PREDERVE AND TRANSITION TENSION SYSTEM FOR WEB SPlicing APPARATUS

Corson Walter Chase, Oak Park, III., and Arne Vigg Pedersen, Gentofte, Denmark, assignors to Mielhe-Goss-Dexter, Incorporated, Wilmington, Del., a corporation of Delaware

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This invention relates in general to web splicing apparatus for making what is known in the art as "flying pasters," i.e., joining the leading edge of a new roll web to a running web drawn from an expiring roll into a web-processing device and severing the old web, all without interrupting or slowing down the feed of the web material to the processing device. More particularly, the invention relates to improvements in prederving a new roll or bringing it up to speed before a splice is made, and in braking the new roll immediately after a splice is made to create transition tension in the new web.

The general aim of the invention is to provide a structurally simple, rugged, and inexpensive arrangement for a precisely prederving a new roll and for creating the proper transition tension in a new roll web.

More specifically, an object of the invention is to greatly reduce the number of control instrumentality required for prederving and transition tensioning, yet without sacrificing performance characteristics or reliability. A related object is to provide apparatus for prederving a new roll at a peripheral speed which is precisely related to the linear speed of a running web—and to accomplish that without the requirement for control components which need to be carefully adjusted during installation or subsequent operation, as for example in servomechanism systems.

Another important object is to create such a prederving system which is readily applied to existing paper equipment, and which is easily adapted to accommodate changes in the relative positions of the web-consuming units, folders, or pasteur components with a minimum of redesign or structural changes in the prederving apparatus.

Another object of the invention is to provide such a simplified arrangement for prederving and transition tensioning in which the magnitude of the tension transition is caused to gradually decrease as the tension created by the regular tension system is progressively increased.

It is a further object of the invention to provide such an improved arrangement for prederving and transition tensioning wherein the value of the transition tension which will be obtained is automatically changed to agree when the value of the maintained running tension is adjusted.

Still another object is to make one adjustable coupling perform two functions, i.e., smoothly accelerating the new roll during prederving, and controlling the value of the braking torque applied to the new roll to create transition tension.

An additional object is to make possible accurate prederving of a new roll from the web-processing device itself or the power drive means thereof, thus eliminating a separate source of power for the prederving energy, and yet at the same time positively protecting against impacts or undue accelerations of the new roll which might strain or otherwise damage the driving connections.

Other objects and advantages will become apparent as the following description proceeds, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a diagrammatic representation of web splicing and tensioning apparatus embodying the features of the present invention and associated with a printing press;

FIG. 2 is a fragmentary, diagrammatic view of a portion of the roll-supporting reel, illustrating the cams, limit switches, slip rings, and brushes associated therewith for control purposes;

FIG. 3 is a side elevation of a part of the substructure of a printing press, particularly showing the physical components of the web splicing apparatus;

FIG. 4 is an end view, taken partially in section along the offset line 4—4 in FIG. 3;

FIG. 5 is a plan view of the prederve and transition tension carriage, together with associated drive connections thereto;

FIGS. 6 and 7 are sectional views, taken substantially along the lines 6—6 and 7—7 in FIG. 5, of a magnetic particle clutch and a magnetic particle brake, respectively;

FIG. 8 is a schematic wiring diagram of the controls for the web splicing apparatus;

FIG. 9 is a graph of the torque versus time variation which is produced by the control means to gradually reduce transition tension;

FIG. 10 is in general similar to FIG. 5, illustrating a modified embodiment of the invention;

FIG. 11 is a section view taken substantially along the line 11—11 in FIG. 10 and showing details of an electric clutch and brake; and

FIGS. 12 and 13 are schematic wiring diagrams which when taken with FIG. 8 illustrate the control means for the modified embodiment.

While the invention has been shown and will be described in some detail with reference to particular embodiments thereof, there is no intention that it be limited to such detail. On the contrary, it is intended to cover all modifications, alternatives, and equivalents falling within the spirit and scope of the invention, as defined by the appended claims.

Referring now to the drawings, the web splicing apparatus schematically illustrated in FIGS. 1 and 2, by way of setting the background environment for the present invention, is of the type disclosed and claimed in the copending application of Chase et al., Serial No. 502,923, filed April 21, 1955, now U.S. Patent No. 2,963,254. Reference may be had to that application for details, and the apparatus will be described here only in general terms to facilitate the understanding of the present invention.

In general, the apparatus includes a movable support for paper rolls, here shown as a reel assembly 15, located beneath a prederving and transition tension assembly 16 on one side and a pasteur carriage assembly 17 on the other side. Axially spaced on a reel shaft 18 are two spiders 20, 20a (FIGS. 1 and 4) which rotatably support three web rolls 21, 22, and 23. The roll 21 may be termed the expiring roll since it is shown in the supply position with the web W being drawn therefrom upwardly into a web-processing device or printing press symbolically represented at 25. The roll 22 may be termed the new roll since it is the one from which the running web will be drawn after a splicing operation has been completed. The roll 23 may be termed the newly-loaded roll since upon advance rotation of the reel shaft 18, it will move to the new roll position and the expired roll 21 will be located for replacement by another roll.

For rotating the reel assembly 15 to successively position the three rolls carried thereby, the reel shaft 18 is drivingly connected with a reel motor RM selected energized from a suitable source through the contacts RMC1, RMC2, and RMC3 of a contactor having a coil RMC. The manner in which the coil RMC is
controlled to energize the motor RM and effect rotation of the reel 18 will be described below.

To sense the angular position of a new roll as it is rotated about its own axis, for a purpose to be explained, each of the roll-supporting spindles carried by the respective arms of the spider 20 has a cam C1, C2, or C3 associated therewith and operative to open and close a pair of breaker points CP1, CP2 or CP3 once each time that the spindle rotates through a given angular position. In order to connect the particular set of contact points associated with the roll in the pre-paste position into the control circuitry, the spider 20 carries a first slip ring which is circular in extent, and a second slip ring 31 made up of three segments S1, S2, S3. Stationary brushes 32 and 34 ride on the slip rings 30 and 31 to complete selective electrical connections as will be apparent from the following description of FIG. 8. Also, in order to sense angular positions of the reel shaft 18, two cams 35 and 36 are carried by the spider 20. The cam 36 cooperates with two stationary limit switch LS2 and LS4 which are actuated whenever their followers are engaged with raised portions 35a spaced at 120° intervals around the periphery of the cam. Similarly, a stationary limit switch LS1 is actuated whenever its follower is contacted by raised portion 35a spaced around the periphery of the cam 35. These three limit switches have contacts which are connected into the control circuits as will be described below in connection with FIG. 8. Finally, to sense when the new roll 22 has been moved adjacent to the running web W, a photoelectric relay PE is mounted so that a light beam directed into it will be broken by the leading edge of the new roll just before the latter reaches the running web.

