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3,294,301

WEB REGISTRATION SYSTEM

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2 Sheets-Sheet 1

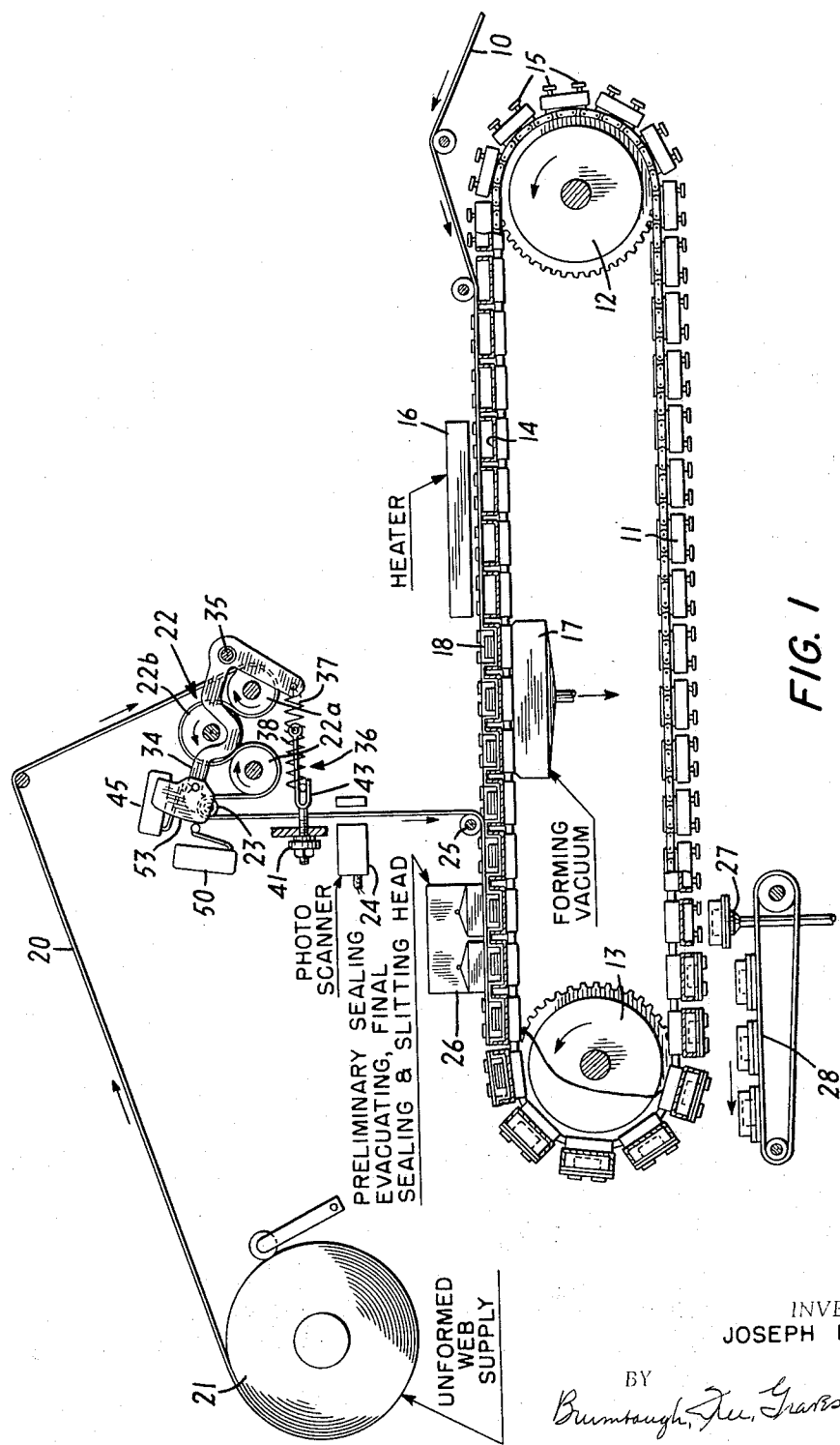


FIG. 1

