Sept. 26, 1944. W. F. HUCK 2,358,928

WEB FEEDING MECHANISM

Filed Jan. 18, 1943 5 Sheets-Sheet 1

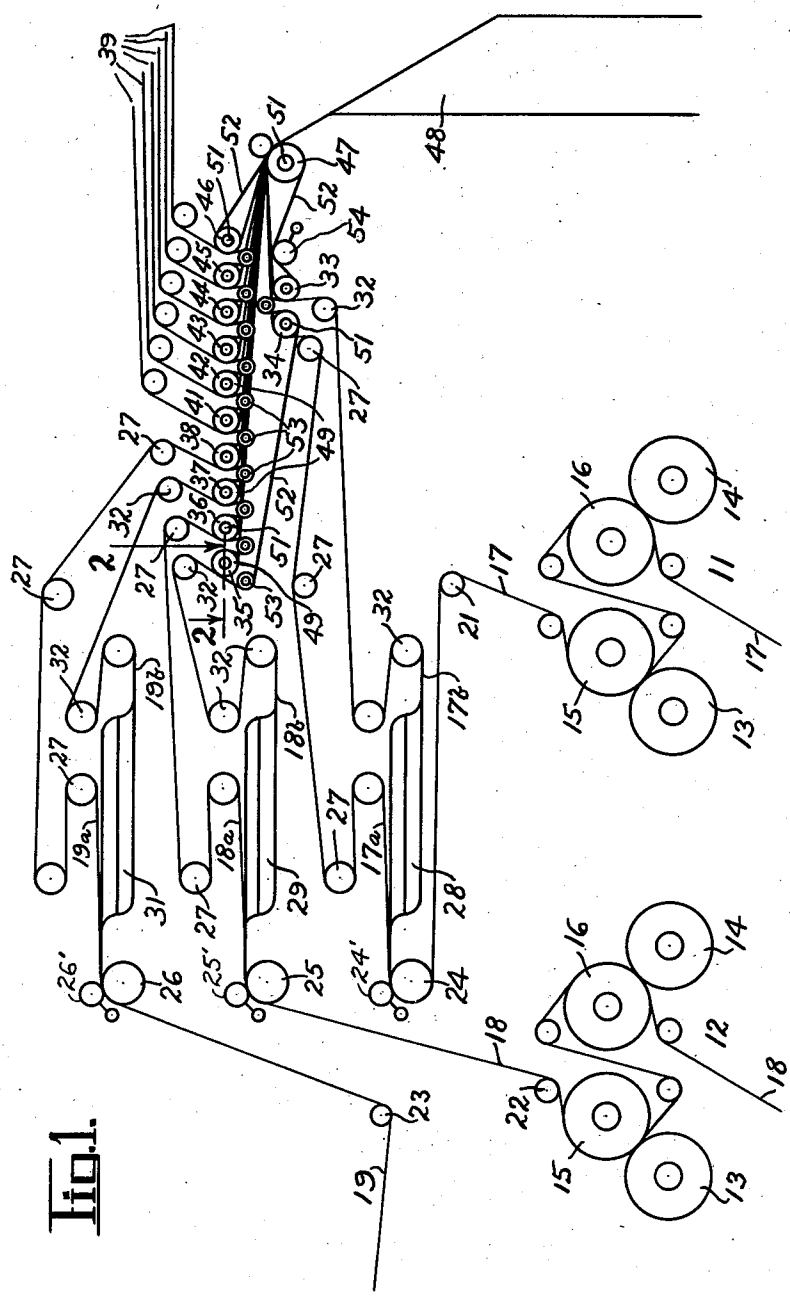

Fig. 1.

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Fig. 2.

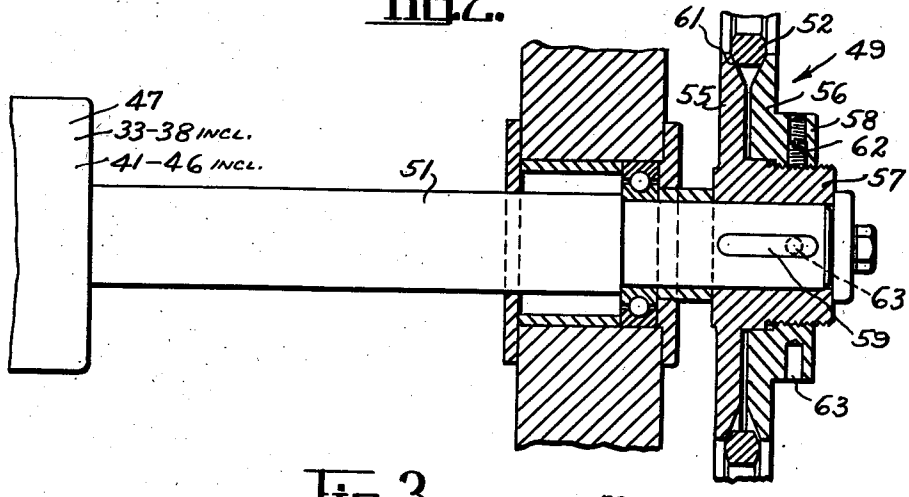


Fig. 3.

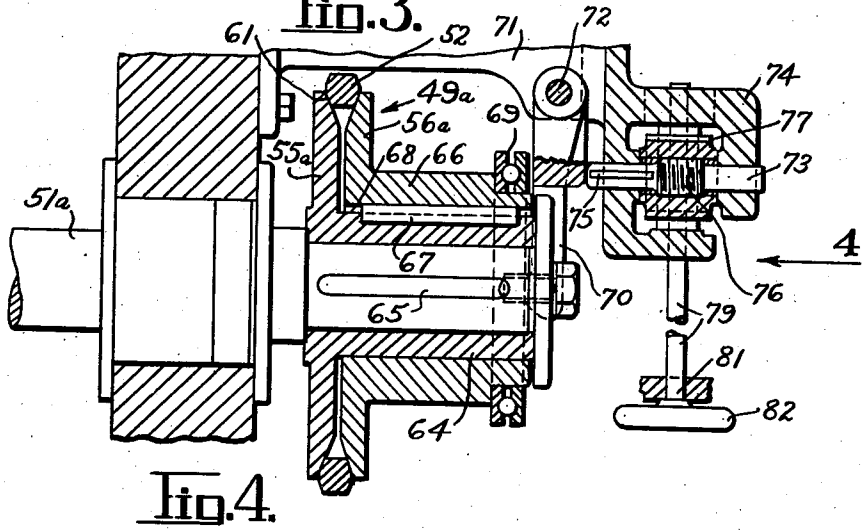
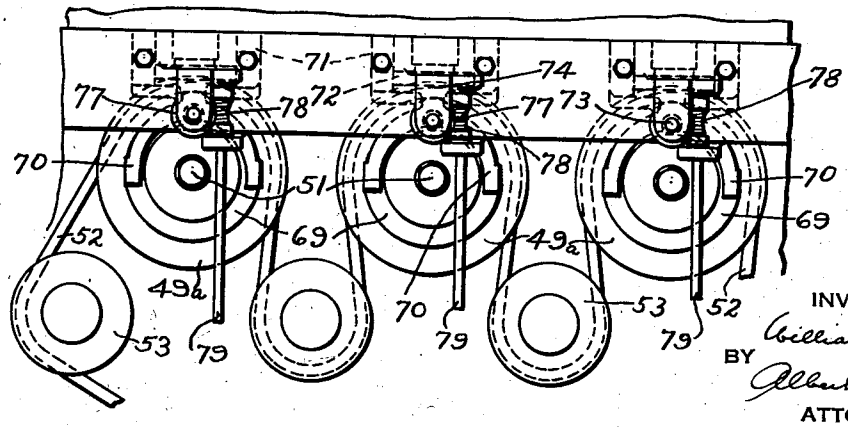


