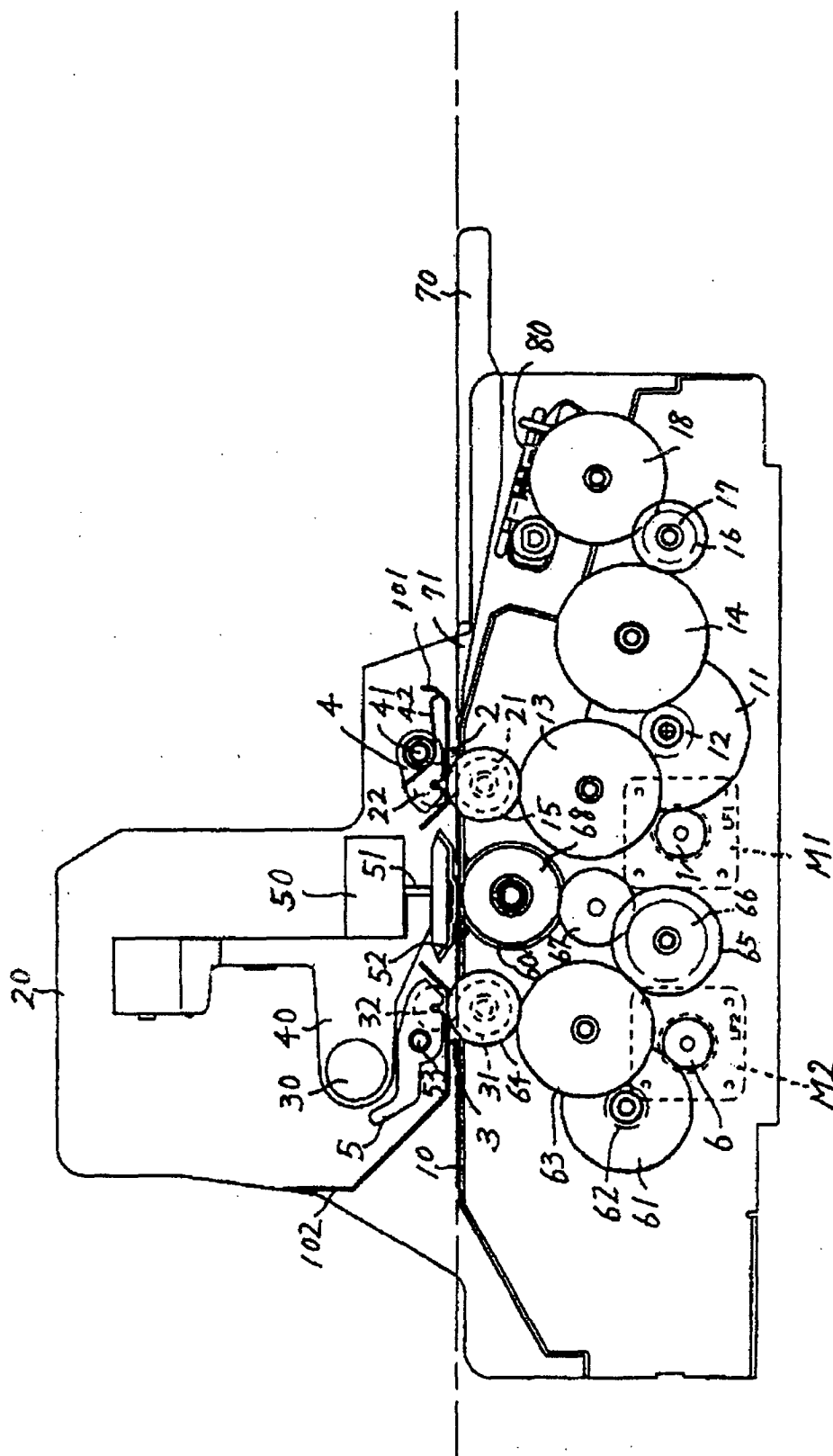


FIG.2

