WEB FEEDING MEANS FOR CONTAINER FORMING APPARATUS

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In accordance with the present invention provision is made for controlling the intermittent linear advance of the web into operative position to the package forming and severing mechanisms in accordance with substantially equally spaced printed indicia on the web defining the length of individual container sections whereby to assure registration within predetermined tolerances of successive printed sections with the package forming and cutting instrumentalities irrespective of variations in the web induced by variations in the humidity and other conditions of operation.

In the illustrated embodiment of the invention the mechanism for controlling the intermittent linear advance of the web includes a detecting element arranged to cooperate with the spaced indicia upon the web during the linear movement thereof and means responsive to said detecting element for varying the linear stroke of the advancing mechanism in accordance with the position of the web at a predetermined time in the cycle during such advance.

In practice, and in accordance with the present invention, the normal uncorrected stroke of the web advancing mechanism is preferably arranged to advance the web a distance slightly less than the predetermined length of a package section or slightly less than the distance between successive indicia, and the correcting stroke of the web advancing mechanism is preferably arranged to advance the web a distance slightly more than the predetermined spacing between successive indicia except in those unusual instances where the web expansion or contraction equals its correction. Thus, the web advancing stroke is continually being increased or decreased relative to the predetermined average spacing, as controlled by the detecting means, the cumulative effect of successive shortened or normal advancing strokes causing the spaced indicia to "creep up" relative to the detecting means and the cumulative effect of successive lengthened or correcting strokes causing the spaced indicia to "creep down" relative to the detecting means, so as to maintain the advance of the web within predetermined limits and in operative relation to the container forming and severing mechanisms, the correcting stroke occurring during the same cycle of advance in which the detection is made.

The present invention is herein illustrated as embodied in a duplex type of packaging machine wherein two printed webs are concurrently advanced into operative position to the bag forming and severing mechanisms and, in accordance with another feature of the invention provision...
is made for selectively controlling the advance of the webs in accordance with the position of the spaced indicia of the respective webs during a predetermined cycle of operation during such advance whereby to assure registration of the webs within predetermined tolerances with their respective container forming and severing mechanisms, the correction of the advancing stroke being made during the same cycle in which such correction is indicated.

Referring now to the drawings, the present invention is illustrated as embodied in a commercial machine for making tea bags from an elongated web or strip of thin paper in accordance with the method disclosed in the United States patent to Patterson, No. 2,372,530 issued February 10, 1942. In general the machine comprises an improvement upon the apparatus disclosed in the United States patent to Patterson, No. 2,385,229 issued September 18, 1945. As herein shown, such machines may be constructed in duplex form for simultaneously producing two strips of connected and filled bags and for severing the strips through sealed portions thereof to form individual tea bags.

In the operation of such a machine, and as illustrated in Fig. 1, a web of heat sealable paper 10 is withdrawn from a supply roll 12 thereof and advanced over container forming mechanism 16 which operates to fold the web longitudinally along a medial line to bring together the two half sections of the web preparatory to forming a strip of connected bag sections 18. The web is preferably drawn over the forming mechanism 16 by vertically and horizontally reciprocable gripping and advancing mechanism 20 operative to nominally advance the strip substantially one bag length in each cycle of operation and to present the strip in operative relation to the sealing mechanism, indicated generally at 22, and which is arranged to apply heat and pressure to seal the strip simultaneously along a transverse zone 24 and an adjacent longitudinal zone 26 during each sealing operation to form a series of connected package sections closed on one side by the folded edge 28 and heat sealed along the remaining side and at the top and bottom.

The paper being unwound from the supply roll 12 and advanced by the gripper mechanism 20 is arranged to pass over a takeup roll 38 mounted for axial movement in a bracket 32 and then over a roller 34 which may be intermittently driven in timed relation to the linear advance of the gripper mechanism. The movable takeup roller 38 is yieldingly urged outwardly in its supporting bracket 32 by springs 36 and is capable of inward movement during the unwinding operation in order to maintain the web relatively taut and to take up any slack between the gripper mechanism and the supply roll. Provision may also be made for preventing inadvertent unwinding of the web from the supply roll 12 by providing the latter with suitable retracting means such as a friction brake or bearing, indicated at 51.