Fig. 4.



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WEB FEEDING MECHANISM

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Fig. 5.

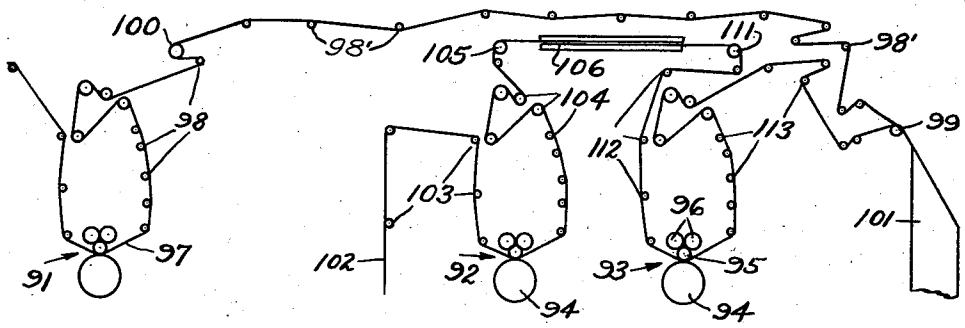

Fig. 7.

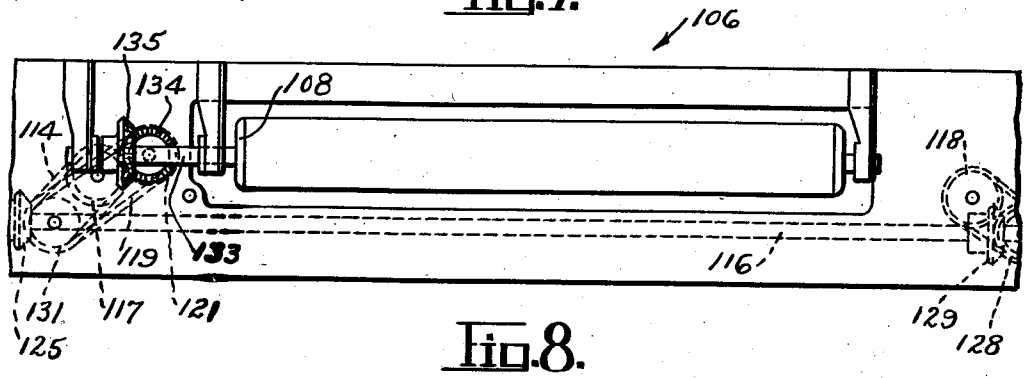

Fig. 8.

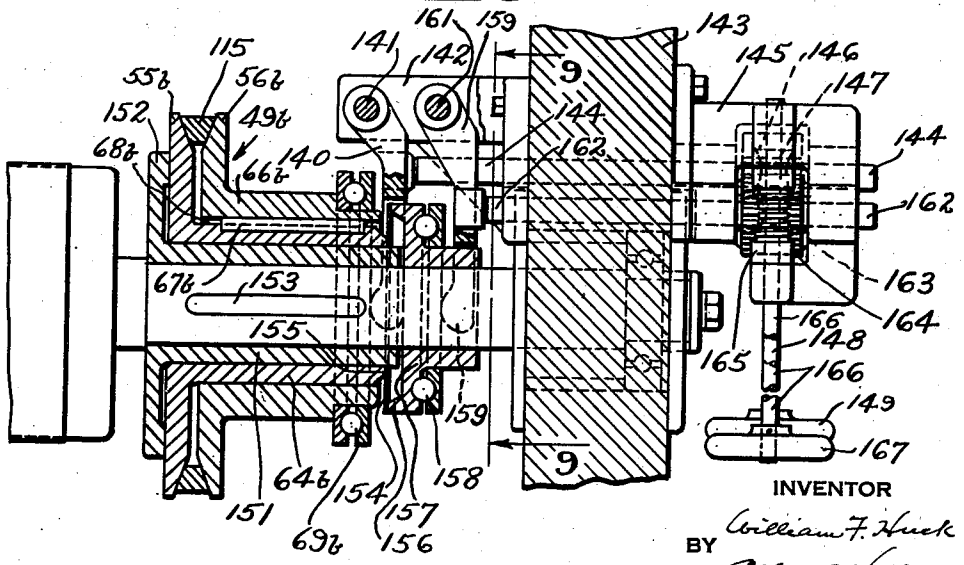

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Fig. 9.

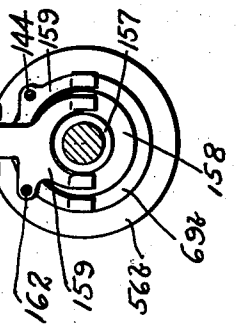

Fig. 6.

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WEB FEEDING MECHANISM

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Fig. 10.

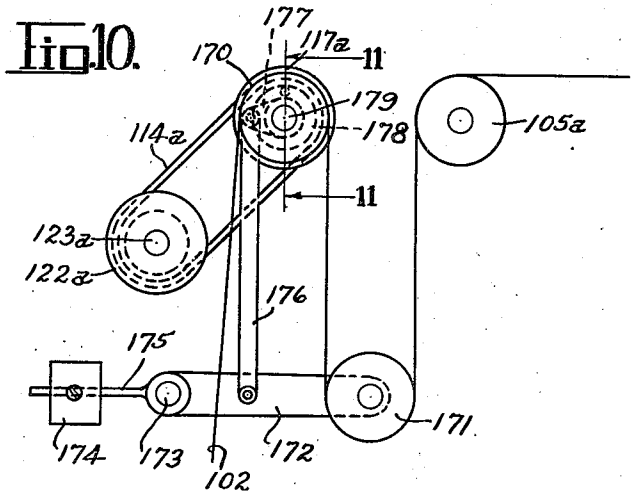


Fig. 12.