A regular tensioning system is provided to brake the rotation of the supply roll 21 and maintain a predetermined, adjustable tension in the web W as it is drawn upwardly into the press 25 at a linear speed dependent upon the press speed, i.e., the speed of a press drive motor FM. This system is preferably of the pneumatic type disclosed and claimed in U.S. Patent No. 2,743,861, issued May 1, 1956 issued to McWhorter, to which reference may be made for a more detailed description. Briefly, the automatic tensioning system includes stationary tension straps 40 spaced along the roll length, fixed to springs 41 at their lower ends, and extending upwardly to anchor points 42, so that they partially wrap and frictionally engage the periphery of the expiring roll 21. The web W passes between spaced rollers 44, 45 and over a floating roller 46 carried by a depending arm 48 pivoted at 49. The arm 48 is balanced between a leading cylinder 50, supplied with air pressure from a reservoir 51 through a pressure regulating valve 52, and a tension control valve 54 supplied with air pressure from the reservoir and connected, upon movement of its plunger 54a, to control the pressure supplied through a conduit 53 to a pneumatic actuator or ram 55 interposed between the lower ends of the tension bolts 40 and a balancing cylinder.

As tension in the web W increases or decreases, the arm 48 is rocked about its pivot 49, thereby shifting the plunger 54a so that the ram 55 increases or decreases the pressure with which the straps 40 engage and frictionally retard the expiring roll 21. The frictional drag of the straps 40 on the expiring roll 21 is thus automatically increased or decreased to maintain the tension in the web W at the desired value. The value of the tension which is automatically maintained in the web may be adjusted by setting a control member, which in this instance is the adjustment knob 52a of the pressure regulating valve 52, the latter determining the force exerted by the leading cylinder 50.

At this point it may also be observed that a pressure-sensitive rheostat PR is interconnected with the running tension control system so that as the controlled value of the running tension is adjusted by setting the valve 52, the value of the variable resistor PR is correspondingly changed. For this purpose, an expansible bellows 60 communicates with the pneumatic conduit on the output side of the pressure regulating valve 52 and the free end of the bellows 60 is pivoted to a swinging arm 61 which carries at its lower end a slidable contact. Thus, the value of the resistance connected between the two lines 62, 63 and leading to the control circuit 64 depends directly upon the value of the tension which is automatically maintained in the running web W.

The 60 drive assembly consisting of line 64 and 5) is mounted on the upper portions of Y-shaped supports 51 which also journal the reel shaft 18. The assembly includes a carriage 66 movable or pivotable between a retracted position (permitting clearance for a roll to pass as the reel rotates) and an operative position (permitting the new roll to be either driven or braked). Such movement is effected by a double-acting pneumatic actuator 68 under the control of a four-way valve 69 shifted between its two positions in response to energization or de-energization of a pre-drive solenoid PDO. The carriage 66 rotatably supports an endless belt 70 which engages with the limit switch 63. Engagement with the new roll 22 (FIG. 1), or retracted (FIG. 3) to permit the newly loaded roll 23 to be rotated by the reel into the new roll position.

It will be understood that prior to a splicing operation 8, as shown in FIG. 8. Finally, to sense when the new roll 22 has been moved adjacent to the running web W, a photoelectric relay PE is mounted so that a light beam directed into it will be broken by the leading edge of the new roll just before the latter reaches the running web.

The paster carriage assembly 17 functions to deflect the running web W against the properly positioned new roll 22 in order to bond the running web to the leading edge of the new roll, and to sever the old web from the expiring roll 21. This assembly includes a carriage 75 pivoted to rock between raised and lowered positions about a support shaft 76 under the influence of a double-acting pneumatic ram 77 controlled by a four-way solenoid valve 78 moved between its two positions in response to energization or de-energization of a paster carriage solenoid PCS. Supported on the paster carriage are a plurality of brushes 79 mounted on a rotatable shaft 80 which is cocked against the biasing force of tension springs (not shown) and retained by means of a latch 81. With the carriage lowered to depend substantially vertically from the pivot shaft 76, the latch 81 may be released by energization of a brush solenoid BS, so that brushes 79 mounted on the shaft 80 swing outwardly and deflect the web W against the rotating new roll 22. This, in turn, causes the web W to adhere to the paste on the leading edge of the new roll web, pulling the latter upwardly into the press. Also supported on the paster carriage 75, are a plurality of knives 82 fixed to a rotatable shaft 84 cocked against the bias of tension springs (not shown) and retained by means of a latch 85. The latch 85 may be shifted upon movement of the armature of the knife solenoid KS, so that, with the carriage 75 in its lowered position, the knives 82 swing outwardly to sever the web W at a point beneath the brushes 79, thus severing the web being drawn from the expiring roll 21.

For sensing the position of the paster carriage 75, a first carriage limit switch 1CLS is mounted on a stationary support and located such that its actuator will be depressed by the carriage itself when the carriage is fully elevated to an out-of-the-way position as illustrated. Further, a second carriage limit switch 2CLS, here shown in the form of a mercury bottle type of switch, is mounted on the carriage itself so that the mercury will have one position in the bottle when the carriage is elevated and another position in the bottle when the paster carriage is lowered. The mercury thus makes
and breaks electrical contacts for control purposes, as will be explained hereinafter. From the foregoing, and with reference to the above-mentioned Patent No. 2,963,234, it will be understood that when the supply roll 21 is about to expire, the reel 15 is rotated to bring the new roll 22 into pre-paste position adjacent the running web W. The end of the pre-drive carriage 66 is lowered until the belt 70 engages the surface of the new roll 22, and the belt driven to accelerate the new roll to a peripheral speed which is related very accurately to the speed of the web W by a predetermined ratio. The paste carriage 75 also having been lowered, release of the brushes 79 deflects the running web W against the new roll, so that the run-up of web adheres to the glue or paste on the leading end of the new web roll. Then, almost instantaneously, release of the knives 82 severs the web drawn from the expiring roll 21. Thereafter, the running web is drawn from the new roll 22. However, when the old web is severed, the tension straps 40 are not engaged with the new roll 22. Means are provided to brake the new roll immediately after a splicing operation to create transition tension, i.e., tension in the new web during the transition period required for the reel 15 to turn sufficiently to bring the new roll 22 into operative engagement with the straps 40. It is to improvements in the simplicity, ruggedness and reliability of the means to predrive the new roll before a splicing operation, and to create transition tension in the new web roll web after a splicing operation, that the present invention is directed.

