

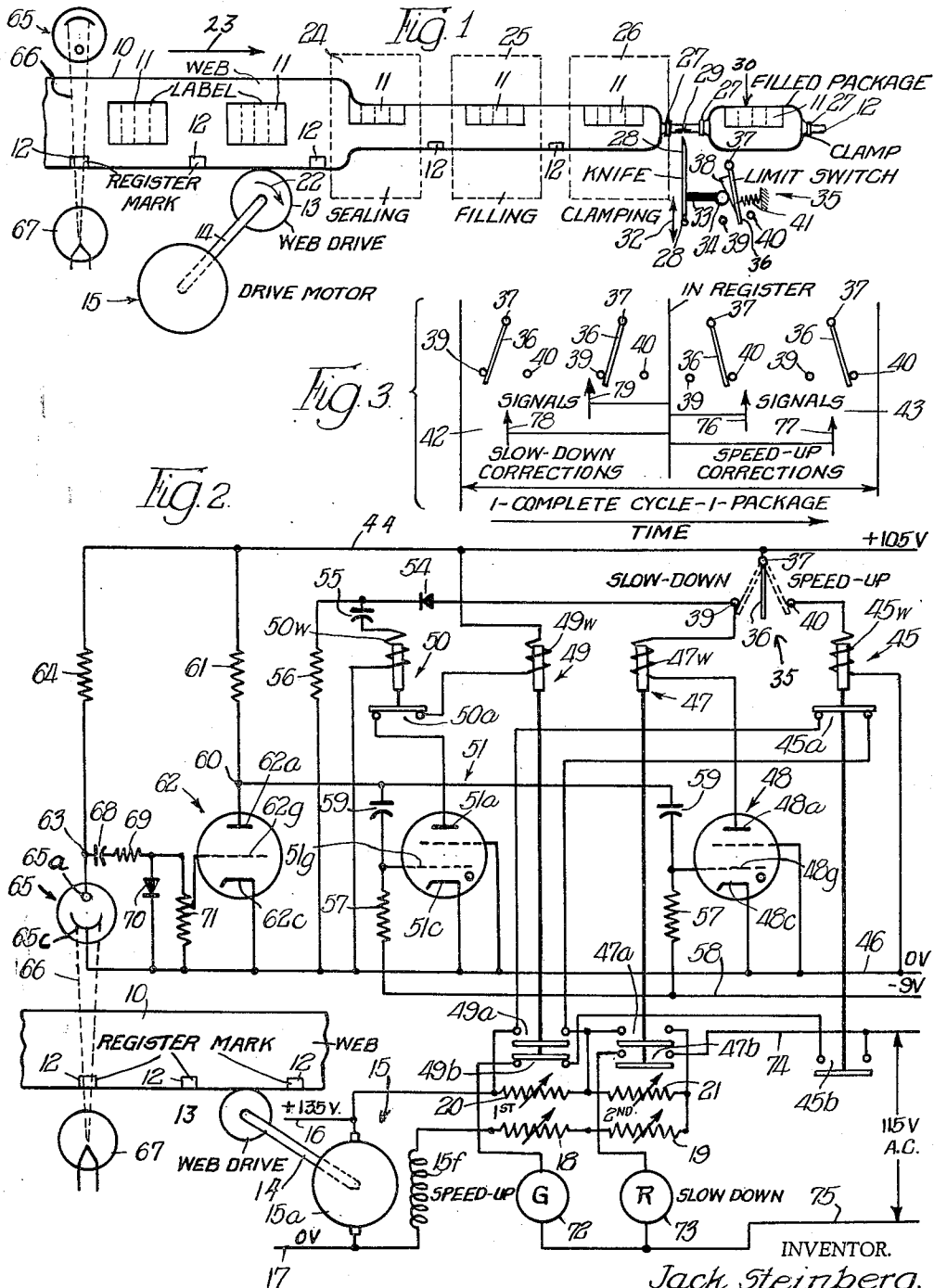
Sept. 25, 1962

J. STEINBERG

3,055,246

WEB FEEDING MEANS

Filed March 13, 1959



Jack Steinberg,

BY

Cromwell, Christ & Warden

1

3,055,246

WEB FEEDING MEANS

Jack Steinberg, Madison, Wis., assignor to Oscar Mayer & Co., Inc., Chicago, Ill., a corporation of Illinois
Filed Mar. 13, 1959, Ser. No. 799,226
15 Claims. (Cl. 83-74)

This invention relates, generally, to web feeding means and it has particular relation to the control of the speed at which the web is fed.

An important use of a continuously fed web is in the packaging of material, such as sausage and the like, using a packaging machine of the kind and character disclosed in U.S. Patent No. 2,831,302, issued April 22, 1958. The packaging machine disclosed in this patent is arranged to feed the material to be packaged into a continuous tube of relatively thin pliable material, such as paper, film, tape, etc., which is arranged to continuously form a longitudinal seal along the juxtaposed edges of the longitudinally extending web to form the tube, then fills it with the material to be packaged, clamps the end of a unit length and cuts off the unit length which is filled with the packaged material. As disclosed in the patent the flat web or film is fed in strip form by feed rollers driven by a motor to the machine which performs the operations just outlined. In order to adjust the speed of the web or film as it is fed to the machine, suitable means are provided for varying the operation of the feed rollers. For this purpose a variable speed mechanism can be interposed between a motor operating at a constant speed and the web drive. Also the speed of the motor itself can be varied, the motor being arranged to drive the feed rollers directly. According to the patent a reciprocating knife is employed for severing a unit length of the web, formed into a container having a top and bottom secured by clamp rings and filled with the material.

It is desirable that each completed package have a label which indicates the nature of the contents, etc. Preferably the label is imprinted on the web when it is flat and before it has been sealed longitudinally to form the tube. It is desirable that such a label be in a uniform location on each of the completed packages. Because of stretching of the web, if it is fed at a fixed speed, the position of the label is likely to vary along each completed package and, if the variation is sufficient, the label may be located partly on one completed package and partly on the next completed package rather than being uniformly located between the ends of each completed package.

