

Oct. 1, 1968

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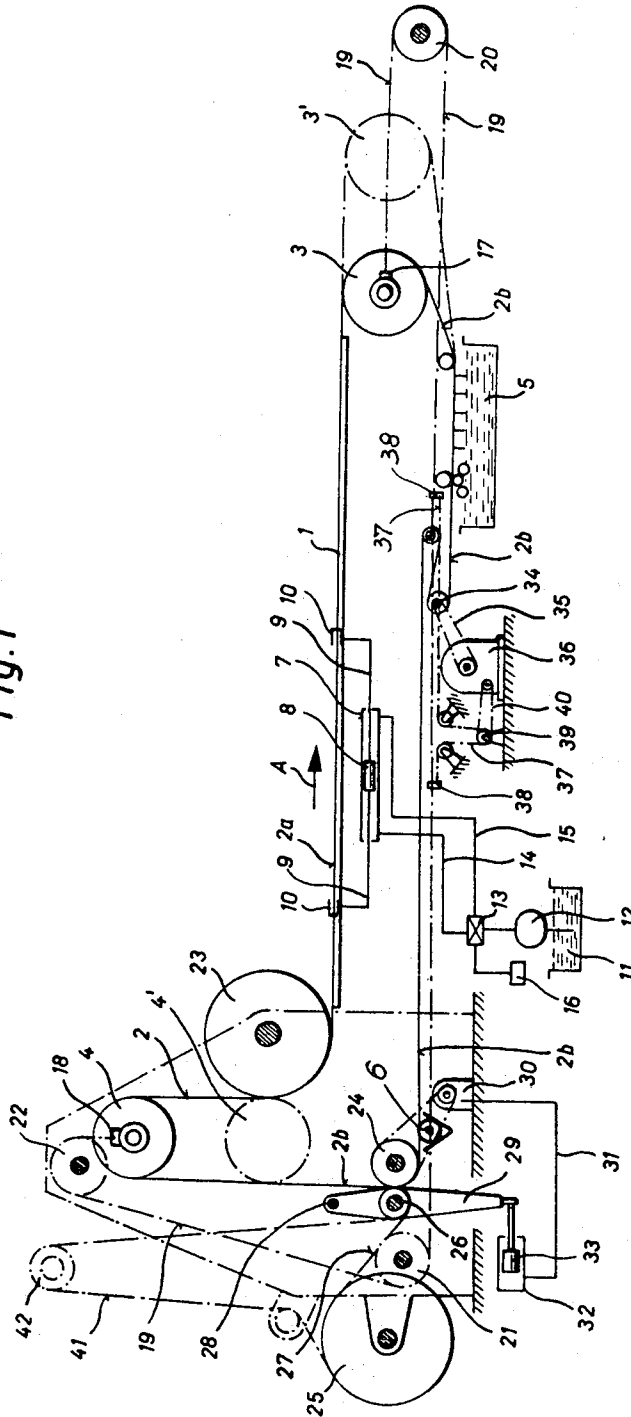
3,403,622