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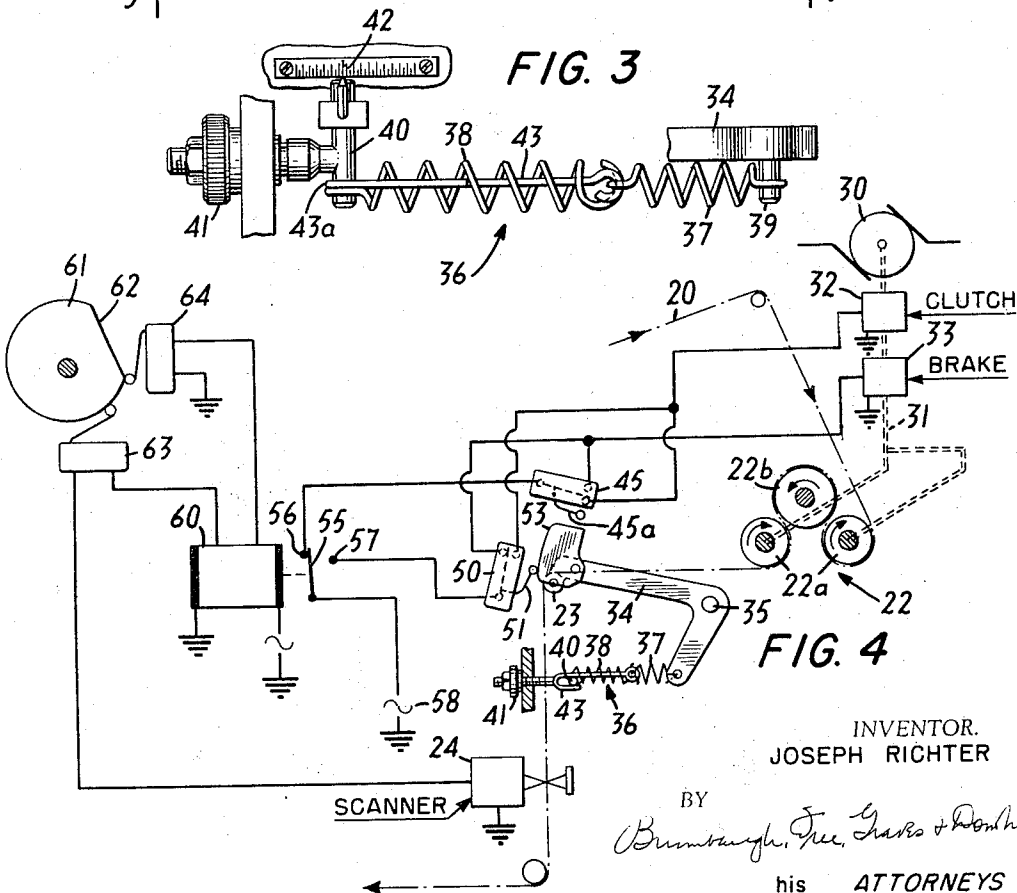
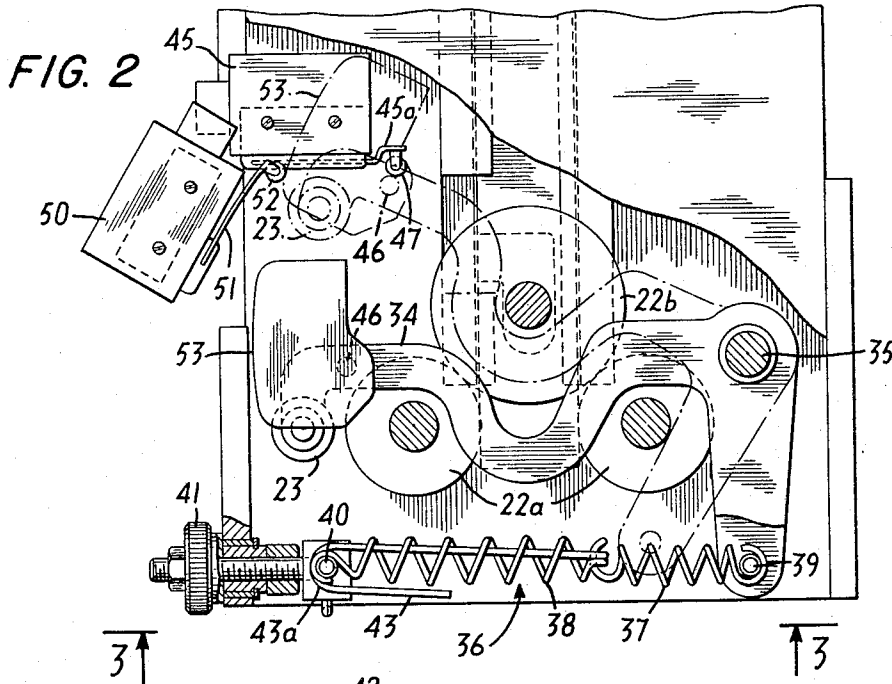
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WEB REGISTRATION SYSTEM