In accordance with the invention, the new roll is pre-driven from the pressure-driven web-processing device or press 25 through a disengageable drive connection which includes a coupling slippable upon the application of a predetermined adjustable torque, so that as predriving begins the coupling slips to cause smooth acceleration of the new roll, but entirely ceases to slip and thus drives the new roll in exact timed relation to the press and therefore in the exact speed relationship to the velocity of the running web after the acceleration period. Further, immediately after a splicing operation, the predriving connection is disengaged and a disengageable braking connection to the new roll, which includes a coupling slippable upon the application of a predetermined, adjustable torque, is completed. The magnitude of that braking torque and thus the amount of transition tension may be made automatically to match the degree of the transmission 109 to the drive shaft 100, the conditions by the tensioning straps 40. Finally, as the reel 15 rotates to move the new roll progressively into engagement with tension straps 40, the slippable coupling in the braking connection is so controlled that the braking torque transmitted thereby to the new roll progressively decreases, thus making the sum of the transition tension and the tension created by the straps 40 equal to the desired value as the regular tension straps gradually assume full control.

Referring now in more detail to FIGS. 3–5, it will be seen that the press motor PM is mounted on the press frame above the paste carriage 75 and has an output shaft 90 working into a transmission 91 which drives the rotary cylinders (not shown) of the printing press. The motor PM is of the variable speed type, so that the press may be driven at any desired speed within a given range.

The predrive assembly 16 includes a mounting frame 95 which is slidable supported on cross bars 96, 97 in order that the belt 70 may be positioned axially of the new roll to have driving engagement with the latter at any selected axial location. To permit lowering or raising of the belt 70 into or out of engagement with the new roll, the predrive belt carriage 66 includes side members 66a which are spaced apart and supported at one end by bearings 98 mounted on a sleeve 99 keyed to but axially slidable along a drive shaft 100. The drive shaft 100 and sleeve 99 may thus rotate relative to the side members 66a, and the side members 66a may pivot about the axis of the drive shaft 100 by virtue of the bearings 98. To rock the carriage 66 about the drive shaft 100 between raised and lowered positions, the pneumatic cylinder 68 is mounted fast on the frame 95, and its piston rod 68a is connected through link 101 to the side members 66a. The belt 70 is trained over pulleys 102 and 103, the former being keyed to the sleeve 99, and the latter being journalled on a rod 104 supported by and at the opposite ends of the side members 66a. With the predrive carriage 66 lowered so that the belt 70 is engaged with the surface of a new roll 22 (as shown in FIG. 1), an effective connection, for either driving or braking, is established between the new roll and the shaft 100.

In carrying out the invention, a disengageable drive connection, including a slippable coupling, is established from the press motor PM, or a rotary part of the press driven by the motor PM, to the shaft 100. For this purpose, a belt 105 is trained over a pulley 106 mounted on the output shaft 90 of the motor PM, and connected to the input pulley 108 of a right-angle gear box 109 having an output shaft with a pulley 110 mounted thereon.

The gear box output pulley 110 is, in turn, drivingly connected by a second belt 111 to a pulley 112 mounted on the input shaft 113 of a drive coupling device 114 which has the characteristic of being slippable at a predetermined adjustable torque. The belt 111 may be passed over an adjustable tighter pulley 114a to tension the same and compensate for excess length therein. In addition to preventing slippage, this construction makes it possible to use all the same parts in installations where distances between units of the press or location of pasters are changed. The distance between pulleys 110 and 112 can be changed considerably without affecting any of the component parts. The drive belts 105 and 111 are preferably of “toothed” construction so that there is absolutely no slippage and the desired drive ratio is obtained.

In the present instance, the coupling device 114 is an electromagnetic particle clutch having an output shaft 115 mounting a pulley 116 connected by a drive belt 118 to a pulley 119 fast on the drive shaft 100. Thus, with the magnetic particle clutch 114 engaged, a drive connection is established from the press motor PM through the drive shaft 100, and through the lowered predrive belt 70 to the new roll 22. When this connection is first established, and acceleration of the new roll begins, the particle clutch 114 will slip so that there is neither a shock imposed on the drive connections nor a sudden load imposed on the press motor PM. However, even though the particle clutch 114 slips, it will transmit a certain torque, depending upon the value of energizing current supplied thereto, so that the new roll will gradually accelerate. As the new roll comes up to full speed, the clutch 114 will cease slipping so that the new roll will be driven in precisely timed relation to the speed of the press (and the velocity of the web W) as determined by the press motor. The torque transmissible by the clutch 114 without slippage thereof is made to have a value low enough to accelerate the new roll without shock but high enough to maintain speed after acceleration. By choosing the dimensions of the several pulleys in this predriving connection as well as the drive ratio for the right-angle transmission 109, the peripheral speed of the new roll may be made to match very exactly the lineal speed of the running web W, or to have exactly the desired ratio to the speed of the web W, prior to a splicing operation. And it is particularly noteworthy that even though the press motor PM may at different times be running at different speeds, both the lineal speed of the running web W and the
rotational speed of the predrawn new roll will be proportional to the press motor speed, so that the necessary matching of the new roll peripheral speed to the linear speed of the running web will be obtained regardless of the particular speed at which the press is operating.

Reference may be had to FIG. 6 for a better understanding of the construction and operation of the magnetic particle clutch 114. As there shown by way of example, this clutch comprises a housing 125 having a flange 130 suitably bolted or otherwise fixed to the press frame members 51. The input shaft 113, which carries the pulley 112, extends into the housing 125 and is journaled by anti-friction bearings 126. Fast on the inner end of the shaft 113 is a cylindrical clutch element 128 made of ferromagnetic material and which is substantially surrounded by a hollow cylindrical clutch element 129 also ferromagnetic and rigid with the inner end of the output shaft 115, the latter also being journaled in the housing by suitable anti-friction bearings 130. The hollow cylindrical element 129 defines with the clutch element 128 a cavity 131 which may be filled with a viscous material such as oil or light grease in which is dispersed a large number of magnetizable particles, e.g., iron fillings or powder. In some instances the cavity may be filled simply with iron powder and the viscous material or oil omitted. The oil-particle mixture 132 is retained within the cavity by a suitable seal 134 at the point where the shaft 113 projects through the hollow cylindrical element 129.

Thus, the two clutch elements 128 and 129 normally are free to rotate relative to one another. For effecting "engagement" of the clutch element 128, 129 a clutch excitation coil 135 is disposed within the housing 125, being closely spaced to the outer surface of the hollow cylindrical clutch element 129. When exciting current is passed through the coil 135, magnetic flux is set up which passes through the insert 136, the clutch element 129, the oil-particle mixture 132, and the clutch element 128. This causes the mixture 132 to stiffen and become much more viscous so that torque is transmitted from one clutch element to the other. The magnitude of the transmissible torque is proportional to the value of the exciting current supplied to the coil 135, and if with the coil 135 energized the torque imposed on the clutch exceeds a certain value, the two clutch elements will slip relative to one another. Thus, a characteristic of this particular type of clutch device is that it will transmit up to a predetermined torque between its input and output shafts which is related to the value of excitation current supplied to the coil 135, and if the torque exceeds a certain value, the two elements will slip while continuing to transmit the predetermined torque. This type of clutch creates a "torque bias" dependent upon the value of excitation current, and that value of torque will continue to be transmitted whether or not the input torque is excessive and the two clutch elements slip relative to one another. However, if the input torque is equal to or less than the torque bias of the clutch, the iron powder locks the two clutch elements together so that the input element drives the output element without relative slippage.