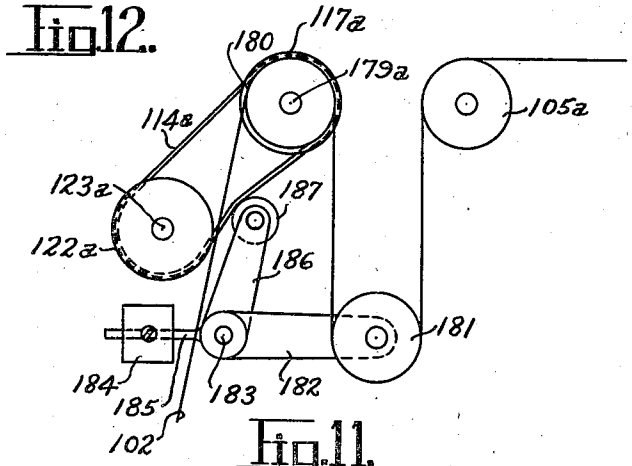
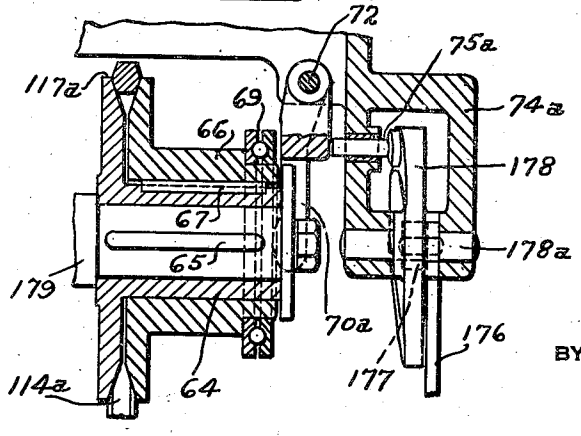


Fig. 11.



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Patented Sept. 26, 1944

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UNITED STATES PATENT OFFICE

2,358,928

WEB FEEDING MECHANISM

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Application January 18, 1943, Serial No. 472,688

30 Claims. (Cl. 270—4)

This invention relates to a driving mechanism adapted to drive forwarding rollers in a rotary web printing machine, to propel the web from the printing cylinder to a folder or other mechanism having a delivery, and similar applications whenever a web or the like is operated upon by components of a machine.

Exemplifications of the invention are herein shown in connection with printing machines for producing newspapers, magazines and similar products wherein one or more webs are forwarded through a printing unit to a folding mechanism and during their travel certain of the webs or portions of them are passed around turning mechanisms which may invert the webs or change their paths of travel as may be necessary in order to produce desired products.

It is customary to provide driven rollers about which the webs are led to pull them through the machine, and in order to maintain the webs taut, these rollers are usually driven at a peripheral speed slightly higher than the speed of the web. This necessitates a small slippage between the rollers and the webs, and produces tension on the webs that creates friction wherever a web passes around turning bars of a web turning mechanism. Where a web is cut into two half sections or ribbons, and one of these ribbons is carried through the machine without being turned while the other ribbon is carried around turning bars to align it with the other ribbon, the resistance to the travel of the web that is turned is considerably greater than the resistance to the travel of the web that is not turned. In consequence, difficulties arise in maintaining the desired tension on the web at the point where it is slit and also at other points in its travel, especially where it is assembled with other webs at the folder. This difficulty can be overcome, however, by the use of mechanism made in accordance with the invention.

Another difficulty that may be overcome by similar corrective action arises in some printing machines where a full-width web is printed with one impression while it is being led through a portion of the machine with one side uppermost, and it is then inverted to bring the other side uppermost for its further travel through the machine where it may receive one or more additional impressions. It has been found that by the use of the web propelling rollers herein disclosed, a full-width web may be carried through a printing machine and held under a tension that will maintain the web taut, while the tension on a portion of the web at and adjacent the turning bars may be considerably relieved and thereby avoid excessive friction between the web and the turning bars.

It is an object of the invention to provide an improved driving mechanism for web propelling or forwarding rollers used in a rotary web printing machine, wherein the web is forwarded through a plurality of components including web turning mechanism.

Another object of the invention is to provide in a web printing machine having web slitting rollers to slit the web into ribbons after printing, a mechanism to insure a substantially equal tension on these ribbons at the slitting rollers.

Another object of the invention is to provide in a multiple web printing machine, mechanism to independently vary the tension on any one of the webs in order to maintain the desired proportionate tension between the webs as they travel from the printing units to be assembled at a folder or other mechanism from which they are passed to a delivery.

Another object of the invention is to provide in a web printing machine improved means to vary the propelling force of the web forwarding rollers while the machine is running.

Another object of the invention is to provide in a web printing machine, means to vary the propelling force of web forwarding rollers in advance of and following a web turning mechanism, whereby the tension of the web forwarded therethrough will be decreased.

Another object of the invention is to provide in a web printing machine, having means to vary the propelling force of web forwarding rollers in advance of and following a web turning mechanism, means whereby the portion of the web at the turning mechanism is automatically maintained at a predetermined tension that is lower than the tension elsewhere throughout its travel through the machine.

It is also an object of this invention to provide available force driving mechanism for forwarding rollers, for webs and the like of generally improved construction, whereby the device will be simple, durable and inexpensive in construction, as well as convenient, practical, serviceable and efficient in its use.

With the foregoing and other objects in view, that will appear as the description proceeds, the invention resides in the combination and arrangement of parts, and in the details of construction hereinafter described and claimed, it being understood that various changes in the precise embodiment of the invention herein dis-

closed may be made within the scope of the claims without departing from the spirit of the invention.