Provision is also made in such prior machines for depositing successive charges of the commodity into successive of the uppermost bag sections as they are being formed. For this reason, feeding mechanism indicated generally at 39, the feeding mechanism operating in timed relation to the operation of the strip advancing and heat sealing mechanisms 20, 22 respectively, and, in the operation of the machine, the open top of a package which has been provided with a charge of the commodity during one cycle of operation is closed during a succeeding cycle. Thereupon, the strip is intermittently advanced to cutting mechanism, indicated generally at 32 which operates to sever the strip through successive transverse sealed portions 24 to form individual filled and sealed package sections 18.

The machine illustrated and described in the Patterson Patent No. 2,385,229 above referred to was particularly designed for producing paper tea bags made from a web of plain, unprinted heat sealable paper, and such machines are at the present time in extensive successful operation. However, when printed webs are used in a machine having a linear web advancing mechanism arranged to advance the web a fixed distance at each cycle of operation, that is the length of a package section, it is difficult to maintain correct registration of successive printed package sections with the package forming instrumentalities since, in practice, the sections may vary due to inaccuracies in printing, atmospheric conditions, stretching of the web during withdrawal or possible slippage of the web. Thus, in the operation of such prior machines on a printed web, any slight variations in the printed sections will be cumulative so that eventually the web will depart from registration with the package forming and cutting mechanisms.

In the illustrated embodiment of the invention, each web gripping and advancing mechanism 20 includes a pair of opposed cooperating gripper units 40, 42 mounted to be horizontally reciprocated into and out of gripping engagement with the web, and to be vertically reciprocated to advance the web each cycle of operation. In practice, the linear stroke of the grippers is initially adjusted so as to normally advance the web a distance slightly less than the package length or distance between successive substantially equally spaced markings 44 on the web. As herein shown, each gripper 40, 42 is also mounted for pivotal movement in its supporting member to be capable of being rocked while in gripping engagement with the web to effect advancement of the web beyond the normal stroke when actuated by control mechanism responsive to the position of the markings 44 at a predetermined time in the web advancing cycle of operation so as to effect a correction in the linear advance of the web during the same cycle in which the lack of registration is detected.

In general, the control mechanism includes a photo-sensitive detector, indicated generally at 46, arranged to cooperate with the spaced markings 44 during the advancing cycle of operation; a timing switch 48 arranged to render the detector operative at a predetermined time in the web advancing cycle, and a solenoid operated member 50 arranged to cooperate with the grippers to effect advancement of the grippers beyond the normal stroke when actuated by the detector mechanism. In practice, the photo-sensitive detector is placed relative to the web so that the light beam is focused on the edge of the web at a point approximately between two markings 44 when the web is at rest as illustrated in Fig. 1. Thus, during intermittent advancement of the web the light beam image may be intercepted by the marking at about the halfway feeding mechanism indicated by its advance, as illustrated in Fig. 7. The detector unit herein illustrated is arranged to be excited to effect a corrective stroke only when the light beam is intercepted by the mark during the "scanning" period that is, when the circuit is closed by the timing switch 48, and then only when the beam is cut off by the leading edge of a rapidly passing mark. If the mark does
not appear during the scanning period, no correction is made, and, if the beam falls directly on the mark and the mark then passes by so that the beam changes position on the relatively lighter background of the web during the scanning period, no correction is made.

In the operation of the apparatus, assuming that the average package length is approximately 2½ inches, for example, successive uncorrected or shortened linear strokes, adjusted to advance the web about ⅛ of an inch less than the average package length, or 2⅝ inches, will effect a gradual or cumulative rising or “creeping up” of the marks 44 relative to the light beam until a point is reached where the light beam is intercepted by a mark moving therepast, and, when this occurs, a correction stroke is applied during the same cycle in which such detection is made, to advance the web a distance slightly more, approximately ⅛ of an inch more, for example, than the average length of a package section, making the total advance about 2½ inches. Thus it will be seen that the web advancing stroke is either increased or decreased relative to the predetermined package length, continually between predetermined limits, unless the variations in the web cause no detection whereby to obtain registration of successive package portions. The gripper forming mechanism and cutting mechanisms within the predetermined permitted tolerances.