Further in carrying out the invention, a disengageable braking connection, including a coupling slippable at a predetermined, adjustable torque, is provided to the drive shaft 100 and thus to the new roll 22 when the belt 70 is engaged with the new roll. As here exemplified in FIG. 5, one end of the drive shaft 100 projects into an electromagnetic brake 138 which is preferably of the magnetic particle type. As shown in detail by FIG. 7, the magnetic particle brake 138 includes a housing 139 having a flange 139a rigidly fixed as by bolts to the frame 51. The drive shaft 100 extends into the housing 139, being journalled in an endurable anti-friction bearing 140 on its inner end a brake rotor 141. Rigidly supported by and connected to the stationary housing 139 is a hollow cylindrical brake stator 142 which surrounds the rotor 141 and defines therewith a cavity 144. This cavity is filled with a viscous material such as oil or grease in which is dispersed a plurality of particles of magnetic material or magnetic fillers as powders. The oil-particle mixture 145 in the cavity 144 thus permits the brake rotor 141 to turn freely relative to the stator 142 when it is not stiffened by magnetic flux passing therethrough. An excitation coil 146 is carried by a magnetic insert 148 forming a core of the rotor 141 and is carried in a manner in the stator 142. Since the insert 148, the stator 142, and the rotor 141 are all made of high permeability metal, when the brake coil 146 is excited with current, magnetic flux passes through the oil-particle mixture 145, causing the latter to stiffen so that braking torque is transferred from the stator 142 to the rotor 141 and thus to the drive shaft 100. The magnitude of this braking torque is dependent upon the value of exciting current supplied to the coil 146, and the braking torque or retarding force on the shaft 100 will remain the same even though a greater input torque to the shaft 100 exists and causes the rotor 141 to slip relative to the stator 142.

The magnetic particle clutch 114, and the magnetic particle brake 138 are so controlled that the latter is released and a predrawing connection is established through the former from the press motor to the new roll prior to a splicing operation. After a splicing operation, the magnetic particle clutch is disengaged by de-energizing its exciting winding; and a braking connection retarding the new roll 22 sufficiently so that the transition tension matches the value of the running tension is established by energization of the brake coil 146. Additionally, after the new roll contacts the tension straps the braking torque created by the magnetic particle brake 138 is caused to progressively decrease as the reel 15 turns after a splicing operation and moves the new roll 22 progressively farther into operative engagement with the regular tensioning straps 40 (FIG. 1).

To bring these control functions about, a control system such as that schematically diagrammed in FIG. 8, is employed. The control system may best be described by a narrative of its sequential operation during one complete cycle of operation.

When the press operator observes that the roll 21 (FIG. 1) from which the running web W is being drawn is about to expire, he depresses a Position push button switch having normally open contacts 150 and 151 (FIG. 8). Closure of the contacts 150 connects the reel motor 92 with the contactor coil RMC across the voltage supply lines L1, L2, thereby energizing the coil 135 of the clutch 114, and closing the photoelectric relay PE, shown physcially in FIG. 1. Simultaneous closure of the contacts 151 energizes the coil POS of a position relay, which then seals in through its normally open contacts POS2 and the normally closed reel limit switch contacts RLS4a. With this, an auxiliary line L3 is placed at the same potential as the line L1. When the reel motor contactor coil RMC was energized, the contacts RMC1, RMC2, and RMC3 (FIG. 1) closed to energize the reel motor RM and cause rotation of the reel 15 in a clockwise direction. Thus, the expiring roll 21 is lowered and the new roll 22 brought to a pre-paste position. When the leading edge of the new roll 22 is aligned with the photoelectric relay PE and intercepts a light directed into the latter, the contacts PE1 (FIG. 8) will open to de-energize the reel motor contactor coil RMC, thus de-energizing the reel motor RM and stopping the reel with the new roll 22 in the desired pre-paste position, as illustrated in FIG. 1.

As soon as the photoelectric relay contacts PE1 open and drop out the reel motor contactor RMC, the normally closed contacts RMC4 in series with the paster carriage solenoid PCS re-close, and thus energize that solenoid thereby engaging the paster carriage, and the normally closed contacts KS4. With the energization of the solenoid PCS, the valve 78 (FIG. 1) is positioned to cause the pneu-
matic ram 77 to lower the paste carriage 75 into a de-
pending position adjacent the running web W. As the paste roll complete one revolution and the contact
points CP2 close a second time, indicating that the
contact points E2 of the relay coil E2 are de-energized, so that the normally closed contacts E1 of that relay now close. This completes an energizing circuit for the brush solenoid BS, so that solenoid BS is energized and the brake latch 81 is as previously explained in connection with FIG. 1. The brushes 79 swing outwardly and deflect the running web W against the surface of the new roll. Release of the brushes also results in closure of the brush limit switch contacts BLSL, preparing an energization circuit for the knife solenoid KS.

When the knives are released, the contacts KR2 of the knife relay KR close to create a seal-in path for both the solenoid KS and the knife relay KR. The pick-up of the relay KR thus signifies that the splicing operation has been completed, i.e., that the old web has been pasted to the leading edge of the new web roll and severed.

When the knives are released, the contacts KR4 of the knife relay KR close to complete an energization path for the magnetic particle clutch coil 135, so that the magnetic clutch is de-energized and the driving connection from the pressure rheostat PR which is previously explained, is automatically adjusted according to the setting of the tension adjustment member 52a (FIG. 1). The magnitude of current through the brake coil 146 depends on the setting of the rheostat PR and thus is proportional to web tension maintained on the expiring roll automatically by the straps 40. As soon as the splicing operation is completed, the prederviving connection through the magnetic clutch 114 is broken, and a transition tension braking connection through the particle brake 138 is established. The magnitude of current flow through the brake exciting coil 146 is determined by the automatic setting of the pressure rheostat PR and thus the braking force exerted by the brake 138 on the new roll will automatically create the same degree of tension in the web as would be obtained under normal circumstances from the tension straps 40. It will be observed from FIG. 8 that when the brake coil 146 is energized, one contact 159 will be charged to the polarity indicated through a charging resistor 160, the two being connected as shown in parallel with the coil 146. The purpose of this capacitor will be made clear below.

As soon as the splicing operation has been completed, i.e., the knives released to sever the web drawn from the expiring roll, it is desirable to rotate the reel 15 to open, the relay coil E is de-energized, so that the normally closed contacts E2 of that relay now close. This completes an energizing circuit for the brush solenoid BS, that solenoid therefore tripping the brake latch 81, as previously explained in connection with FIG. 1. The brushes 79 swing outwardly and deflect the running web W against the surface of the new roll. Release of the brushes also results in closure of the brush limit switch contacts BLSL, preparing an energization circuit for the knife solenoid KS.

