United States Patent

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[72] Inventor **Ernest H. Treff**
Groton, Conn.

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[73] Assignee **Harris-Intertype Corporation**
Cleveland, Ohio
a corporation of Delaware

[54] **AUTOMATIC WEB TENSION AND REGISTER CONTROL**
10 Claims, 2 Drawing Figs.

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[51] **Int. Cl.** **B65h 39/16,** B65h 25/10
[50] **Field of Search** 270/52, 41; 226/28, 30, 40, 44, 25; 101/179, 181, 248

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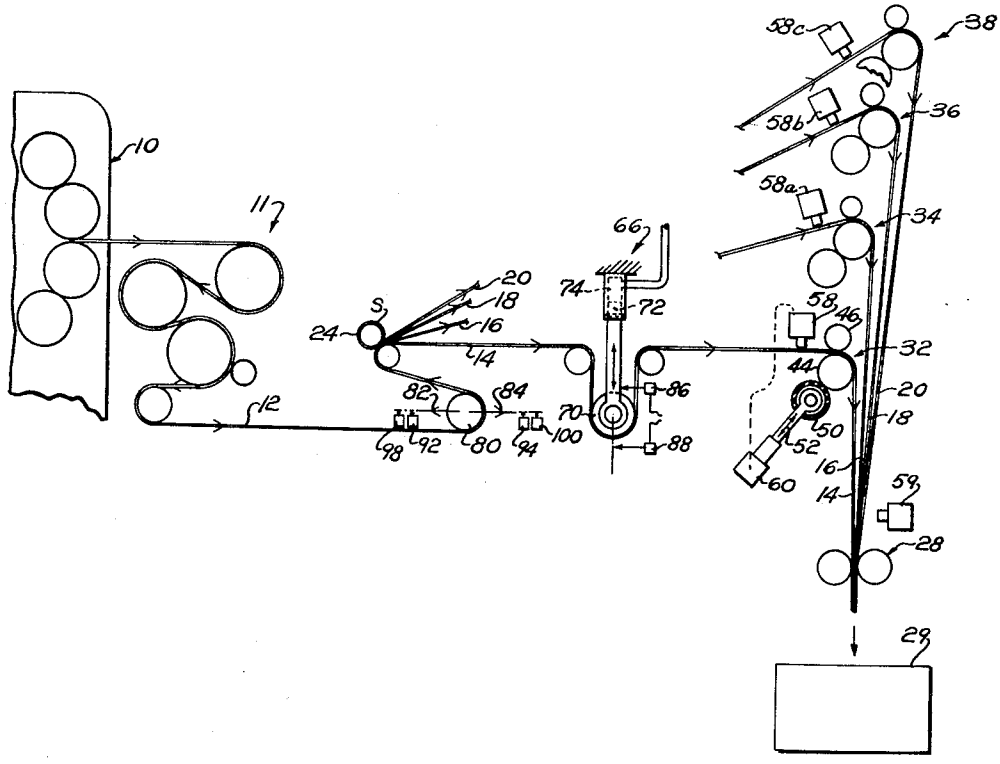
Primary Examiner—Lawrence Charles
Attorney—Yount, Flynn and Tarolli

ABSTRACT: An automatic web tension and register control associated with a web traveling from a printing press to a folder includes a variable speed drive means for varying the speed of the ribbon, and a control means associated with the variable speed drive means for controlling the operation of the drive means. A tension control means maintains a substantially constant tension in the ribbon of material between the printing press and the variable speed drive. The variable speed drive is operative to vary the speed of movement of the ribbon while maintaining substantially constant the length of the ribbon between the drive and a processing unit or an assembly for working on the ribbon.