Accordingly, among the objects of this invention are: To maintain a predetermined relation between each label and the location of the cut of each unit length or completed package from the web; to position the label at a predetermined location along each unit length; to provide for varying the speed at which the web is fed to the packaging machine in a new and useful manner and thereby keep the label, which is applied to the web before it is fed to the machine, at a predetermined location between the ends of the completed package; to control the speed at which the web is fed in response to the operation of the knife that cuts the completed package from the web in a new and improved manner; to divide the time required to move a unit length of the web, corresponding to each completed package, into two zones each being variable but with the sum of the times being a constant for a given unit length; to initiate and terminate a slow-down correction in one zone and to initiate and terminate a speed-up correction in the other zone; to effect the control through the interaction of limit means operable for each unit length or completed package to and from a first position and from and to a second posi-

2

tion and a register mark on the web, one for each unit length; to provide means responsive to the occurrence of the register mark in one zone for initiating a change in speed in one direction away from a predetermined speed, and means responsive to the occurrence of the register mark in the other zone for initiating a change in speed in the opposite direction toward said predetermined speed; to initiate a slow-down correction as a result of the presence of a register mark in a predetermined position when the limit means is in one position and to terminate such a correction as the result of the limit means moving from the one position; to initiate a speed-up correction as a result of the limit means moving to the second position and to terminate such a correction as the result of the presence of a register mark in a predetermined position; and to indicate the direction that speed correction is being made when such correction is taking place.

Other objects of this invention will, in part, be obvious and in part appear hereinafter.

This invention is disclosed in the embodiment thereof shown in the accompanying drawing and it comprises the features of construction, combination of elements and arrangement of parts that will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

For a more complete understanding of the nature and scope of this invention reference can be had to the following detailed description, taken together with the accompanying drawing, in which:

FIGURE 1 illustrates, diagrammatically, the manner in which the web can be formed into a tubular package, filled with a material, the ends of a unit length clamped and the completed package severed from the web;

FIGURE 2 illustrates, diagrammatically, the circuit connections that can be employed for controlling the speed of a motor used to drive the web as illustrated in FIGURE 1; and

FIGURE 3 shows the timed relationship between the operation of the limit switch and the signal that is provided as a result of the passage of a register mark through a light beam.

Referring first to FIGURE 1 of the drawing, it will be observed that the reference character 10 designates a web of suitable material such as paper, film, tape, etc., suitable for receiving and packaging a material such as sausage. For each unit length of the web a label 11 is imprinted thereon. As employed herein unit length of the web 10 refers to the length necessary to cover the material for one completed package. It is desirable that the label 11 be located at a uniform position along each unit length. It may be located midway the ends of each unit length or nearer one end than the other. However, it is desirable that the position of the label 11 be maintained substantially at a uniform position on each of the completed packages. In order to accomplish this control, provision is made for varying the speed at which the web 10 is fed. This control is effected, in part, as the result of the passage of a register mark 12 one for each unit length. It will be observed that the register marks 12 are located on the web 10 at a position where no other printing appears or at a location which is spaced somewhat from the respective label 11. Preferably the register mark 12 is located along the edge of the web 10 and is relatively small in size as compared to the size of each label 11.

By varying the speed at which the web 10 is fed to the packaging machine of the type disclosed in the patent above referred to, it is possible to control the position of the label 11 on the completed package. The drive for the web 10 is accomplished through suitable feed rollers as disclosed in the patent. For illustrative pur-

poses the web drive 13 is indicated, diagrammatically, in FIGURE 1 by a single feed roller and it is connected by a shaft 14 to a drive motor that is indicated, generally, at 15. As shown in FIGURE 2 the drive motor 15 can be a direct current motor of the shunt type. It may include an armature 15a and a shunt field winding 15f. The motor 15 can be connected for energization between conductors 16 and 17 to which a direct voltage is applied, for example, a voltage of the order of 135 volts. For the purpose of manually adjusting the speed of the motor 15 a master speed control rheostat 18 can be employed and connected in series circuit relation with a vernier speed control rheostat 19 and both are connected in series circuit relation with the shunt field winding 15f and between the conductors 16 and 17. For illustrative purposes it is pointed out that the rheostat 18 may have a resistance of 1,000 ohms while the rheostat 19 may have a resistance of 200 ohms. In accordance with this invention provision is made for automatically controlling the speed at which the motor 15 rotates the shaft 14 to operate the web drive 13. For this purpose a first resistor 20 is provided in series circuit relation with a second resistor 21. The first and second resistors 20 and 21 are connected in series circuit relation and are interposed in the circuit to the shunt field winding 15f with the rheostats 18 and 19. For illustrative purposes it is pointed out that the first and second resistors 20 and 21 may be adjustable and each may have a resistance of 500 ohms.

When the motor 15 is energized and the other parts of the packaging machine are in operation, the web drive 13 is rotated in the direction indicated by the arrow 22 thereon and the web 10 is fed in the direction indicated by the arrow 23 to a sealing mechanism that is indicated diagrammatically at 24. The sealing mechanism 24 provides a longitudinal seal along the juxtaposed edges of the web 10 and forms a tube that can be filled with the material by the filling mechanism that is indicated, diagrammatically, at 25. Following the operation of the filling mechanism 25 a clamping mechanism, indicated diagrammatically at 26, operates to apply a clamp ring 27 to the outer end of the filled part of the tube. A reciprocating knife 28 then operates to cut at 29 the completed package that is indicated, generally, at 30. It will be observed that the completed package 30, now filled with material, has its ends securely clamped by clamp rings 27. Also it will be observed that the label 11 is located wholly on the completed package 30 and between the ends thereof. As pointed out above, it can be located uniformly between the ends or at any desired location therealong with each successive completed package 30 having the label 11 located thereon in the same position.

