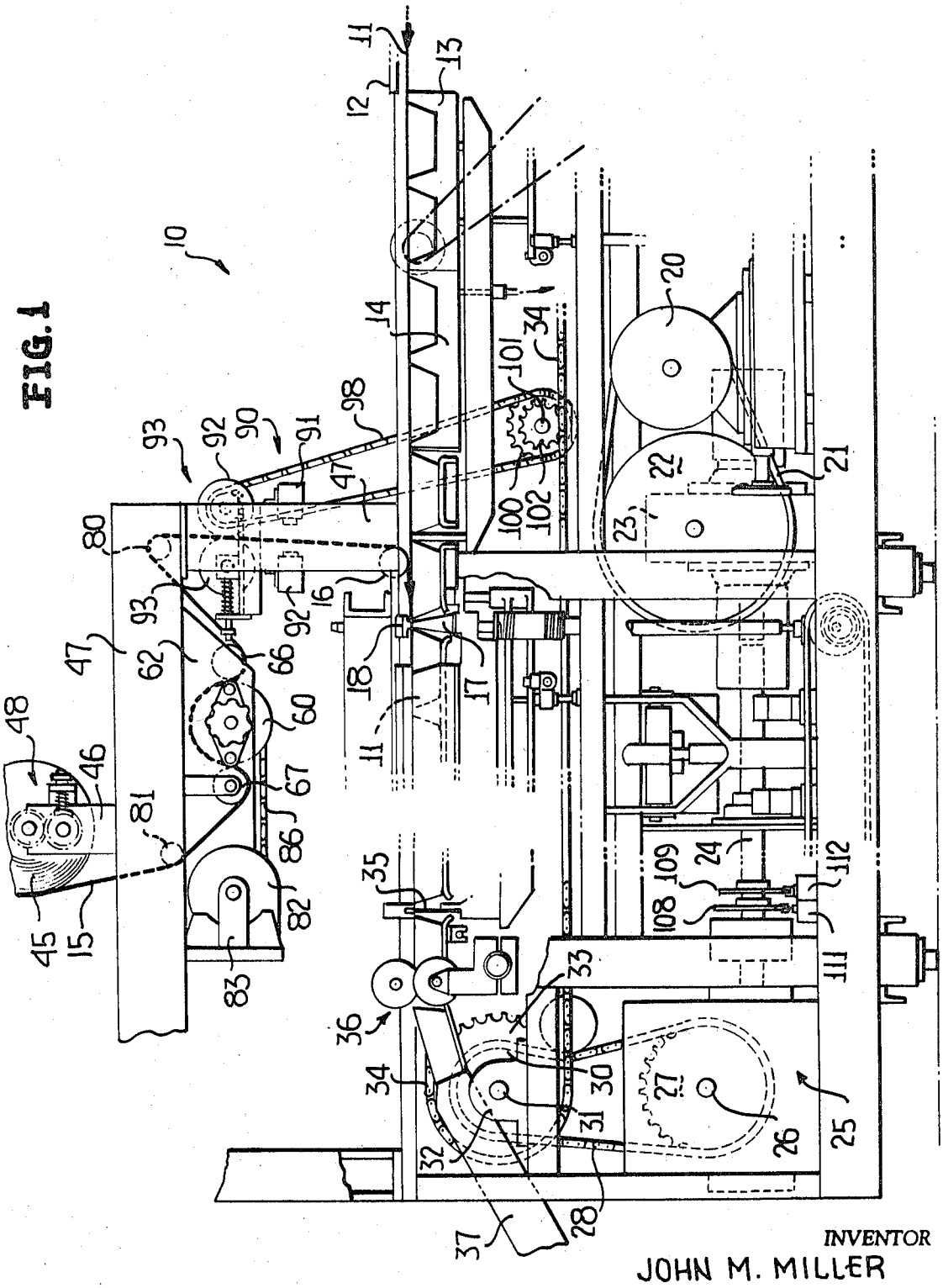
Jan. 19, 1971 J. M. MILLER 3,555,768

METHOD AND APPARATUS FOR HANDLING AND REGISTERING WEBS FOR FORMING PACKAGES

Filed Feb. 26, 1968 5 Sheets-Sheet 1

FIG. 1

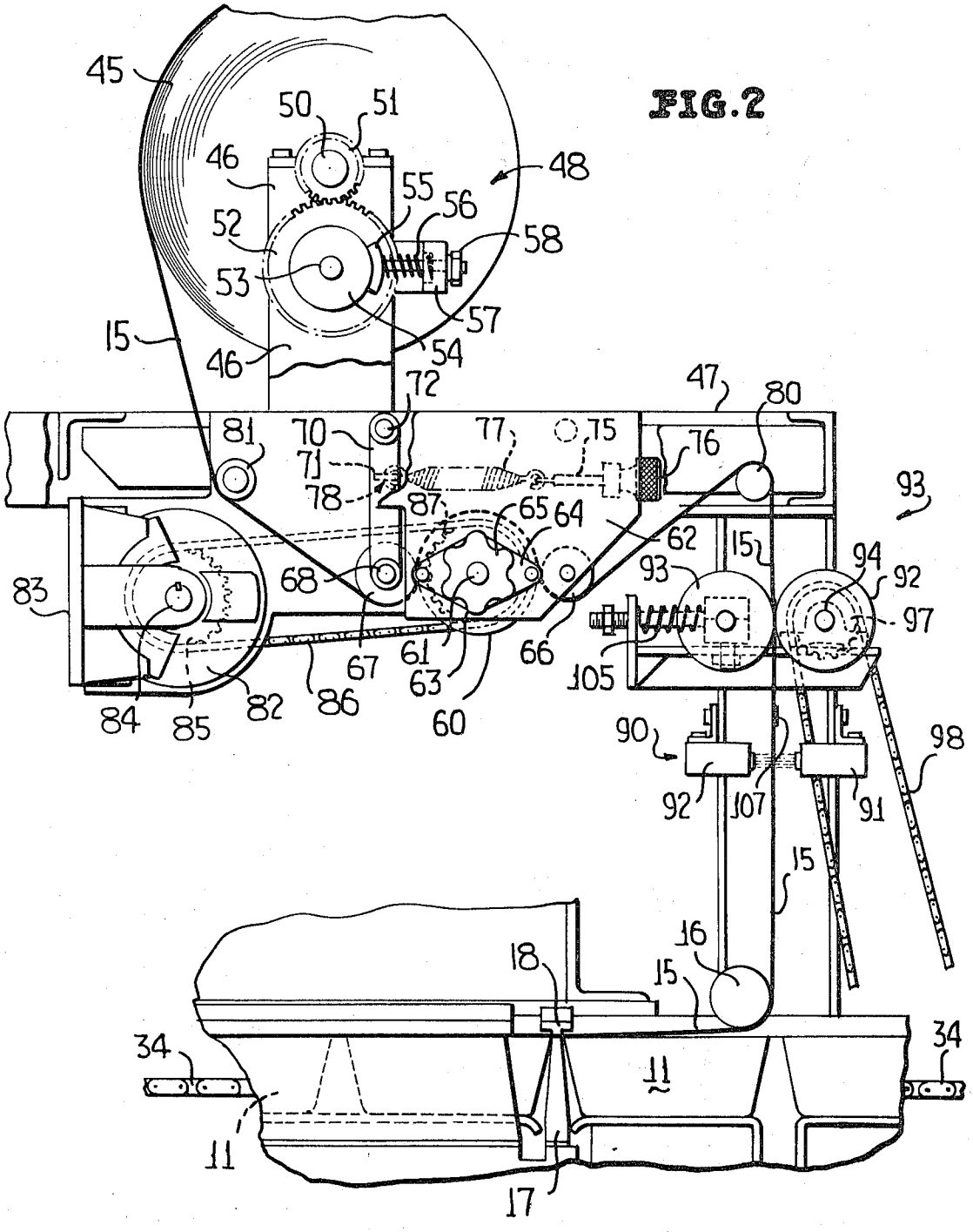


INVENTOR
JOHN M. MILLER

BY
Mason, Porter, Diller & Brown
ATTORNEYS

Jan. 19, 1971 J. M. MILLER 3,555,768
METHOD AND APPARATUS FOR HANDLING AND REGISTERING WEBS FOR FORMING PACKAGES
Filed Feb. 26, 1968 5 Sheets-Sheet 2

