May 26, 1953 A. J. ALBRECHT 2,639,664

SHEET CONVEYER

Filed Dec. 14, 1946 3 Sheets-Sheet 1

FIG. 1

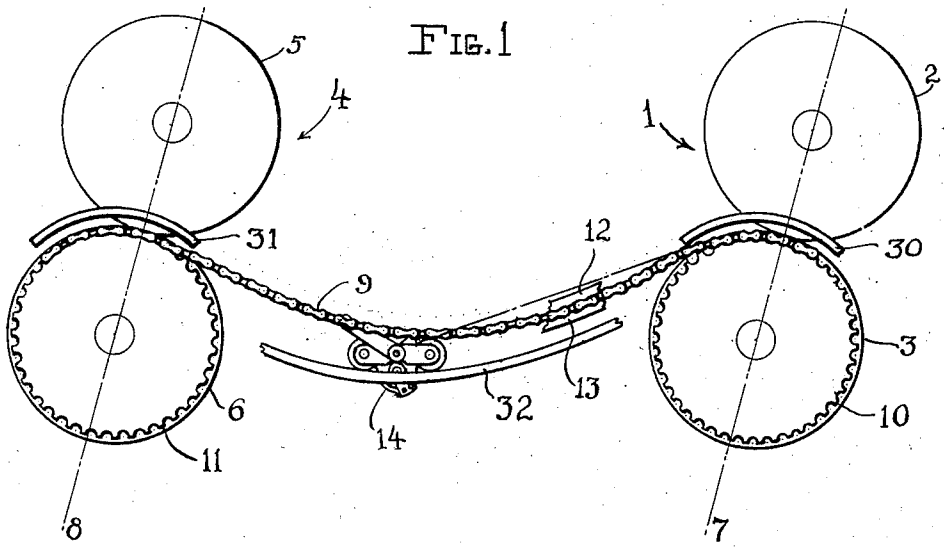
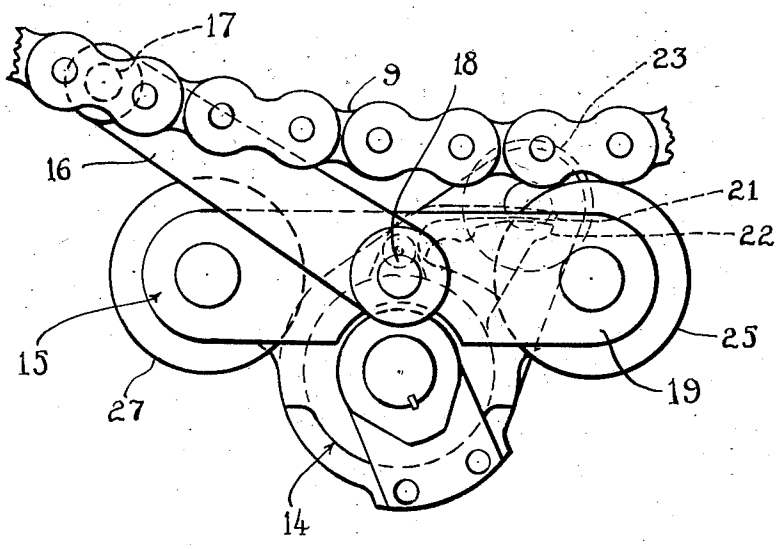