Preferred embodiments of the invention are illustrated in the accompanying drawings, wherein:

Figure 1 shows a diagrammatic arrangement of a portion of a rotary web printing machine in which the features and principles of this invention are embodied;

Figure 2 is a sectional view through a roller adjusting device adapted for use with the web forwarding mechanism of the invention;

Figure 3 is a sectional view through a roller adjusting device adapted for use with the web forwarding mechanism, and which is adapted for operation to adjust the roller while the printing machine is running;

Figure 4 is an enlarged end view of a plurality of roller adjusting devices of the form shown in Figure 3 as they would appear when applied to a printing machine of the form shown in Figure 1;

Figure 5 is a diagrammatic arrangement of a portion of a somewhat different form of rotary web printing machine in which the features and principles of this invention may be embodied;

Figure 6 is a top plan view of a web turning mechanism adapted for use with the printing machine shown in Figure 5 and showing means to adjust the web forwarding rollers thereof;

Figure 7 is a side view of the mechanism shown in Figure 6 looking in the direction of arrows 7—7 in Figure 6;

Figure 8 is a sectional view through a roller driving means and taken on the line 8—8 of Figure 6;

Figure 9 is a sectional view taken on the line 9—9 of Figure 8;

Figure 10 is a schematic view of an arrangement whereby a floating roller, running in a loop of the web, controls a roller adjusting device;

Figure 11 is a sectional view taken on the line 11 of Figure 10, of a roller adjusting device and means actuated by the floating roller to control the same; and

Figure 12 is a modified arrangement whereby a floating roller controls the propelling force of a web forwarding roller.

The printing machine diagrammatically illustrated in Figure 1 includes printing units 11 and 12, each having a pair of plate cylinders 13 and 14 and impression cylinders 15 and 16, adapted to print impressions upon webs 17 and 18 respectively. One, or more, additional printing units may be included in the press structure and adapted to print upon a web, or webs, 19. The printed webs 17, 18 and 19 are led from the printing units over guide rollers 21, 22 and 23 respectively to web slitting mechanisms including slitting rollers 24, 25, and 26, with cooperating slitting wheels 24', 25' and 26' respectively, whereby the webs are slit lengthwise into two, or more, ribbons, as desired. In the machine illustrated in Figure 1, each of the webs 17, 18 and 19 are slit into two ribbons 17*a*—17*b*, 18*a*—18*b*, and 19*a*—19*b* respectively. The ribbons 17*a*, 18*a* and 19*a* are led about guide rollers 27 to web forwarding rollers 34, 36 and 38 respectively, and the ribbons 17*b*, 18*b*, and 19*b* are led through web turning mechanism 28, 29 and 31 respectively, to bring them into alignment with the ribbons 17*a*, 18*a* and 19*a*. They are then led about guide rollers 32 to web forwarding rollers 33, 35 and 37 respectively. Other ribbons 39 which may have been printed by other printing units (not shown) may be individually led about forwarding rollers 41, 42, 43, 44, 45 and 46 and then together with the ribbons 17*a*, 17*b*, 18*a*, 18*b*, 19*a* and 19*b*, led over a drag roller 47 to a folder mechanism 48, which may cut the webs into sheets, after which they are folded and passed on to a delivery.

The slitting rollers 24, 25 and 26 may be driven by the usual arrangement of shafts and gearing connecting with the main shaft of the machine (not shown). With this arrangement, the slitting rollers are usually driven at a peripheral speed slightly higher than the web speed and act as web forwarding rollers. However, in certain classes of work, at least, it has been found that it is unnecessary to drive the slitting rollers because satisfactory control of the ribbons may be obtained by means of the novel driving mechanism for forwarding rollers, herein disclosed.

It will be understood that the ribbons 17*b*, 18*b* and 19*b* that are led through the web turning mechanisms, require a greater pull than do those led directly to the web guiding roller 27 from the slitting rollers 24, 25, and 26, due to the friction of the ribbons on the web turning bars included in the web turning mechanism. If not counteracted, this friction of the ribbons in the web turning mechanism will produce unequal tension on the ribbons as they leave the slitting rollers 24, 25 and 26 and cause unsatisfactory slitting and in some instances tearing of the web.

The mechanism herein shown for driving the web forwarding rollers 33—38 inclusive and 41—46 inclusive so that they may produce the desired propelling force on each ribbon includes V-grooved pulleys 49 (Figure 2), one keyed to the shaft 51 of each roller 33—38, 41—46 and to the shaft of the drag roller 47. These pulleys are preferably each adjustable to vary its effective diameter where the pulley is engaged by a belt 52. The belt 52 is preferably hexagonal in section and led over the adjustable pulley 49 on the shaft 51 of the drag roller 47 (Figure 1), which is driven by a suitable connection (not shown) with the folding mechanism. From the pulley of the drag roller 47, the belt 52 is led about a belt tightening pulley 54 and then in succession about the adjustable pulleys of the rollers 33 to 38 and 41 to 46 inclusive; but in passing from each pulley to the next in the group, the belt is led about an idler pulley 53. From the pulley of the roller 46 the belt runs to the pulley of the drag roller 47, completing the circuit.

Adjustment of each pulley 49 (Figure 2) to vary the diameter of its belt engaging face, is effected by changing the spacing between side flanges 55 and 56, which extend from hubs 57 and 58 respectively. The hub 57 that carries the flange 55 is secured to the roller shaft 51 by a key 59 while the hub 58 that carries the flange 56 is screw-threaded on the hub 57, and thus the flange 56 may be moved toward or away from the flange 55 and vary the effective diameter of the pulley at its point of engagement 61 with the belt 52. A set screw 62 may be provided in the hub 58 to seat against the hub 57 and lock the pulley flanges in their adjusted positions. Wrench holes 63 are also provided to facilitate rotation of the hub 58 upon the hub 57 in adjusting the pulley 49.

An adjustable grooved pulley of modified form which permits adjustments to be made while the machine is running, is shown in Figures 3 and 4. In this arrangement, a hub 64 that carries a flange 55*a* is keyed to a roller shaft 51*a* by a key 65 and a hub 66 that carries a flange 56*a* is slip-

keyed to the hub 64 by a key 67 fixed in the hub 64, which engages a key slot 68 in the hub 66. The hub 66 carries a thrust bearing 69, against which a forked lever 70 presses and when the lever is moved toward the left as seen in Figure 3, it moves the pulley flange 56a toward the pulley flange 55a. The forked lever 70 is pivoted to a stationary frame part or bracket 71, by a pin 72, and is acted upon by a stud 73, slidably mounted in a bracket portion 74 and keyed against rotative movement in respect thereto by a key 75. The stud 73 is provided with a threaded portion 76, intermediate its ends, upon which an internally threaded worm-wheel 77 rides, and when rotated, moves the stud 73 axially.

A worm gear 78 (Figure 4), arranged to cooperate with the worm-wheel 77 is secured to a shaft 79, that is extended downwardly and provided at its remote end 81 with a handwheel 82 by which it may be rotated.