FIG. 2



INVENTOR
JOHN M. MILLER

BY
Mason, Porter, Diller & Brown
ATTORNEYS

Jan. 19, 1971 J. M. MILLER 3,555,768

METHOD AND APPARATUS FOR HANDLING AND REGISTERING WEBS FOR FORMING PACKAGES

Filed Feb. 26, 1968 5 Sheets-Sheet 3

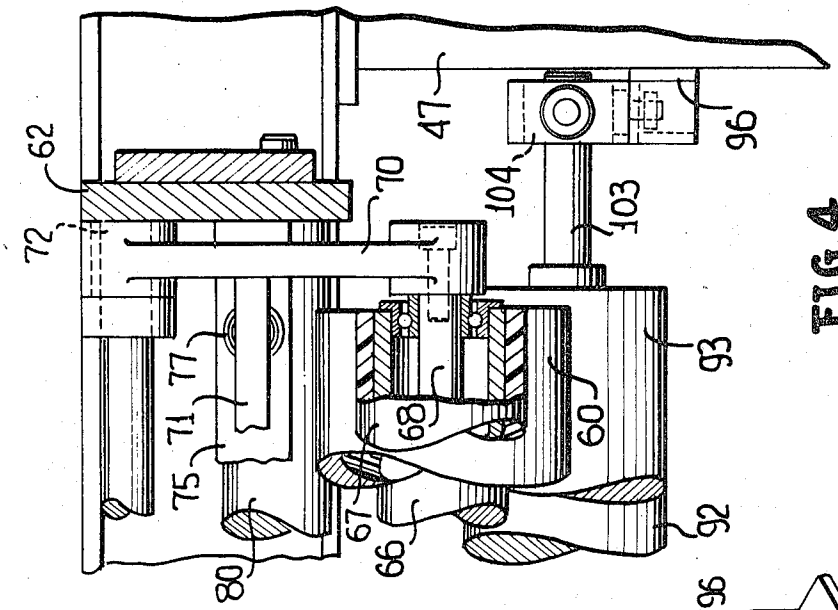


FIG. 4

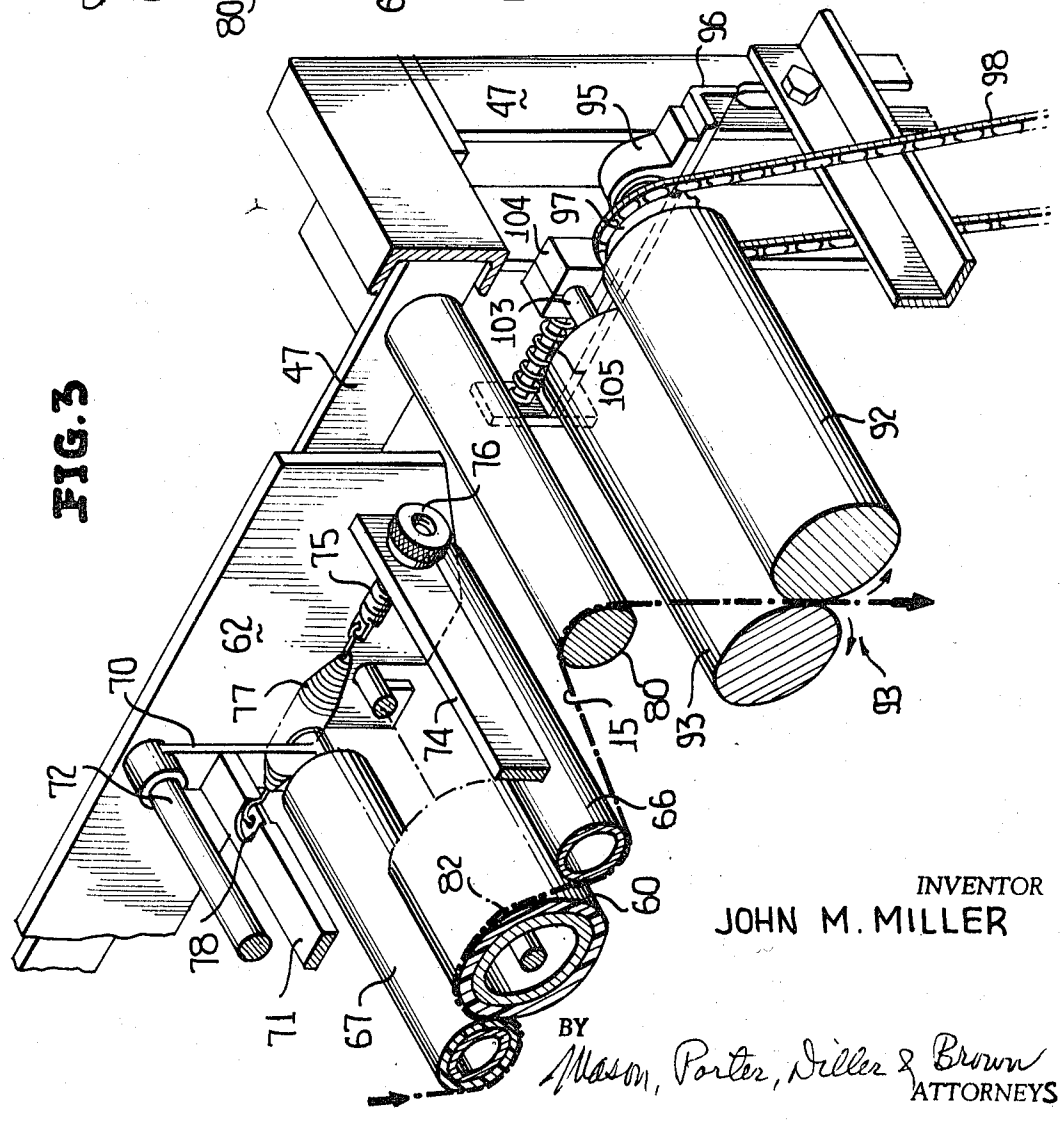


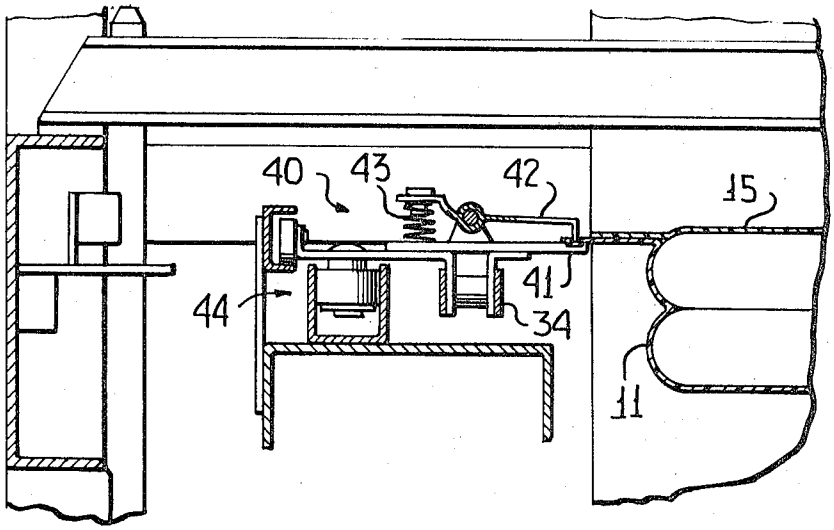
FIG. 3

INVENTOR
JOHN M. MILLER

BY Mason, Porter, Diller & Brown
ATTORNEYS

Jan. 19, 1971 J. M. MILLER 3,555,768
METHOD AND APPARATUS FOR HANDLING AND REGISTERING WEBS FOR FORMING PACKAGES
Filed Feb. 26, 1968 5 Sheets-Sheet 4