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rent-adjusting rheostat 155 to the line L2. The rheostat 155 may be manually adjusted so that the value of current flowing through the clutch coil 135 creates the de-
sired tension force on the new roll. With the new roll 135 energized, the magnetic particle clutch 114 creates driving connection from the press motor PM through the belt 104, the transmission 109, the belt 111, and belt 118, the drive shaft 100, and the predervive belt 70 to the new roll as previously explained. Because the particle clutch 114 slips before transmitting more than a prede-
termined value of torque, the shock or jar is imposed on the press motor PM. Rather, the particle clutch 114 slips considerably at first, gradually accelerating the new roll until the latter is up to speed and all slippage of the magnetic particle clutch ceases because it is no longer required to transmit a torque greater than that needed to overcome frictional resistance to rotation. Since the belts in the driving connection are preferably of the toothed variety to prevent slippage, and since the drive ratio from the press motor to the new roll can be chosen by selecting pulleys of proper diameter, the new roll 22 is driven in timed relation to the press motor PM and the linear speed of the running web W. The peripheral speed of the new roll has precisely the desired relation to the linear speed of the web W, either exactly equaling that linear speed or no more than 1%, as may be desired in any particular installation.

After the new roll 22 has been predervived up to speed, the operator momentarily depresses a Paste push button switch having normally open contacts 156 (FIG. 8). This results in energization of the coil PA of a paste relay 157, thereby connecting the contacts PA close to seal in the relay PA from the line L3. Also, the normally open contacts PA2 close to prepare a circuit for the energization of a control relay E.

It will be seen that the contact points CP2 controlled by the cam C2 on the spindle for the new roll 22 are at this time connected in series across the lines L1 and L2 by the brush and slip ring 33, 30 and the brush 34 and slip ring segment S2. Closure of the contacts CP2 indicates that the glue pattern on the leading edge of the new roll has just passed a point opposite the running web W, and causes driving of the new roll 22.

As a result, the relay contacts E1 are momentarily closed and the coil D of an auxiliary relay is momentarily en-
ergized by current flow from the line L3 through the now closed contacts PA1 and the closed contacts E1. When the relay D is energized, its normally open con-
tacts D1 in parallel with the contacts E1 close to create a holding circuit. When the contact points CP2 then re-
bring the new roll into operative engagement with the tensioning straps 40. For this purpose, normally closed contacts KR5 are connected in series with the paster carriage solenoid PCS. Thus, upon energization of the knife relay KR, the contacts KR5 open to de-energize the solenoid PCS, thereby causing the valve 75 (FIG. 1) to move the pneumatic ram 77 in a direction on to raise the paster carriage 75. When the paster carriage 75 is partially retracted, the normally closed second carriage limit switch contacts 2CLSo reclose, and energize the contactor coil RMC through the now closed contacts PA3. It will be observed that at the beginning of the operational cycle, the contacts 2CLSo were closed with the paster carriage raised, but the contacts PA3 were then open so that the contacts 2CLSo did not create an energization path for the coil RMC. Upon this energization of the contactor coil RMC, the contacts RMC1, RMC2, RMC3 close to energize the reel motor RM (FIG. 1) which drives the reel in a clockwise direction moving the new roll 22 toward the tensioning straps 40.

Just as the new roll 22 starts to engage the tensioning straps 40, the cam 35 carried by the reel actuates the limit switch contacts RLSL1 (FIG. 2). Thus, the reel limit switch contacts RLSLx and RLSL1 (FIG. 8) both open just as the new roll starts to engage the straps 40. As a result, the coil 146 for the magnetic particle brake 138 is disconnected from the supply lines L1, L2 but it is not completely de-energized at this time. Rather, the capacitor 159 serves as a means for gradually reducing the current flow through the brake exciting coil 146 and thus gradually reducing the retarding torque created by the brake 138 as the new roll moves progressively into operative engagement with the tensioning straps 40. This will be clear since one may observe that as soon as the contacts RLSLx and RLSL1 open, the capacitor 159, which was previously charged with the polarity noted in FIG. 8, begins to discharge through the resistor 160 and the brake coil 146.

The variations in web tension created by the straps 40, 45 on the one hand, and the belt 70 engaged with the new roll and retarded by the brake 138, on the other hand, are graphically illustrated in FIG. 9. During the period between the time instants t1 and t2, the straps 40 are engaged with the expiring roll, and create tension of a selected value indicated at 161 in the running web W. As assumed that prewinding of the new roll begins at the instant t1, and that the splicing is completed (the knives sever the old web after it has been pasted to the leading end of the new roll) at the instant t2. Between the instants t1 and t2 (the latter marking the instant the new roll contacts the straps 40 as the reel rotates), the brake 138 is energized and retards the new roll to create transition tension in the new web which has a value indicated at 162. During this interval, the straps 40 do not contribute to the web tension, since the new roll is not in contact with them.

Then, when the new roll makes initial contact with the straps 40 (at the instant t3) and moves progressively into firmer engagement with them, the tension in the web created by those straps gradually increases, as illustrated by the curve 163 in FIG. 9. But at the instant t3, the coil 146 for the brake 138 is disconnected from its energizing circuit by opening of the contacts RLSLx, RLSL1, so that the capacitor 159 begins to discharge an exponentially decaying current through the coil 146 (FIG. 8). As a result, the tension in the web contributed by the brake 138 and belt 70 acting on the new roll smoothly decreases in value is shown at 164 in FIG. 9. The sum of the increasing and decreasing tension values 163, 164 is a substantially constant tension 165 in the web between the time instants t1 and t4. After the instant t4, the standby and the automatic pneumatic tensioning system are again in full control of the web tension.

It will be seen, therefore, that by this apparatus the tension in the web running into the press is maintained substantially constant and uniform over the entire cycle of a splicing operation.

As the new roll 22 advances into full engagement with the tensioning straps 40, the cam 36 actuates the reel limit switch RLS2 (FIG. 2). Thus, normally closed reel limit switch contacts RLSLx (FIG. 8) open to drop out the relay PD, thereby causing the normally open contacts PD2 (which were closed to seal in the solenoid PDS even though the carriage limit switch contacts 1CLS1 opened as the paster carriage was retracted) to re-open to de-energize the predrive solenoid PDS. As a result, the valve 69 is set to move the pneumatic ram 68 (FIG. 1) so that it raises the predrive carriage 65 to its elevated position.