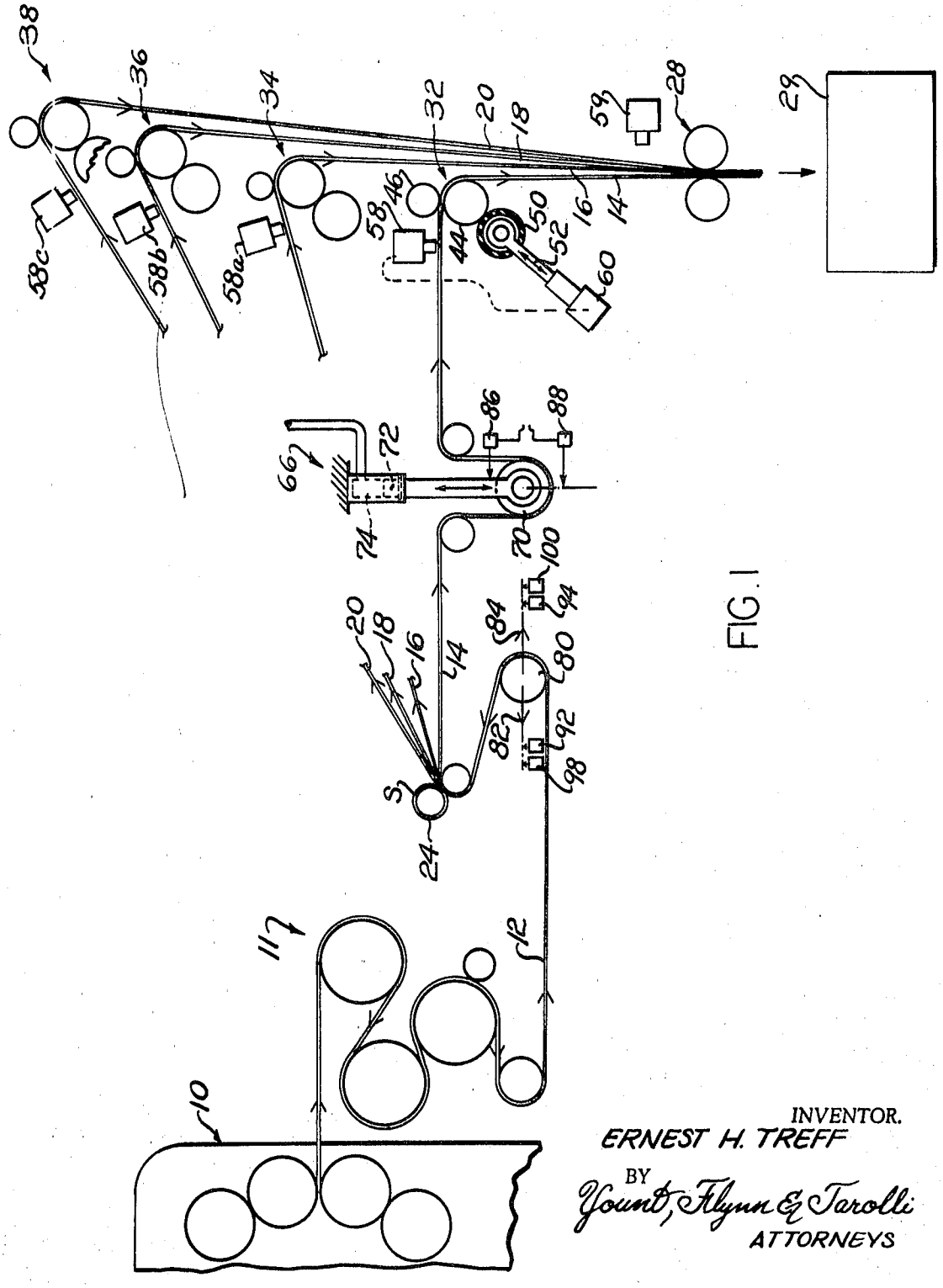


FIG. 1

INVENTOR.
ERNEST H. TREFF
BY
Yount, Flynn & Tarolli
ATTORNEYS

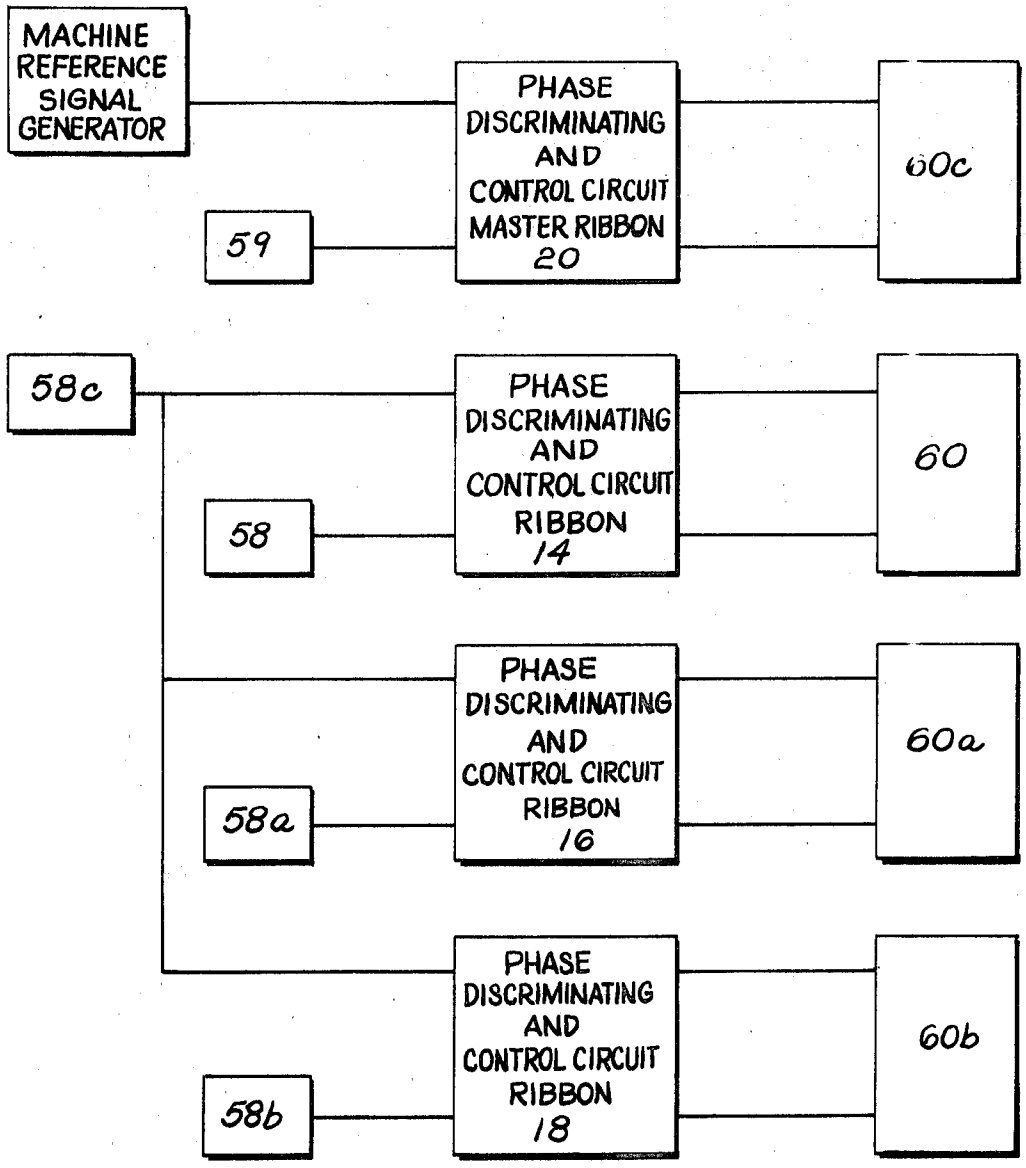


FIG. 2

INVENTOR.
ERNEST H. TREFF
BY
Yount, Flynn & Tarolli
ATTORNEYS

AUTOMATIC WEB TENSION AND REGISTER CONTROL

This invention relates to an apparatus for controlling the tension in a moving strip or ribbon and registration of the ribbon with other ribbons.

Printed webs from printing presses are customarily cut into a plurality of ribbons or strips which, while traveling at high speeds, are brought into registration in a face-to-face relationship, folded and cut into signatures. Due to a lack of uniformity in the paper forming the printed web from which the ribbons or strips are cut, including different moduli of elongation or elasticity, the tension in the ribbons varies and registration problems result. Heretofore, it has been customary to maintain the ribbons in registration with each other by moving compensator rolls which vary the length of the paths through which the ribbons travel before being brought into face-to-face relationship. Due to the relatively high speeds at which the ribbons are traveling, errors in registration must be detected and the relative positions of the ribbons quickly and accurately adjusted to minimize the duration of improper registration between the ribbons. When errors in registration are corrected by moving a compensator roll to vary the length of the path of travel of a ribbon, a relatively long period of time is required before the correction in registration is achieved. This time period is in the order of 5 times the time required for the length of material between the printing press and the folder to move through that distance. This long time period results in much waste, since many feet of web material are processed before the correction is effected. Moreover, it has been found that the quality of the product from a folder is highest if constant tension is maintained on the ribbons of web material being directed to the folder. This is particularly difficult to attain because the cutoff of the ribbon creates a tension change in the ribbons. Furthermore, a registration system which includes movement of a roll to change web path length also effects a change in web tension.

Accordingly, it is an object of this invention to provide an apparatus for maintaining a plurality of ribbons advancing to a processing unit in substantial registration with each other and for quickly and accurately correcting any misregister of the ribbons which may occur and yet maintain a constant tension in substantially the entire length of all the ribbons even while misregister correction is being effected.

Another object of this invention is to provide a web register apparatus for effecting a change in the speed of movement of a ribbon relative to a processing unit for working on the ribbon to register the ribbon to the processing unit while maintaining the tension of the ribbon substantially constant.

Another object of this invention is to provide a web register apparatus including a variable speed drive means for varying the speed of movement of a traveling ribbon to thereby correct errors in registration of the ribbon and a control means for sensing a section of the traveling ribbon ahead of the variable speed drive means to detect errors in the registration of the ribbon and initiating a change in the speed of operation of the drive means before the sensed section of ribbon is engaged by the variable speed drive means.