WEB PRINTING MACHINES

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2 Sheets-Sheet 1

Fig. 1



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Fig. 2

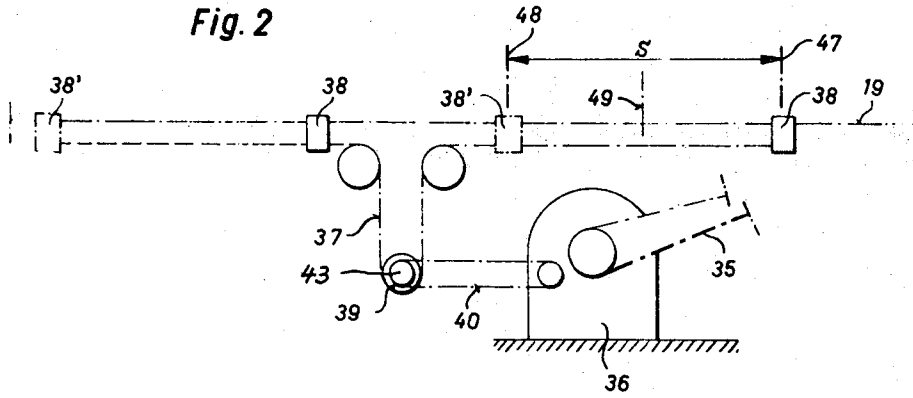


Fig. 3

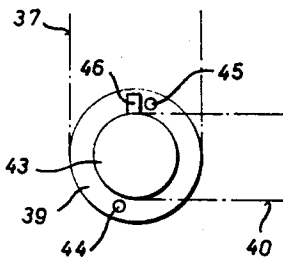
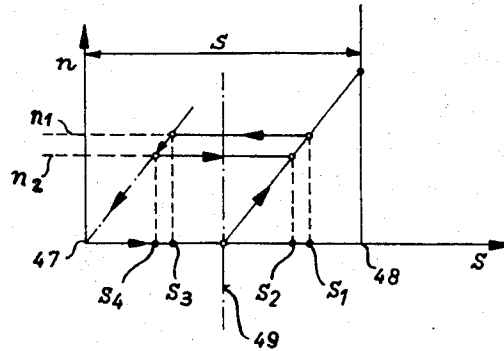


Fig. 4

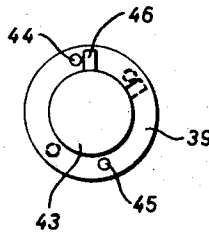


Fig. 5

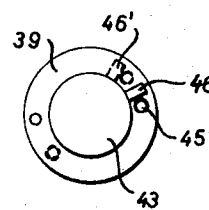


Fig. 6

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WEB PRINTING MACHINES

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8 Claims. (Cl. 101—126)

ABSTRACT OF THE DISCLOSURE

A web printing machine of the kind having an endless conveyor belt trained over two spaced-apart rollers, a printing table associated with the web-carrying upper conveyor flight, means for moving the upper flight intermittently to carry the web to and from the printing table and means for continuously moving the lower flight, the latter means including means for displacing the rollers in unison toward and away from the respective ends of the printing table. Improved operation is achieved by (1) mounting the roller which is nearest the point of engagement of the web with the conveyor belt for displacement in a direction inclined at an angle of 45°–90° to the plane of the table and (2) engaging the web with the conveyor belt before the belt passes over the just-mentioned roller.

Disclosure

The present invention relates to web printing machines such as screen printing machines.

In the case of screen printing machines, the textile or web which is supposed to receive the imprint is guided by means of a conveyor belt across a printing table. This movement takes place intermittently since the screen printing has to be carried out during the time that the web is at a standstill. The periodic movement, in the case of several screen printing machines of this kind, is produced through advancing elements, which for example have been arranged frictionally to engage the conveyor belt on both sides of the printing table, in order to move it by one unit length. For the drive of the advancing elements there may be provided a piston which can slide within a cylinder and which can be acted upon by pressure oil, said piston being in constant connection with the advancing elements.

In the past, the periodic movement of the web that is to be printed has brought about the fact that during the intermittent movement not only the whole conveyor belt but also all elements in contact with it, such as for example the rollers about which it is passed as well as the rollers of a device for applying glue and of a washing arrangement, have to be accelerated and decelerated. Therefore, a relatively large mass has had to be accelerated from the standing still position and then has to be retarded to the standing still position, during which time the intermittent movement has to be carried out in the shortest possible time or with the greatest possible speed in order to achieve good economy in the operation of the machine. Because of all this, great driving forces have been needed for the intermittent operation. Beyond that, the possibility has also existed that as a result of this intermittent operation, deformations or sag in the conveyor belt may result which under certain circumstances would impair the precision of the printing. Another disadvantage of the prior intermittent operation is that the operative efficiency of rollers, which are in contact with the conveyor belt and which are used for application of the glue and for the washing process, changes depending on whether the conveyor belt is at a standstill or is in

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motion. In many cases, too heavy an application of glue to the conveyor belt takes place when the belt is at a standstill, a fact which has an unfavorable effect with regard to the evenness of the print later on when the web secured to the belt by that glue is being printed on.

For eliminating the aforesaid disadvantages, in our British Patent No. 1,037,407, the rotatable elements or rollers carrying the conveyor belt are continuously moved in unison towards and away from the respective ends of the conveyor belt. At the point where the web joins the conveyor a supply roller, which may be heated, is provided for pressing the web onto the conveyor.