FIG. 5



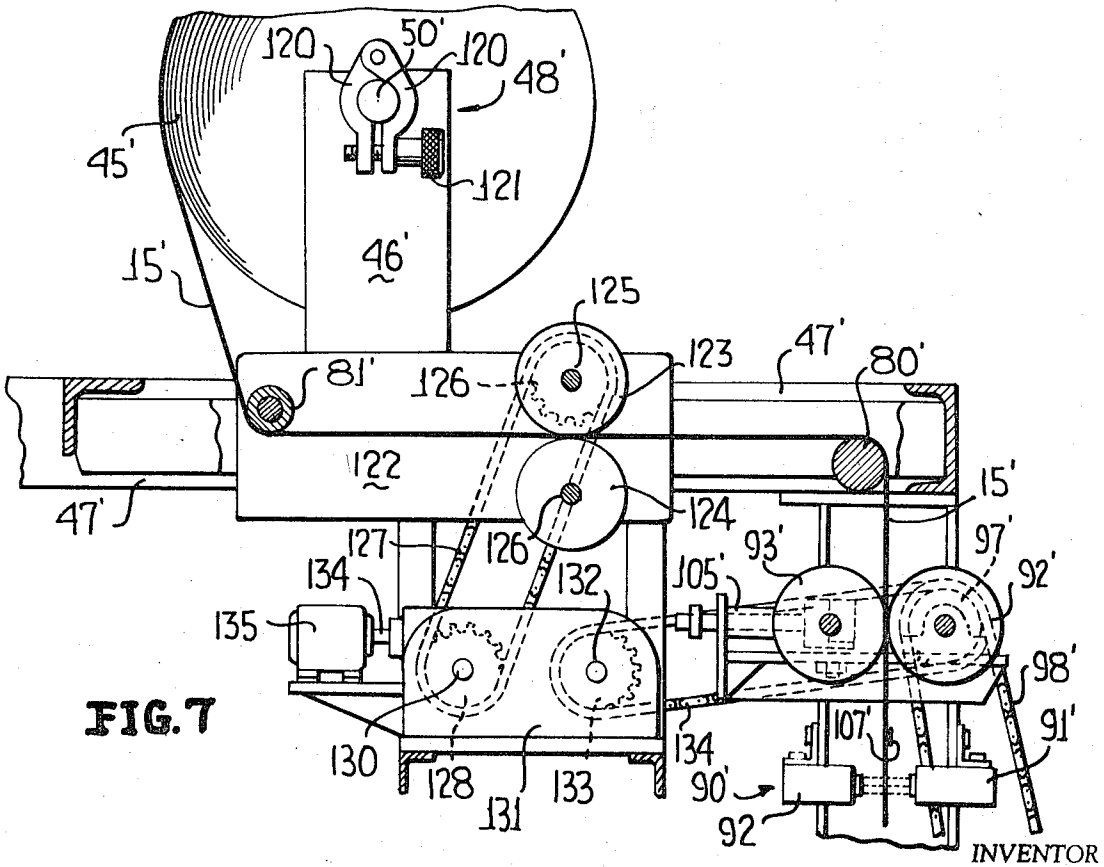


FIG. 7

INVENTOR
JOHN M. MILLER

BY
Mason, Porter, Miller & Brown
ATTORNEYS

Jan. 19, 1971 J. M. MILLER 3,555,768

METHOD AND APPARATUS FOR HANDLING AND REGISTERING WEBS FOR FORMING PACKAGES

Filed Feb. 26, 1968 5 Sheets-Sheet 5

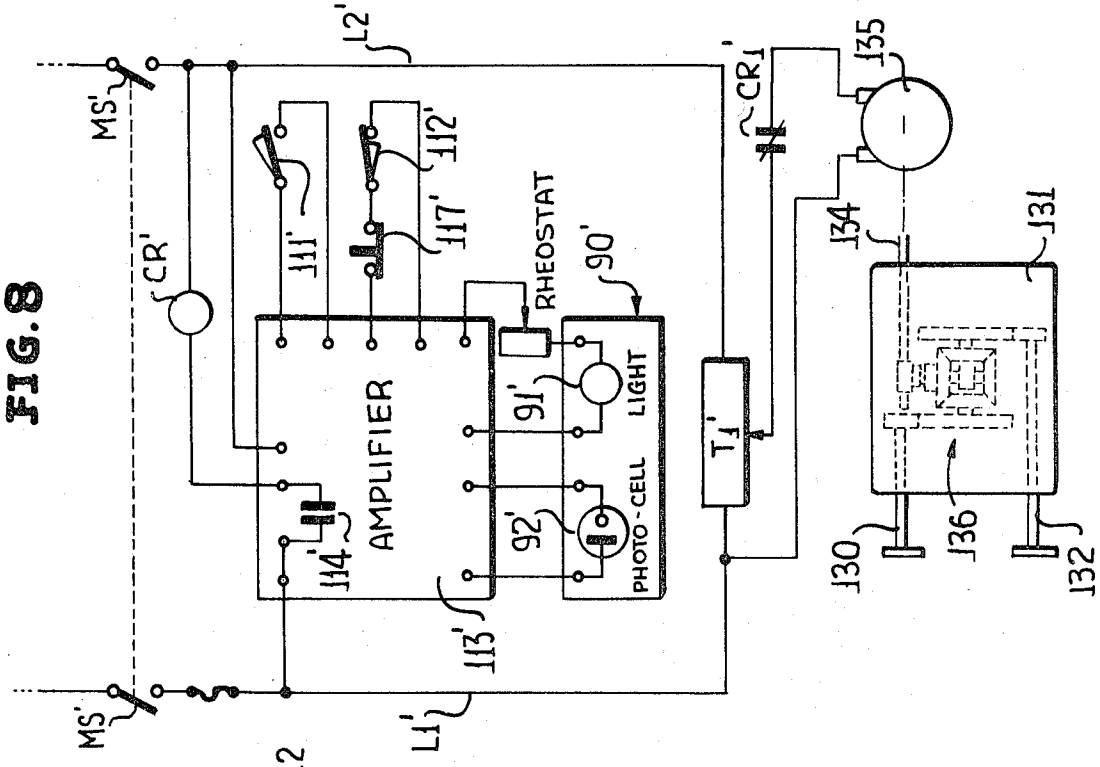


FIG. 8

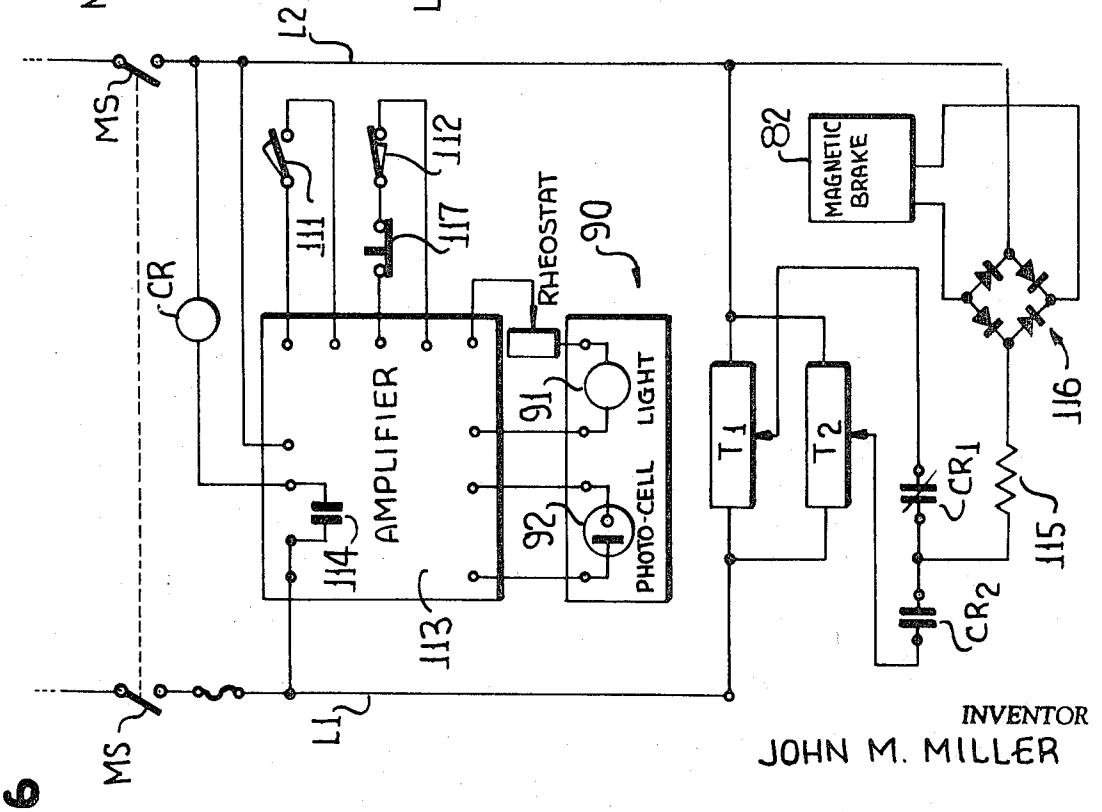


FIG. 6

INVENTOR
JOHN M. MILLER

BY Mason, Porter, Miller & Brown
ATTORNEYS

United States Patent Office 3,555,768 Patented Jan. 19, 1971

3,555,768

METHOD AND APPARATUS FOR HANDLING AND REGISTERING WEBS FOR FORMING PACKAGES

John M. Miller, Mount Vernon, Ohio, assignor to Continental Can Company, Inc., New York, N.Y., a corporation of New York

Filed Feb. 26, 1968, Ser. No. 708,000
Int. Cl. B65b 7/16, 57/04; B31b 49/00
U.S. Cl. 53—39 21 Claims

ABSTRACT OF THE DISCLOSURE

Methods and apparatus for forming filled packages from a first web having fill pockets thereon and a second cover web having markings for registration with the pockets are disclosed herein. The pocketed and marked webs are brought together and intermittently or step-by-step advanced in the formation of packages and tensioning of the marked cover web is employed to effect registration of the markings thereon with the pocks of the further web. Abrupt tension changes in the marking bearing cover web, commonly resultant from the step-by-step advancing of such web, are reduced by feeding the cover web in synchronism with the advancing of both webs and at a point preceding the application of the cover web to the pocketed web.