Still another object of this invention is to provide an apparatus including a tension control means for maintaining a substantially constant tension in a ribbon as the ribbon is moved from one processing unit, such as a printing press, to a second processing unit, such as a folder, and variable speed drive means for varying the speed of the ribbon relative to the second processing unit while maintaining substantially constant the length of the ribbon between the drive means and the second unit to thereby quickly and accurately effect registration of the ribbon with the second unit.

Yet another object of this invention is to provide an apparatus which includes a printing press for printing on a web of material, cutter means for splitting the web into a plurality of ribbons, a plurality of tension control means for maintaining the tension in associated ribbons substantially constant, a plurality of drive means for moving the associated ribbons toward a unit for working on the ribbons, and a plurality of control means for varying the speed of operation of the associated drive means to thereby maintain a predetermined registered relationship between the plurality of ribbons and the unit for working on the ribbons.

These and other objects and features of the invention will become more apparent upon consideration of the following description taken in connection with the accompanying drawings in which:

FIG. 1 illustrates schematically a tension and register control apparatus for providing registration between a plurality of ribbons which are cut from the same web while maintaining tension in the ribbons substantially constant; and

FIG. 2 illustrates a schematic control circuit forming a part of the tension and register control of FIG. 1.

Although the present invention is usable in many different environments, it is illustrated in the drawings in connection with a printing press **10** having a well-known chill roll unit **11** associated therewith. The press **10** prints on a web of material **12** which is advanced therethrough. The printed web **12**, after leaving the chill roll unit **11**, is slit longitudinally into a plurality of ribbons **14**, **16**, **18** and **20** by a cutter assembly **24**. The ribbons **14**, **16**, **18** and **20** are properly registered and brought into face-to-face engagement with each other by a pair of rollers **28** prior to being folded longitudinally and cut transversely to form a plurality of signatures in a folder assembly **29**. The printing press **10** and folder assembly **29** are illustrated schematically, since their structure is not important to the present invention.

Although the ribbons are cut from the same web **12** of printed material, the paper forming the web is usually nonuniform across its relatively wide width. Therefore, each of the webs **14—20** will have somewhat different characteristics. These different characteristics, such as different moduli of elasticity, usually result in errors in registration at the rolls **28**. Moreover, the vagaries of the mechanical dynamics of a folder or other assembly which is associated with the rolls **28** create registration problems due to the fact that tension changes in the ribbons inherently are created by operation of the cutoff in the folder. In order to maintain a substantially constant register between the ribbons **14**, **16**, **18** and **20**, it is necessary to compensate for the variations in the characteristics of the paper forming the ribbons and the operation of a folder unit or assembly, or other assembly for working on the ribbons. To this end, variable speed drive assemblies **32**, **34**, **36** and **38** are associated with each of the ribbons for independently varying the speed of movement of the associated ribbons.

The variable speed drive assembly **32** is adjustable to maintain the ribbon **14** in substantial registration with the other ribbons by moving the ribbon **14** at a speed which is either faster or slower than a predetermined normal speed which corresponds to the speed of operation of the printing press **10** and the folder assembly associated with the rolls **28**. When an error in registration occurs due to the ribbon **14** being ahead of its registered position, the rate of operation of the variable speed drive assembly **32** is reduced to reduce the speed of movement of the ribbon **14** and bring the ribbon back into registration. Similarly, when an error in registration occurs due to the ribbon **14** being behind its registered position, the rate of operation of the drive assembly **32** is increased to increase the speed of travel of the ribbon **14** and bring the ribbon into its registered position.

To provide this variation in the speed of movement or travel of the ribbon **14**, the drive assembly **32** includes a hard surfaced steel roll **44**, driven by a resilient surfaced, rubber drive roll **50** which is driven by a suitable source of power. A resilient roll **46** forms a nip with roll **44** which controls the speed of the paper. The ribbon **14** passes through a nip formed between the rolls **44**, **46**. The rubber drive roll **50** is movable, as indicated by the arrow **52** in the drawing, toward and away from the steel roll **44** which is mounted for rotation about a fixed longitudinal axis. When the rubber drive roll **50** is moved toward the steel roll **40**, the extent of compression of the rubber roll **50** is increased and the rate of rotation of the driven steel roll **44** and speed of travel of the web **14** are in-

creased. On the other hand, when the rubber roll **50** is moved away from the steel roll **44**, the extent of compression of the rubber roll **50** is decreased and the rate of rotation of the steel roll **44** and speed of movement of the web **14** are correspondingly decreased. The roll **50** is moved by a motor **60** which may take many different forms.