FIG. 2



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SHEET CONVEYER

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FIG. 4

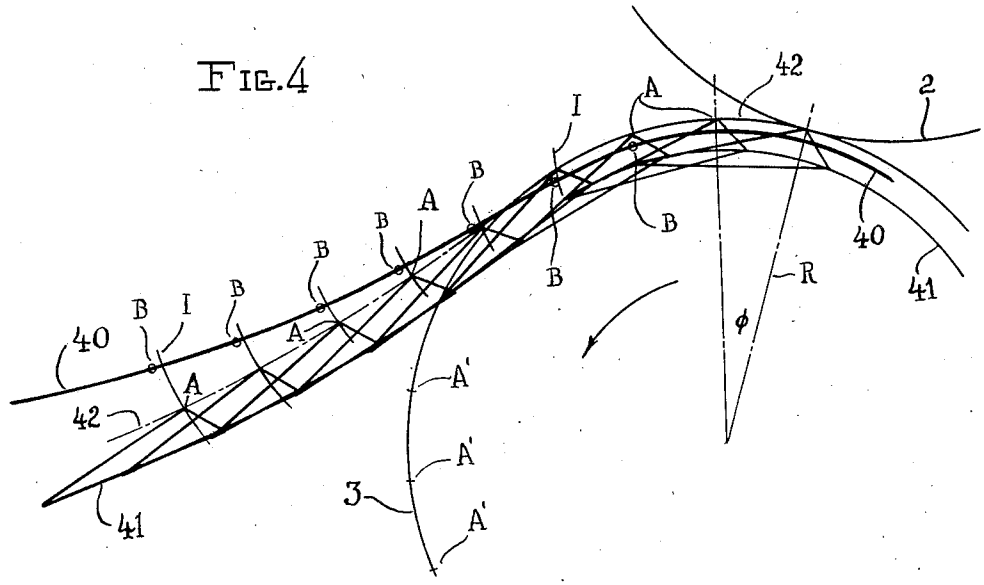
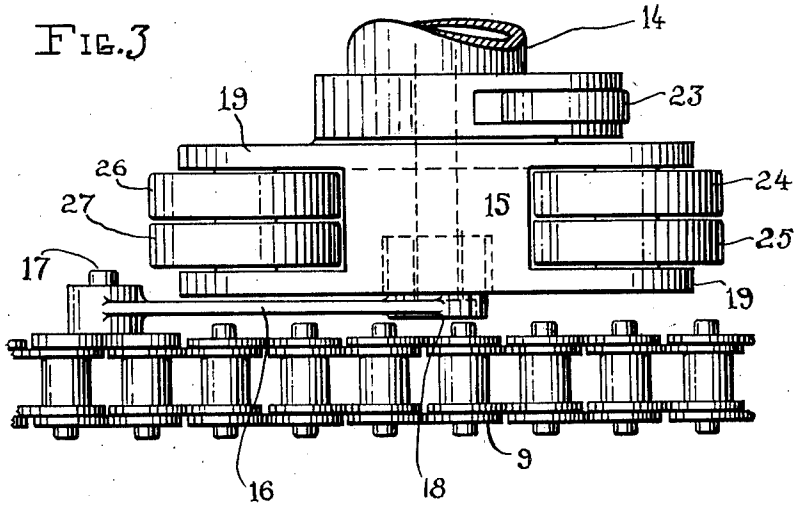


FIG. 3



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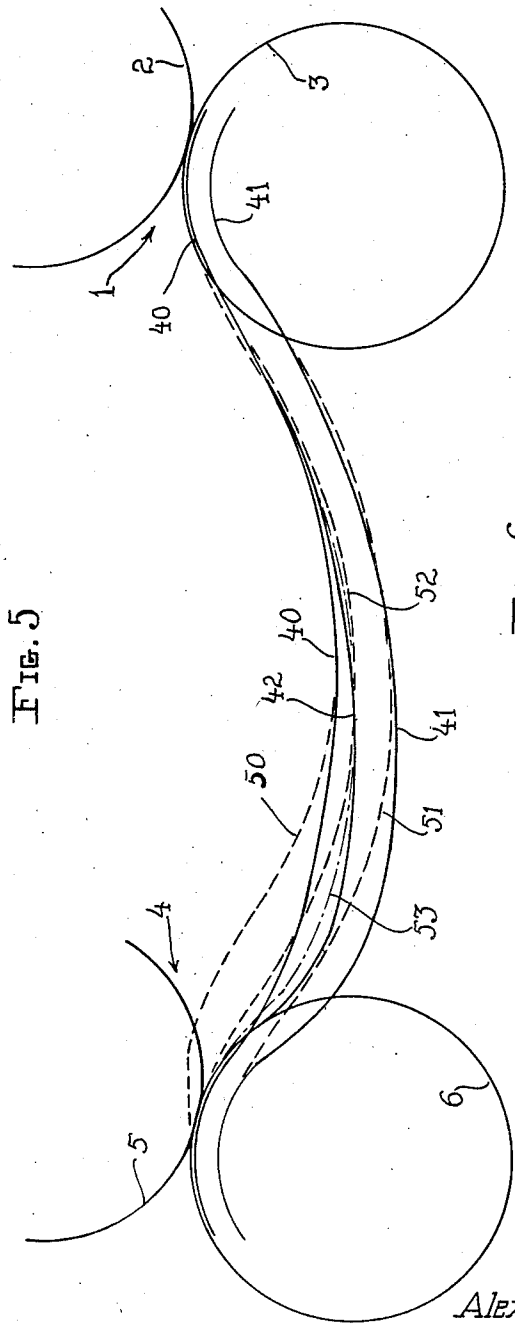