As the rotatable elements are displaced, the supply roller is also displaced, so that during all the stages of operation, the web and the conveyor run off the supply roller and off the rotatable element, even though at a speed varying between a maximum and minimum value. Since the supply roller, acting at the same time as deflecting roller for the web to be printed is displaceable, the latter cannot be arranged very close to the web roll, which would result in an advantageous, continuously shorter web draw-off. The acceleration and retardation occurring with the variable conveyor speed and web speed, in addition to the long web feed is particularly disadvantageous in the case of stretchable printing fabrics.

It is now the purpose of the present invention to provide a web printing machine in which the aforesaid disadvantages are obviated.

According to the invention there is provided a web printing machine comprising an endless conveyor trained around two rotatable elements, the upper flight of the conveyor being adapted to carry a web to be printed to and from a printing table, means being provided operative on the said upper conveyor flight for advancing the flight intermittently with intervening stops of given duration for printing onto the web, means for continuously moving the lower conveyor flight, which is between said rotatable elements, notwithstanding intermittent movement of said upper conveyor flight, said rotatable elements being mounted for movement in unison towards and away from the respective ends of the printing table, the rotatable elements being advanceable through a predetermined distance, one towards and one away from the printing table, as the upper conveyor flight advances, and means responsive to the stopping of the upper conveyor flight for retracting said rotatable elements for said predetermined distance while said upper conveyor flight is stationary, at least the rotatable element situated nearer the point where the web joins the conveyor, being displaceable above the plane of the printing table in a direction inclined at an angle of at least 45° to the plane of the table.

In order that the invention may more readily be understood, the following description is given, merely by way of example, reference being made to the accompanying drawings, in which:

FIGURE 1 shows schematically, in side elevation, one embodiment of screen printing machine according to the invention;

FIGURE 2 is an enlarged detail view of the machine according to FIGURE 1 showing the means for driving the lower flight;

FIGURE 3 shows a speed diagram for the infinitely variable gear for driving the lower flight;

FIGURES 4 to 6 show different positions of control wheels for speed regulation.

Referring to the drawings, in FIGURE 1 there is shown the printing table 1 of a screen printing machine. A printing conveyor belt 2, which passes around two opposite end rotatable elements in the form of rollers 3 and 4, extends with its upper flight 2a over the surface of the table 1, so that it is supported by the latter during

printing. The lower conveyor flight 2b extends under the table 1 through a washing installation 5 and a glue application device 6. For driving the conveyor belt 2 in its upper flight 2a in the direction of an arrow A there is provided a piston 8 slidable in a cylinder 7 and having driving elements 10 provided on rods 9, which elements, during the advancing movement of the piston 8 establish a releasable frictional connection with the belt 2. The elements 10 may be, for example, hydraulically or magnetically operated tongs or suction shoes. Displacement of piston 8 in cylinder 7 is produced by the alternating action of pressurized oil on its two sides. This pressurized oil is pumped continuously by a pump 12 from a tank 11 and is fed to the cylinder 7 by way of a reversing valve 13 through pipes 14 and 15. The reversing valve 13 is controlled, for example, by a time-controlled servoelement 16.

The two rollers 3, 4 are displaceable from the end positions shown in solid lines to the end positions 3', 4' shown in chain lines. This means that the roller 4 mounted at the entry of the machine can be raised and lowered, and the roller 3 is horizontally displaceable. In order to keep the conveyor belt 2 tensioned, despite the displaceability of the rollers 3, 4, the bearings 17, 18 of the rollers 3, 4 are connected together by a pull member, for example a chain 19, which is passed around deflecting wheels or sprockets 20-22. Instead, however, each bearing 17, 18 may be engaged by its own, for example weight-loaded, pull member, tending to pull the deflecting rollers 3, 4 apart for tensioning the conveyor belt 2.

The displaceable rollers 3, 4 with the conveyor belt 2 and the chain 19, when the machine is stationary, constitute a stable, motionless arrangement. The natural weight of the roller 4 pulls the roller 3 by means of the chain 19 for tensioning the endless conveyor belt 2 to the right in the drawing. The conveyor belt 2 is also deflected by the stationary rollers 23, 24.