The variable speed drives **34**, **36** and **38** are similar in construction to the drive **32** described above and, therefore, will not be described in detail. The same reference numerals are used herein in connection with the drives **34**, **36** and **38** as are used with drive **32** but with a *b* or *c* added thereto. The cooperation between the rubber drive roll **50** and steel roll **44** and the manner of mounting these rolls is set forth in greater detail in U.S. Pat. Nos. 3,093,069 and 3,220,347, to H. J. Luehrs, and therefore will not be described in greater detail.

Scanners **58**, **58***a*, **58***b* and **58***c* are associated with the ribbons **14**, **16**, **18** and **20**, respectively, for detecting a series of marks or other indications on the respective ribbons. The scanners **58**, **58***a*, **58***b* and **58***c* may be of any suitable construction, such as photoelectric cells. In addition, a scanner **59** is located adjacent to the rolls **28** for purposes of detecting a series of marks or other indications on the ribbon **20**, which may be considered a master ribbon. A machine reference signal (see FIG. **2**) is provided to indicate the position of the folder cutoff mechanism. The signal from the scanner **59** and the machine reference signal are applied to a phase discriminating and control circuit. The phase discriminating and control circuit may be of any conventional design, within the skill of the art. The phase discriminating and control circuit provides an error signal to control the motor **60***c* to move the roll **50***c* to bring ribbon **20** into register with the cutoff in the folder. The error signal from the phase discriminating circuit is a function of the phase difference or time difference between when the phase discriminating circuit receives the machine reference signal and when the phase discriminating circuit receives the signal from the scanner **59**. If the machine reference signal is received first and then the signal from the scanner **59** is received, the motor **60***c* is operated to increase the speed of the web **20** in proportion to the time interval between receipt of the signals by the phase discriminating circuit. Conversely, if the scanner **59** signal is received first and then the machine reference signal is received, the motor **60***c* is operated to decrease the speed of the web **20** in proportion to the time between when the signals are received.

Each of the other ribbons, namely, **14**, **16** and **18**, are then registered with the ribbon **20**. The scanner **58***c* which is associated with the ribbon **20** provides a reference signal for all of the other scanners. If the signals from the other scanners indicate that the respective ribbons **14**, **16** and **18** are out of register, either being in advance or delayed behind the ribbon **20**, then an error signal is provided to effect operation of the motor associated with the variable speed drive mechanisms, respectively, associated with those ribbons. The signals from the scanner **58***c* is applied to phase discriminating circuits which also receive signals from the respective scanners **58**, **58***a* and **58***b*. The signals from the scanner **58***c* and the scanner **58** are applied to a phase discriminating circuit similar to that described above in connection with registry of the master control ribbon **20** to the cutoff in the folder. The phase discriminating circuit provides an error signal for controlling the motor **60**, which, in turn, will effect registry of the ribbon **14** to the control ribbon **20**. Similar arrangements, as can be readily seen in FIG. **2**, are provided for ribbons **16** and **18** in order to register those ribbons with the master control ribbon **20**.

The particular circuitry which is illustrated schematically in FIG. **2** has been simplified for purposes of illustration. Other control arrangements, of course, could be utilized to provide the necessary signal for controlling the motors **60**–**60***c* to control the speed of advance of the webs with respect to each other in response to a sensing of misregister. These other controls could include computer controls to which the signals from all of the scanners are applied and are compared in order to provide the necessary error signal to control the motors.

Since the ribbons **14**, **16**, **18** and **20** are traveling at a relatively high speed, an error in registration between the ribbons must be quickly detected and corrected before a relatively large number of signatures are made with pages which are not properly registered relative to each other. To this end, the scanners or sensors **58**–**58***c* are positioned upstream or ahead of the respective drive assemblies associated with the ribbons. In this position, when an error is detected in the registration of the ribbons, operation of the motors may be initiated to vary the speed of movement of the ribbons before the scanned section of the ribbon and the registration indicator mark have passed into the nip of the rolls **44**, **46** of the drive assemblies. The error signal which is produced immediately causes the appropriate motor to operate to immediately increase or decrease the speed of movement of the ribbon. Moreover, by placing the scanners close to cutoff, ultimate errors at cutoff introduced by paper differences between the ribbons are reduced.

Upon the generation of an error signal, the drive assembly immediately varies the speed of the ribbon to eliminate the registration error associated with the error signal. With known registration correction devices, a compensator roll is moved to correct the registration error by varying the length of the path along which the ribbon travels. Since a section of the ribbon must travel along the complete path length between the printing press and folder after the compensator roll is moved before the change in path length becomes fully effective, these known registration correction devices are relatively slow in effecting a correction after movement of the compensator roll. Moreover, movement of the compensator roll is effected relatively slowly in response to an error signal, further adding to the time in correcting registration. On the other hand, the drive assemblies are operative to directly change the speed of movement of the ribbons to quickly eliminate any error in registration without waiting for a section of the ribbon to travel along a changed path length. Of course, the drive assemblies **32**, **34**, **36** and **38** are quick to respond to an error signal generated to correct any errors in registration of the respective ribbons associated with these drive assemblies. Since the drive assemblies are independently operable, an error in registration of any one of the ribbons can be corrected by the associated drive assembly with no practical effect on the other ribbons.