Rotation of the handwheel 82 in one direction will thus act through the shaft 81, worm-gear 78, worm-wheel 77 and stud 73, to move the hub 66, and the flange 56a toward the flange 55a and increase the effective diameter of the pulley 49a, while rotation of the handwheel 82 in the opposite direction will permit separation of the flange 56a from the flange 55a by the pressure of the belt 52 with consequent decrease in the effective diameter of the pulley.

It will be seen that with the equipment shown in Figure 1, the speed of each of the web forwarding rollers 33 to 38 and 41 to 46 inclusive may be varied as desired. The rollers 33, 35 and 37, which propel ribbons that are carried around turning bars, may be driven at a higher speed than the rollers 34, 36 and 38, which carry ribbons having less resistance to overcome. Thus the rollers 33, 35 and 37, may be adjusted to impose sufficient additional pull on the turned ribbons, to counteract the frictional resistance at the turning bars, and maintain equal pull on the ribbons cut from each web as they leave the slitting roller, and equalize the tension on all the ribbons as they approach the drag roller 47 at the folder. By the use of equipment so arranged, it is unnecessary to provide means for driving the slitting mechanism of machines for printing products, because an even tension is assured at all points widthwise of the web while it is being slit, and inaccurate slitting or tearing of the web is avoided. If desired, an ordinary V-grooved pulley may be substituted for the adjustable pulley 49 on the shaft of the drag roller 47, but the use of an adjustable pulley at this point makes it possible to simultaneously increase or decrease the speed of all of the web forwarding rollers merely by adjusting the pulley of the drag roller 47.

In Figure 5 a portion of a rotary intaglio web printing machine is illustrated and shows printing units 91, 92 and 93 each having an intaglio form cylinder 94, with a cooperating impression roller 95 engaged by a pair of pressure back-up cylinders 96. The printing unit 91 is shown printing an impression on a web 97 that may have previously been printed on one or both sides by other printing units (not shown). From the unit 91, the web 97 is led about guide rollers 98 to and over a web forwarding roller 100, and thence by guide rollers 98' to a drag roller 99 associated with a folding mechanism 101. Another web 102 is led about guide rollers 103 to the printing unit 92, where an impression is printed on one side, and it is then led about guide rollers 104 and a web forwarding roller 105 to a web turning mechanism 106 (Figure 6), wherein the web is led successively about a turning bar 107, an inverting roller 108, and a turning bar 109, whence it is led about forwarding roller 111 and guide rollers 112 to present the unprinted side of the web to the form cylinder of the printing unit 93. After leaving the printing unit 93 the web 102, now printed on both sides, is led about rollers 113 to the drag roller 99 where it meets the web 97 and both are received by the folding mechanism 101.

The drag roller 99 and rollers in the folding mechanism 101 are driven slightly faster than the speed of the web to insure that any slackness in the webs at the time of starting the machine will be taken up, and the webs will thereafter be held taut, to insure their proper register with each other and for action thereon by the folding mechanism 101.

As a result of this tautness in the web, it is drawn quite tightly about the turning bars of the web turning mechanism 106. On rotogravure machines, and especially where the webs are wide, this friction frequently results in smutting of the ink and other difficulties in connection with the forwarding of the web. In Figure 6, means are shown for driving the web forwarding rollers 105 and 111 in such manner that the tension on the portion of the web between these rollers and passing through the turning mechanism 106, will be substantially reduced and the friction between it and the turning bars greatly relieved.

The web forwarding roller 105 and the web forwarding roller 111 are driven through belts 114 and 115 respectively from a connection with a common drive shaft 116 by means of adjustable pulleys 117 and 118, which may be the same as either of the adjustable pulleys shown in Figures 2 and 3. It has also been found desirable in some instances, to drive the web inverting roller 108 (Figures 6 and 7), from a connection with the drive shaft 116, and this is accomplished through a belt 119, and an adjustable pulley 121, also the same as the adjustable pulleys shown in either Figure 2 or Figure 3.

The belt 114, included in the drive for the web forwarding roller 105, is led about the adjustable pulleys 117 and 122, the latter being secured to a cross-shaft 123 having a driving connection with the common drive shaft 116 through bevel gears 124 and 125.

The belt 115, included in the drive for the web forwarding roller 111, is led about the adjustable pulley 118, and an adjustable pulley 126 that is secured to a jack shaft 127 which has a driving connection with the common drive shaft 116, through bevel gears 128 and 129. The belt 119, included in the drive for the web inverting roller 108, is led about the adjustable pulley 121 and an adjustable pulley 131 which is secured to the cross-shaft 123. The adjustable pulley 121 is connected to a jack shaft 132 which in turn is drivingly connected to the shaft 133 of the inverting roller 108 through bevel gears 134 and 135.

The adjustable pulleys 117, 118, and 121 may be of either of the forms shown in Figures 2 or 3, but for rotary intaglio printing and whenever there is a tendency for slippage of the web on the forwarding rollers to cause smutting it is preferable to use adjustable pulleys of the form shown in Figures 8 and 9 wherein an adjustable friction clutch is built into the structure, thereby providing an adjustable torque variable speed driving device. The friction clutch allows slippage between the web forwarding rollers and their driving means and thereby eliminates objectionable

slippage between the web and the forwarding rollers.

This combined adjustable pulley and friction clutch, herein called a clutch pulley, as shown in Figures 8 and 9, includes an adjustable pulley **49***b*, similar to those shown in Figures 2 and 3, and having side flanges **55***b* and **56***b* provided with hub portions **64***b* and **66***b* respectively, which are prevented from relative rotation, though permitted relative axial motion by a key **67***b*, secured to the hub **64***b* and cooperating with a key slot **68***b* in the hub **66***b*. A ball thrust bearing **69***b* is mounted on the hub **66***b*. The ball thrust bearing is adapted to be engaged by a forked lever **140** pivoted by a pin **141** to a bracket **142** secured to a machine frame member **143**. An elongated threaded stud **144** engages the forked lever **140**, and extends through the frame **143** into a bracket **145**. The stud **144** is moved longitudinally by mechanism substantially the same as that shown in Figure 3, including an internally threaded worm-wheel **146**, which engages the thread on the stud and is arranged to be rotated by a worm-gear **147** carried by a rod **148** having a handwheel **149** at its lower end.