The web draw-off, for example fabric draw-off, is effected from a reel 25. The web 27, after travelling a short distance from the reel 25, runs over heating and pressing roller 26 onto the lower flight 2b of the conveyor belt 2. When the web 27 and conveyor belt 2 run together, they are both connected together temporarily by sticking for fixing the web in the usually several successive stages of the printing operation with different printing stencils, relative to the latter. The heating and pressing roller 26 is mounted on a lever 29, pivotal on the pin 28, and can bear with varying pressure on the roller 24. The particular application pressure between the rollers 24, 26 depends on the speed of the lower flight 2b and hence on the peripheral speed of the roller 24. The roller 24 drives a hydraulic pump 30, the hydraulic fluid from which acts through a conduit in a cylinder 32 and presses the heating and pressing roller 26 against the roller 24 by means of a piston 33 and the lever 29, with a pressure dependent on the speed of roller 24 and thus ensures constant adhesive force.

The lower flight 2b of the conveyor belt 2 is driven by a roller 34, which in its turn is driven by an electric motor 36 by means of a chain 35 via an infinitely variable gear, not shown. The ends of a chain 37 are secured by cross-pieces 38 to the chain 19. The chain 37 drives a wheel 39. Thence the drive is effected via a control device, to be explained later, by means of a chain 40 onto the infinitely variable gear, not shown, of the motor 36. The particular position of the cross-pieces 38, relative to the stationary motor 36, corresponds to a definite, adjusted driving speed of the roller 34. The displacement travel of the chain 19, and hence of the cross-pieces 38 serves as an adjustment parameter for the controllable drive of the lower flight 2b. The control is shown in FIGURE 2 and following figures and is explained later.

Instead of being fed straight from the reel 25 to roller 26 as illustrated at 27, the fabric may be fed, as illustrated at 41, from the reel 25 over a straightening ap-

paratus (not shown), a fabric web guide and possibly other devices, and thence via a deflecting roller 42 to the heating and pressing roller 26. In this method of guiding the fabric, the advantage of a short fabric entry between the reel 25 and the roller 26 does not exist.

The operation of the machine with the driving arrangement described for the continuous movement of the lower flight 2b takes place, in principle, in such a manner that during the standstill times of the upper flight 2a, a certain length of belt is always conveyed from the exit side of the upper flight 2a to the entry side thereof by the displacement of the rollers 3 and 4 from the chain line position 3', 4' approximately to the solid line position. On the other hand, due to the movement of the rollers 3 and 4 during each intermittent movement of the upper flight 2a, part of the belt length required by the lower flight 2b will be compensated, since during this movement, the roller 3 is displaced in the same direction, i.e., in the direction of the arrow A, and the roller 4 will be displaced vertically downward. Thus, the speed of the lower flight 2b can be kept much lower during the repeat movement of the upper flight 2a than the speed of the upper flight 2a would require per se.

This arrangement has the advantage that no part of the conveyor belt comes to a stop at the washing installation 5, at the glue application device 6 and at the sticking point on the rollers 24, 26 as long as the machine is in operation. Due to the fact that the lower flight 2b runs off the rollers 24, 26 continuously, a continuous draw-off of the fabric from the reel 25 is ensured, either with the fabric 27 or 41. Due to the stationary rollers 24, 26, the draw-off speed of the fabric 27 or 41 is equal to the speed of the lower flight 2b, and like the latter, is substantially less than the speed of the upper flight 2a during the intermittent movement. During the operation of the machine and at the commencement of the intermittent movement of the upper flight 2a, the rollers 3, 4 are approximately in the solid line position shown. The elements 10 engage the top flight and displace the latter by a repeat length in the direction of the arrow A. The roller 34 drives the lower flight 2b at a lower speed than the element 10 drives the upper flight 2a. Since, therefore, the belt length is not conveyed from the lower flight 2b over the roller 4 to the upper flight 2a, and at the roller 3 a larger belt length of the upper flight 2a obtains than can be conveyed by the slower drive of roller 34, the roller 4 moves vertically downward and the roller 3 outwardly to the right until the rollers 3, 4 are situated approximately in their position according to 3', 4'. During the printing process the upper flight 2a is at rest. The roller 34, continuing to drive, exerts a pull on the lower flight 2b at the roller 3, so that the latter moves from its position 3' to the left approximately into the solid line position. Owing to the positive coupling of the rollers 3, 4 by means of the chain 19, the roller 4 is moved upwardly from its position 4' into approximately the solid line position, so that then a fresh working cycle can recommence. The displacement path of roller 4 is above the plane of the table 1.

The maximum distance of rotation of the wheel 39 serving to control the motor 36 is determined by the displacement of the rollers 3, 4 to their respective two end positions. A rotated end position of the wheel 39 may be used, in the manner explained later, for stopping the entire screen printing machine. An end position of the rollers 3, 4 corresponding to this position of the wheel 39 should naturally not occur during normal operation.