The printing press **10**, in the main, is operated at a substantially constant rate so that the web **12** moves at a substantially constant speed to the cutter assembly **24**. When the drive assembly **32** is operated at either a slightly increased or decreased speed relative to the printing press **10**, the speed of travel of the ribbon **14** is correspondingly varied. A tension control assembly **66** is provided to enable the speed of travel of the ribbon **14** to be increased without rupturing or increased stretching of the ribbon when the rate of operation of the drive assembly **32** is increased and to absorb or take up slack in the ribbon **14** when the rate of operation of the drive assembly is decreased. The tension control assembly **66** thus tends to maintain a substantially constant tension in the ribbon to thereby eliminate registration errors which could result from a greater or lesser stretching of the ribbon upon a variation in the rate of operation of the drive assembly. Of course, tension control assemblies which are similar in structure to tension control assembly **66** are associated with the ribbons **16**, **18** and **20** for independently maintaining a substantially constant tension in these ribbons.

To provide this constant tension in the ribbon **14**, the tension control assembly **66** includes a roller **70** which is pressed or urged downwardly against the ribbon **14** with a substantially constant force. Although the roll **70** can be pressed against the ribbon **14** by many different known devices, in the illustrated embodiment of the invention a piston **72** connected with the roll **70** is forced downwardly by air pressure in a chamber **74**. When the rate or speed of operation of the drive assembly **32** is increased, the speed of travel of the ribbon **14** is increased and the piston **72** and roll **70** move upwardly against the substantially constant air pressure in the chamber

74 to thereby maintain a substantially constant tension in the ribbon 14 and prevent excessive stretching or breaking of the ribbon. Conversely, when the speed of operation of the drive assembly 32 is decreased, the piston 72 moves outwardly from the chamber 74 under the influence of the air pressure in the chamber to take up any slack in the ribbon 14 and maintain the tension in the ribbon substantially constant.

From the foregoing description, it can be seen that the scanners 58, 58*a* and 58*b* sense marks on sections of the associated ribbons 14, 16 and 18 before the sections of the ribbons are engaged by the drive assemblies 32, 34 and 36. If there is a misregistration of one of the ribbons, the associated phase discriminating circuit generates an error signal to energize the motor 60. Energization of the motor 60 moves the resilient drive roll 50 relative to the axis of rotation of the hard surfaced roll 44 to thereby vary the speed of rotation of the roll 44. The tension control assembly 66 operates contemporaneously with the drive assembly 32 either to take up slack in the ribbon 14 resulting from a slowing of the speed of travel of the ribbon or to reduce the length of the path of travel of the ribbon before it reaches the drive assembly 32 to thus maintain a substantially constant tension on the ribbon 14. This constant tension on the ribbon 14 tends to result in a substantially uniform stretching or elongation of the ribbon to minimize the number of times registration errors occur.

When the rate of operation of the drive assemblies 32, 34, 36, 38 is either increased or decreased to a relatively large extent, due to some unforeseen characteristic of the ribbons 14, 16, 18, 20, respectively, or other reason, it is desirable to at least temporarily increase or decrease the rate of travel of the web 12 and the ribbons. This is to prevent the tension control assembly associated with the ribbons from being rendered ineffective for maintaining a substantially constant tension in the associated ribbon due to the roll 70 being moved to either an upper or lower limit of its travel. To this ends, a compensator roll 80 is mounted for movement in a direction transverse to its axis of rotation, that is, in the direction of either the arrow 82 or the arrow 84, to vary the path length of the web 12 before the web reaches the cutter assembly 24.

If the rate of operation of the drive assembly 32 is greatly increased, the roll 70 is moved upwardly, as viewed in the drawing, to actuate an upper limit switch 86 which completes a circuit to energize a drive assembly for the roll 80 to thereby move the roll 80 in the direction of the arrow 82. This movement of the roll 80 decreases the path of travel for the web 12 and increases the rate at which the web passes through the cutter assembly 24 to provide extra length in the ribbons to enable the roll 70 to move downwardly toward the position shown in the drawing. Conversely, when the rate or operation of the drive assembly 32 is decreased, the slack in the ribbon 14 is taken up by the tension control assembly 66 so that the roll 70 moves downwardly. When the rate of operation of the drive assembly 32 is decreased by a substantial amount, the roll 70 is moved downwardly (as viewed in the drawing) to operate a limit switch 88. Operation of the limit switch 88 energizes the drive assembly for the compensator roll 80 to move the roll in the direction of the arrow 84. This movement of the compensator roll 80 increases the length of the path of travel of the web 12 to decrease the rate at which the web travels through the cutter 24 and the speed at which the ribbons travel.