It has been pointed out that the completed package 30 is severed at 29 by a reciprocating knife 28. The reciprocating movement of the knife 28 is indicated by the double headed arrow 32. Advantage is taken of the reciprocating movement of the knife 28, as indicated by the arrow 32, to effect a control of the drive motor 15 in conjunction with the control that is provided by the passage of each register mark 12 through a light beam. For this purpose the knife 28 is provided with a laterally extending arm 33 which carries a roller 34 at its outer end to control the operation of limit means, indicated generally at 35. The limit means 35 is in the form of a limit switch and will be so referred to hereinafter. The limit switch 35 includes a switch blade 36 which is pivoted at 37 and is provided with a cam 38 that is engaged by the roller 34. As the knife 28 reciprocates, the interaction between the roller 34 and the cam 38 is such as to cause the switch blade 36 to move out of engagement with a contact 39 or out of a first position or a slow-down position into engagement with a contact 40 in a second position or a speed-up position. A spring 41 reacts against the switch blade 36 to bias it against the force exerted thereon by the roller 34. It will be under-

stood that the switch blade 36 engages either the contact 39 in the first position or slow-down position or it engages the contact 40 in the second position or speed-up position and that the time required for movement between these positions is relatively small as compared to the time that the switch blade 36 is in one or the other position. The time that the switch blade 36 is in one or the other position is controlled by the relationship between the roller 34 and the shape of the cam 38. It will be understood that the showing of this relationship in FIGURE 1 is diagrammatic and that any suitable control arrangement can be employed which will provide for maintaining the switch blade 36 in one or the other position for any desired length of time with these times being variable as may be desired and with the time required for shifting from one position to the other to be relatively small. While it is desirable that the operation of the limit switch be directly controlled by the operation of the knife 28, it will be understood that it can be controlled by any means which operate timewise in synchronism with the movement of the knife 28.

The arrangement for the control of the limit switch 35 is such that it is related to the time required for moving the unit lengths of the web 10 through the packaging machine. It is related to the time required for each completed package 30 to be produced by the packaging machine. The complete cycle for the formation of the completed package is illustrated in FIGURE 3 in relation to the functioning of the limit switch 35. Here it will be observed that the cycle, timewise, is divided into zones 42 and 43. In zone 42 the switch blade 36 is in the first or slow-down position where it is in engagement with the contact 39. In the other zone 43 the switch blade 36 is in the second or speed-up position where it is in engagement with the contact 40. The zone 42 can be termed a slow-down zone and during it, as will appear hereinafter, the second resistor 21 is short circuited to lower the total resistance in series with the field winding 15f and thus reduce the speed of the motor 15. The zone 43 is a speed-up zone and during it the first resistor 20, which normally is short circuited, is introduced into the circuit including the field winding 15f, thereby increasing the resistance of this circuit and causing an increase in the speed of the drive motor 15. The control of the drive motor 15 is effected under the conjoint action of the movement of the register mark 12 through a light beam or with respect to a light beam and the operation of the limit switch 35. While this invention is disclosed in conjunction with a shunt type of direct current motor, it will be understood that other equivalent variable speed driving means can be employed for varying the speed of the web drive 13.

The circuit connections that can be employed for controlling the operation of the motor 15 are shown in FIGURE 2 and now will be described. It will be observed that a conductor 44 is provided which is energized at a positive polarity having a voltage of 105 volts. It will be understood that other voltages can be employed, this particular voltage being indicated for illustrative purposes. In the speed-up position of the limit switch 35 the conductor 44 is connected to energize a winding 45w of a first control relay that is indicated, generally, at 45. The first control relay 45 has normally closed contacts 45a which shunt the first resistor 20 and thus serve to reduce the resistance in the circuit including the shunt field winding 15f by the amount of the resistance of the first resistor 20. The first control relay 45 is provided with normally open contacts 45b the function of which will be set forth hereinafter. The energizing circuit for the operating winding 45w is completed, as indicated, to a conductor 46. It will be understood that the conductors 44 and 46 are connected across a suitable direct current source the voltage of which, as indicated, is 105 volts.

When the limit switch 35 is in the slow-down position, a circuit is completed from the energized conductor 44

for energizing an operating winding 47w of a second control relay that is indicated, generally, at 47. The second control relay 47 has normally open contacts 47a that are connected in shunt with the second resistor 21 and when closed act to short circuit this resistor and reduce the resistance in the circuit to the shunt field winding 15f with the result that the speed of the motor 15 is reduced. The second control relay 47 is provided with normally open contacts 47b the function of which will be set forth hereinafter.

The energizing circuit for the operating winding 47w of the second control relay 47 is completed to the conductor 46 through a first electric valve that is indicated, generally, at 48. The valve 48 preferably is of the thyatron type and it is provided with an anode 48a, a cathode 48c, and a control electrode 48g.

Also connected for energization to the conductor 44 is an operating winding 49w of a third control relay that is indicated, generally, at 49. The third control relay 49 is provided with normally open contacts 49a which are in parallel with the normally closed contacts 45a of the first control relay 45 and also in shunt with the first resistor 20. The third control relay 49 also is provided with normally closed contacts 49b the function of which will be set forth hereinafter. The energizing circuit for the operating winding 49w extends through normally closed contacts 50a of a fourth control relay that is indicated, generally, at 50 and is provided with an operating winding 50w. The energizing circuit for the operating winding 49w also extends through a second electric valve that is indicated, generally, at 51. The second electric valve 51 preferably is of the thyatron type and it is provided with an anode 51a, a cathode 51c, connected to the conductor 46, and a control electrode 51g.

The circuit for energizing the operating winding 50w of the fourth control relay 50 from the energized conductor 44 when the limit switch 35 is in the slow-down position extends through a diode 54 and a capacitor 55 to the other conductor 46. A capacitor discharge resistor 56 is connected in shunt circuit relation across the capacitor 55 and the operating winding 50w in series circuit relation therewith.

In order to maintain the first and second electric valves 48 and 51 in the non-conducting state, cut-off resistors 57 are connected to the respective control electrodes 48g and 51g and for energization to a conductor 58 which is connected to a suitable direct current source as to provide a negative bias. For example, the negative bias may be of the order of 9 volts as indicated.

In order to overcome the negative bias applied to the control electrodes 48g and 51g, capacitors 59 are connected thereto, as indicated, and are commonly connected to a junction 60 between a third resistor 61 and a third electric valve that is indicated, generally, at 62. The third electric valve 62 is normally conducting close to the saturation level and it is provided with an anode 62a, a cathode 62c and a control electrode 62g. It will be observed that the third resistor 61 and the third electric valve 62 are connected between the conductors 44 and 46.

