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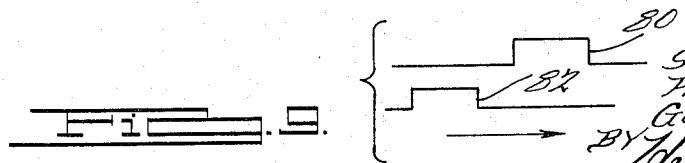
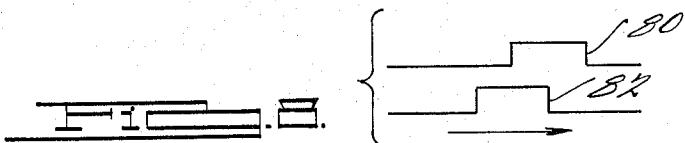
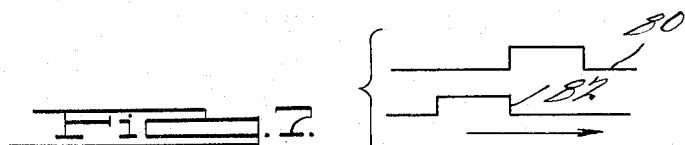
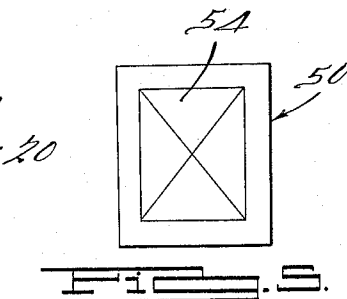
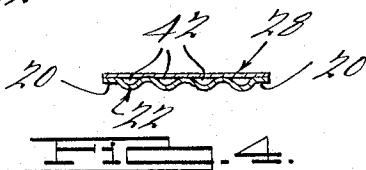
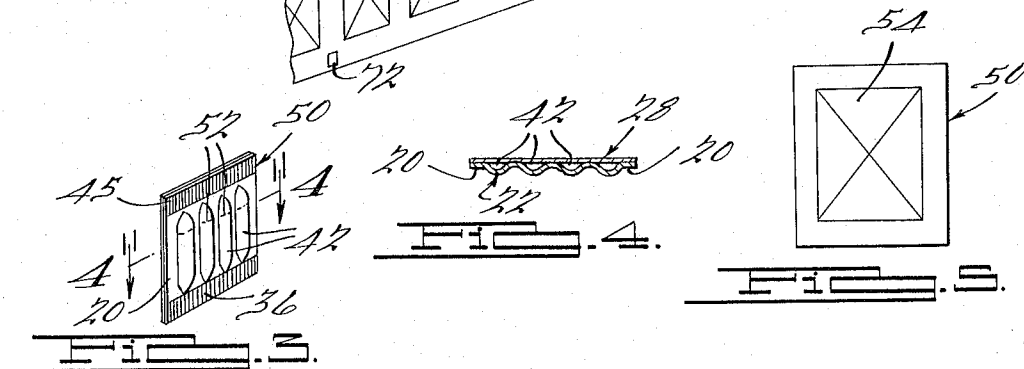
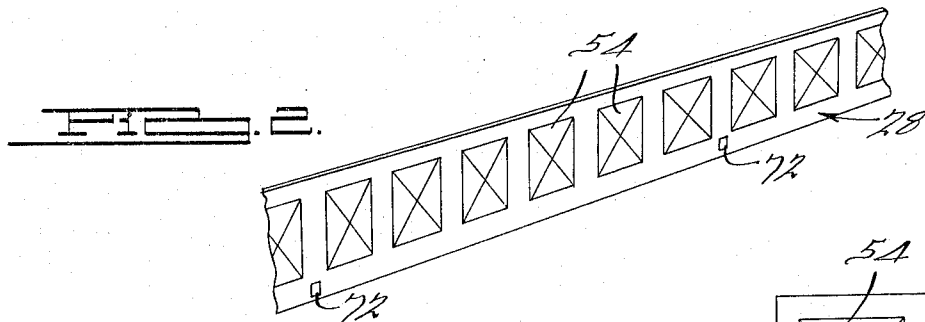
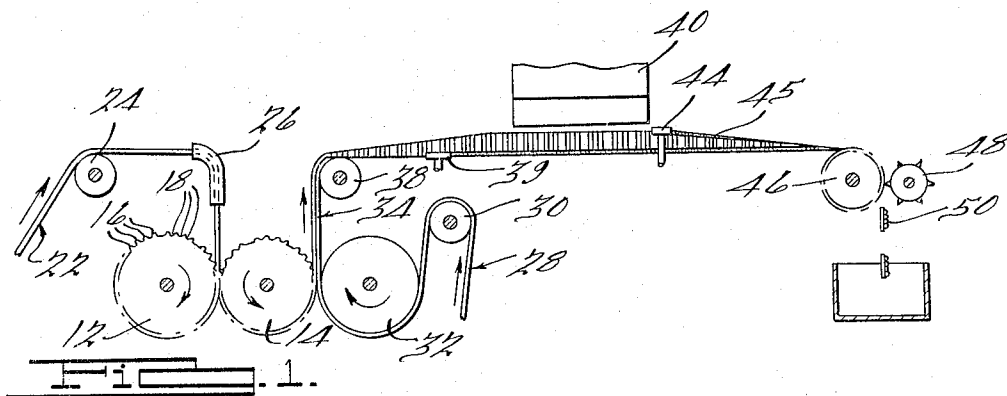
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3,276,183