FIG. 5

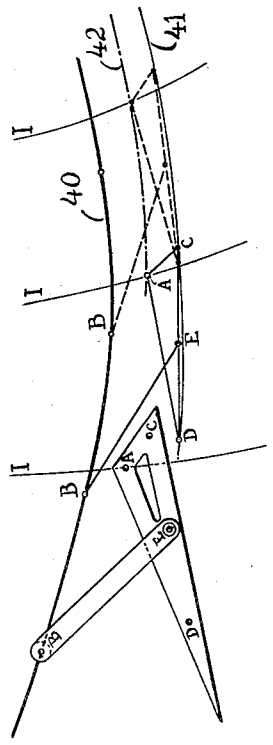


FIG. 6

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UNITED STATES PATENT OFFICE

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SHEET CONVEYER

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Application December 14, 1946, Serial No. 716,318

7 Claims. (Cl. 101—183)

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This invention relates to improvements in printing presses of the sheet fed flexible conveyor type.

A general object of the invention is to provide an improved means for conveying the sheets from unit to unit of a press, preventing the sheets from clinging to the blanket or other printing cylinders of the press.

With this and still other objects which will appear in the following full description in mind, the invention consists in the combination and arrangements of parts and details of construction which will now first be fully described in connection with the accompanying drawing, and will then be more particularly pointed out in the appended claims.

In the drawing:

Figure 1 is a schematic view, in side elevation, with parts broken away, showing two adjacent units of a multiple sheet fed printing press of the chain conveyor type;

Figure 2 is a much enlarged view showing a portion of the chain conveyor and the gripper bar mechanism carried thereby;

Figure 3 is a plan view of the mechanism of Figure 2;

Figure 4 is a diagrammatic view, enlarged with respect to Figure 1, and showing the development of paths of movement for certain of the machine elements;

Figure 5 is a diagrammatic view on an intermediate scale of enlargement showing a number of paths of movement of the various elements; and

Figure 6 is a diagram illustrating a method of developing successive positions of the sheet carrying elements.

The present invention is concerned principally with an improvement upon the flexible conveyor type of sheet fed press and the method of printing practiced therewith. Such machines and method of printing are well known in themselves, being described, for example, in Huck Patent 2,138,405 and Eckhard Patent 2,286,032, and the following specification describes only those features necessary for a full understanding of the present invention. In a sheet fed press of the flexible conveyor type, the sheets are carried through the various units of the press by a pair of endless sprocket chains equipped with sheet carriers in the form of gripper bars having grippers for holding the sheets by their forward edges, and spaced at intervals along the chains. The present invention relates to the gripper bar mechanism and its association with the chain

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and to the path of travel of the elements as the sheet emerges from a unit and as it travels between units. Since the mechanism between any two units will be the same, all that is necessary for an understanding of the present invention is a description of the novel elements and the interaction thereof in the passage of a sheet from one unit to the next. Accordingly, in Figure 1 there are shown schematically only two adjacent printing units, it being understood that any desired number of successive units may be utilized, and the frame structure and other conventional elements are omitted.

Printing unit 1 comprises a blanket or other printing cylinder 2 cooperating with an impression cylinder 3, and printing unit 4 comprises a blanket or other printing cylinder 5 cooperating with an impression cylinder 6. The portion of the figure included between the line of centers 7 of the cylinders of unit 1 and the line of centers 8 of the cylinders of unit 2 is a typical section, which may be reduplicated for showing any number of units printing successively upon the sheets. The sheets are carried through the units and from unit to unit by a pair of conveyor chains 9, only one of which is shown, it being understood that a similar chain is provided at the other end of the cylinders, and the chain passes around sprocket wheels 10 and 11, coaxial with and driven with the impression cylinders 3 and 6. Between units, the chain 9 is guided by means of upper and lower guides 12 and 13, such as shown more fully in the Huck patent above referred to, and only fragments of which are shown in the drawing.