The control electrode 62g of the third electric valve 62 is connected to a junction 63 between a fourth resistor 64 and a photo-cell that is indicated, generally, at 65. The photo-cell 65 has a cathode 65c on which light rays 66 impinge from a light source 67 which may be an incandescent lamp. It will be observed that the web 10 is interposed between the photo-cell 65 and the light source 67 so that the light rays 66 are interrupted by the register mark 12. Instead of having the light rays 66 interrupted by the register mark 12, the arrangement may be such that the light rays 66 are reflected from the register mark 12 onto the cathode 65c of the photo-cell 65. It will be observed that the photo-cell 65 has an anode 65a which is connected to the junction 63 and that the cathode 65c is connected to the conductor 46. The other ter-

minial of the fourth resistor 64 is connected to the conductor 44.

The junction 63 between the fourth resistor 64 and the photo-cell 65 is connected to the control electrode 62g of the third electric valve 62 through a capacitor 68 and a voltage divider resistor 69. The junction between the voltage divider resistor 69 and the control electrode 62g is connected through a diode 70 to the conductor 46. A gain control resistor 71 is connected in shunt with the diode 70 to control the voltage applied to the control electrode 62g.

It is desirable that an indication be given as to whether the drive motor 15 is operating under speed-up or slow-down conditions. For this purpose a speed-up indicator 72 and slow-down indicator 73 are provided. They may be indicator lamps of the incandescent type and provided with green and red lenses, as indicated. Provision is made for selectively energizing the indicators 72 and 73 from a suitable current source represented by the conductors 74 and 75. For example, these conductors can be connected to 115 volt alternating current source as indicated. As will appear hereinafter the indicators 72 and 73 are selectively controlled by the operation of the contacts 45b, 47b and 49b.

As pointed out hereinbefore the time required for completing the package 30 is divided into a slow-down zone 42 and speed-up zone 43. In the slow-down zone 42 the motor 15 can have only a slow-down correction applied thereto which is initiated by the register mark 12 with the limit switch 35 in the slow-down position and is terminated when the limit switch 35 leaves this position. In the speed-up zone 43 a speed-up correction is applied automatically to the motor 15 when the limited switch 35 moves into the speed-up position. The speed-up correction is terminated either by the register mark 12 or by the movement of the limit switch 35 out of the speed-up position.

In describing the operation of the speed control system disclosed herein, it will be assumed that the limit switch 35 is in the speed-up position or in the second position. Under these circumstances the operating winding 45w of the first control relay 45 is energized and its contacts 45a are opened and contacts 45b are closed. Since the electric valve 51 is non-conducting, the operating winding 49w of the third control is not energized and its contacts 49b are closed. A circuit then is completed from energized conductor 74 through contacts 45b and contacts 49b to energize the speed-up indicator 72 and indicate that a speed-up operation is being effected by the motor 15.

As a result of the opening of normally closed contacts 45a by the energization of the operating winding 45w of the first control relay 45, the short circuit around the first resistor 20 is removed and this resistor is inserted in the circuit to the field winding 15f resulting in an increase in speed of the motor 15.

Next a register mark 12 is interposed between the light source 67 and the photo-cell 65 so as to interrupt the light rays 66. A decrease in light impinging on the anode 65a results and the resistance of the photo-cell 65 is increased. This causes the potential at the junction 63 to become more positive. This is reflected from one side of capacitor 68 to the other and is impressed across the voltage divider resistor 69 which is in series with the diode 70, the latter being in parallel with gain control resistor 71. This positive-going signal or impulse reacts with the diode 70 as having a very low resistance as compared to the resistance of the resistors 69 and 71. The resulting voltage at the junction between these resistors rises to an extremely small value and it is quickly reduced to zero by the short time constant of the combination of capacitor 68, resistor 69 and diode 70. This leaves the capacitor 68 charged to the full value of the voltage appearing at junction 63.

As a result of continued movement of the web 10 in the direction indicated by the arrow 23, the register mark

12 moves out of the position shown in FIGURE 2 where it intercepts the light rays 66 and the amount of light impinging on the anode 65a of the photo-cell 65 is increased. This results in a reduction of the resistance of the photo-cell 65 and a lowering of the potential at the junction 63 or a negative-going change which is reflected to the other side of the capacitor 68 which is associated with the voltage divider resistor 69 and diode 70. Since this is negative-going change, rather than a positive-going change, to such a signal the diode 70 appears to have very high resistance. The resultant voltage appearing at the junction between the resistor 69 and 71 is dependent upon their dividing action or relative values and they are chosen so as to provide about 90% of the signal voltage and apply the same to the control electrode 62g. It will be recalled that the third electric valve 62 is normally conducting close to its saturation level. Accordingly, on application of the signal just referred to to its control electrode 62g the current carrying ability of the third electric valve 62 is reduced with the result that the voltage drop through the third resistor 61 is reduced and the junction 60 is raised to a higher positive potential than previously existed there. This positive-going change is impressed by capacitors 59 upon the control electrodes of the first and second electric valves 48 and 51. Since the first electric valve 48 is not connected to the energized conductor 44 under the assumed conditions where the limit switch 35 is in the speed-up position, no change in its operation takes place. However, since the second electric valve is connected for energization through normally closed contacts 50a of the fourth control relay 50 to the energized conductor 44 through the operating winding 49w of the third control relay 49, this relay is operated to close its normally open contacts 49a. This short circuits the first resistor 20 and reduces the resistance in the circuit to the field winding 15f which was inserted by the opening of the contacts 45a of the first control relay 45. As a result the speed-up correction applied to the motor 15 is terminated. The time at which the speed-up correction is terminated is indicated at 76 in FIGURE 3 and also at 77, the difference resulting from the difference in the location of the register mark 12 for a given unit length of the web 10. In the event that the signal, as described, did not appear during the speed-up zone 43, then the movement of the limit switch 35 from the speed-up or second position would open the energizing circuit to the operating winding 45w with the result that the contacts 45a would be reclosed and the speed-up correction terminated by the short circuiting of the first resistor 20 by these contacts instead of by the operation of contacts 49a.

A further result of the operation of the third control relay 49 is the opening of its contacts 49b. This results in deenergization of the speed-up indicator 72. The same result is obtained if the speed-up correction continues until the limit switch 35 moves out of the speed-up or second position followed by deenergization of the operating winding 45w of the first control relay and opening of its contacts 45b.