The hubs **64***b* of the clutch pulleys associated with the rollers **105** and **111**, and with the jack shaft **132** are not keyed to their shafts, but are rotatably mounted upon a hub portion **151** of a clutch disc **152** which is keyed to the respective roller shaft or jack shaft by a key **153**. The clutch disc **152** is arranged to be engaged by the pulley flange **55***b* when the latter is moved axially on the hub **151** toward it. Means for pressing the pulley flange **55***b* into engagement with the disc **152** includes a flat spring ring **154** slidably mounted on the hub portion **151** with its inner edge in engagement with an end **155** of the hub **64***b*. The outer edge of the spring ring **154** is engaged by a flange **156** on an operating sleeve **157** slidably mounted on the respective roller shaft or jack shaft. The flange **156**, preferably forms one plate of a ball thrust bearing **158** adapted to be engaged by a forked lever **159** which is pivoted by a pin **161** to the bracket **142**.

A stud **162** engages the forked lever **159** to press it against the thrust bearing **158** and through the spring ring **154** to resiliently force the pulley flange **55***b* into engagement with the clutch disc **152** to effect a driving connection from the adjustable pulley to the respective roller shaft or jack shaft. As in arrangement shown in Figure 3, the stud **162** is extended through the frame **143** into the bracket **145** and has a threaded portion **163** cooperating with an internally threaded worm-wheel **164**, which is arranged to be rotated by a worm-gear **165** carried by a rod **166** having a handwheel **167** at its lower end. Rotation of the handwheel **167** in the proper direction causes the forked lever **159** acting through the spring ring **154** to press the pulley flange **55***b* against the clutch disc **152** and to vary the pressure as desired. Both of the studs **144** and **162** are slide-keyed to the bracket **145**, as in the form shown in Figure 3, to prevent rotation.

If adjustability of the clutches, while the machine is running, is not required, simplification can obviously be effected by substituting a nut screw-threaded on each of the respective shafts and bearing against the sleeve **157** for the handwheels **167** and their connections to and including the thrust bearings **158**.

With the equipment shown in Figure 6, the driving torque and potential speed of each of the rollers **105**, **108** and **111** may be adjusted so that when the web turning and inverting mechanism shown is employed as depicted in Figure 5, friction between the web and the turning bars may be considerably reduced. The web is drawn through the printing units and to the drag roller **99** under considerable tension, because of the pull imposed thereon by that roller. Were it not for the clutch pulleys through which the rollers **105**, **108** and **111** are driven, a heavy friction would result between the web and the turning bars **107** and **109**, but by adjusting the pulley on the roller **105** to produce a strong forward pull or drag on the web, and the roller **108**, to produce substantially less drag, the friction of the web as it passes over the turning bar **107** may be very materially reduced. Then by adjusting the clutch pulley associated with the roller **111** to produce still less drag on the web than that caused by the roller **108**, it is possible to reduce the friction between the web and the turning bar **109**. This reduction of the pressure of the web on the turning bars reduces the tendency to smutting of the ink, and simplifies the ink drying problem that is incident to the operation of these machines. While adjustable pulleys are herein shown for variably driving the roller **108**, it is not always necessary to drive this roller, for in many cases the friction between the web and the turning bars can be sufficiently reduced by the use of adjustable pulleys on the rollers **105** and **111** only.

The adjustable pulleys, shown in Figures 2 and 3, may be employed in the arrangement shown in Figure 6, if the friction clutch feature is not required. In such cases, the pulleys may be adjusted to drive the rollers potentially at the speeds necessary to maintain the desired reduced friction between the web and the turning bars but allowing the belts to slip, so that there is no slippage between the rollers and the web. Alternatively, the pulleys may be adjusted to positively drive the rollers at the required speed and depend on slippage between the rollers and the web in cases where such slippage would not cause smutting.

It will be understood that clutch pulleys as shown in Figure 8 may be substituted for the simpler form of adjustable pulley described in connection with the machine shown in Figure 1, and that these clutch pulleys may also be employed advantageously to drive any web forwarding rollers such as the slitting rollers **24**, **25** and **26** (Figure 1), because they may be driven at a higher speed than the speed of the web and the friction clutch can be adjusted to provide only the necessary propelling force to keep the web taut, so there need be no slippage between the web and the roller, such slippage as is required, taking place between the roller and the means employed to drive it.

In the arrangement shown in Figures 10 and 11, one of the roller adjusting devices is controlled by a floating roller running in a loop in the web. With the parts disposed as shown, this arrangement is adapted for application to the mechanism shown in Figures 6 and 7 and hence applicable to the press shown in Figure 5. In Figure 10, the roller **105***a* corresponds with the roller **105** in Figures 5 and 6.

A floating roller **171** is carried by arms **172** which are secured to a rotatably supported shaft **173**. A weight **174** is adjustably secured to a rod **175** projecting from a hub on an arm **172**. A link **176** is pivotally secured at one end to the said arm **172** and at the other end to an arm **177**, extending from the hub of a face-cam **178**,

secured to a shaft 178a (Figure 11) rotatably supported in a bracket 74a corresponding to the bracket 74 of Figure 3. The face of the cam 178 engages the head of a plunger 75a slidably supported in the bracket 74a and engaging a forked lever 70a, corresponding to the forked lever 70 of the mechanism illustrated in Figure 3, to vary the effective diameter of the adjustable pulley 117a, which corresponds with the pulley 117 shown in Figure 6. In this instance the pulley 122a, shaft 123a, and the belt 114a correspond with the pulley 122, shaft 132, and belt 114 shown in Figure 6. The web 102 is led over a roller 170, then around the floating roller 171, and then over the roller 105a. Other elements and parts shown in Figure 11 correspond in form and operation with those shown in Figure 3 and therefore have the same reference numerals. Variation in the tension of the web 102 causes the roller 171 to rise or fall, thus moving the arm 172, link 176, and the face-cam 178, which latter acts on the plunger 75a to cause the forked lever 70a to vary the effective diameter of the pulley 117a. It is obvious that if desired, the automatic control arrangement shown in Figures 10 and 11 can be applied to the means for regulating the pressure of the pulley flange 55b against the clutch disc 152 shown in Figure 8.

In the arrangement shown in Figure 12, slippage of the belt 114a on the pulleys 117a and 122a is varied by means of a floating roller 181 running in a loop in the web 102. The roller 181 is carried on arms 182 which are secured to a rotatably supported shaft 183. A weight 184 is adjustably secured to a rod 185 extending from a hub on an arm 182. Another arm 186, extending from the hub on the said arm 182 has a belt tightening roller 187 journaled in its upper end and in running engagement with the belt 114a to vary its pressure on the pulleys 117a and 122a. The web 102 is led over a roller 180, carried on a shaft 179a then around the floating roller 181, and then over the roller 105a, corresponding to the roller 105 in Figure 6. It will be seen that an increase in web tension will raise the roller 181 and press the roller 187 against the belt 114a thereby increasing the speed of the roller 180 and feeding the web enough faster to relieve the tension.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiments be considered in all respects as illustrative and not restrictive, reference being had to the claims rather than to the foregoing description to indicate the scope of the invention.