REGISTER CONTROL DEVICE FOR PACKAGING APPARATUS

Filed March 22, 1963

2 Sheets-Sheet 1



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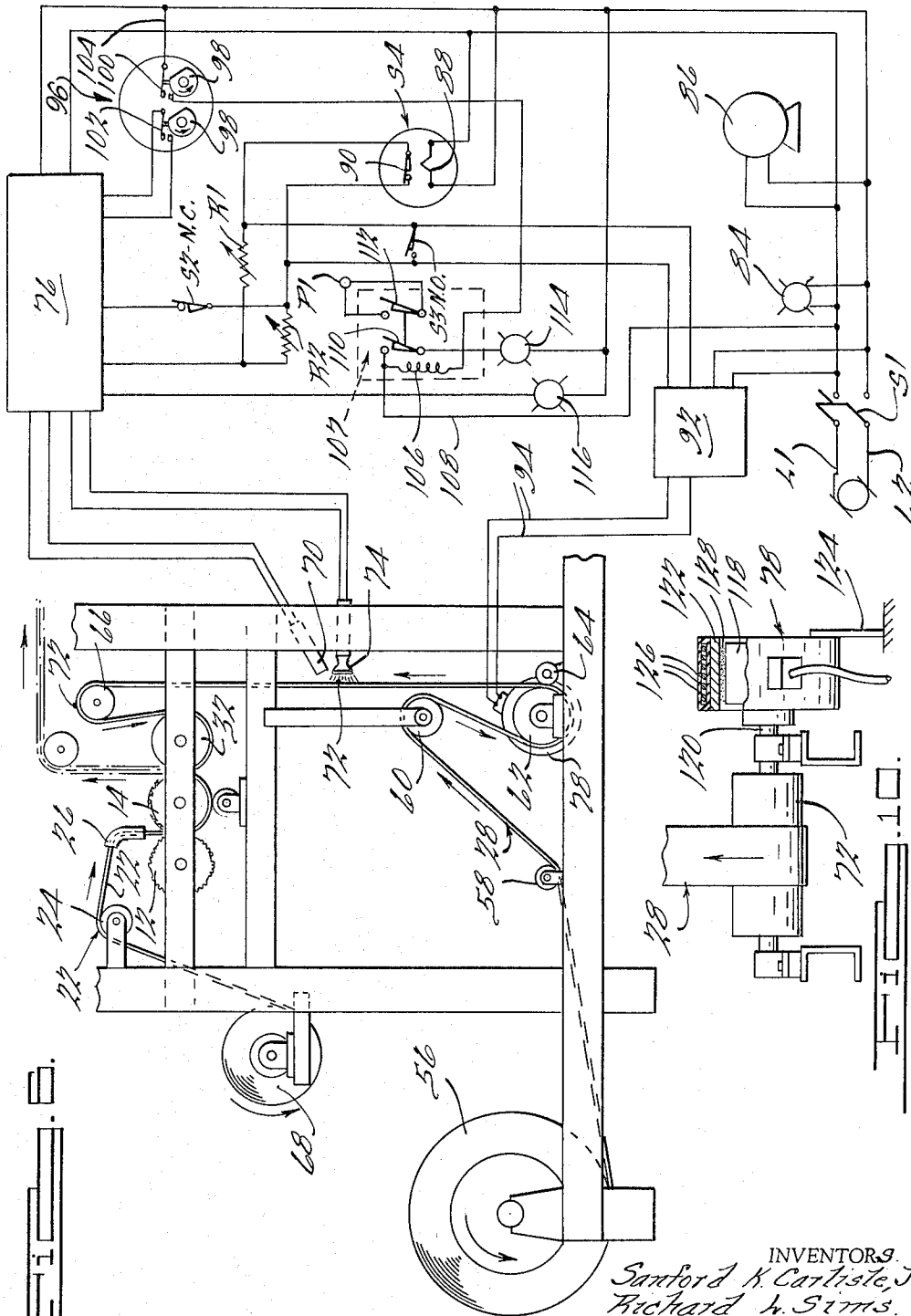
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REGISTER CONTROL DEVICE FOR PACKAGING APPARATUS