In such machines, the speed of travel of the conveyor chain at any given point is approximately equal to the speed of travel of the sheet through the printing units, and, hence, the length of the arc of the chain, from the impression line of the unit to the gripper bar will be approximately equal to the length of the paper which has been fed through the unit.

In previous machines, the gripper bars have been fixed to the conveyor chains, and the distance from the grippers to the line of impression of the printing cylinders along the shortest path, is composed of a tangent from a gripper to the impression cylinder and an arc on the cylinder to the line of impression. This distance is less than the length of conveyor chain which has passed through the unit and is led therefrom in an arcuate path. Accordingly, as the grippers travel along the upwardly concave path between units, an increasing slack in the paper is created.

Since due to the adhesive character of the ink, the paper has a tendency to cling to the blanket or other printing surface, the tail end of the sheet may wrap thereon to an appreciable extent, until the slack is taken up. Thereafter the sheet will be whipped or snapped off the printing cylinder, creating an undesirable disturbance in the movement of the sheet. According to the present invention, provision is made for eliminating this difficulty, in a way which will now be described.

Instead of securing the gripper bars to the conveyor chains in a fixed relation, means which permits of relative movement is employed. A preferred method of providing for this movement is shown in the drawing. The gripper bar, designated by the numeral **14**, is secured at each end to a carriage, designated generally by the numeral **15**, and these carriages, in turn, are attached to the conveyor chains by means of links **16**, pivotally mounted on stub shafts **17**, attached to the conveyor chains **9**, and providing for limited movement of the carriage **15** out of the path of the conveyor chains. Each link **16** is pivotally connected to its carriage **15** by means of a trunnion **18** mounted on the carriage **15**, to which, in turn, the gripper bar **14** is attached. The gripper bar **14**, carries cooperating gripper fingers **21** and jaws **22** (Figure 2) which hold the leading edge of a sheet of paper, and the gripper fingers are provided with the usual operating mechanism, including a roller **23**. The gripper operating mechanism is well known in itself and forms no part of the present invention, and accordingly is not fully shown herein.

Each frame **15** carries guide engaging rollers **24, 25, 26** and **27** by means of which it is guided, determining the position of the trunnions **18** on an arc around the stub shaft **17**, upon which the link **16** is carried, and also controlling the angular position of the carriage **15** about the axis of trunnions **18**. Upper guides or cam arcs **30** and **31** are provided at the units for the purpose of engaging the outer rollers **25** and **27** and forcing the bar down into the impression cylinder against the usual stops provided for this purpose, so as to position the grippers accurately for inserting the sheet between the cylinders and guiding its leading edge as it emerges from the impression line. Guide rails **32** are provided between the units for supporting the gripper bars and are engaged by the rollers **26** and **24** which determine the position of the carriage in this portion of its travel. Upper as well as lower guide rails may be provided between units but ordinarily will not be required.

By thus guiding the gripper carriage **15**, it is possible to maintain a distance from the grippers to the impression line, which is substantially equal to the length of the portion of a sheet which has passed through the unit, at every instant during its passage, and accordingly prevent formation of the objectionable slack hereinbefore mentioned.

One method for developing the desired paths of travel is illustrated diagrammatically in Figure 4, in which a path **40** for the conveyor chain **9** is assumed, this path preferably being of slightly shorter radius than the impression cylinder **3**, where concentric with the impression cylinder and extending concentric with its periphery from the line of impression to the point where the chain leaves the sprocket **10**, and beyond the point following a reversely curved path designed for smooth action and extending toward the impression cylinder of the following unit.