What I claim is:

1. In a web printing machine, the combination of a plurality of printing units each arranged to print a web, a web forwarding roller in the path of each web and arranged to propel it from the printing unit toward a drag roller acting on all of the webs, and a variable speed driving device for each of the forwarding rollers, whereby tension on each of the several webs being propelled toward the drag roller may be separately adjusted.

2. In a web printing machine having a printing unit, a folder and web slitting and turning means in the path of the web between the printing unit and the folder to slit the web into ribbons and turn one of the said ribbons to superimpose it over another ribbon, a web forwarding roller in the path of each ribbon between the turning means and the folder, and variable speed driving means for each web forwarding roller, whereby a roller propelling a turned and superimposed ribbon may be driven for a higher potential speed than a roller propelling a ribbon that is not turned, and thereby impose substantially the same pulling force on each edge of the web as it is presented to the slitting means.

3. In a web printing machine having a printing unit, a folder, web slitting means to slit the web into ribbons, and web guiding means to guide the ribbons to the folder through separate paths differing in resistance, a web forwarding roller in the path of each ribbon and variable speed driving means for each of the said web forwarding rollers, whereby a roller propelling a ribbon led through a path having high resistance may be driven for a higher potential speed than a roller propelling a ribbon that is led through a path of low resistance, and thereby impose substantially the same pulling force on each edge of the web as it is presented to the slitting means.

4. In a web printing machine, the combination of a plurality of printing couples and a folder, means to forward a web printed by a first printing couple to a web turning mechanism, thence to a second printing couple, and thence to a folder having a drag roller, the said turning mechanism including a first web forwarding roller, a first web turning bar, an inverting roller, a second web turning bar, and a second web forwarding roller; with a variable speed device for driving each web forwarding roller, whereby the first web forwarding roller may be driven at a speed potentially faster than web speed, and the second web forwarding roller may be driven at a potentially slower speed, to thereby relieve tension on the portion of the web passing around the turning bars.

5. In a web printing machine, a plurality of printing units each arranged to print upon a web, a drag roller acting on all of the webs, a web forwarding roller adapted to act upon each web to forward it from a printing unit toward the drag roller, and a separately adjustable variable speed driving device for each of the web forwarding rollers.

6. In a web printing machine having a plurality of printing units each arranged to print upon a web and means to slit a web into ribbons after it has been printed, a drag roller acting on all of the ribbons formed by the said slitting means, a web forwarding roller adapted to act upon each ribbon to propel it from the slitting means toward the drag roller, and a variable torque driving device for each of the forwarding rollers.

7. In a web printing machine, a plurality of printing units each arranged to print upon a web, a drag roller acting on all of the webs, a web forwarding roller adapted to act upon each web to forward it from a printing unit toward the drag roller, and an adjustable torque variable speed driving device for each of the web forwarding rollers.

8. In a web printing machine having a plurality of printing units each arranged to print upon a web, means to slit the web into ribbons after it has been printed, and means to turn one of the ribbons, a web forwarding roller following the slitting means to act on an unturned ribbon to forward it from the slitting means, a web forwarding roller following the web turning means to act on a turned web ribbon to forward it from the turning means, and a variable speed driving device for each of the forwarding rollers.

9. In a web printing machine having a first printing unit arranged to print upon one side of a web, a second printing unit arranged to print upon the opposite side of the web, a web turning device between the printing units, a drag roller acting on the web and following the second printing unit, a web forwarding roller preceding the web turning device, a web forwarding roller following the web turning device, and an adjustable torque variable speed driving device for each of the web forwarding rollers.

10. In a web printing machine having a first printing unit arranged to print upon one side of a web, a second printing unit arranged to print upon the opposite side of the web, a web turning device between the printing units, a web forwarding roller preceding the web turning device, a web forwarding roller following the web turning device, and a separately adjustable driving device for each of the web forwarding rollers to drive it at a potential speed different from the speed of the web, and of the other web forwarding roller.

11. In a web printing machine having a first printing unit arranged to print upon one side of a web, a second printing unit arranged to print upon the opposite side of the web, a web turning device between said printing units, said web turning device including web turning bars and an inverting roller between the turning bars, a web forwarding roller preceding the web turning bars, a web forwarding roller following the web turning bars, and an adjustable speed variable torque driving device for each of the web forwarding rollers and for the inverting roller.

12. In a web printing machine having a first printing unit arranged to print upon one side of a web, a second printing unit arranged to print upon the other side of the web, a web turning device between said printing units, a drag roller acting on a plurality of webs and following the second printing unit, the web turning device including web turning bars and a web inverting roller between the turning bars, a web forwarding roller preceding the web turning bars, a web forwarding roller following the web turning bars, and an adjustable speed variable torque driving device for each of the web forwarding rollers, for the outside roller, and for the drag roller.

13. In a web printing machine having a printing unit, a folder, a web slitting and a web turning means between the printing unit and the folder to slit the web into ribbons and turn a first ribbon to superimpose it over a second ribbon that is not turned, a web forwarding roller to act on each of the ribbons, driving means for each of the ribbon forwarding rollers, and means to adjust the driving torque applied to each forwarding roller to vary the tension on the web ribbon forwarded thereby.

14. In a web printing machine having a printing unit, a folder, a web slitting and a web turning means between the printing unit and the folder to slit the web into ribbons and turn a first ribbon to superimpose it over a second ribbon that is not turned, a web forwarding roller to act on each of the ribbons between the turning means and the folder, a drag roller arranged to act on all of the ribbons and disposed between the forwarding rollers and the folder, a first driving means for each of the ribbon forwarding rollers, a second driving means for the drag roller, means to adjust the driving torque applied to each forwarding roller to vary the tension on the ribbon forwarded thereby, and means to adjust the driving torque applied to the drag roller to simultaneously vary the tension on all of the ribbons acted on by the drag roller.

15. In a web printing machine, a plurality of printing units each arranged to print upon a web, a drag roller acting on all of the webs, a web forwarding roller adapted to act upon each web to propel it from the printing unit toward the drag roller, a variable speed driving device for each of the web forwarding rollers, and each of the driving devices including cooperating adjustable V-grooved pulleys, and means to vary the effective diameter of each of the pulleys.