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2 Sheets-Sheet 2



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3,276,183

REGISTER CONTROL DEVICE FOR PACKAGING APPARATUS

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1 Claim. (Cl. 53—51)

The present invention broadly relates to packaging apparatus for making containers or packets of the type employed for dispensing individual servings of various commodities such as spices, sugar, salt, and the like and more particularly to a novel register control device for maintaining a printed web in appropriate registered alignment with and centered relative to a second web which subsequently are united for forming the container.

The register control device comprising the present invention is particularly applicable to high speed automatic packaging machines of the general type described in U.S. Patent No. 2,826,020, granted March 11, 1958. In machines of this general type, a continuous composite ribbon is manufactured by combining two continuous webs or strips of the appropriate configuration which are secured to each other after which the continuous ribbon is filled with a desired commodity, sealed and thereafter is cut into individual packages or containers. In an apparatus of this type, the rate of production is extremely high and the two webs move rapidly through the apparatus at speeds usually greater than 75 feet per minute. It is frequently desirable to imprint or emboss one of the webs of which the package is comprised with suitable indicia such as instructions in the use of the package or in advertising subject matter. Because of the high rates of speed involved and due to the fluctuations in the physical properties of the web material as influenced by its composition, structure, and surrounding atmospheric and temperature conditions, it is extremely difficult to synchronize the movement of the printed web relative to the second web so as to assure that the indicia will at all times remain centered on the resultant individual package. When the imprinted web moves out of registry subsequent cutting of the continuous strip into individual packets or dispensing containers results in a mutilation of the imprinted message which seriously detracts from the appearance, informative nature, and usability of the package.

Because of this problem it has been conventional in the past to form the continuous strip from two webs wherein the imprinted or embossed indicia has a spacing frequency of greater than two per width of the final package to assure that a complete message or design is incorporated on each package. Alternatively, the continuous strip is formed of two unprinted webs and the individual packages cut therefrom are thereafter subjected to a second operation in which an imprinted or embossed overlay web is placed and adhesively secured to the face of each individual packet in appropriate centered relationship. This latter practice is extremely costly, tedious and time consuming and substantially detracts from the efficiency and economy of the operation.

It is accordingly a principal object of the present invention to provide a register control device for accurately controlling the registration of imprinted or embossed indicia on one web relative to the resultant package so as to assure a centering of that message thereon.

Another object of the present invention is to provide a web having a plurality of repetitive indicia thereon which are disposed on a repetitive spacing increment less than the width of the resultant package and providing for controlled tensioning means for stretching the imprinted or

embossed web into appropriate register with the resultant package.

Still another object of the present invention is to provide an improved register control device for packaging apparatus which is completely automatic and which is operative to maintain two webs in appropriate registered relationship and which device is of simple control, durable construction, and efficient and economical operation.