Referring now to Figs. 1 and 2 for a more detailed description of the web advancing apparatus, as therein shown, opposed gripper units 40, 42 are arranged to be horizontally reciprocated in brackets 52, 54 respectively the latter being adjustably clamped upon vertical rods 56, 58 supported for vertical reciprocation in suitable bearings provided in the machine frame. The rods 56 and 58 are arranged to be vertically reciprocated in timed relation to the operation of the package forming mechanisms by a cam 60 mounted fast on the main cam shaft 160, and, as herein shown, provision is made for initially adjusting the effective stroke of the cam in order to adjust the linear advance of the grippers with relation to the length of package sections of the web. The rods 56, 58 are secured at their lower ends to a pair of yoke shaped tie pieces 62 only one of which is shown, the tie piece 62, having a central slotted portion 64 for cooperation with a slide block 66 mounted on one end of an eccentric stud 68 carried in a lever 70 fast on a rocker shaft 72, the eccentric stud being rotatably adjustable in the lever 70 as shown in Fig. 10. The eccentric end of the stud 68 is provided with a roller 74 cooperating with the fixed cam path of the cam 60.

With this construction it will be seen that by rotary adjustment of the eccentric stud 68 the effective length of the lever arm 70 may be varied, rotary adjustment in one direction operating to increase the distance from the center of the rocker shaft 72 to the center of the roller 74 to decrease the effective stroke, and, rotary adjustment in the opposite direction operating to decrease the distance from the center of the roller shaft to the center of the roller to increase the stroke. Thus, the linear movement of the gripper units may be initially adjusted so as to provide the desired finite linear advance or distance slightly less than the average spacing between successive markings 44. It will be understood that the gripper carrying brackets 52, 54 may also be adjusted on their respective rods 56, 58 to align the cooperating gripper units 40, 42 for cooperation with successive transverse sealed portions 24 of the web.

While the above description has been confined thus far to the operation of one pair of cooperating gripper units 40, 42 for advancing a web of container forming material into operative relation to the bag forming instrumentalities, it will be understood that in the duplex machine herein illustrated, an identical simultaneously operating pair of gripper units 400, 420 are carried by the brackets 52, 54 respectively, as illustrated in Fig. 9, the brackets being also adjustably supported upon similar vertical rods 566, 580 arranged to be vertically reciprocated by the cam 60 through similar connections including a lever arm fast on the rocker shaft 72 so that in operation, the gripper units are simultaneously operated to cause the webs to be advanced into operative relation to their respective container forms, filling and severs mechanisms.

As illustrated in Figs. 2 and 9, each gripper unit 40, 42 and their corresponding units 400, 420 are supported for horizontal reciprocation upon individual rods 76 slidingly carried in the brackets 52, 54, each rod being provided with a coil spring 80 interposed between a portion of its supporting bracket and a collar 82 adjustably secured to the rod, the springs being arranged to urge the grippers inwardly into cooperating engagement with their opposing grippers and the container forming webs. The rods 76 of each unit are joined at their outer ends by a tie piece 82 and each tie piece carries a roller 84 arranged to cooperate with elongated cams 86 secured to vertical cam shafts 88, 90 respectively. Thus, in the operation of the machine, the gripper units 40, 400 and 42, 420 are horizontally reciprocated simultaneously into and from engagement with the webs, the springs 80 effecting a yielding engagement therewith and the cams 86 operating to positively separate the grippers. The vertical cam shafts 88, 89 are arranged to be rotated from the main cam shaft 160 by connections including bevel gears 92, 94 to the vertical shaft 98, bevel gears 98, 95 to a horizontal shaft 100, and a second set of bevel gears to the vertical shaft 90.