A pair of limit switches 92, 94 are associated with the compensator roll 80 for varying the rate of operation of the chill rolls 11 when the compensator roll 80 has been moved through a relatively large distance from its normal position shown in the drawing. Thus, when the drive assembly 32 is operated continuously at a relatively high speed, the compensator roll 80 is moved in the direction of the arrow 82 and actuates the limit switch 92. Actuation of the limit switch 92 completes a circuit to increase the speed of rotation of the chill rolls. Conversely, when the drive assembly 32 is operated at a relatively low speed, the compensator roll 80 is moved in the direction of the arrow 84 to actuate the limit switch 94. Actuation of the limit switch 94 completes a circuit to decrease the rate of operation of the chill rolls 11. A pair of alarm switches 98 and 100 are provided at opposite sides of the compensator 80 and are actuatable to complete circuits to warn an operator of the printing press of an excessive amount of travel of the compensator roll 80. Furthermore, in a press arrangement which includes an infeed having an automatic tension control, it may not be necessary to include either a compensator roll or change the speed of the chill rolls, in view of the fact that the total variation experienced by the constant tension dancer roll 70 may only vary within small limits.

In view of the foregoing description, it can be seen that a web processing apparatus is provided wherein the web 12 is cut into a plurality of ribbons 14, 16, 18 and 20 which are maintained in registration by variable speed drive assemblies 32, 34, 36 and 28. The variable speed drive assemblies are independently operated by associated control assemblies to quickly vary the rate of travel of the associated ribbon. Since the drive assemblies act to directly vary the speed of travel of the associated ribbons without the necessity of waiting for the ribbons to travel along a changed path length, the drive assemblies 32—38 are able to quickly correct any error in registration to thereby maintain the ribbons in substantial registration at all times. The scanners 58, 58*a*, and 58*b* are mounted ahead of the associated drive assemblies so that the control assemblies can detect an error in the registration of the associated ribbon and initiate a suitable variation in the rate of travel of the ribbon before the section of the ribbon on which the error was first detected passes into the drive assembly. A tension control assembly, similar to the tension control assembly 66, is associated with each of the ribbons to maintain the ribbons under substantially constant tension and thereby tends to effect a substantially constant elongation of the associated ribbon to reduce the tendency of the ribbons to get out of correct registration. phase

I claim:

1. Apparatus for use in processing a strip of material which travels from one web processing unit to a second web processing unit, said apparatus comprising variable speed drive means for varying the speed of said strip relative to said second unit while the length of said strip extending between said variable speed drive means and said second unit remains substantially constant, said variable speed drive means including at least one roll which engages said strip and is rotated at variable speeds about a fixed axis of rotation to move said strip toward said second unit, control means operatively connected to said variable speed drive means for regulating the operation of said variable speed drive means to register said strip with said second processing unit, and tension control means for maintaining a constant tension in said strip between said first unit and said variable speed drive means as said strip travels from said one unit to said second unit and while a change in the speed of web advance is occuring.

2. An apparatus as set forth in claim 1 wherein said control means includes sensor means located between said variable speed drive means and said tension control means for detecting when the speed of operation of said variable speed drive means should be varied to maintain said predetermined relationship between said strip and said second unit.

3. An apparatus as set forth in claim 1 wherein said tension control means includes a roll which is movable to vary the length of said strip located between said one unit and said variable speed drive means, said roll being adapted to be pressed against said strip with a substantially constant force during operation of said apparatus to thereby vary the length of said strip between said one unit and said variable speed drive means while maintaining a substantially constant tension in said strip.

4. An apparatus comprising a printing press for printing on a web of material, cutter means for slitting said web of printed material into a plurality of ribbons, a plurality of tension control means each of which is associated with one of said ribbons for maintaining a substantially constant tension in the as-

sociated ribbon, a plurality of drive means each of which is mounted in driving engagement with an associated one of said ribbons for moving the associated ribbon toward a processing unit for working on said plurality of ribbons, sensing means for each ribbon for sensing indicia indicative of the position of the respective ribbons, and a plurality of control means operatively connected with said sensing means and operative in response to said sensing means sensing misregister of one ribbon with respect to at least one other ribbon to operate one of said drive means for varying the speed of operation of the drive means independently of the other drive means to thereby substantially maintain a predetermined registered relationship between said plurality of ribbons, each of said sensor means being positioned ahead of an associated one of said drive means so as to enable the associated ribbon to move past said sensor means before moving through the associated drive means to thereby enable said control means to at least initiate a varying of the speed of operation of the associated drive means before the portion of the ribbon sensed by said sensor means in is engaged by the associated drive means.