As the final step in the cycle of operation, the cam 36 actuates the reel limit switch RLS4 (FIG. 2), thereby opening the normally closed contacts RLSL4 (FIG. 8) in the sealing circuit for the relay coil POS. Thus, the relay POS is dropped out so that the contacts POS2 open and de-energize all control components connected to the auxiliary line L3. With this, the relay PA is de-energized, and the contacts PA3 re-open to break the sealing circuit for the reel motor contactor RMC. Therefore, the contacts RMC1, RMC2, RMC3 in FIG. 1 to de-energize the reel motor RM and the apparatus is thus in its regular running condition with the web being taken from the roll 22 instead of the roll 21.

When the roll 22 is about to expire the above-described sequence of operations will be repeated except that this time the roll 23 will be the "new roll" to which the running web is spliced.

Referring next to FIGS. 10–13, a second embodiment of the invention is there illustrated which performs with all of the advantages of the first-described embodiment and requires but a single slippable drive coupling. Insofar as like parts are employed in the second embodiment, the same identifying reference characters will be used, and only the principal differences between the two embodiments will be described.

Referring to FIG. 10, the predrive carriage 66 is adapted to be raised or lowered about the shaft 100, and the belt 70 is arranged to be driven from or braked by the shaft 100, as previously described. Similarly, a drive connection is made from the press motor PM through the belt 105, the transmission 109, and the belt 111 to the pulley 112, as previously described. In this second embodiment, however, the shaft 100 is not directly associated with a magnetic particle brake, as previously described, but is simply journaled by a suitable bearing 170 in the frame 51.

For creating either a drive connection from the pulley 112 (and thus the motor PM) or a braking connection, to the shaft 100 and the belt 70, a brake and a clutch are arranged to be operative on an intermediate drive shaft 174. This latter brake and clutch need not be slippable couplings, and in preferred form are embodied by a combination electromagnetic brake-clutch 172.

FIG. 11 best illustrates the construction of the brake-clutch 172. As there shown, the pulley 112 is mounted on an input shaft 174 journals in a housing 175 having a flange 175a bolted or otherwise fastened to the press frame 51. The inner end of the shaft 174 is flanged and carries a plurality of circularly spaced pins 176 on which is sidable a magnetic armature 178 having a friction clutch surface 179. Fast on the end of an output shaft 180, journaled in the housing 175, is a flange member 181 which carries a clutch element 184 and a clutch winding 184 and having a friction surface 185 disposed opposite the surface 179 on the armature 178.

For the purpose of supplying energizing current to the clutch coil 184, the latter is connected with slip rings 186 mounted in an insulating member 188 carried by the flange member 181 and in contact with the brushes 190 supported by the housing 175 and leading to electrical terminals 190.
It will be apparent, therefore, that if energizing current is supplied to the clutch winding 184, the armature 178 will be attracted axially toward the clutch element 162 so that the friction surfaces 179 and 185 will come into firm driving engagement. Under these circumstances, therefore, the input shaft 174 will positively drive the output shaft 180.

For the purpose of braking the shaft 180, the flange member 181 carries a plurality of circularly spaced pins on which is axially slideable a brake armature 194 having a friction surface 195. Axially opposite the armature 194, a brake stator 196 is rigidly fixed to the housing 171, containing a brake coil 199 and having a friction surface 199. When exciting current is supplied to the brake coil 198, the brake armature 194 will be attracted toward the brake member 196, bringing the frictional surfaces 195 and 199 into firm engagement so that the shaft 180 is held stationary.

While it is possible that this electromagnetic brake and clutch might slip if exceedingly high torques are applied thereto, it is most desirable in operation to prevent relative rotation between the cooperating clutch and brake surfaces because that would cause undue wear and necessitate frequent repair or replacement. Thus, the present brake and clutch embodied by the device 172 is intended to function to hold the positive action between the clutch elements and the cooperating brake elements. It will be apparent that a positive drive connection is established from the input shaft 174 to the output shaft 180 whenever the clutch coil 184 is energized; and that a positive braking connection is established from the stationary housing 175 to the output shaft 180 whenever the brake coil 198 is energized.

As shown in FIG. 11, the output shaft 180 is connected by a positive coupling 200 to the intermediate drive shaft 171. The shaft 171 forms the input to a slipperable coupling which is here shown in FIG. 10 as a magnetic particle clutch 114 which is similar in all respects to the particle clutch 114 of FIG. 6 previously described. As shown in FIG. 10, the particle clutch 114A has an output shaft 201 mounting a pulley 202 which is connected by a belt 204 to a pulley 205 fast on the drive shaft 100. It will thus be apparent that whenever a drive connection is established through the clutch 172, the magnetic particle clutch 114A is also included in the connection from the press motor PM to the clutch coil 184 and the new roll 22. On the other hand, when a braking connection is established by the device 172, as shown in FIG. 11, the clutch 201 is also included in the braking connection from the frame 51 to the drive shaft 100, the belt 70 and the new roll 22.

By this arrangement, means are provided which enable to disengage the driving connection from the press motor, or a part rotatable therewith, to the new roll, such connection including the positive clutch in the device 172 as well as a slippable drive coupling formed by the particle clutch 114A. Additionally, when it is desired to brake the new roll in order to create transition tension, the brake within the device 172 positively holds the output shaft 180 stationary, the braking connection from that output shaft to the new roll including the slippable coupling device embodied by the particle clutch 114A. Therefore, during braking, the friction brake elements 195, 199 need not slip relative to one another, but the clutch elements within the particle clutch 114A may slip relative to one another and transmit a torque depending upon the value of the current employed to excite the coil of the particle clutch 114A.

The manner in which the predriving connection, including the slippable particle clutch 114A, and the braking connection, including the slippable particle clutch 114A, are controlled before and after the slipping operation may best be understood with reference to FIGS. 8, 12 and 13. FIG. 12 illustrates in the dotted enclosure A' controls which are substituted for those in the dotted enclosure B of FIG. 8, in carrying out the second embodiment of the invention.

In this second embodiment, therefore, the cycle of operation proceeds as previously described with reference to FIG. 8 up to the time when the Preditive push button switch is actuated. When the motor PDI is close to seal in the coil PD and thus place the auxiliary line 124 at the same potential as the main power line L1, the excitation coil 135A for the magnetic particle clutch 114A is energized by current flow through a full wave array of rectifiers 210, normally closed contacts RLS1a, normally closed contacts KR7 (control relay coil KR) and normally closed contacts RLS1b. Simultaneously, current flows through a full wave array of rectifiers 214 through normally closed contacts KR8 (FIG. 13) and the clutch coil 184 of the clutch-brake device 172. Therefore, a driving connection from the motor PM is established through the clutch-brake device 172, and the slippable magnetic particle clutch 114A is energized to transmit a predetermined torque to the drive shaft 100, the belt 70 and the new roll 22. Because the particle clutch 114A can slip, no shock or overload is placed on the press drive motor PM. The new roll 22 is therefore smoothly accelerated until it reaches full speed and the magnetic particle clutch 114A ceases to slip.