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2 Sheets-Sheet 2



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WEB REGISTRATION SYSTEM

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This invention relates to a novel web registration system in which a stretchable web having repeat printed impressions thereon is fed and registered with respect to another moving element by stretching the web, sometimes more and sometimes less, an amount necessary to insure proper registration.

In certain conventional web registration systems, and particularly in the web registration systems employed in packaging machines in which packages are made from roll stock, repeat impressions printed on the web, including sensing indicia, are printed at intervals slightly less than necessary to achieve proper registration between each printed impression and the element with respect to which it is to be registered. For example, in packaging machines in which repeat labels are printed on a web which is to be registered with respect to moving trays or die cavities of a packaging machine, the center-to-center spacing of the labels printed on the web is slightly less than the center-to-center spacing between the trays or die cavities of the packaging machine so that proper registration between the labels and the trays or die cavities can be maintained by controlled stretching of the web. In such machines the web is usually stretched between two sets of feed rolls, or between a set of feed rolls and the moving trays or die cavities of the machine. In these machines, the sensing indicia printed on the web is detected by an electric eye photoscanner, and changes in the amount of stretching necessary to maintain proper registration are obtained by changing the relative speed of one set of feed rolls with respect to the other or changing the relative speed of the one set of feed rolls with respect to the speed of travel of the trays or die cavities.

While these conventional web registration systems have worked satisfactorily in machines in which the web is fed continuously to continuously moving trays or die cavities, difficulty has been encountered in achieving proper registration in machines in which the web is fed to trays or die cavities which are advanced intermittently. In such intermittent machines, perfect registration is difficult to achieve due to slippage between the web and the feed rolls and the difficulty of achieving registration by making small changes in the speed of the feed rolls. In addition, it has been found that in such intermittent machines in which the film is stretched for purposes of registration between two sets of feed rolls and then fed in relaxed condition to the machine, the elastic memory of the film causes unpredictable shrinkage in the web which makes proper registration difficult to achieve.

The web registration system of the present invention differs from the conventional web registration systems, inter alia, in that it does not depend on the constant speed adjustment of a set of feed rolls to make the necessary variations in the stretching of the film to achieve proper registration. Moreover, the stretching is not isolated from the machine nor is the film fed to the machine in relaxed condition, so that the elastic memory of the film is not an obstacle to achieving proper registration.

The web registration system of the present invention provides a novel approach to film registration which has proved highly satisfactory for use in machines in which the film is fed intermittently to a moving part which is advanced intermittently. This novel web registration system includes a film take-up roll which takes up slack in the span of the web intermediate a set of web feeding rolls

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and the machine utilizing the web, means for causing the take-up roll to exert a minimum stretching effect on the web over one operating range of the take-up roll and a substantially greater stretching effect on the web over another range thereof, means controlled by the position of the take-up roll in each of the separate ranges of operation thereof to control the starting and stopping of the feed rolls of the web registration system, and means controlled by the detection of the sensing indicia on the web for rendering one or the other of said control means operative, depending on whether a greater or lesser amount of stretching is required to achieve proper registration.

An ancillary feature of the web registration system of the present invention is a novel spring arrangement which causes the movable take-up roll to exert a greatly increased stretching action on the web over one range of movement of the take-up roll than over another range of movement thereof.