The foregoing, and other objects and advantages of the present invention are achieved by providing a continuous web having a repetitive pattern of embossed or printed indicia thereon which are spaced at a frequency of a controlled increment less than the width of the final individual package and which web is fed through a supply system incorporating automatic variable tensioning means therein for stretching the web to a greater or lesser magnitude to maintain appropriate registration of the pattern thereon relative to a second strip in response to sensing means operatively associated with the tensioning means.

Other objects and advantages of the present invention will become apparent on the reading of the following specification taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a schematic elevational view of an exemplary packaging apparatus to which the present invention is applicable;

FIGURE 2 is a fragmentary perspective view of a continuous web having a repetitive imprinted or embossed pattern thereon and provided with registration marks at preselected intervals therealong;

FIGURE 3 is a perspective view of an individual dispensing package made in accordance with the machine shown in FIGURE 1;

FIGURE 4 is a horizontal sectional view of the package shown in FIGURE 3 and taken along the line 4—4 thereof;

FIGURE 5 is an elevation view of the back surface of the package shown in FIGURE 3, illustrating an imprinted pattern substantially centered relative to the side edges of the package;

FIGURE 6 is a fragmentary side elevation view of the package forming apparatus shown in FIGURE 1, and a diagrammatic view of the wiring circuitry associated therewith for providing automatic register control of a web relative to the side edges of a package being formed;

FIGURES 7-9 are diagrammatic views of the relationship between the square wave forms created by a rotary selector switch and a photoelectric sensing device when the web is in a registered, advanced, and retarded position, respectively, relative to the side edges of a package; and

FIGURE 10 is a fragmentary side elevation view partly in section of the braking roll provided with a magnetic brake mechanism for applying a preselected control braking force thereto.

The automatic register device comprising the present invention is predicated on the principle that thin sheets or film material including paper and plastic materials, for example, possess an inherent degree of resiliency enabling a controlled elongation or stretching thereof responsive to a controlled tensioning of the web. The stretchability of such materials is affected by numerous factors including variations in the structure and compositions of the sheet stock, the type and thickness of coatings applied on the surfaces thereof, the humidity and temperature of the environment, etc. These factors are particularly pronounced in coated-one-side paper stock which comprises an eminently satisfactory material of which individual dispensing type packages are made.

The stretchability aspects of the imprinted or embossed web coupled with a preselected spacing interval of the imprinted or embossed pattern relative to the width of

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the package provides the means for effecting dynamic controlled advancement or retardation of the web relative to the package maintaining appropriate dynamic registry of the pattern relative to the edges of a final package. In accordance with this relationship, the web is imprinted or embossed with a repetitive pattern spaced at intervals which are slightly smaller than the width of the resultant package. The differential between the pattern width and resultant package width will vary depending on considerations such as the degree of stretchability of the web, the size of the package being formed, and the accuracy of registration required. In the manufacture of fluted type dispensing packages of the type shown in FIGURE 3 having a width in the order of 1 1/4 inches and employing a web comprised of paper provided with a thermoplastic resin coating on one surface thereof, it has been found that imprinting or embossing the pattern repeat in an interval of several thousandths of an inch shorter than the width of the resultant package provides for satisfactory control of the registration of the web relative to the package.

Because of the shorter distance between pattern repeats, the imprinted web will have a natural tendency to advance relative to the second web of which the package is comprised. Advancement of the imprinted web relative to the second web beyond a preselected magnitude can be corrected by applying a preselected corrective tension to the imprinted web effecting a stretching or elongation thereof wherein movement of the imprinted web is retarded relative to the second web bringing the two webs back into registry. In accordance with the present invention this is achieved by applying a preselected tension for a predetermined time period during which the imprinted web is retarded relative to the second web. At the completion of the corrective tensioning of the imprinted web, the tension is released and the imprinted web again commences to advance into registration and beyond registration at which point corrective action is again applied. In accordance with the preferred practice of the present invention, a base or pilot tension is continuously applied to the imprinted web which is periodically supplemented by the corrective tension to maintain the two webs in appropriate register. Movement of the imprinted web to an advanced position can suitably be detected by sensing means such as a photoelectric cell operative to read registration indicia imprinted on the imprinted or embossed web which electrically communicates this information to a suitable control circuit which is operative to apply the appropriate corrective action in a manner subsequently to be described.