16. In a web printing machine, a plurality of printing units each arranged to print upon a web, a drag roller common to all of the webs, a web forwarding roller adapted to act upon each web to propel it from the printing unit toward the drag roller, an adjustable speed variable torque driving device for each of the web forwarding rollers and for the drag roller, each of the driving devices including cooperating adjustable V-grooved pulleys, means to vary the effective diameter of each of said pulleys, a friction clutch between each of the pulleys and the roller driven thereby, and means to adjust the effective friction of each clutch.

17. In a web printing machine, a plurality of printing units each arranged to print on a web, a web forwarding roller in the path of each web and arranged to impose a pulling force thereon to propel it from the printing unit toward a drag roller acting on all of the webs, and an adjustable torque driving device for one of the web forwarding rollers, whereby the pulling force imposed on the web by the said one roller may be adjusted to a different value from the pulling force imposed on a web by another forwarding roller.

18. In a web printing machine, a web propelling roller, a pulley, a driving belt engaging the pulley, means for varying the effective diameter of the pulley over the area engaged by the belt, and an adjustable friction clutch interposed between the roller and the pulley, whereby the roller may be driven for a speed potentially different from the speed of the web and the clutch may be adjusted to maintain a desired pulling force of the roller on the web while permitting the roller to run at web speed.

19. In a web printing machine, a web propelling roller, a pulley, a driving belt engaging the pulley, adjusting means for varying the effective diameter of the pulley over the area engaged by the belt, a friction clutch interposed between the roller and the pulley, and adjusting means for the clutch, whereby the roller may be driven for a speed potentially different from the speed of the web and the clutch may be adjusted to maintain a desired pulling force of the roller on the web while permitting the roller to run at web speed; one of the said adjusting means being operable while the machine is running.

20. In a web printing machine having a web turning device arranged to turn a web during its travel through the machine to position its under side uppermost, a web propelling roller having a variable speed driving device and positioned to feed the web toward the turning device, a floating roller rotatably held in a movable member and running in a loop in the web between the web propelling roller and the turning device, and means connecting the movable member with the variable speed driving device, whereby variation in the tension of the web at the turning device will control the speed of the web propelling roller.

21. In a web printing machine having a web turning device arranged to turn a web during its travel through the machine to reverse the relative positions of its opposite sides, a web propelling roller having a variable torque driving device and positioned to feed the web toward the turning device, a floating roller rotatably held in a movable member and running in a loop in the web between the web propelling roller and the turning device, and means connecting the movable member with the variable torque driving device, whereby variation in the tension of the web at the turning device will vary the torque imposed on the web propelling roller.

22. In a web printing machine having a web turning device arranged to turn a web running through the machine to reverse the relative positions of its opposite sides, a web propelling roller having a driving pulley and positioned to feed the web toward the turning device, a second pulley driven in timed relation with the machine, a belt operably connecting the pulleys, first means to vary the effective diameter of one of the pulleys, a floating roller carried on a movable member and supported by the web between the web propelling roller and the turning device, and second means connecting the movable member with the first means, whereby variation in the tension of the web at the turning device will vary the speed of the web propelling roller.

23. In a web printing machine having a web turning device arranged to turn a web running through the machine to position its under side uppermost, a web propelling roller positioned to feed the web toward the turning device, a pulley having a clutch to connect it to the web propelling roller, a second pulley driven in timed relation with the machine, a belt operably connecting the pulleys, first means to vary the engaging pressure of the clutch, a floating roller carried on a movable member and supported by the web between the web propelling roller and the turning device, and second means connecting the movable member with the first means, whereby variation in the tension of the web at the turning device will vary the driving force imposed on the web propelling roller.

24. In a web printing machine having a web turning device arranged to turn a web during its travel through the machine to position its under side uppermost, a web propelling roller having a driving pulley and positioned to feed the web toward the turning device, a second pulley driven in timed relation with the machine, a belt operably connecting the pulleys, a floating roller carried on a movable member and supported by the web between the web propelling roller and the turning device, and a belt tightening device associated with the movable member and arranged to vary the pressure of the belt on the pulleys, whereby variation in the tension of the web at the turning device will vary the driving force imposed on the web propelling roller.

25. In a web printing machine having a web turning device arranged to reverse a web during its travel through the machine, a first web propelling roller from which the web is led to the turning device, a second web propelling roller to which the web is led from the turning device, means for driving the propelling rollers, and means for adjusting the driving means, whereby the first propelling roller will impose a greater pull on the web than the second propelling roller and the tension of the web between the propelling rollers will be lower than elsewhere in the machine.

26. In a web printing machine having a first printing unit arranged to print upon one side of the web, a second printing unit arranged to print upon the opposite side of the web, a web forwarding roller between the printing units, an adjustable driving device for the web forwarding roller to drive it at a speed potentially different from the speed of the web, a floating roller rotatably held in a movable member and running in a loop in the web, and means connecting the movable member with the adjustable speed driving device, whereby variation in the tension of the web at the floating roller will control the speed of the web forwarding roller.

27. In a web printing machine having a printing unit, a folder, a web slitting and a web turning means between the printing unit and the folder to slit the web into two ribbons and turn one ribbon to superimpose it over the other ribbon, a driven drag roller to forward both ribbons to the folder, a variably driven forwarding roller between the turning means and the drag roller, and means for adjusting the driving torque imposed on the forwarding roller to regulate the pulling force applied to the turned ribbon being propelled toward the drag roller.

28. In a web printing machine a plurality of printing units, a folder, means for leading a web from each printing unit to the folder, a web slitting and a web turning means between each printing unit and the folder, to slit each web into ribbons and turn a first ribbon to superimpose it over a second ribbon, a variably driven forwarding roller in the path of each first ribbon to apply a pulling force thereon to propel it toward a driven drag roller acting on all of the ribbons, and means for adjusting the driving torque imposed on each forwarding roller.

29. In a web printing machine having a printing unit, a folder, a web slitting and a web turning means between the printing unit and the folder to slit the web into two ribbons and turn one ribbon to superimpose it over the other ribbon, a driven drag roller to forward both ribbons to the folder, a variably driven forwarding roller between the turning means and the drag roller, and means operable while the machine is running, for adjusting the driving torque imposed on the forwarding roller to regulate the pulling force applied to the turned ribbon being propelled toward the drag roller.

30. In a web printing machine a plurality of printing units, a folder, means for leading a web from each printing unit to the folder, a web slitting and a web turning means between each printing unit and the folder, to slit each web into ribbons and turn a first ribbon to superimpose it over a second ribbon, a variably driven forwarding roller in the path of each first ribbon to apply a pulling force thereon to propel it toward a driven drag roller acting on all of the ribbons, and means operable while the machine is running, for adjusting the driving torque imposed on each forwarding roller.

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