As above stated, the cooperating gripper units 40, 42 and the corresponding pair of cooperating gripper units 400, 420 are mounted for pivotal movement so that when actuated by the control mechanism, the grippers effect an advance of the web a distance slightly more than that of the predetermined reciprocating stroke of the grippers, and, as best shown in Figs. 4 and 5, the gripper unit 40 includes a web engaging member 102 mounted in a retaining member 104 supported upon two spaced rods 106, 108 slidingly mounted in rocker members 110, 112 supported for pivotal movement in a U-shaped bracket 114 secured to the end of the horizontally reciprocable rod 76. The rod 76 is reduced in diameter at the connecting end and the U-shaped bracket 114 is assembled against the shoulder provided by the reduced diameter and is retained on the rod by a block 116 keyed to the end of the rod, the bracket being secured to the block to prevent rotation of the bracket. The rocker members 110, 112 are fitted between the side faces of the block 116 and the arm 114 with a flat slot in a line parallel to the bridge bracket and are pivotally mounted therebetween upon spaced axially aligned pins 122, 124 extending from the arms 118, 120 respectively and pins 126, 128 extending from opposite sides of the
The solenoid operated stop bar 50 arranged to be extended into the path of a stud 158 adjustably carried in the arm 143 of the rocker member 142. The solenoid 162 is arranged to be energized to effect repositioning between the two opposing gripping units. In Fig. 3, the stop bar 50 is connected to one arm 156 of a three-armed lever pivotally mounted at 168, a second arm 169 being connected by a link 170 to the solenoid actuator, and the third arm 171 being connected by a spring 174 arranged to retain stop bar 50 in a retracted position until moved by the operation of the solenoid. A stop screw 175 may be provided for cooperation with the arm 164 to adjustably limit the retracted position of the bar 50, as shown.

Referring now particularly to Fig. 7, the detecting unit 46 is arranged to energize the solenoid 162 to effect an additional advance of the web when the unit is actuated by a registration mark 44, and, as herein shown, the detecting unit may comprise any usual or prior automatic registering system adapted to concentrate a beam of light on the web and arranged to be excited by a rapid change in the reflective characteristics of the surface upon which the beam is concentrated. The light beam is concentrated to the reduced end of the light beam to a dark surface of the moving web, the dark beam being herein illustrated as comprising the spaced registration marks 44, arranged to intercept the beam, and when the detecting unit is actuated it is arranged to operate a relay 176 to close a circuit 178 to the solenoid 162. In practice, the light beam is on all the time but the unit is operative to actuate the relay 176 upon interception of the beam only during a predetermined time in the cycle of operation, herein defined as the scanning period, and being a time when the web has been advanced substantially halfway in its movement from one position of operation to another.

As shown in Fig. 6 and 7, the scanning period is controlled by the timing switch 45 which includes a stationary contact 150 and a movable contact 162, the movable contact 162 being normally urged into circuit closing engagement with the stationary contact 150 by a leaf spring 154. The contacts so that in operation the rockingly mounted unit 40 is normally maintained in a horizontal position with the unit 42 and, when the arm 148 of unit 42 is rocked in a clockwise direction, viewing Fig. 5, the opposing unit 46 will be correspondingly rocked in a counterclockwise direction. The web engaging element 138 may and preferably will be made of a yieldable material and is provided with a relatively flat web engaging face, and, the cooperating element 102 is preferably provided with a knurled gripping surface corresponding to the line of rocking movement.

From the description thus far it will be observed that in operation the printed container forming web 10 having spaced registration marks 44 thereon, corresponding to the length of successive package sections, will be intermittently advanced a distance slightly less than the distance between registration marks, initial adjustment of the amount of linear feed being accomplished by rotation of the eccentric roller stud 88 and the lever arm 90, and it will be observed that each gripper unit is mounted for cooperating pivotal movement to permit an additional increment of the web to be advanced when correction is required. As best shown in Fig. 5, the rocking of the gripper units to effect such additional advancement of the web includes the solenoid operated stop bar 50 arranged to be extended into the path of a stud 158 adjustably carried in the arm 143 of the rocker member 142.
It will be understood that the characteristics of the preferred detector unit 46 are such that if the light beam 44 is directed onto the relatively lighter surface of the web material during the scanning period, such position being indicated generally in Fig. 7 wherein the switch contacts 160, 162 are closed and the light beam is about to be intercepted by a mark 44, indicating that the package sections are lagging slightly behind substantially uniform registration with the container forming and severing instrumentalities.

Upon interception of the light beam by the registration mark at such time, the relay 176 will be activated to close the circuit 178 to the solenoid 162 which is in turn energised to extend the stop bar 50 into the path of the rocker arm 148 so that as the gripper members approach the end of their normal stroke, the web is given an additional and preferably predetermined increment of advancement by the cooperative rocking action of the rocker members 140, 142.