Fluted dispensing packages of the type shown in FIGURE 3 can be conveniently made in accordance with the apparatus as schematically shown in FIGURE 1 which is of the type more fully shown and described in the aforementioned United States patent to which reference is made for a more detailed discussion of the individual components thereof. As shown in FIGURE 1 the exemplary machine comprises a pair of cooperating rolls 12, 14 which are rotatably mounted for rotation about substantially horizontal axes and which rolls are provided with a plurality of projections 16 and indentations 18 of substantially semi-circular cross section extending longitudinally along the peripheral surfaces thereof. The projections 16 and recesses 18 are arranged in a plurality of series usually ranging from about 2 up to about 6 and are separated by spaces greater than those between the projections of each series forming planar web sections indicated at 20 in FIGURE 3. A continuous strip 22 is advanced over a roll 24 and passes through a guide shoe 26 through which the strip is advanced in alignment into the bite portion of the cooperating rolls 12, 14 as shown in FIGURE 1.

The conjugate meshing relationship between the projections and the recesses of the cooperating rolls imparts a preselected corrugated or fluted pattern to the strip 22.

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A second or imprinted strip 28 is advanced around a guide roll 30 and extends therefrom around the lower portion of a roll 32 disposed in bearing contact against the periphery of the cooperating roll 14. In accordance with this arrangement the second continuous strip 28 is positioned in overlying contact with the first corrugated strip 22 and the strips are tenaciously united to each other such as by means of a suitable adhesive or by heat sealing the two strips together. In order to effect a heat sealing of the strips 22, 28 the mating surfaces thereof are provided with a thin coating of a suitable thermoplastic resin material such as polyethylene or polyvinyl chloride, for example, which on passing over the heated rolls 14 and 32 are heat softened and become tacky effecting adherence of the two strips at their points of contact which on subsequent cooling form a unitary composite continuous fluted ribbon indicated at 34.

The fluted ribbon 34 thereafter passes upwardly and around a guide roll 38 and passes between a pair of crimping rolls 39 compressing and heat sealing the two strips to each other forming a sealed edge indicated at 36 in FIGURE 3 along the lower edge of the fluted ribbon. The ribbon is thereafter twisted toward a substantially upright position as it passes beneath a filling hopper 40 from which a suitable commodity is dispensed effecting a filling of the interiors of the individual flutes 42 as best seen in FIGURE 4. On passing beyond the filler hopper 40 the upper open edge of the fluted ribbon 38 passes between a pair of heated crimping rolls 44 effecting a sealing of the upper edge thereof along an edge indicated at 45 and hermetically sealing the commodity within the flutes. The filled and sealed fluted ribbon is thereafter twisted to a position where the flutes are disposed on the underside thereof and the continuous ribbon is trained around an indexing roll indicated at 46 formed with a plurality of projections and depressions corresponding to the corrugated configuration of the continuous ribbon. A cutter roll 48 which is mechanically coupled to the indexing roll 46 is operative to sever the continuous ribbon at a point substantially midway of the planar web sections 20 forming therewith individual packets or packages 50 of the type shown in FIGURE 3. The flutes 42 of the package 50 may be provided with a series of transverse slits or perforations 52 to facilitate subsequent rupture of the package for shaking or dispensing the contents therefrom.

The mechanical cutter arrangement assures that severance of the continuous fluted ribbon will occur at a point substantially midway between each of the intervening flat planar sections which in turn define the width of the resultant individual dispensing packages. It will accordingly be appreciated that when an imprinted web or strip 28 is employed as shown in FIG. 2 which is provided with a repetitive imprinted or embossed pattern indicated at 54, it is necessary to maintain appropriate registration of the patterns 44 relative to the planar web sections 20 so as to assure a centering of the pattern 54 in substantially the center of the package 50 as shown in FIG. 5. Registration of the imprinted web 28 relative to the cleavage points defining the side edges of the package will now be described with particular reference to FIG. 6.