For a full understanding of the present invention, reference can be made to the detailed description which follows and to the accompanying drawings in which:

FIGURE 1 is a front elevational view illustrating a packaging machine equipped with the web registration system of the present invention;

FIGURE 2 is an enlarged view of part of the web registration system shown in FIGURE 1;

FIGURE 3 is a view taken along the line 3—3 of FIGURE 2, looking in the direction of the arrows; and

FIGURE 4 is a schematic circuit diagram of the web registration system of the present invention.

Referring to the drawings, the web registration system is shown as applicable to a vacuum packaging machine in which a vacuum-formable film 10 is fed to a series of intermittently moving trays 11 of a chain-like conveyor. The chain of trays is moved intermittently in a closed path around spaced-apart sprockets 12 and 13, one of which is intermittently driven to advance and index successive trays at the various stations of the machine. The trays each contain one or more die cavities 14 into which the film 10 is drawn by vacuum to shape it in the form of a cup. The trays also carry spring-urged clamps 15 along both sides which are lifted to open position to permit the film 10 to be fed into overlying relationship with the trays and then closed to hold the edges of the film on the trays.

The trays 11 and the film 10 in overlying relationship therewith are advanced intermittently beneath a web heater 16 and then above a manifold vacuum conduit 17 which draws the heated film into the die cavities, thereby forming product-receiving cups or pockets in the film 10 into which the product 18 is inserted. The trays are then advanced to a point where a cover film 20 is fed into overlying relationship with the vacuum formed film 10.

The cover film 20 is fed from an unwind roll 21 through a set of feed rollers 22, over a slack take-up dancer roll 23, past an electric eye photoscanner 24, and then around a guide roll 25 onto the top of the formed film 10.

The products are packaged between the films 10 and 20 by feeding the trays 11 to successive station beneath a vertically reciprocating head 26 which forms a preliminary seal between the webs to define a package, evacuates the air from the package, finally seals the evacuated package and then slits the webs to define separate packages. The trays 11 are then advanced stepwise around the sprocket wheel 13 to an inverted position where the clamps 15 are opened and the packages are removed from the inverted trays by vertically moving suction cups 27 which lower the packages onto the discharge conveyor 28.

The vacuum packaging machine as thus far described is conventional and forms no part of the present invention.

In such machines, either of the films 10 or 11 may have printed repeat impressions thereon, for example, a label identifying the product and including the brand name thereof, which film must be registered with respect to the moving trays so that the information will appear at the appropriate place on each package. The web registration system of the present invention is shown in the drawings and described herein as applicable to a machine in which the cover film 20 is registered with respect to the moving trays of the packaging machine, but, of course, it is understood that the web registration system can be used to register either or both of the films 10 and 20.

The films generally used in packaging machines of the type described are stretchable films, for example, composite nylon-saran-polyethylene or Mylar-saran-polyethylene films. The film 20 is fed from an unwind roll 21 by a feed roll assembly 22 which includes two driven rolls 22a and an intermediate idler roll 22b in pressure engagement with the driven rolls. As schematically shown in FIGURE 4, the driven rolls 22a are driven by a drive motor 30 through a drive transmission 31 which includes a clutch 32 and a brake 33. As will be described below, the clutch and brake are operated through an electrical circuit which causes the brake to be applied when the clutch is disengaged, and the brake to be released when the clutch is engaged.

The film 20 is held tautly between the feed roll assembly 22 and the machine by the dancer roll 23 supported between a pair of arms 34 pivoted at 35 to side frames of the machine. The arms 34 are pivotally urged in a clockwise direction, as viewed in the drawings, by a novel spring arrangement, generally designated by the reference numeral 36.

The film 20 has repeat impressions, including repeat sensing indicia, to be registered with the trays 11. The repeat impressions are printed on the film 20 at distances slightly less than the center-to-center spacing between successive trays. The sensing indicia is detected by the electric eye photoscanner 24, and when the position of the sensing indicia in the machine cycle indicates that the film is in substantially proper registration with the die cavities of the trays 11 a minimum stretching force is exerted on the film 20 by the dancer roll 23. However, when the photoscanner 24 detects that the sensing indicia on the film 20 is ahead of its position with respect to the appropriate tray, indicating that a greater amount of stretching is required for proper registration, the dancer roll 23 is shifted to a different range of operation where it exerts a greater stretching action on the film until the film and the moving trays are restored to proper registration, whereupon the lighter stretching force is restored. More specifically, the stretching action on the film is varied by controlling the position at which the dancer roll 23 stops the feed of the film 20. The spring 36 is designated to exert a minimum stretching action on the film in one range of operation of the dancer roll and a substantially greater stretching action in another range of operation thereof.