The invention relates generally to package forming machines wherein first and second webs are brought together and joined to form a series of fill containing packages, and more particularly to machines of the type in which a marking bearing cover web and a pocket bearing further web are advanced intermittently or in step-by-step fashion and joined to form packages wherein the markings and the pockets are correctly registered.

In the past, package forming machines have been provided wherein first and second webs of heat sealable plastic material are provided on relatively large supply rolls to be joined together in the formation of fill containing packages. Commonly, fill pockets are provided in a first of the webs while fill identifying or advertising markings are provided on the other web which is joined with the pocket containing web to form sealed fill containing packages, marked in accordance with consumer requirements. Inasmuch as it is often required that the markings or designs provided upon a cover web be exactly located or registered with the fill pockets of the further web, it has been necessary to provide arrangements whereby the location of cover web markings with respect to the location of the pockets provided in the web to which the cover is to be applied is carefully monitored and controlled for exact registration between the desired markings and the fill accommodating pockets.

Inasmuch as it is never possible to provide exactly equal spacing of the pockets provided in one of the webs and the markings provided upon the other of such webs such as to maintain constant registration of the markings and pockets without some "drift" during the employment of a package forming machine, it has been suggested that the markings provided upon the cover web be given a spacing somewhat less than the spacing of the pockets provided in the further web such that when the two webs are joined in a package forming process, the markings of the cover web will tend to advance slightly with respect to the pockets. In this type of suggested registration system, the tension applied to the cover web during the joining together of the cover web and the pocketed further web is controlled so as to stretch the marking bearing cover web whenever the markings thereon tend to advance beyond an acceptable limit of registration. In one such

suggested system, first and second tension levels are made available for application to the cover web whereby the first of such tension levels is not quite sufficient to cause the spacing of the markings to equal the spacing of the pockets, while the second tension level is sufficient to stretch the web to a point at which the spacing of the markings exceeds the spacing of the pockets. In this type of system, application of the cover web to the pocketed web while the cover is maintained at the lower level of tension provides a gradual creeping forward of the markings of the cover web with respect to the pockets of the further web, while the employment of the second, higher tension level is effective to cause the pockets of the pocket bearing web to move forward in position with respect to the markings. Constant surveillance of the relative positions of the markings and pockets is maintained, as through the use of a photo-electric sensor or electric eye employed to control the level of tension applied to the cover web.

Employment of systems of the aforementioned types and the pockets in packaging machines wherein both and the sprockets in packaging machines wherein both such webs are continuously fed from relatively large web supply rolls. However, numerous packaging machines employ intermittent or step-by-step feeding of the package forming webs wherein each of the webs is abruptly advanced during a portion of a package forming cycle and abruptly halted and maintained immobile during a further part of such cycle. As will be apparent, the abrupt pulling forward from a supply roll of a web which by its nature stretches under tension, causes abrupt inertial tension changes detrimental to the employment of tensioning of such a web for the aforementioned purposes. Thus, it becomes difficult to employ differential tensioning of a cover web to effect the correct registrations of markings provided thereon where such web is repeatedly pulled forward by the advancing mechanism of the package forming machine inasmuch as abruptly increased tension is exhibited by such cover web during the initial forward movement of the cover web in a particular cycle and further inasmuch as web relaxation is exhibited during the portion of the package forming cycle wherein the web is again brought to rest.

The abrupt pulling forward or jerking forward of the cover web as described hereinabove further may result in a shearing or deformation of the web due to the suddenly increased tension thereon and such increased tension coupled with intermittent periods of relaxation commonly results in wrinkling of the cover web at its point of application to the remaining package forming web. Application of a braking force to the commonly employed web supply rolls such as to prevent the relaxation of the cover web is rendered difficult by the changes in inertia resultant from the reduction of web maintained on the supply rolls and attempts have been made to provide a displaceable "idler" roll or "dancer" roll intermediate the package forming machine and the web supply rolls so as to provide a small web inventory which is drawn off during each cycle and which is sufficient to prevent the abrupt tensioning of the cover web at the beginning of each cycle. However, the provision of dancer rolls in the web path increases the difficulty of applying tension to the cover web to effect proper web marking registration inasmuch as a relatively slack portion of web is provided in the web feed path.

In accordance with the foregoing, then, it is an object of this invention to provide methods and apparatus capable of controlling the tensioning of a web in an intermittently driven or step-by-step driven package forming machine.

Similarly, it is an object of this invention to provide methods and apparatus for facilitating the registering of

markings printed upon a first web with fill-accommodating portions of a second web wherein the first and second webs are joined together to form a filled package and wherein both such webs are intermittently advanced during package formation.

A further object of this invention is to provide package forming machines of the type employing a step-by-step or intermittent web advancing drive, cover web feed provisions driven in synchronism with the web advancing drive to avoid abrupt tensional changes in the cover web in the area thereof intermediate the web advancing drive and the cover web feeding provisions.

Additionally, it is an object of this invention to provide cover web feeding provisions of the foregoing type wherein feeding of the cover web occurs prior to application of the cover web to the additional web and wherein such feeding is at substantially the same web feed speed as the web feed speed of the web advancing drive.