Now it will be assumed that the limit switch 35 is operated to the first or slow-down position. As described, the operating winding 45w of the first control relay 45 is deenergized when the switch blade 36 moves out of engagement with the contact 40. Contacts 45a are closed to short circuit the first resistor 20. When the limit switch 35 reaches the slow-down or first position with the switch blade 36 in engagement with contact 39 a circuit is completed from the conductor 44 through the diode 54 to the capacitor 55 and capacitor discharge resistor 56. Capacitor 55 begins to charge to the voltage of the conductor 44 through the operating winding 50w of the fourth control relay 50. Since the other terminal of the operating winding 50w is connected to the conductor 46, the fourth control relay 50 is operated for the brief time that is required to charge the capacitor 55 and its contacts 50a are opened. The result of the opening of the contacts 50a is to open

the energizing circuit for the operating winding 49w of the third control relay 49. However, the operating winding 49w is not energized since the second electric valve 51 is held in the non-conducting state by the negative bias applied to the control electrode 51g as previously described. As soon as current flow ceases into the capacitor 55, the operating winding 50w is deenergized and contacts 50a are reclosed. As long as the switch blade 36 remains in the slow-down or first position, capacitor 55 remains fully charged. Thereafter it is discharged by capacitor discharge resistor 56. The function of the diode 54 is to isolate the capacitor 55, operating winding 50w and resistor 56 from the anode circuit of the first electric valve 48.

As the result of the engagement of the switch blade 36 with the contact 39 in the slow-down or first position of the limit switch 35, a circuit is completed from the energized conductor 44 to the operating winding 47w of the second control relay 47. However, the energizing circuit is not completed at this time since the first electric valve 48 is held in the non-conducting state by the application to its control electrode 48g of the negative bias. Now if a register mark 12 causes a positive signal to be applied to the control electrodes 48g and 51g of the first and second electric valves 48 and 51 in the manner previously described, the first electric valve 48 will be rendered conducting and likewise the second electric valve 51 will be rendered conducting. Accordingly the operating windings 47w and 49w of the second and third control relays 47 and 49 are energized and both of these relays are operated. Contacts 47a are closed to short circuit the second resistor 21, thereby reducing the resistance in series with the shunt field winding 15f to cause the drive motor 15 to be reduced in speed. The operation of the third control relay 49 results in the closing of its normally open contacts 49a. However, no change in functioning of the motor 15 results since these contacts already are shunted by the normally closed contacts 45a of the first control relay 45 and thus the first resistor 20 merely has another short circuit placed therearound. The slow-down signal occurs during the slow-down zone 42 as indicated in FIGURE 3. It may occur early in this zone as indicated in 78 or later as indicated at 79, depending upon the position of the register mark 12. The slow-down correction then continues until the limit switch 35 leaves the slow-down or first position. When this takes place the switch blade 36 moves out of engagement with the contact 39 and the operating winding 47w for the second control relay 47 is deenergized and its contacts 47a are opened. This removes the short circuit around the second resistor 21, increases the resistance in the circuit to the shunt field winding 15f and terminates the slow-down correction for the motor 15.

A further result of the movement of the switch blade 36 out of engagement with the contact 39 is to open the charging circuit for the capacitor 55. It discharges through the resistor 56. However, since the second electric valve 51 remains in the conducting state, the energizing circuit for the operating winding 49w of the third control relay 49 remains completed and at contacts 49a the short circuit around the first resistor 20 is maintained. This arrangement makes it impossible for a speed-up correction to occur in the same unit length of the web 10 that there has been a slow-down correction applied to the motor 15. When the switch blade 36 again engages the contact 39, the operating winding 50w of the fourth control relay 50 is energized as described hereinbefore and contacts 50a are opened. This cuts off the second electric valve 51 and deenergizes operating winding 49w of the third control relay 49.

A further result of the energization of the operating winding 47w of the second control relay 47, previously described, is to close its contacts 47b. This completes an energizing circuit for the slow-down indicator 73 between

the energized conductors 74 and 75. This indication continues as long as the second control relay 47 remains in the operated position.

Once the correct speed of the web 10 has been established and the position of the label 11 on the completed package 30 properly centered, the tendency for the position of the label 11 to shift along the completed package 30, as successive packages are formed, caused by changes in the speed in the motor 15, stoppage of the mechanism, slippage of the web 10 on the feed rollers, such as the roller 13, stretching, etc., can be overcome by applying the slow-down or speed-up corrections to the motor 15 in the manner previously described. This arrangement also can be employed to establish the correct speed initially. Suitable adjustment of the rheostats 18 and 19 are made to accomplish this.

The operator, by observing the speed-up and slow-down indicators 72 and 73 can determine when the correct speed has been reached. When the packaging machine is operating with the label 11 in correct register on the completed package 30, neither of the indicators 72 or 73 is operated. They will be operated momentarily when a small correction is required in one direction or the other. When the label 11 is in the correct position the photo-cell signal applied to the third electric valve 62 occurs just as the switch blade 36 makes contact with the contact 40, thereby energizing the operating winding 49w of the third control relay 49 at the same time that the operating 45w of the first control relay 45 is energized, thus preventing a speed-up correction.

Once the correct speed of the web 10 has been achieved, the label 11 can be centered by varying the position of an idler roller which is interposed between the photo-cell 65 and the cut 29 and over which the web 10 is trained. By changing the position of this idler roller by means of a suitable worm gear and knob, the length of the web 10 between the photo-cell 65 and the cut 29 can be varied. Thus, no matter what the length of the package 30 or position of the register mark 12 with reference to the label 11, both the cut-off point and the location of the register mark sensing device remain fixed.

Operation of the circuit as described hereinbefore depends upon a signal caused by an increase of light. For operation dependent upon a decrease of light as a signal, particularly where the decrease is of a very short duration, resistor 64 and photo-cell 65 can be reversed in position, with anode 65a connected to source of positive potential 44, cathode 65c connected to resistor 64 at point 63, and the other end of resistor 64 connected to 46.

While the present invention has been described in considerable detail with reference to this particular application, it will be obvious that the same principles can be employed with other circuitry to operate at higher speeds and with closer control. For this purpose magnetic pickups, solid state amplifier and control elements and amplitude as time variations can be used.

Since certain changes can be made in the foregoing construction and system and different embodiments of the invention can be made without departing from the spirit and scope thereof, it is intended that all matters shown in the accompanying drawing and described hereinbefore shall be interpreted as illustrative and not in a limiting sense.