The spring arrangement 36 can best be described with reference to FIGURES 2 and 3 of the drawings. The spring arrangement 36 includes a heavy spring 37 and a light spring 38 connected in series intermediate the anchoring pin 39 carried by one of the pivotal arms 34 and an adjustable anchoring pin 40. The force which the heavy spring 37 exerts per increment of stretch is a multiple of the force which the light spring 38 exerts for the same amount of stretch, for example, in the order of about 10:1. The pin 40 can be adjusted with respect to the frame of the machine by the rotation of an adjustable knob 41, the rotation of which imparts movement to the pin 40 relative to the indicator 42 to regulate the spacing between the pins 39 and 40. The heavy spring 37 is connected at one end to the light spring 38 and at the other end to the anchoring pin 39, and it is also connected to the pin 40 by a lost motion hook 43 having a hook-like end 43a which passes around the pin 40. In the raised

position of the arms 34, as shown in FIGURE 1, the hook end 43a of the hook 43 is spaced apart from the pin 40. As the pivotal arm 34 moves from the upper position indicated by the broken lines in FIGURE 2 to the lower position indicated by the solid lines, initially the resistance to the pivotal motion of the arm 34 will be exerted by the light spring 38 only until the hook-like end 43a of the hook 43 engages the pin 40. After the lost motion afforded by the hook element 43 is used up by the expansion of the light spring 38, the hook element 43 engages the pin 40 and provides a fixed anchorage for the heavy spring 37 so that thereafter the further pivotal motion of the arm 34 will be resisted by the heavier spring.

When the amount of stretch required in the film 20 to achieve proper registration with the moving trays 11 is such that only the minimum amount of stretch is required, the arm 34 and the dancer roll supported thereby will operate throughout an upper range or, more specifically, in a range from the upper position in FIGURE 2 to a position intermediate the upper and lower positions indicated in that figure. During the operation of the machine in which this minimum stretching force is applied to the film, the operation of the clutch 32 and brake 33 is controlled by a switch 45. When the pin 46 carried by one of the pivotal arms engages a roller 47 carried by the actuating arm 45a of the switch 45, the clutch 32 is disengaged and the brake 33 is applied to stop the feed of the film 20. As the chain of trays 11 is advanced, the film 20 moves with the trays pulling the dancer roll 23 downwardly, so that initially the film is subjected to the stretching force exerted by the light spring 38 and thereafter, if necessary, to the force exerted by the heavy spring 37. The downward pivotal movement of the pivotal arm 34 causes the pin 46 to move out of contact with the roller carried by the actuator for the switch 45, thereby causing the engagement of the clutch 32 and the release of the brake 33 so that the feed rolls begin to advance the web while the trays 11 are advanced to the next station. The film continues to be fed by the set of feed rolls 22 until the pivotal arm 34 again rises to the position at which it actuates the switch 45 and stops the drive to the feed rolls. The operation of the web registration system will continue to operate in this manner while the electric eye photoscanner 24 senses that there is substantial registration between the sensing indicia on the film and the trays.

When the electric eye photoscanner 24 detects that the sensing indicia is running ahead of the advance of the trays, the switch 45 will be rendered inoperative during that cycle, and the operation of the clutch 32 and brake 33 will be controlled during that cycle (and successive cycles until proper registration is restored) by a switch 50. The switch 50 has an actuator 51 which carries a roller 52 thereon and is actuated by the cam surface 53 of one of the pivotal arms 34. The switch 50, however, is actuated when the arms 34 and the dancer roll 23 are in positions displaced in a counterclockwise direction from their respective positions for actuating the switch 45. As a result, during any cycle in which the switch 50 is in control, the feed rolls will not advance the film until the dancer roll 23 has moved a considerable distance and the action of the heavy spring 37 has been brought into play.