As shown in FIGURE 6, the imprinted continuous strip 28 is supplied from a feed roll 56 and extends therefrom over a fixed guide 58; up over a snubber pulley 60; around and between a brake roll 62 and pinch roll 64; up and around an infeed-guide roll 66; and thence around the roll 32 as hereinbefore described. The strip 22 similarly extends in a continuous manner from a feed roll 68; over the guide roll 24; through the guide shoe 26 and between the cooperating forming rolls 12 and 14 as previously described. The advancement of the strip 28 having an imprinted repetitive pattern thereon is dynamically controlled relative to the corrugated configuration imparted to the strip 22 by the cooperating rolls 12 and 14 such that the two strips as they advance into overlying

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relationship at the bite of the rolls 14 and 32 are disposed in appropriate registration relative to each other.

This registration is achieved by applying a preselected corrective braking action to the brake roll 62 in response to sensing means such as a photoelectric eye 70 mounted on the frame of the machine which is adapted to sense the relative disposition of suitable illuminated indicia such as the registration marks 72 as best seen in FIGURE 2 which are imprinted at preselected intervals along the edge of the continuous strip 28. The registration marks 72 are preferably located substantially midway between the patterns on the printed strip 28 such that they will be located along the line of severance of the continuous ribbon and lay on the edge of the packets formed. Illumination of the strip 28 as it passes before the photoelectric eye 70 is achieved by a lamp 74 whereupon variations in the reflected light received by the photoelectric eye is transmitted to a registration control unit indicated generally at 76. The location of the focal point of the photoelectric eye 70 is established by a definite mechanical relationship which is correlated with the disposition of the depressions and projections on the forming rolls 12 and 14 such that when the backing strip 28 is in register with the fluted strip 26, the photoelectric eye 70 will sense the presence of a registration mark 72 on the strip 28 passing before the photoelectric eye 70. The mechanical placement of the photoelectric eye can be conveniently achieved by spacing it one or a multiple of the distances between registration marks from the point of tangential contact of the forming roll 14 and guide roll 32 at which the two strips are mated to each other.

The current impulse transmitted by the photoelectric eye to the register control unit 76 is correlated with a current impulse transmitted from a rotary selector switch 96 (FIGURE 6) of the type well known in the art which is mechanically driven by the forming rolls 12 and 14 and is operative to close its contact each time the forming rolls 12 and 14 have rotated through a peripheral distance corresponding to the formation of a series of packages equivalent to the spacing between registration marks 72 on the backing strip 28. The closing of the selector switch contact is mechanically coupled so as to occur at substantially the midpoint of the formation of the planar web section 20. Each time the selector switch point closes a pulse is sent to the register control unit which analyzes the pulse transmitted thereby relative to the pulse received from the photoelectric eye to determine whether any corrective action is required.

The register control unit 76 is of a type well known in the art and a detailed discussion thereof is not necessary for a full understanding of the present invention. Suffice it to say that the register control unit operates as a simple rate of change amplifier effecting amplification of the pulse received from the photoelectric eye and the rotary selector switch which in turn is capacity coupled to a thyatron tube. If the amplified pulses received are in appropriate position indicating appropriate register a rejection of the amplified pulse occurs. On the other hand, if the pulses overlap indicating an advanced position of the backing web relative to the corrugated web, the amplified pulse is switched to fire the thyatron tube which actuates a double pole contactor applying additional resistance to the circuit and simultaneously starts an electronic resistance-capacitance type timer for maintaining the resistance in the circuit for a preselected time period. At the expiration of the timed interval, the contactor is deenergized and the thyatron tube is reset preparatory for the next operation. A commercially available unit suitable for this purpose is a Fisher-Pierce #4412 control unit.

During the timing interval corrective action is applied comprising energization of a suitable braking mechanism such as a magnetic brake 78 coupled to the brake drum or roll 62 applying a preselected increased tension and effecting stretching of the backing strip 28 achieving a

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controlled retardation thereof relative to the fluted strip 22. The inherent tendency of backing strip 28 to advance in accordance with the short-printing of the repetitive pattern thereon effects progressive advancement of the backing strip to a point where corrective action is again required in a manner as previously described.