Then, the operator momentarily closes the Predisive push button switch, so that the brush solenoid BS is energized to release the brushes and the knife solenoid KS subsequently energized to release the knives, as previously described in connection with FIG. 8. When the knife solenoid KS is energized, the knife control relay KR is also energized. Therefore, immediately after a splicing operation, the contacts KR8 (FIG. 13) open to de-energize the clutch coil 184, while the contacts KR9 close to energize the brake coil 198. Thus, the clutch in the device 172 is released to dis-engage the driving connection from the press motor PM, while the brake in the device 172 is engaged to hold the output shaft 180 (FIG. 11) stationary. Also, when the knives are released and the relay KR energized, the contacts KR7 (FIG. 12) open so that current flow through the magnetic particle clutch coil 135A is then limited according to the setting of the pressure rheostat PR. The setting of this rheostat PR is, as previously explained in connection with FIG. 1, varied automatically according to the value of tension which is automatically maintained in the running web by the straps 40. Thus, with the shaft 180 held stationary by the electromagnetic brake, the magnetic particle clutch 114A transmits only a predetermined braking torque to the shaft 100, the belt 70, and the new roll 22. And because the value of the current through the particle clutch coil 135A is controlled now by the pressure rheostat PR, the transition tension created by the magnetic particle clutch and the positive brake has the same value as would be obtained if the new roll were already in engagement with the tensioning straps 40.

During the period that the clutch coil 135 is energized by current flow through contacts RLS1a, rheostat PR, and contacts RLS1b, the relay contacts KR6 will be closed, so that the capacitor 212 charges through the resistor 211 to the polarity indicated.

Then, as previously explained in connection with FIG. 8, the rel coil begins to rotate clockwise moving the new roll 22 into engagement with the straps 40. Just as the new roll contacts the straps, the reel limit switch RLS1 is actuated, as previously explained. Then, the contacts RLS1a and RLS1b in FIG. 12 both open, disconnecting the magnetic particle clutch coil 135A from the energizing lines L1, L2. Immediately, the capacitor 212, which was charged through the resistor 211 when the contacts KR6 closed in response to release of the knives, begins to discharge as shown by the dotted line arrow in FIG. 12 through the clutch coil.
Therefore, the braking torque transmitted by this particle clutch from the now stationary shaft 189 decays exponentially as shown by the graph 164 in FIG. 9. As the new roll moves progressively into operative engagement with the tensioning straps 48, the braking torque exerted on the new roll by the particle clutch 114A and the mechanical brake 194 progressively decreases.

The remainder of the operating cycle of the controls operate in exactly the same way as previously described in connection with FIG. 8. It will be understood from the foregoing that in this second embodiment, the braking clutch device 172 serves to establish a positive drive connection from the press motor to the intermediate drive shaft 171, or to exert a positive, locking braking force on the shaft 171. However, by virtue of the location of the slippable coupling exemplified by the magnetic particle clutch 114A, the latter is included in both the drive and braking connections to the new roll. Therefore, during predrawing, energization of the magnetic particle clutch results in the latter transmitting the torque bias to the new roll, its components slipping as necessary until the new roll reaches full speed. Also, when transition is to be excited, the current value used to excite the coil of the particle clutch 114A determines the value of that transition tension, and this is made automatically to agree with the regular tension maintained by the straps 48 by virtue of the automatic adjustment of the pressure rheostat 156. Finally, the excitation current through the coil 135A of the magnetic particle clutch 114A is caused to decay exponentially as the new roll moves into the tensioning straps 48 by controls, shown in FIG. 12, which cause the capacitor 212 to discharge through the coil 135A. Thus, in the preferred embodiment of the invention, a single magnetic particle coupling serves two purposes and is effectively present in both the predrawing and braking connections to the new roll.

We claim:

1. In apparatus for splicing a new roll web to a running web drawn from an expiring roll into a web-processing device having power-driven rotary parts, said apparatus including tensioned straps engaging the expiring roll to create tension in the running web of a predetermined adjustable value, and means for moving the new roll into engagement with the straps after a splice has been made; the combination comprising a disengageable drive connection between one of said rotary parts and said new roll, said drive connection including a first slippable coupling capable of transmitting an adjustable predetermined torque, a disengageable braking connection to said new roll, said braking connection including a second slippable coupling capable of exerting an adjustable predetermined retarding force on said new roll to oppose rotation of the latter, means for completing said drive connection to accelerate the new roll prior to a splicing operation, and means for disengaging said drive connection and completing said braking connection to exert a retarding force of a first magnitude on the new roll immediately after a splicing operation so that tension in the web corresponding in value to the tension in the running web of said expiring roll, and means responsive to the new roll being moved into initial engagement with said straps for gradually reducing the retarding effect of said second slippable coupling in said braking connection to smoothly reduce the retarding force on the new roll from said first magnitude so that the retort tension imparted to said new web is maintained substantially at said predetermined value.

2. The combination set forth in claim 1 further characterized by adjustable control means to vary the tension in said straps and the resultant tension created in the running web, and means varied automatically as an incident to adjustments of said control means to correspondingly change the torque initially transmissible by said braking connection coupling, so that the web tension during the transition period immediately following a splicing operation will be substantially the same as that created by said straps prior to the splicing operation.

3. In apparatus for splicing a new roll web to a running web drawn from an expiring roll into a power-driven printing press, the combination comprising a reel rotatably supporting said rolls and rotatable to bring them successively into a supply position, straps positioned to frictionally engage said reel, said straps responsive to the tension in the running web to automatically vary the tension in said straps so as to maintain the web tension at a predetermined value, a disengageable drive connection between said press and said new roll including a slippable electromagnetic coupling which transmits a torque substantially proportional to the excitation current supplied thereto, a disengageable braking connection to said new roll including a slippable electromagnetic coupling which transmits a braking torque substantially proportional to the excitation current supplied thereto, means for disengaging said braking connection while adjusting said braking connection and exciting the coupling thereby so as to create a first value prior to a splicing operation so that the new roll is accelerated and driven in timed relation to the press, means for disengaging said driving connection while completing said braking connection and exciting the coupling thereby so as to create a second value immediately after a splicing operation so that transition tension is created in the web drawn from the new roll, means for rotating said reel to bring the new roll into engagement with said straps after a splicing operation, and means operative in response to the said moving said new roll into initial engagement with said straps for causing the exciting current supplied to the coupling in said braking connection to gradually and smoothly decay over a time period substantially equal to that required for the new roll to reach full engagement with said straps.

4. The combination set forth in claim 3 further including means for automatically setting the predetermined tension maintained in the web by said straps, and means coupled with and adjusted as an incident to change in said setting means for changing the said second current value, so that the transition tension created by said braking connection is made substantially equal to the running tension maintained by said straps.