What is claimed as new is:

1. Means for controlling the feed of a web having a register mark for each unit length comprising, in combination, web feeding means, variable speed driving means operatively connected to said web feeding means for moving the web, speed control means for changing the speed of said variable speed driving means, means operated for each unit length of web, limit means operated by said unit length operated means to and from a first position and from and to a second position for each unit

length of web and dividing the time required for moving such length into two zones each corresponding to the time that said limit means occupies said first or said second position respectively, and means controlled by the position of the register mark with respect to said zones for controlling the operation of said speed control means.

2. The invention, as set forth in claim 1, wherein the means controlled by the position of the register mark also control the operation of indicating means showing whether the speed of the driving means is above or below a predetermined speed.

3. Means for controlling the feed of a web having a register mark for each unit length comprising, in combination, web feeding means, variable speed driving means operatively connected to said web feeding means for moving the web, speed control means for changing the speed of said variable speed driving means, means operated for each unit length of web, limit means operated by said unit length operated means to and from a first position and from and to a second position for each unit length of web and dividing the time required for moving such length into two zones each corresponding to the time that said limit means occupies said first or said second position respectively, means responsive to the occurrence of the register mark in one zone for controlling the operation of said speed control means to initiate a change in speed of said driving means in one direction away from a predetermined speed, and means responsive to the occurrence of the register mark in the other zone for controlling the operation of said speed control means to initiate a change in speed of said driving means in the opposite direction toward said predetermined speed.

4. Means for controlling the feed of a web having a register mark for each unit length comprising, in combination, web feeding means, variable speed driving means operatively connected to said web feeding means for moving the web, speed control means for changing the speed of said variable speed driving means, means operated for each unit length of web, limit means operated by said unit length operated means to and from a first position and from and to a second position for each unit length of web and dividing the time required for moving such length into two zones each corresponding to the time that said limit means occupies said first or said second position respectively, means responsive to the occurrence of the register mark in one zone for controlling the operation of said speed control means to decrease the speed of said driving means to a speed below a predetermined speed, and means responsive to the occurrence of the register mark in the other zone for controlling the operation of said speed control means to decrease the speed of said driving means from a speed above said predetermined speed to said predetermined speed.

5. Means for controlling the feed of a web having a register mark for each unit length comprising, in combination, web feeding means, variable speed driving means operatively connected to said web feeding means for moving the web, speed control means for changing the speed of said variable speed driving means, means operated for each unit length of web, limit means operated by said unit length operated means to and from a first position and from and to a second position for each unit length of web and dividing the time required for moving such length into two zones each corresponding to the time that said limit means occupies said first or said second position respectively, means responsive to the occurrence of the register mark in one zone when said limit means is in said first position for controlling the operation of said speed control means to initiate a change in speed of said driving means in one direction away from a predetermined speed to another speed, means responsive to movement of said limit means away from said first position for controlling the operation of said speed control means to restore the speed of said driving means to said predetermined speed, means responsive to movement of said limit means to

said second position for controlling the operation of said speed control means to initiate a change in speed of said driving means in the opposite direction away from said predetermined speed to another speed, and means responsive to the occurrence of the register mark in the other zone when said limit means is in said second position for controlling the operation of said speed control means to restore the speed of said driving means to said predetermined speed.

6. Means for controlling the feed of a web having a register mark for each unit length comprising, in combination, web feeding means, variable speed driving means operatively connected to said web feeding means for moving the web, speed control means for changing the speed of said variable speed driving means, means operated for each unit length of web, limit means operated by said unit length operated means to and from a first position and from and to a second position for each unit length of web and dividing the time required for moving such length into two zones each corresponding to the time that said limit means occupies said first or said second position respectively, means responsive to the occurrence of the register mark in one zone when said limit means is in said first position for controlling the operation of said speed control means to decrease the speed of said driving means to a speed below a predetermined speed, means responsive to movement of said limit means away from said first position for controlling the operation of said speed control means to increase the speed of said driving means to said predetermined speed, means responsive to the movement of said limit means to said second position for controlling the operation of said speed control means to increase the speed of said driving means to a speed above said predetermined speed, and means responsive to the occurrence of the register mark in the other zone when said limit means is in said second position for controlling the operation of said speed control means to decrease the speed of said driving means to said predetermined speed.

7. Means for controlling the feed of a web having a register mark for each unit length comprising, in combination, web feeding means, a variable speed electric motor operatively connected to said web feeding means for moving the web, variable resistance means for changing the speed of said electric motor, means operated for each unit length of web, limit means operated by said unit length operated means to and from a first position and from and to a second position for each unit length of web and dividing the time required for moving such length into two zones each corresponding to the time that said limit means occupies said first or said second position respectively, and means controlled by the position of the register mark with respect to said zones for varying the resistance of said variable resistance means and thereby the speed of said electric motor.

8. The invention, as set forth in claim 7, wherein the electric motor is a direct current shunt motor and the variable resistance means is connected in circuit with the shunt field winding of the motor.

9. The invention, as set forth in claim 8, wherein the variable resistance means comprises a pair of series connected resistors connected in series with the shunt field winding and one of said resistors normally is short circuited.

10. Means for controlling the feed of a web having a label and a register mark for each unit length comprising, in combination, web feeding means, variable speed driving means operatively connected to said web feeding means for moving the web, means operated for each unit length of the web, speed control means for changing the speed of said variable speed driving means to position the label at a predetermined location along each unit length and including first and second control devices, limit switch means operated synchronously with said unit length operated means to and from a slow-down position

and from and to a speed-up position for each unit length of the web and dividing the time required for moving such length into two zones each corresponding to the time that said limit switch means occupies said speed-up position or said slow-down position respectively, a first control relay having normally closed contacts shunting said first control device and an operating winding connected to be energized when said limit switch means is in said speed-up position; a second control relay having normally open contacts shunting said second control device and an operating winding connected to be energized through a first electric valve having a control electrode when said limit switch means is in said slow-down position; a third control relay having normally open contacts shunting said first control device and an operating winding connected to be energized through normally closed contacts of a fourth control relay in series with a second electric valve having a control electrode; said fourth control relay having an operating winding connected to be energized when said limit switch means is in said slow-down position; means applying a biasing potential to said control electrodes to maintain the respective electric valve non-conducting; a third electric valve having a control electrode and normally conducting current from a direct current source through a resistor; capacitor means interconnecting the junction between said third electric valve and said resistor and said control electrodes of said first and second electric valves, a photo-cell normally rendered conducting by light from a light source interrupted by the register mark and energized from said direct current source through a resistor, and circuit means interconnecting said control electrode of said third electric valve and the junction between said photo-cell and its associated resistor.