An angle ϕ is arbitrarily chosen to indicate an angular motion of the cylinder **3**, and starting at the radius of the line of impression R, points A are laid out on the cylinder periphery to indicate its movement through successive distances equal to the arc of the angle ϕ. Other equally spaced points B are then laid out on the chain path **40** starting at the point where the axis of a stub shaft **17** is found, when the leading edge of a sheet is at the line of impression R. These points B are spaced apart a distance equal to the arc of the angle ϕ at the pitch line of the sprocket **10**, and indicate positions of the stub shaft **17**, after each forward movement of the cylinder **3** from the line R, and through angle ϕ.

Involutes I are then constructed from the points A' on the impression cylinder **3** for determining the distance the leading edge of the sheet travels from the line of impression, with each successive movement of the cylinder through an angle ϕ. As the cylinder **3** is rotated counterclockwise in printing a sheet, the grippers carrying the forward or leading edge of the sheet follow the angular motion of the cylinder through several successive angles ϕ, but after the leading edge of the sheet moves away from the cylinder, each subsequent forward movement corresponding to a cylinder movement through angle ϕ should bring the sheet edge to a position on one of the involutes I, if slack is to be avoided.

An arc having a radius equal to the length of the link **16** may be described from each of the points B on the path **40**, and the paths of travel of the leading edge of a sheet carried by the gripper jaws, and the path of the carriage rollers may now be constructed. Since the three paths are all circular and concentric with the cylinder **3** for a distance on either side of the line of impression, and with the impression line as a beginning, the first few successive positions are readily laid out and each successive position of the elements is developed from the previous one to complete the paths. In Figure 6, the letter A indicates the gripper jaw position, the letter B the position of the stub shaft **17**, the letters C and D the guide roller axes and the letter E the axis of the trunnions **18**. It is known that the point **9** must be on an arc inscribed about the point B on the chain path **40**, and that the point A should be located on the appropriate involute I.

In Figure 6 the path **40**, and the paths **41** and **42**, as thus far developed, are shown, and a known position of the points A to E is indicated, these points being connected by full lines. A prior position is also indicated, the points being connected by phantom lines. The mechanical elements are represented for simplicity by the triangle ACD and link BE pivoted thereto at E. This assembly is placed as shown in the figure, the point B being known and the point A being placed on the involute I, in a tentative position. Keeping point B fixed, the triangle may now be moved down, with point A remaining on the involute I until the roller center C lies on the path **41**, determining a new position for all the points. By repeating this process the complete paths are readily laid out.

The size of angle ϕ has been exaggerated, for clarity of illustration. This angle may be as small as is desirable for obtaining the required accuracy in the various paths. Likewise it is not necessary that the angular increment employed in constructing the successive points be a fixed increment, since finer increments may be used at critical points along the path and larger increments at non-critical points. The successive points may also be located without a special me-

chanical appliance, one or two approximations serving to place each set of points with the necessary accuracy.

In the foregoing discussion, it has been assumed that the successive involutes will be drawn so as to pull the sheet off the impression cylinder with no slack. It is, however, desirable to allow some small slack, a slack of the order of one-quarter of an inch being suitable, and a greater amount of slack being permissible provided the tendency of the sheet to follow the blanket cylinder is corrected. It will be observed that immediately adjacent the impression point, the leading edge of the sheet, point A, is traveling on a radius somewhat greater than that of the chain path. Since the elements are traveling at equal angular speeds, the sheet tends to run somewhat ahead of the chain, and this action may be utilized for gradually creating the amount of slack desired. The gripper path crosses the chain path after leaving the impression cylinder, and it will be observed that where the chain path is concave upwardly and the gripper path below it, the speed of travel of the gripper path is increased by comparison with that of the chain.

In previous constructions where the grippers have a fixed relation to the conveyor chains, the speed of travel of the grippers has been greater than the speed of the chain, where the chain path is convex upwardly, and less than the speed of the chain where the chain path is concave upwardly. The consequent slowing down of the grippers relative to the chain tended to increase the difficulties due to slack rather than to minimize them.