It is yet another object of this invention to provide cover web tensioning provisions in combination with cover web feedings provisions of the aforementioned types such as to control the tensioning applied to the cover web to effect registration of markings on the cover web with fill accommodating portions of the remaining web.

Still another object of this invention is to provide tensioning of a cover web through the employment of magnetic brake provisions in combination with tension controlling cover web feed provisions in a step-by-step web advancing package forming machine.

It is a further object of this invention to provide the tensioning of a cover web through the employment of first and second cover web feed provisions and driving means coupled with the feed provisions for providing differences in the web feed speed of each such feed provisions so as to effect tensioning of the cover web intermediate the feed provisions and in combination with a step-by-step web advancing package forming machine.

Further still, it is an object of this invention to provide methods and apparatus for registering cover web markings with fill accommodation portions of a further web during the joining together of such webs in the formation of filled packages by the step-by-step advancing of both webs through the application of repeated abrupt forces thereto and by the application of a variable tension to the cover web sufficient to stretch the cover as required in the registration of the markings thereon with the fill accommodating portions of the additional web and by continually feeding the cover web in synchronism with the advancing thereof to effect a reduction in the abrupt tensioning in the cover web resultant from the step-by-step advancing thereof.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims, and the several views illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a fragmentary side elevational view of package making machine structure in accordance with this invention, and illustrates web advancing provisions, cover web supply provisions and a cover web feed mechanism driven in synchronism with the web advancing provisions.

FIG. 2 is an enlarged fragmentary side elevational view of a portion of the structure shown in FIG. 1, and illustrates in greater detail cover web tensioning provisions and cover web feed rolls forming part of the cover web feeding mechanism.

FIG. 3 is an enlarged fragmentary perspective view of a portion of the apparatus illustrated in FIG. 2 and shows in greater detail a cover web tensioning roll for applying a pretermined amount of tension to the cover web and a pair of cover web feed rolls for engaging the cover web preceding its joinder with a further web and for

feeding the cover web in synchronism with the advancing provisions of the package forming machine.

FIG. 4 is an enlarged fragmentary cross-sectional view of the several rolls of FIG. 3, and shows the relative positioning of the cover web tensioning and feeding provisions and the mounting of these provisions on the side thereof not illustrated in FIG. 3.

FIG. 5 is an enlarged fragmentary vertical cross-sectional view illustrating one form of a portion of the web advancing provisions of the packaging machine.

FIG. 6 is a diagrammatic circuit illustration showing web tension control provisions suitable for controlling the tension applied to the cover by the web tensioning arrangements illustrated in FIGS. 1–4.

FIG. 7 is an enlarged fragmentary side elevational view of an alternate cover web tensioning arrangement, and shows first and second cover web feed rolls and a speed differential drive coupled to the first and second feed rolls for varying the tension applied to the cover web.

FIG. 8 is a diagrammatic circuit illustration of control provisions suitable for controlling the tension applied to the cover web through the use of the tensioning arrangement illustrated in FIG. 7.

Referring to the drawings in detail, there is illustrated generally at **10** in FIG. 1 a package forming machine of the type to which the invention may be applied and wherein a first web **11** is drawn into the machine for the forming of fill accommodating pockets therein. The web **11** is preferably thermoplastic in nature and is supplied from a suitably provided supply roll (not shown). A suitable pre-heating means **12** is provided proximate the web **11** adjacent its point of entry into the machine **10** to allow pocketing of the web **11** by a set of vertically reciprocable mold provisions **13** into which the web **11** is drawn for the formation of the pockets therein. A further set of vertically reciprocable mold provisions **14** are provided for holding the pockets recently formed in the mold **13** against deformation upon engagement of the mold **14** with such recently formed pockets. Filling of the pockets of the web **11** may be effected manually or by suitable automatic filling provisions capable of employment in combination with the over-all package forming machine **10**. A cover web **15** is entrained into engagement with the pocketed web **11** adjacent a cover web engaging roll **16**. The cover web **15** is, of course, entrained into engagement with the pocketed web **11** for the covering of the pockets subsequently to the filling of the pockets with the desired commodity. Upon engagement of the cover web **15** with the pocketed web **11**, heat-sealing of the two webs is effected through the utilization of vertically reciprocable heat sealers **17** and aligned web back-up provisions or plates **18**.

In package forming machines of the type generally referred to by the numeral **10** in FIG. 1, web advancement is of an intermittent or step-by-step nature and the advancement of the pocketed web **11** in this fashion imparts step-by-step advancement or intermittent movement to the cover web **15** by reason of the sealed together engagement of the webs **11** and **15**.

Drive provisions for the machine **10** include a suitably selected drive motor **20** connected in driving engagement as at **21** with the input provisions **22** of a power transmission unit **23** coupled to a drive shaft **24**. The drive shaft **24** provides an input to a suitably chosen stepper or indexing mechanism generally indicated at **25**. The stepper mechanism **25** provides a step-by-step or intermittent motion output to the webs **11** and **15** via an output shaft **26**, and an output sprocket **27** engaging a first driven chain member **28** which is entrained about a driven sprocket **30** rotatably mounted by a shaft **31** journaled for rotation in a shaft mounting trunnion **32**. An additional sprocket **33** is mounted upon the rotatable shaft **31** and is in driving engagement with a web conveying chain **34** which extends longitudinally along the machine

10 and which is entrained at the other end thereof about a further suitably selected sprocket (not shown).