11. Means for controlling the feed of a web having a label and a register mark for each unit length comprising, in combination, web feeding means, variable speed driving means operatively connected to said web feeding means for moving the web, means operated for each unit length of the web, speed control means for changing the speed of said variable speed driving means to position the label at a predetermined location along each unit length and including first and second control devices, limit switch means operated synchronously with said unit length operated means to and from a slow-down position and from and to a speed-up position for each unit length of the web and dividing the time required for moving such length into two zones each corresponding to the time that said limit switch means occupies said speed-up position or said slow-down position respectively, a first control relay having normally closed contacts shunting said first control device and an operating winding connected to be energized when said limit switch means is in said speed-up position; a second control relay having normally open contacts shunting said second control device and an operating winding connected to be energized through a first electric valve having a control electrode when said limit switch means is in said slow-down position; a third control relay having normally open contacts shunting said first control device and an operating winding connected to be energized through normally closed contacts of a fourth control relay in series with a second electric valve having a control electrode; said fourth control relay having an operating winding connected to be energized when said limit switch means is in said slow-down position; means applying a biasing potential to said control electrodes to maintain the respective electric valve non-conducting; a third electric valve having a control electrode and normally conducting current from a direct current source through a resistor; capacitor means interconnecting the junction between said third electric valve and said resistor and said control electrodes of said first and second electric valves, a photo-cell normally rendered conducting by light from a light source interrupted by the register mark and energized

13

from said direct current source through a resistor, circuit means interconnecting said control electrode of said third electric valve and the junction between said photo-cell and its associated resistor, slow-down and speed-up indicators commonly connected to one terminal of a current source, normally open contacts on said second control relay for connecting said slow-down indicator for energization to another terminal of the last mentioned current source when said second control relay is operated, and normally open contacts on said first control relay connected in series with normally closed contacts on said third control relay for connecting said speed-up indicator to said other terminal of said last mentioned current source when said first control relay is operated and said third control relay is not operated.

12. Means for controlling the feed of a web having a label and a register mark for each unit length comprising, in combination, web feeding means, variable speed driving means operatively connected to said web feeding means for moving the web, means operated for each unit length of the web, speed control means for changing the speed of said variable speed driving means to position the label at a predetermined location along each unit length and including first and second series connected resistors, limit switch means operated synchronously with said unit length operated means to and from a slow-down position and from and to a speed-up position for each unit length of the web and dividing the time required for moving such length into two zones each corresponding to the time that said limit switch means occupies said speed-up position or said slow-down position respectively, a first control relay having normally closed contacts shunting said first resistor and an operating winding connected to be energized from a direct current source when said limit switch means is in said speed-up position; a second control relay having normally open contacts shunting said second resistor and an operating winding connected to be energized from said direct current source through a first electric valve having an anode, a cathode and a control electrode when said limit switch means is in said slow-down position; a third control relay having normally open contacts shunting said first resistor and an operating winding connected to be energized from said direct current source through normally closed contacts of a fourth control relay in series with a second electric valve having an anode, a cathode and a control electrode; said fourth control relay having an operating winding connected to be energized from said direct current source when said limit switch means is in said slow-down position; means applying a negative biasing potential to said control electrodes to maintain the respective electric valve non-conducting; a third electric valve having an anode, a cathode and a control electrode and normally conducting current from said direct current source through a third resistor; capacitor means interconnecting the junction between the anode of said third electric valve and said third resistor and said control electrodes of said first and second electric valves, a photo-cell normally rendered conducting by light from a light source interrupted by the register mark and energized from said direct current source through a fourth resistor, and circuit means interconnecting said control electrode of said third electric valve and the junction between said photo-cell and said fourth resistor.

13. Means for controlling the feed of a web having a label and a register mark for each unit length comprising, in combination, web feeding means, variable speed driving means operatively connected to said web feeding means for moving the web, means operated for each unit length of the web, speed control means for changing the speed of said variable speed driving means to position the label at a predetermined location along each unit length and including first and second series connected resistors, limit switch means operated synchronously with

14

said unit length operated means to and from a slow-down position and from and to a speed-up position for each unit length of the web and dividing the time required for moving such length into two zones each corresponding to the time that said limit switch means occupies said speed-up position or said slow-down position respectively, a first control relay having normally closed contacts shunting said first resistor and an operating winding connected to be energized from a direct current source when said limit switch means is in said speed-up position; a second control relay having normally open contacts shunting said second resistor and an operating winding connected to be energized from said direct current source through a first electric valve having an anode, a cathode and a control electrode when said limit switch means is in said slow-down position; a third control relay having normally open contacts shunting said first resistor and an operating winding connected to be energized from said direct current source through normally closed contacts of a fourth control relay in series with a second electric valve having an anode, a cathode and a control electrode; said fourth control relay having an operating winding connected to be energized from said direct current source when said limit switch means is in said slow-down position; means applying a negative biasing potential to said control electrodes to maintain the respective electric valve non-conducting; a third electric valve having an anode, a cathode and a control electrode and normally conducting current from said direct current source through a third resistor; capacitor means interconnecting the junction between the anode of said third electric valve and said third resistor and said control electrodes of said first and second electric valves, a photo-cell normally rendered conducting by light from a light source interrupted by the register mark and energized from said direct current source through a fourth resistor, circuit means interconnecting said control electrode of said third electric valve and the junction between said photo-cell and said fourth resistor, slow-down and speed-up indicator lamps commonly connected to one terminal of a current source, normally open contacts on said second control relay for connecting said slow-down indicator lamp for energization to another terminal of the last mentioned current source when said second control relay is operated, and normally open contacts on said first control relay connected in series with normally closed contacts on said third control relay for connecting said speed-up indicator lamp to said other terminal of said last mentioned current source when said first control relay is operated and said third control relay is not operated.