By means of the control elements 37-40 for the infinitely variable gear of the motor 36, a speed of the lower flight 2b is adjusted in accordance with the particular position of the chain 19 and hence in accordance with the position of the deflecting rollers 3, 4. The speed variation of the lower flight 2b may be designed such that a slight acceleration and a slight retardation occurs, and such that the maximum speed of the continu-

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ously moved lower flight 2b is approximately half the speed of the intermittently moved upper flight. In respect of time, the speeds of the upper and lower flights 2b and 2a may overlap, such that during the drive of the upper flight 2a, the lower flight 2b is accelerated to maximum speed; during the stoppage of the upper flight 2a, the drive of the lower flight is retarded to minimum speed, and then, on the next working cycle again, it accelerates slowly together with the rapidly accelerated movement of the upper flight 2a.

Instead of the vertical direction of displacement of the roller 4, the latter may also be adapted to be displaced at an angle of at least 45° to the plane of table 1. The direction of displacement of the roller 4 may thus be an angle of 45°-90° to the plane of table 1, the advantage of the short fabric entry being retained. The roller 3 may also be arranged to be displaced in a direction which is inclined to the plane of the table 1 in the same way as the roller 4.

The control of motor 36 for driving the lower flight operates as follows:

A wheel 43 is mounted freely rotatable on the spindle of wheel 39. The wheel 39 carries two mutually opposite pins 44, 45, and the wheel 43 has a stop 46 for these pins 44, 45 (FIG. 4). The position of the wheels 39, 43 according to FIG. 4 occurs at the position of the crosspieces 38 fixed to the chain 19 according to FIGS. 1 and 2. The rollers 3, 4 are situated in the solid line position according to FIG. 1, which is the end position. The cross-pieces 38 in FIGS. 1, 2 have been displaced to the extreme right, and the wheel 39 has rotated the wheel 43 by means of pins 44, 45 in the anticlockwise direction to the position according to FIGURE 4. In this position of wheel 43, the infinitely variable gear of motor 36 has been set to zero speed by means of the chain 40. The extreme right-hand cross-piece 38 in FIGURES 1, 2 is in a position 47, assumed stationary. In the diagram according to FIG. 3, the displacement path S of the rollers 3, 4, and hence of the cross-pieces 38 is plotted as abscissa; the ordinates show the particular driving speed n of the wheel driving the chain 35 (FIG. 1). In position 47 of the cross-piece 38, the speed n is equal to zero, as already mentioned (FIGURES 2, 3).

If, now, the movement of the upper flight 2a is started, the cross-pieces 38 in FIGS. 1, 2 are displaced to the left. The wheel 39 can be rotated by the chain 37 in the clockwise direction to the solid line position according to FIG. 5, without the wheel 43 being rotated. In this position according to FIG. 5, the cross-pieces 38 have been displaced to the left by the distance to position 49, assumed stationary (FIGS. 2, 3), the speed n remaining zero (FIG. 3). On further displacement of the cross-pieces 38 to the left and rotation of the wheel 39 in the clockwise direction, the wheel 43 is rotated by the pin 44 in the clockwise direction to the dash line position according to FIG. 5, and the speed increases linearly with increasing rotation of the wheel 43 (FIG. 3). Before the end position 3' of the roller 3, corresponding to the position 48 of the displaceable cross-piece 38 in FIGURE 2, the speed n_1 has been reached after the distance s_1 ; the movement of the upper flight 2a is terminated and the cross-piece 38 moves to the right again in FIGS. 1, 2. At the same time, the wheel 39 is rotated in the anticlockwise direction out of the dash-line position of FIGURE 5; the wheel 43 remains unchanged. The speed n_1 thus remains constant (FIGURE 3). Up to rotation of wheel 39 into the solid line position, according to FIGURE 6, the wheel 43 remains stationary unaltered and n_1 remains adjusted. If at this point of time, the next movement of the upper flight 2a again starts, the speed n_1 still remains adjusted. On displacement of the rollers 3, 4 through their distance s_1 minus s_3 to and fro, the lower flight 2b will then be moved continuously at the same speed. Owing to tolerances occurring after several repeat lengths, and owing to speed fluctuations, the recip-