Instead of assuming a desirable chain path, a gripper path may be assumed and the chain path laid out therefrom, by a process similar to that previously described. Figure 5 shows a set of paths laid out by each of the two methods. In that figure, the three paths **40**, **41** and **42**, represent, respectively, chain, roller center and gripper paths which are laid out for a specimen construction according to the method of Figures 4 and 6, by assuming as a starting point the chain path **40**. It will be observed that in this case, the gripper path **42** and roller path **41** are sharply curved as they approach the unit **4**, which may be undesirable under high speed operating conditions. Figure 5 shows also a set of three broken line paths **50**, **51** and **52** derived by assuming a gripper path **52** and then constructing the corresponding roller path **51** and chain path **50**. It will be observed that in this case, while the gripper path and roller path have a desirable formation, the chain path **50** is sharply bent as it approaches the unit **4**, which again is an undesirable condition. The most desirable path for all elements may be derived by selecting a gripper path **53**, intermediate between the paths **42** and **52**, and such as shown by the phantom lines of Figure 5. By selecting such an intermediate path, a smooth curvature at all points of all the paths may be obtained, only a few trials at critical points being necessary to determine the most suitable path.

What is claimed is:

1. In a multiple unit rotary printing press, a flexible sheet conveyor, press driven means for driving the conveyor at a constant speed with relation to the press and in a curved path between a pair of successive printing units, a sheet carrier, means movably attaching the sheet carrier to said conveyor, and means for accelerating the sheet carrier relative to the conveyor in its passage between the units, and while a sheet held by the carrier is still being printed by the first of the said pair of printing units, to regulate slack of a sheet emerging from said printing unit.

2. In a multiple unit rotary printing press, a flexible conveyor arranged for taking a sheet from a printing unit, press driven means for driving said conveyor in a curved path and at a constant speed relative to the press, a sheet carrier, means movably attaching the sheet carrier to said conveyor, and means for guiding the sheet carrier in a different curved path to regulate slack of a sheet emerging from a printing unit.

3. In a multiple unit rotary printing press, a flexible conveyor arranged for taking a sheet from a printing unit, press driven means for driving said conveyor in a curved path and at a constant speed relative to the press, a sheet carrier means swingably attaching the sheet carrier to said conveyor, and means for guiding the sheet carrier in a different curved path to regulate slack of a sheet emerging from a printing unit.

4. In a multiple unit rotary printing press, a flexible conveyor arranged for taking a sheet from a printing unit, press driven means for driving said conveyor in a curved path and at a fixed speed relative to the press, a carriage, means swingably and pivotally attaching the carriage to said conveyor for moving bodily around an axis on the conveyor and for rotating about its own axis, a sheet carrier on said carriage and eccentric to the carriage axis, and guide means for bodily moving and rotating said carriage to guide the sheet carrier in a different curved path to regulate slack of a sheet emerging from a printing unit.

5. In a multiple unit rotary printing press, a flexible conveyor arranged for taking a sheet from a printing unit, press driven means for driving said conveyor in a curved path between printing units and at a constant speed relative to the press, a sheet carrier, means movably attaching the sheet carrier to said conveyor, and means for guiding the sheet carrier in a different curved path to regulate slack of a sheet emerging from a printing unit until the sheet has emerged therefrom and thereafter, and as the sheet carrier approaches the next printing unit, establishing the same position of the sheet carrier relative to the conveyor as existed as it approached the first mentioned printing unit.

6. In a multiple unit rotary printing press, a flexible conveyor arranged for taking a sheet from a printing unit, press driven means for driving said conveyor in a curved path between printing units and at a constant speed relative to the press, a sheet carrier, means swingably attaching the sheet carrier to said conveyor, and guide means for swinging the sheet carrier to regulate slack of a sheet emerging from a printing unit until the sheet has emerged therefrom and thereafter, and as the sheet carrier approaches the next printing unit, swinging back the carrier into the same position relative to the conveyor as existed as it approached the first mentioned printing unit.

7. In a multiple unit rotary printing press, a flexible conveyor arranged for taking a sheet from a printing unit, press driven means for driving said conveyor at a constant speed relative to the press in an upwardly convex path through a printing unit and an upwardly concave path between units, a carriage, means swingably and pivotally attaching the carriage to said conveyor

for revolving around an axis on the conveyor and for rotating about its own axis, a sheet carrier on said carriage and eccentric to the carriage axis, and guide means for revolving and rotating said carriage to guide the sheet carrier in a path above the convex portion of the conveyor path and below the concave portions thereof to regulate slack of a sheet emerging from a printing unit.

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