In a machine cycle in which the switch 50 is in control of the advance of the film, the range of operation of the dancer roll 23 is shifted in a counterclockwise direction from its range of operation when the switch 45 is in control of the advance of the film. In the cycle in which the switch 50 is in control of the advance of the film, the feed rolls 22 will not begin to advance the film until the tension in the film has pulled the dancer roll 23 and the pivotal supporting arms 34 therefore downwardly to a position at which the cam surface 53 is out of contact with the actuator 51 of the switch 50. Thus, the feed of the film will not begin until the dancer roll is shifted into a

different range of its operation in which the effect of the heavier spring 37 is brought into play, substantially increasing the stretching action on the span of the film intermediate the feed rolls 22 and the moving chain of trays. This increased stretching action continues until the photo-scanner 24 detects that the sensing indicia and the printed impressions on the film have been restored to proper registration with the trays 11, at which time the control of the operation of the feed rolls 22 is restored to the switch 45.

Turning to the circuit diagram in FIGURE 4, the position of the relay controlled switch 55 determines which of the switches 45, 50 will be operative to control the clutch 32 and brake 33 during the machine cycle. When the switch 55 is in the position shown engaging the contact 56, the switch 45 is rendered operative and the switch 50 inoperative. When the switch 55 is shifted into engagement with the contact 57, the switch 50 is rendered operative and the switch 45 inoperative.

The operative switch 45 or 50 normally supplies power from the source 58 through the switch 55 and either the switch 45 or 50 to maintain the clutch 32 engaged. During such times no power is supplied to the brake 33 and it remains in released condition. When the operative switch 45 or 50 is actuated by one of the pivotal arms 34, the circuit to the clutch 32 is broken, disengaging the clutch, and the circuit to the brake 33 is established, applying the brake to stop the feed of the film.

The position of the switch 55 is controlled by the operation of a relay 60 which is responsive to the position of the rotating cam 61 at the time that the photoscanner 24 detects the sensing mark on the film. The cam 61 is driven in synchronism with the packaging machine and makes one revolution for each indexing cycle of the machine. The cam 61 has a flat 62 thereon. When the sensing indicia on the film is detected by the photoscanner 24 while the flat of the cam is controlling the operation of the switch 63, indicating that the sensing indicia is ahead of schedule and the film requires additional stretching for purposes of registration, power is transmitted to the relay 60 which, in turn, operates to move the switch 55 from the contact 56 to the contact 57, thereby rendering the switch 45 inoperative and the switch 50 operative. When the flat of the timing cam actuates the switch 64 the latter functions to reset the relay 60 and restore the switch 55 in engagement with the contact 56.

If during the next indexing cycle of the machine the photoscanner again detects the sensing indicia ahead of schedule, the operation described above will be repeated, again rendering the switch 50 operative to control the drive of the film feeding rollers 22. Eventually, the overstretching of the film which results when the feed of the film is controlled by the switch 50 will cause the sensing indicia to be detected in its proper relationship with respect to the positions of the trays and the timing cam so that the sensing occurs while the switch 63 is in engagement with the high portion of the cam. During that indexing cycle and as many successive cycles as that proper registration continues to exist, the switch 45 will remain in control of the film feed, and the dancer roll 23 will exert the minimum stretching action on the film.

The web registration system of the present invention has been shown and described herein in a single preferred form and by way of example only, and obviously, many other modifications and variations can be made therein within the spirit of the invention. For example, the web registration has been shown as applicable to a packaging machine, but obviously, it has general application to machines and apparatus in which it is desirable to register a web with respect to another moving element by controlling the amount of stretch which is imparted to the web. The invention, therefore, is not to be limited to any particular form or embodiment, except insofar as such limitations are set forth in the claims.

I claim:

1. A web registration system for registering a stretch-

able film with respect to an intermittently moving element of a machine which takes the film as it is needed comprising film feeding means, a movable film take-up roll acting on the film intermediate the film feeding means and the said intermittently moving element, means acting on the said take-up roll and causing it to exert a greater stretching action on the film over one range of movement of the take-up roll than over another range of its movement, means controlled by the position of the take-up roll for controlling the operation of the film feeding means, and means responsive to sensing indicia on the film for changing the film take-up roll from one operating range to another to increase the amount of stretch when the sensing indicia is detected early and to decrease the amount of stretch when the sensing indicia is detected late.