Thereafter, in the operation of the apparatus, the gripper units are moved apart to disengage the web and are returned to their normal horizontally aligned position for cooperation with the next succeeding transversely sealed portion of the web during the next cycle of operation. It will thus be seen that the correcting action of the web advancing mechanism occurs during the same cycle of operation that a deviation from a substantially uniform position of advancement is detected so as to assure that none of the package sections deviate from such position beyond predetermined commercially acceptable limits.

From the description thus far it will be seen that in the operation of the web advancing mechanism successive normal or uncorrected web advancing strokes which are slightly less than the average spacing of the printed package sections of the web will cause the marks to rise relative to the light beam concentrated on the moving web and that this action will be cumulative so that eventually the mark will intercept the light beam, as described, to effect additional advancement of the web. As herein shown, similar control mechanism is provided for controlling each web of a duplex container forming machine, and includes a similar detecting unit 488, solenoid operated bar 500, and timing switch 460 so that in operation, although the web advancing mechanisms are simultaneously operated through the earm 50, yet each web may be individually controlled to add directly an additional advancement of the web as determined by its individual detecting unit.

Thus, the package forming webs are maintained in substantially uniform registered relation with their respective package forming mechanisms comprising the package sealing mechanism 22, filling mechanism 36, and severing mechanism 32 which may comprise the mechanisms illustrated and described in the Patterson Patent No. 2,385,229 above referred to, and to which reference may be had for a more complete description of the structure and mode of operation of such mechanisms. As herein shown, successive connected filled and sealed packages advanced into operative position to the severing mechanism 32 are cut off and received in suitable guides 390, 392 through which they are advanced by intermittently operated pusher arms 394, 396 to be delivered from the machine.

From the above description it will be seen that provision is made in the present apparatus for controlling the intermittent advance of a printed web of container forming material into operative position to the package forming and severing mechanisms in accordance with substantially equally spaced printed indicator marks defining the length of individual container sections, the control means being adapted to correct the linear advance of the web during the same cycle in which a deviation from the predetermined spacing is detected beyond the permitted tolerances.

While the preferred embodiment of the invention has been herein illustrated and described it will be understood that the invention may be embodied in other forms within the scope of the following claims.

Having thus described the invention, what is claimed is:

1. In a machine of the character described, a combination, web feeding means for intermittently advancing a web having substantially equally spaced registration marks thereon defining successive package sections comprising a pair of horizontally and vertically reciprocable grippers arranged to intermittently advance the web through a normal fixed stroke slightly less than the predetermined package length each cycle of operation, control means including means for detecting the position of a registration mark at a predetermined time during the advance of the web, and means responsive to said control means arranged to cooperate with said grippers to increase the advancing stroke when and only when a deviation from a predetermined position beyond an allowable tolerance is detected as determined by the detecting means by the registration mark during said predetermined time for advancing the web an additional fixed increment as the grippers approach the end of their normal advancing stroke whereby to obtain a net advance slightly more than the predetermined package length during the same cycle of operation in which such deviation is detected.

2. In a machine of the character described, in combination, web feeding means for intermittently advancing a web having substantially equally spaced registration marks thereon defining successive package sections comprising a pair of horizontally and vertically reciprocable grippers arranged to intermittently advance the web through a normal fixed stroke slightly less than the predetermined package length each cycle of operation, said grippers being also mounted for pivotal movement, control means including means for detecting the position of a registration mark at a predetermined time during the advance of the web, and means cooperating with said grippers and responsive to said detecting means when and only when a deviation from a
predefined position beyond an allowable tolerance is detected as determined by the interception of the detecting means by the registration mark during said predetermined time for effecting pivotal movement of the grippers as they approach the end of their normal advancing stroke to effect a longer stroke and thus effect an additional fixed increment of advance of the web to obtain a net advance slightly more than the predetermined package length during the same cycle of operation in which such deviation is detected.