The foregoing comparison of the square wave forms analyzed by the register control unit can best be described in connection with FIGS. 7-9. As shown in FIG. 7 the register control unit receives the square wave impulse 80 from the selector switch and the square wave impulse 82 from the photoelectric eye which are illustrated in the registered condition wherein the trailing edge of the square wave 80 is disposed just ahead of the leading edge of the square wave 82. In accordance with the backing strips natural tendency to advance, the square wave 82 as shown in FIG. 8 moving in the direction of movement of the imprinted web as indicated by the arrow overlaps the trailing edge of the square wave 80 which effects a firing of the thyatron tube applying a corrective tensioning or stretching action of a preselected magnitude for a predetermined time period effecting a retardation of the web such that the square wave forms 80 and 82 assume a slightly retarded position as illustrated in FIG. 9. The natural tendency of the backing web to advance thereafter achieves advancement toward the completely registered position illustrated in FIG. 7 followed thereafter by further advancement to the position shown in FIG. 8 wherein a subsequent corrective action is again taken.

The operation of the machine will now be described with particular reference to the wiring diagram as illustrated in FIG. 6. The circuit is energized by the closing of manual contact S1 whereby an alternating current is transmitted thru conductors L1, L2 effecting illumination of on-off indicator light 84 and simultaneously energizing electric motor 86 which is drivingly coupled to the form rolls effecting advancement of the strips 22, 28, and the composite fluted ribbon 34. A preselected pilot braking or base drag is applied to the magnetic brake 78 by a variable resistor R1 to effect a slight tensioning of the backing strip 28 avoiding any slack therein. The magnitude of the pilot tension applied can be controlled by adjusting the variable resistor R1 so that an initial stretch is applied to the imprinted web. The initial stretch is of a magnitude less than the difference between the pattern repeat and the width of the final package to maintain the inherent advancing characteristics of the imprinted web relative to the fluted pattern of the first web.

During initial start-up of the machine, the pilot tension is undesirable and frequently occasions rupture of the backing strip 28. Accordingly, a suitable time delay switch S4 is preferably employed in the circuit comprising a filament 88 which is comprised of a bimetallic strip and upon heating for a preselected time period is operative to open contact 90 placing the variable resistor R1 in series with the control circuit. During the initial start-up, contact 90 is in the closed position shunting the resistors R1 and R2 thereby increasing the bias voltage and substantially eliminating the transmission of any current to the magnetic brake 78 and eliminating any drag on the printed web 28.

In accordance with the preferred practice of the present invention a regulated D.C. voltage power supply unit 92 is provided to assure a constant source of D.C. voltage in spite of fluctuations in the line voltage. The voltage control unit 92 is electrically connected to the magnetic brake 78 by means of conductors 94 as shown in FIG. 6. The voltage control unit 92 may be of any of the types well known in the art such as a model commercially designated as ABC 15-1, (-1M) sold by Kepco, Inc. of Flushing, N.Y. As hereinbefore set forth, on the opening of contact 90, the pilot or base voltage is applied to the magnetic brake 78 applying a preselected initial tension to the backing strip 28. The pilot tension can be selected by varying the variable resistor R1 which provides an

initial stretch to the strip preventing an excessive degree of relative advancement thereof, thereby avoiding the necessity of over-corrective control by the system.

A rotary cam operated selector switch 96 of the type well known in the art is drivingly coupled by a reference shaft to the forming rolls 12 and 14. In the specific switch shown, two cams 98 are included which are operative to actuate breaker point contacts 100, 102 respectively. Contacts 102 are electrically connected to the register control unit 76 for forming the square wave impulse for comparison with the square wave impulse received from the photoelectric cell. Contacts 100 are electrically connected to line L2 by conductor 104 and to coil 106 of a control relay 107 indicated in dotted lines. The coil 106 in turn is electrically connected to line L1 by means of conductor 108. The relay is provided with a pair of normally opened (N.O.) mechanically coupled contacts 110, 112 which are normally biased toward the open position. The contacts 110, 112 are closed in response to the energization of the coil 106 responsive to the closing of contacts 100 of the rotary selector switch 96. On closing of contact 110, timing light 114 is illuminated for an instant which visually signals the operator that a registration mark 72 should be positioned in alignment with a suitable reference mark at a preselected point along the machine such as at the vertical center line or the input feed roller 68 as shown in FIGURE 6. The timing light 114 facilitates initial registration during adjustment and start-up of the apparatus. The contact 112 of the relay 107 is electrically connected to a plug P1 adapted to receive a jack of a stroboscope, if desired, to facilitate alignment and adjustment of the apparatus as may be required from time to time.