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rocating path of the rollers 3, 4 may vary somewhat. This means that the wheel 39 no longer rotates to-and-fro without action on the wheel 43, but the pin 45 swings the stop 46 to position 46' (FIGURE 6). A lower speed n_2 is now selected (FIGURE 3). The reciprocating path of the rollers 3, 4 is now s_2 minus s_4 (FIGURE 3). On further operation of the screen-printing machine, the speed n_2 is adjusted. The speed may therefore hunt between n_1 and n_2 during operation. Both speeds n_1 , n_2 , however, may lie very close to each other. A change from n_1 to n_2 and vice versa only occurs after a number of repeats of the upper flight 2a. Movement of the lower flight is thus effected at approximately constant speed.

While preferred embodiments of the present invention have been described, further modifications may be made without departing from the scope of the invention. Therefore, it is to be understood that the details set forth or shown in the drawings are to be interpreted in an illustrative, and not in a limiting sense, except as they appear in the appended claims.

What we claim is:

1. A web printing machine comprising an endless conveyor trained around two rotatable elements the upper flight of the conveyor being adapted to carry a web to be printed to and from a printing table, means being provided operative on the said upper conveyor flight for advancing the flight intermittently with intervening stops of given duration for printing onto the web, means for continuously moving the lower conveyor flight, which is between said rotatable elements, notwithstanding intermittent movement of said upper conveyor flight, said rotatable elements being mounted for movement in unison towards and away from the respective ends of the printing table, the rotatable elements being advanceable through a predetermined distance, one towards and one away from the printing table, as the upper conveyor flight advances, and means responsive to the stopping of the upper conveyor flight for retracting said rotatable elements for said predetermined distance while said upper conveyor flight is stationary, at least the rotatable element situated nearer the point where the web joins the conveyor, being displaceable above the plane of the printing table in a direction substantially perpendicular to the plane of the table.

2. A web printing machine according to claim 1, wherein the lower flight of the conveyor is led round a deflecting roller at the point where the web joins the conveyor, the web being pressed against this roller by a supply roller, around which the web is passed on its way from a supply.

3. A web printing machine according to claim 2, wherein the supply roller is heated.

4. A web printing machine according to claim 1, wherein said two rotatable elements are connected together by means of a pull member, which is carried over deflecting wheels to keep the conveyor taut.

5. A web printing machine according to claim 1, wherein the lower flight is driven by a motor through an infinitely variable gear.

6. A web printing machine according to claim 4, wherein said pull member is carried over a first deflecting wheel, coaxial with which there is provided a control wheel acting on and infinitely variable gear, and the two wheels having stops whereby the control wheel may be driven in both directions of rotation, by the first wheel in the manner of a follow-up pointer.

7. A web printing machine according to claim 6, wherein the first wheel has two diametrically opposite pins and the control wheel has a stop engageable by these pins for rotating the control wheel in both directions of rotation through approximately 180° relative to the control wheel.

8. In a web printing machine of the type including a supply of web to be printed, a printing table, an endless conveyor having an upper flight and a lower flight, said conveyor being trained around first and second rotatable

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elements so as to provide an upper flight adapted to carry a length of the web to and from said printing table and so as to provide a lower flight, means operative on said upper flight for intermittently advancing said upper flight with intervening stops to permit printing on the web, means for continuously moving said lower flight, which is between said rotatable elements, notwithstanding intermittent movement of said upper flight, said rotatable elements being mounted for movement in unison toward and away from the respective ends of said printing table and being advanceable through a predetermined distance, one toward and one away from said printing table, as said upper flight advances, and means responsive to the stopping of said upper flight for retracting said rotatable elements for said predetermined distance while said upper conveyor flight is stationary, the improvement which permits the initial point of contact between said endless conveyor and said web to be located close to said supply of web to thereby reduce the length of web which is subjected to acceleration and retardation by intermittent operation of said upper run, said improvement also effecting improved uniformity of the speed at which said web is withdrawn from said supply, said improvement compris-

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ing mounting means associated with the rotatable element which is situated nearer the point where said web engages said conveyor for displacing said last-named rotatable element above the plane of said printing table in a direction inclined at an angle of at least 45° to the plane of said table, said improvement further comprising pressing roller means in advance of said last-named rotatable element, with respect to the direction of conveyor movement, for pressing said web into contact with said conveyor, said pressing roller means being fixed against movement corresponding to displacement of said last-named rotatable element.

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