2. A web registration system for registering a stretchable film with respect to a moving part of a machine which takes the film intermittently as it is needed comprising film feeding means, a movable film take-up roll which takes up slack in the span of the film intermediate the film feeding means, means acting on the film take-up roll to cause it to exert a slight stretching effect on the film over one operating range of the take-up roll and a greater stretching effect over another operating range thereof, separate means controlled by the position of the take-up roll in each of the operating ranges thereof to control the starting and stopping of the film feeding means, and means responsive to the position of sensing indicia on the film during each machine cycle for rendering one or the other of said control means operative, depending on whether a greater or lesser amount of stretching is required to achieve proper registration.

3. A web registration system as set forth in claim 2 including a movable support for the take-up roll and a spring device acting on the movable support comprising a heavy spring and a light spring connected in series, whereby during the initial movement of the support only the force of the light spring is exerted on the support to resist the movement of the support, and a lost motion connection between the heavy spring and an anchorage so that when the support is moved by an amount sufficient to use up the lost motion the further movement of the support will be resisted by the heavy spring.

4. In a web registration system which includes film feeding means and a movable film take-up roll acting on the film intermediate the film feeding means and the said moving part, means for causing the take-up roll to exert a greater stretching action on the film over one range of its movement than over another range thereof comprising a light spring and a heavy spring connected in series and resisting the movement of the take-up roll from one extreme position to another extreme position, the heavy spring being disposed intermediate the light spring and the take-up roll, and lost motion means connecting the end of the heavy spring remote from the take-up roll with an anchorage whereby the initial movement of the take-up roll is resisted by the action of the light spring until the lost motion connection provides a fixed anchorage for the heavy spring and thereafter the further movement of the take-up roll is resisted by the action of the heavy spring.

5. A web registration system for registering a film with an intermittently moving part of a machine which takes the film as it is needed comprising feed rolls for advancing the film to the moving part, the said feed rolls gripping the film so as to prevent the feed of the film when the feed rolls are stopped, a film take-up roll intermediate the feed rolls and the machine to take up slack in the film and to exert a stretching action on the film, means supporting the take-up roll for movement, spring means acting on the film take-up roll to exert a greater stretching action on the film in one range of its movement than in another range, means controlled by the position of the take-up roll in one range of its travel for controlling the operation of the feed rolls, means controlled by the

position of the take-up roll in another range of its travel for controlling the operation of the feed rolls, film scanning means for detecting sensing indicia on the film, and means responsive to the position of the sensing means during each machine cycle for selecting which of the two means for controlling the operation of the feed rolls will be rendered operative, thereby controlling the range of travel of the take-up roll and the stretching action exerted by the take-up roll on the film during that cycle.

6. A web registration system for registering a film with respect to a moving part of a machine which takes the film as it is needed comprising feed rolls for advancing a film to the machine, means for driving and braking the feed rolls, a film take-up roll acting on the film intermediate the feed rolls and the machine to take up slack and exert a stretching action on the film, movable support means for the take-up roll which permits the take-up roll to retreat when the film is taken by the machine and the feed rolls are braked, means acting on the take-up roll and causing it to exert a greater stretching action on the film as the take-up roll retreats, a first and second control means for the said feeding and braking means, the end control means being responsive to the position of the take-up roll in one range of travel and the other control means being responsive to the take-up roll in an-

other range of travel, film scanning means which detects sensing indicia on the film, and means responsive to the time at which the sensing means is detected during each machine cycle for selecting which of the two feed control means is to be rendered operative.

7. A web registration system as set forth in claim 6 in which the means acting on the take-up roll and causing it to exert a greater stretching action on the film as the take-up roll retreats including a heavy spring and a light spring connected in series to an anchorage, the heavy spring being intermediate the light spring and the take-up roll, and a lost motion connection connecting the end of the heavy spring to an anchorage, permitting the movement of the take-up roll to be resisted initially by the light spring and thereafter by the heavy spring.

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