During initial start-up of the machine, a discrepancy in the registration between the backing strip 28 and the edges of the package can be manually corrected by means of manual advance switch S3 and normally closed manual retard switch S2. For example, if the backing strip is excessively retarded, normally open advance switch S3 can be closed shunting the pilot resistor R1 thereby removing pilot braking from the magnetic brake and effecting rapid advancement of the backing strip 28 in accordance with its inherent advancing tendency. On the other hand, if the backing strip is substantially advanced, normally closed retard switch S2 can be manually opened for a preselected time period impressing resistors R1 and R2 across the circuit applying a combined pilot braking and corrective braking force to the magnetic brake 78 effecting a rapid retarding of the backing strip into registration. On subsequent release of the manual advance switch S3 or manual retard switch S2 the control system assumes its normal automatic register action.

When the backing strip 28 advances to a position at which the thyatron tube is fired, a control relay or contactor (not shown) within the register control unit 76 is opened whereby corrective resistor R2 is placed in series with pilot resistor R1 applying an increased corrective voltage to the magnetic brake 78 and increasing its braking force. During the corrective time delay period, correction indicator light 116 is illuminated to visually advise the operator of the action taking place. The magnitude of corrective braking action applied can be varied by adjustably positioning the variable resistor R2 and by adjusting the timer in the register control unit for the duration in which the corrective braking action is applied. Accordingly, but adjusting the variable resistors R1 and R2 and the timer, the frequency of corrective action and the limits of accuracy within which the two webs are maintained in registry can be accurately controlled.

In the exemplary embodiment illustrated in FIGURE 10 a magnetic brake 78 of the type well known in the art is illustrated comprising a rotor 118 coupled to a shaft 120 on which the brake roll 72 is affixed. A stator 122 surrounds the rotor 118 and is secured by means such as an arm 124 to the frame or stationary portion of the machine. The stator 122 is provided with a coil 126 to which the pilot current and corrective current is applied for magnetizing magnetic particles 128 disposed between the stator and rotor increasing frictional rotative resistance therebetween and increasing resultant braking action of the brake. Alternate suitable braking devices such as servo-actuated mechanical brakes as well as fluid brakes of the types well-known in the art can be satisfactorily employed in lieu of the magnetic brake herein shown and described.

While it will be apparent that the embodiments of the invention herein disclosed are well calculated to fulfill the objects of the invention, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claim.

What is claimed is:

An apparatus for making fluted packets having registered indicia on the faces thereof comprising a pair of forming rolls disposed in rolling engagement and having a conjugate repetitive contour on the peripheries thereof, first feed means for continuously feeding a first strip between said rolls and imparting an embossed configuration thereto reoccurring at fixed spaced intervals, switch means drivingly coupled to said rolls for signaling the dynamic position of said embossed configuration relative to a reference point, second feed means for feeding a second strip in overlying bonded relationship to the said first strip forming therewith a composite ribbon, said second strip provided with a repetitive pattern thereon disposed at a spacing frequency shorter than said fixed spaced intervals of said embossed configuration and further provided with registration marks therealong disposed at preselected fixed intervals, said second feed means including brake means for intermittently applying a preselected tension to said second strip effecting a stretching of the pattern thereon to a width greater than said fixed spaced intervals of said embossed configuration, sensing means for sensing the dynamic position of said registration marks on said second strip relative to said reference point, control means operatively associated with said switch means and said sensing means for intermittently energizing said brake means for a predetermined time period responsive to the advancement of said pattern on said second strip a preselected increment out of registration relative to said embossed configuration on said first strip, means for filling and sealing said ribbon, and cutter means for severing said ribbon at intervals corresponding to said fixed spaced intervals of said embossed pattern forming therewith a plurality of individual packets.

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