5. An apparatus as set forth in claim 4 wherein each of said tension control means includes a roller which is urged into engagement with the associated ribbon with a substantially constant pressure independently of the other tension control means to thereby provide a substantially constant tension in the associated ribbon independently of the tension in the other ribbons.

6. Apparatus as set forth in claim 5 and further including means responsive to the operation of at least one of said tension control means to vary the length of said web located between said cutter means and said printing press when said one tension control means is in a predetermined operating condition.

7. Apparatus as set forth in claim 4 wherein each of said drive means includes hard surfaced roll means mounted for rotation about a fixed axis and adapted to engage the associated one of said ribbons and a resilient surfaced drive roll cooperating with said hard surfaced roll means, said drive roll being movable relative to said fixed axis of rotation to vary the extent of compression of the resilient surface of said drive roll to thereby vary the rate of rotation of said hard surfaced roll means and the speed of movement of the ribbon associated with said drive roll.

8. Apparatus for use in processing a strip of material having register marks thereon and which strip travels from one web processing unit to a second web processing unit, said apparatus comprising a plurality of rollers mounted for rotation about fixed axes and defining a control nip through which said strip passes, variable speed drive means for varying the speed of rotation of said rollers about their fixed axes to vary the speed of said strip relative to said second unit, sensor means located ahead of said control nip for generating a register signal in response to movement of each register mark in turn past said sensor means prior to passage of the register marks through said control nip, means for generating reference signals having a predetermined relationship with an operating cycle of said second unit, control means for detecting a change in the relationship between said reference and register signals from a predetermined relationship corresponding to a condition in which said strip is in registration with said second unit and for initiating a change in the speed of operation of said variable speed drive means in response to detection of a change in the relationship between said reference and register signals from said predetermined relationship.

9. Apparatus for use in processing a plurality of strips material having register marks thereon and which strips of material travel from one web processing unit to a second web processing unit, said apparatus comprising a plurality of rollers for defining a plurality of control nips through each of which one of said plurality of strips passes, variable speed drive means for varying the speed of rotation of said rollers to vary the speed of the associated strips relative to said second unit, a plurality of sensor elements mounted ahead of the control nips, each of said sensor elements being associated with one of the strips for generating first register signals in response to movement of register marks past said sensor elements prior to passage of the register marks through said control nips, sensor means associated with at least one of the strips at a location after the control nip associated with the one strip for generating second register signals in response to movement of register marks on said one strip past said sensor means after passage of the register marks on said one strip through the control nip associated with said one strip, and control means for operating said variable speed drive means in response to said first and second register signals to substantially maintain a predetermined relationship between said plurality of strips and said second web processing unit.

10. Apparatus for use in processing a web of material which travels from one web processing unit including a printing press and a cutter means for slitting a printed web from the printing press into a plurality of strips to a second web processing unit including a folder means in which the plurality of strips are brought into superimposition, said apparatus comprising a plurality of variable speed drive means for varying the speed of each of said strips relative to said second unit while the length of each of said strips extending between said variable speed drive means and said second unit remains substantially constant, each of said variable speed drive means including a drive roll of a resiliently deflectable material which cooperates with a hard surface roll mounted for rotation about a fixed axis, said drive roll being movable toward and away from the axis of rotation of said hard surfaced roll to vary the rate of rotation of said hard surfaced roll and the speed at which an associated one of said strips is moved by said drive means, control means operatively connected to said variable speed drive means for regulating the operation of said variable speed drive means to register said strips with said second processing unit, said control means including a plurality of sensor means each of which is located along an associated one of said strips ahead of said variable speed drive means for detecting registration indicator means on said strips before said registration indicator means passes through said drive means and providing a signal indicative of variations in the position of said registration indicator means from a predetermined position, said control means being operatively associated with said drive roll of each of said drive means to vary the position of said drive roll relative to said hard surfaced roll as a function of a signal from an associated one of said sensor to thereby vary the speed at which the associated one of said strips is driven, and tension control means for maintaining a constant tension in said strips between said one unit and said variable speed drive means as said strips travel from said one unit to said second unit and while a change in the speed of advance of said strips is occurring, said tension control means including a plurality of rolls each of which is movable to vary the length of an associated one of said strips located between said one unit and said variable speed drive means, each of said rolls being adapted to be pressed against said strips with a substantially constant force during operation of said apparatus to thereby vary the length of said strips between said one unit and said variable speed drive means while maintaining a substantially constant tension in said strips.