5. In apparatus for splicing a new roll web to a running web drawn from an expiring roll into a power-driven printing press, the combination comprising tensioned straps frictionally engaging the expiring roll to create tension in the running web, a tension control system responsive to tension in the web to vary the tension in said straps and maintain the web tension at a predetermined value, an adjustable member in said system for setting the value of maintained web tension, means for moving the new roll into engagement with said straps after a splicing operation, a disengageable drive connection from the press to the new roll and including an electromagnetic particle coupling, a disengageable braking connection from a stationary member to the new roll and including an electromagnetic particle coupling, means for completing said drive connection and exciting the coupling therein prior to a splicing operation to predrive the new roll, means for disengaging said drive connection and completing said braking connection and exciting the coupling therein immediately after a splicing operation to create transition tension in the new roll web, and means for changing the value of exciting current supplied to the coupling in the braking connection as an incident to adjustment of said adjustable member.

6. In apparatus for splicing a new roll web to a running web drawn from an expiring roll into a power-driven...
web-consuming device, the combination comprising tensioned straps frictionally engaging the expiring roll to create tension in the running web of a predetermined adjustable value, means for moving the new roll into engagement with said straps after a slicing operation, a shaft and means including a slippable coupling operable to transmit up to a predetermined adjustable torque connecting said shaft to the new roll, a clutch for releasably connecting said shaft to be driven from the web-consuming device, a brake for releasably braking said shaft so as to effect a braking force in opposition to the adjustable torque transmitted by said slippable coupling, means for engaging said clutch prior to a splicing operation to predrive the new roll, means for releasing said clutch and engaging said brake immediately after a splicing operation to create tension in the new roll web corresponding in value to the tension in the running web of said expiring roll during the interval required to move the new roll into engagement with said straps, and means responsive to the new roll being moved into initial engagement with said straps for smoothly reducing the braking force imparted by said brake so that the total tension imparted to said new web is maintained substantially at said predetermined value.

7. In apparatus for splicing a new roll web to a running web drawn from an expiring roll into a power-driven printing press, the combination comprising tensioned straps frictionally engaging the expiring roll to create tension in the running web, means for moving the new roll into engagement with said straps after a splicing operation, a shaft and means including a magnetic particle clutch having an exciting coil drivingly connecting said shaft with said new roll, an electric clutch drivingly connected between said shaft and the press, an electric brake operative on said shaft, means for energizing said electric clutch and exciting said particle clutch with current of a first value prior to a slicing operation, means for de-energizing said electric clutch and energizing said brake and for changing the exciting current supplied to said particle clutch to a second value immediately after a splicing operation.

8. In apparatus for splicing a new roll web to a running web drawn from an expiring roll into a power-driven printing press, the combination comprising tensioned straps frictionally engaging the expiring roll to create tension in the running web, means for moving the new roll into engagement with said straps after a splicing operation, a shaft and means including a magnetic particle clutch having an exciting coil drivingly connecting said shaft with said new roll, an electric clutch drivingly connected between said shaft and the press, an electric brake operative on said shaft, means for energizing said electric clutch and exciting said particle clutch with current of a first value prior to a slicing operation, means for de-energizing said electric clutch and energizing said brake and for changing the exciting current supplied to said particle clutch to a second value immediately after a splicing operation, and means responsive to the position of the new roll for gradually reducing the exciting current supplied to said particle clutch as the new roll is moved progressively into engagement with said straps.

9. In apparatus for splicing a new roll web to a running web drawn from an expiring roll into a power-driven printing press, the combination comprising tensioned straps frictionally engaging the expiring roll to create tension in the running web, means for automatically controlling the tension in said straps and including a manually adjustable member for setting the value of the controlled tension, means for moving the new roll into engagement with said straps after a splicing operation, a shaft and means including a magnetic particle clutch having an exciting coil drivingly connecting said shaft to the new roll, an electric clutch for drivingly connecting said shaft to the printing press, an electric brake for retarding said shaft, means for energizing said electric clutch and exciting said particle clutch coil with current of a first value prior to a splicing operation, means for energizing said electric brake and exciting said particle clutch coil with current of a second value immediately after a splicing operation, said last-named means including a variable resistor for determining the second current value, means for adjusting the value of said resistor in proportion to the setting of said adjustable member, a capacitor connected in parallel with said particle clutch coil, and means for terminating the exciting current to said coil as the new roll is moved into said straps so that said capacitor exponentially discharges through said coil to progressively reduce the braking force on said roll as the retarding force created by said straps increases.

10. In apparatus for splicing a new roll web to a running web drawn from an expiring roll into a web-consuming device, the combination comprising tensioned straps frictionally engaging the expiring roll to create tension in the running web, means responsive to tension in the web for varying the tension in said straps to maintain the web tension at a predetermined value, an adjustment member for varying the tension maintained by said last-named means, means for moving the new roll into engagement with said straps after a splicing operation, a disengageable braking connection to said new roll, said braking connection including a torque-transmitting coupling which slips to limit the braking torque transmitted thereby to a predetermined value, means responsive to the setting of said adjustment member to correspondingly adjust the predetermined limit torque transmitted by said coupling, and means for completing said braking connection immediately after a splicing operation, so that the new roll is retarded and tension created in the new web during the interval required for the new roll to move into engagement with said straps.

11. In apparatus for splicing a new roll web to a running web drawn from an expiring roll into a web-consuming device, the combination comprising tensioned straps frictionally engaging the expiring roll to create tension in the running web, means for moving the new roll into engagement with said straps after a splicing operation, a disengageable braking connection to said new roll, said braking connection including a torque-transmitting coupling which slips to limit the braking torque transmitted thereby to a predetermined value, means for completing said braking connection immediately after a splicing operation so that the new roll is retarded and tension created in the new web during the interval required for the new roll to move into engagement with said straps, and means responsive to the new roll reaching a position of initial engagement with said straps for controlling said coupling to exponentially reduce with passing time the torque transmitted by said coupling as the new roll moves progressively into engagement with said straps.

12. In apparatus for splicing a new roll web to a running web drawn from an expiring roll into a web-consuming device, the combination comprising tensioned straps frictionally engaging the expiring roll to create tension in the running web, means responsive to tension in the web for varying the tension in said straps to maintain the web tension at a predetermined value, an adjustment member for varying the value of the web tension maintained by said last-named means, means for moving the new roll into engagement with said straps after a splicing operation, a disengageable braking connection to said new roll and including an electromagnetic particle coupling which slips to limit the braking torque transmitted thereby to a value substantially proportional to the exciting current supplied thereto, means for completing said braking connection immediately after a splicing...
operation, means for exciting said electromagnetic coupling with current of a value proportional to the setting of said adjustment member immediately after a splicing operation, so that the new roll is retarded and tension substantially equal to that maintained by said straps is created in the new web during the interval required for the new roll to move into engagement with said straps.

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