14. Means for controlling the feed of a web having a label and a register mark for each unit length comprising, in combination, web feeding means, variable speed driving means operatively connected to said web feeding means for moving the web, means operated for each unit length of the web, speed control means for changing the speed of said variable speed driving means to position the label at a predetermined location along each unit length and including first and second series connected resistors, limit switch means operated synchronously with said unit length operated means to and from a slow-down position and from and to a speed-up position for each unit length of the web and dividing the time required for moving such length into two zones each corresponding to the time that said limit switch means occupies said speed-up position or said slow-down position respectively, a first control relay having normally closed contacts shunting said first resistor and an operating winding connected to be energized from a direct current source when said limit switch means is in said speed-up position; a second control relay having normally open contacts shunting said second resistor and an operating winding connected to be energized from said direct current source through a first electric valve having an anode, a cathode

and a control electrode when said limit switch means is in said slow-down position; a third control relay having normally open contacts shunting said first resistor and an operating winding connected to be energized from said direct current source through normally closed contacts of a fourth control relay in series with a second electric valve having an anode, a cathode and a control electrode; said fourth control relay having an operating winding connected to be energized from said direct current source when said limit switch means is in said slow-down position; means applying a negative biasing potential to said control electrodes to maintain the respective electric valve non-conducting; a third electric valve having an anode, a cathode and a control electrode and normally conducting current from said direct current source through a third resistor; capacitor means interconnecting the junction between the anode of said third electric valve and said third resistor and said control electrodes of said first and second electric valves, a photo-cell normally rendered conducting by light from a light source interrupted by the register mark and energized from said direct current source through a fourth resistor, and circuit means interconnecting said control electrode of said third electric valve and the junction between said photo-cell and said fourth resistor, light impinging on said photo-cell and interrupted by a register mark when said limit switch means is in said slow-down position and then again impinging thereon rendering said third electric valve non-conducting and said first and second electric valves conducting whereupon said operating winding of said second control relay is energized and its normally open contacts are closed to short circuit said second resistor thereby reducing the speed of said driving means until said limit switch means moves out of said slow-down position whereupon said operating winding of said second control relay is deenergized and its contacts are opened and the slow-down of said driving means is terminated, said operating winding of said fourth control relay being energized when said limit switch means is in said slow-down position and its normally closed contacts being opened thereby preventing energization of said operating winding of said third control relay, said limit switch in said speed-up position effecting energization of said operating winding of said first relay and opening of its normally closed contacts to insert said first resistor in circuit and thereby increase the speed of said driving means until light impinging on said photo-cell is interrupted by a register mark and then again impinges thereon rendering said third electric valve non-conducting and said first and second electric valves conducting whereupon said operating winding of said third control relay is energized and its normally open contacts are closed to short circuit said first resistor and thereby terminate the speed-up of said driving means.

15. Means for controlling the feed of a web having a label and a register mark for each unit length comprising, in combination, web feeding means, variable speed driving means operatively connected to said web feeding means for moving the web, means operated for each unit length of the web, speed control means for changing the speed of said variable speed driving means to position the label at a predetermined location along each unit length and including first and second series connected resistors, limit switch means operated synchronously with said unit length operated means to and from a slow-down position and from and to a speed-up position for each unit length of the web and dividing the time required for moving such length into two zones each corresponding to the time that said limit switch means occupies said speed-up position or said slow-down position respectively, a first control relay having normally closed contacts shunting said first resistor and an operating winding connected to be energized from a direct current source when said limit switch means is in said speed-up position; a second control relay having normally open contacts shunting said

second resistor and an operating winding connected to be energized from said direct current source through a first electric valve having an anode, a cathode and a control electrode when said limit switch means is in said slow-down position; a third control relay having normally open contacts shunting said first resistor and an operating winding connected to be energized from said direct current source through normally closed contacts of a fourth control relay in series with a second electric valve having an anode, a cathode and a control electrode; said fourth control relay having an operating winding connected to be energized from said direct current source when said limit switch means is in said slow-down position; means applying a negative biasing potential to said control electrodes to maintain the respective electric valve non-conducting; a third electric valve having an anode, a cathode and a control electrode and normally conducting current from said direct current source through a third resistor; capacitor means interconnecting the junction between the anode of said third electric valve and said third resistor and said control electrodes of said first and second electric valves, a photo-cell normally rendered conducting by light from a light source interrupted by the register mark and energized from said direct current source through a fourth resistor, circuit means interconnecting said control electrode of said third electric valve and the junction between said photo-cell and said fourth resistor, light impinging on said photo-cell and interrupted by a register mark when said limit switch means is in said slow-down position and then again impinging thereon rendering said third electric valve non-conducting and said first and second electric valves conducting whereupon said operating winding of said second control relay is energized and its normally open contacts are closed to short circuit said second resistor thereby reducing the speed of said driving means until said limit switch means moves out of said slow-down position whereupon said operating winding of said second control relay is deenergized and its contacts are opened and the slow-down of said driving means is terminated, said operating winding of said fourth control relay being energized when said limit switch means is in said slow-down position and its normally closed contacts being opened thereby preventing energization of said operating winding of said third control relay, said limit switch in said speed-up position effecting energization of said operating winding of said first relay and opening of its normally closed contacts to insert said first resistor in circuit and thereby increase the speed of said driving means until light impinging on said photo-cell is interrupted by a register mark and then again impinges thereon rendering said third electric valve non-conducting and said first and second electric valves conducting whereupon said operating winding of said third control relay is energized and its normally open contacts are closed to short circuit said first resistor and thereby terminate the speed-up of said driving means, slow-down and speed-up indicator lamps commonly connected to one terminal of a current source, normally open contacts on said second control relay for connecting said slow-down indicator lamp for energization to another terminal of the last mentioned current source when said second control relay is operated, and normally open contacts on said first control relay connected in series with normally closed contacts on said third control relay for connecting said speed-up indicator lamp to said other terminal of said last mentioned current source when said first control relay is operated and said third control relay is not operated.

References Cited in the file of this patent

UNITED STATES PATENTS

2,038,452	Sharkey et al.	Apr. 21, 1936
2,078,496	Jaite	Apr. 27, 1937
2,208,420	Gulliksen	July 16, 1940
2,830,811	Paul	Apr. 15, 1958