3. In a machine of the character described, in combination, web feeding means for intermittently advancing a web having substantially equally spaced registration marks thereon defining successive package sections, comprising a pair of horizontally and vertically reciprocable grippers arranged to normally advance the web through a normal fixed stroke slightly less than the predetermined package length each cycle of operation, said grippers being also mounted for pivotal movement, control means including a normally inoperative photo-sensitive detector arranged to cooperate with said registration marks, a timing switch for rendering said detector operative to detect the position of a registration mark at a predetermined time during the advance of the web, and a solenoid operated member responsive to said control means when and only when a deviation from a predetermined position beyond an allowable tolerance is detected as determined by the interception of the detecting means by the registration mark during said predetermined time for cooperation with and engage a portion of said grippers to effect an additional advancing movement through a normal fixed stroke whereby to obtain a net advance slightly more than the predetermined package length during the same cycle of operation in which such deviation is detected.

6. In a machine of the character described, in combination, web feeding means for intermittently advancing a web having substantially equally spaced registration marks thereon defining successive package sections comprising a pair of horizontally and vertically reciprocable grippers arranged to normally advance the web through a normal fixed stroke slightly less than the predetermined package length each cycle of operation, control means including means for detecting the position of a registration mark at a predetermined time during the advance of the web, and means responsive to said control means arranged to cooperate with said registration marks to effect an additional advancing movement through a normal fixed stroke whereby to obtain a net advance slightly more than the predetermined package length during the same cycle of operation in which such deviation is detected.

7. In a machine of the character described, in combination, web feeding means for intermittently advancing a web having substantially equally spaced registration marks thereon defining successive package sections comprising a pair of horizontally and vertically reciprocable grippers arranged to normally advance the web through a normal fixed stroke slightly less than the predetermined package length each cycle of operation, said grippers being also mounted for pivotal movement and having opposed web engaging elements, one comprising a flat faced resilient member and the other comprising a cooperating curved face, control means including means for detecting the position of a registration mark at a predetermined time during the advance of the web, and means responsive to said detecting means and movable into engagement with a portion of said grippers to effect an additional advancing movement through a normal fixed stroke whereby to obtain a net advance slightly more than the predetermined package length during the same cycle of operation in which such deviation is detected.
as determined by the interception of the detecting means by the registration mark during said predetermined time, for effecting pivotal movement of the grippers to increase the advancing movement as they approach the end of their normal advancing stroke and thus effect an additional fixed increment of advance of the web to obtain a net advance slightly more than the predetermined package length during the same cycle of operation in which such deviation is detected.

8. In a duplex machine of the character described, in combination, web feeding means for intermittently advancing two webs each having substantially equally spaced registration marks thereon, defining successive package sections, comprising a pair of horizontally and vertically reciprocable grippers for each web, means for operating said grippers simultaneously to normally advance the webs a fixed distance slightly less than the predetermined package length each cycle of operation, control means for each web including means for detecting the position of a registration mark at a predetermined time during the advance of the web, and means responsive to said control means arranged to cooperate with the respective grippers to increase the advancing movement when and only when a deviation from a predetermined position beyond allowable tolerances is detected as determined by the interception of the detecting means by the registration mark during said predetermined time for selectively effecting an additional fixed increment of advance of such web as the grippers approach the end of their normal advancing stroke whereby to obtain a net advance slightly more than the predetermined package length during the same cycle of operation in which said deviation is detected.

9. In a duplex machine of the character described, in combination, two web feeding means for intermittently advancing webs each having substantially equally spaced registration marks thereon, defining successive package sections, comprising a pair of horizontally and vertically reciprocable grippers for each web, means for operating said grippers to normally advance the webs simultaneously a fixed distance slightly less than the predetermined package length each cycle of operation, said grippers being also mounted for pivotal movement, control means for each web including means for detecting the position of a registration mark at a predetermined time during the advance of the webs, and means responsive to said control means including a member movable into engagement with and arranged to cooperate with and effect pivotal movement of the grippers to increase the stroke as they approach the end of their normal advancing stroke when and only when a deviation from a predetermined position beyond allowable tolerances is detected as determined by the interception of the detecting means by the registration mark during said predetermined time whereby to selectively effect an additional fixed increment of advance of a web to obtain a net advance slightly more than the predetermined package length during the same cycle of operation in which such deviation is detected.

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