Transverse severing of the individually filled and covered package forming pockets is effected at **35** and longitudinal severing of transversely spaced packages is effected through utilization of the cutting provisions indicated at **36**. Thus, individual filled packages are delivered from the package forming machine **10** via a discharge chute **37** for the subsequent handling thereof.

Step-by-step advancement of the pocketed web **11** and the cover web **15** is effected, as best illustrated in FIG. 5 through the employment of suitable web engaging means. generally referred to by the numeral **40** carried by the intermittently driven web advancing chain **34**. As illustrated in FIG. 5, the web engaging means **40** may include first and second web clamping members **41** and **42** and means for biasing the clamping members into clamping engagement with the joined webs **11** and **15**, as for example, the spring bias means **43** in biasing engagement between the pivotally mounted clamping member **42** and the lower clamping member **41**. Actuation of the pivotally mounted clamping member **42** into and out of clamping engagement with the joined webs may be effected through suitable cam actuating provisions (not shown) or alternate provisions suitable for effecting movement of the pivotally mounted member **42** into clamping engagement with the periphery if the joined webs and release of the joined webs for discharge from the package forming machine **10**. As further illustrated in FIG. 5, the intermittently driven chain **34** may be guided in its movement relative to the path of conveyance of the webs **11** and **15** through the provision of suitable guide roller means generally indicated by the numeral **44**.

Returning to FIG. 1, the cover web **15** is supplied from a cover web supply roll **45** suitably journaled upon a roll stand **46** which, in turn, is supported upon a frame superstructure **47** affixed to and above the framework of the machine **10**. Overrunning of the web supply roll **45** is prevented by a supply roll brake means **48**, illustrated more fully in FIG. 2.

The supply roll **45** is supported upon a shaft **50**, journaled for rotation by the roll stand **46** and the shaft **50** has affixed thereto a gear **51** in engagement with a further brake gear **52** which, in turn, is affixed to a further shaft **53** which also is journaled for rotation by the roll stand **46**. A braking disk **54** is affixed to the shaft **53** and a brake shoe **55** frictionally engages the periphery of the disk **54** to restrain movement of the supply roll **45** via the geared engagement of the gears **51** and **52**. The brake shoe **55** is biased into engagement with the periphery of the braking disk **54** by the interpositioning of a compression spring **56** intermediate the shoe **55** and a brake shoe mounting bracket **57**. Adjustment of the force applied to the braking disk **54** via the brake shoe **55** is provided through the inclusion of manual adjustment means **58**.

Tensioning of the cover web **15** is provided by the inclusion of a rubber sheathed main tension roll **60** mounted upon a shaft **61** journaled for rotation by a pair of side plates **62** of the frame super-structure **47**.

The side plates **62** are provided with downwardly opening slots **63** which allow removal of the roll **60** upon detachment of a pair of shaft support bearing means **64**. The shaft **61** is provided with a knob **65** allowing the manual movement of the tension roll **60**.

An idler roll **66** is supported between the side plates **62** adjacent the tension roll **60** for movement with the web **15**. A rubber sheathed presser roll **67** is located adjacent the main tension roll **60** opposite the idler roll **66** and the presser roll **67** has its ends trunnioned at **68** in the free lower ends of a suspension frame **70**, said frame **70** including an intermediate connecting bar **71** and having free swinging support at **72** on the plates **62**, as illustrated in FIGS. 2 and 3.

A cross bar **74** is fixedly supported between the plates **62** and extends parallel to the rolls **60**, **66** and **67** and threadedly receives anchor rods **75** having knurled manually operable adjuster nuts **76** thereon. The rods **75** are connected to the forward ends of tension springs **77**, as shown in FIGS. 2 and 3, and the other ends of the springs **77** are connected at **78** to the bar **71** of the swingable frame **70**. The springs **77** constantly urge the presser roll **67** against the main tensioning roll **60**, and the degree of tensioning pressure may be readily adjusted by turning the knurled nuts **76**. An idler roll **80** is mounted on the frame **24** forwardly of the tension rolls as best shown in FIGS. 2 and 3, and a further idler roll **81** is mounted on the plates **62** beneath the supply roll **45**. It will be apparent from FIGS. 2, 3 and 4 that the cover web **9** passes down from the supply roll **45** under the guide or idler roll **81** and under the tensioning presser roll **67**, upwardly over the main tensioning roll **60** and down under the idler roll **66**, thus presenting a bight **79** of the web over the main tensioning roll **60** between the aforementioned rolls **66** and **67** as clearly shown in FIG. 2. From the idler roll **66**, the cover web **15** passes upwardly over the idler roll **55** and thence downwardly toward the location of application of the cover web **15** to the pocketed web **11**.

A magnetic brake unit **82** is supported at **83** on the super-structure **47**, as best shown in FIGS. 1 and 2, and the brake unit **82** includes a rotor shaft **84** having a sprocket **85** fixed thereon and chain coupled at **86** with a sprocket **87** fixedly connected to the main tensioning roll **60**. The magnetic brake unit **82** applies controlled drag or braking action on the main tensioning roll **60** via the chain coupling **86** to resist drawing off of the cover web **15** from the supply roll **45** as the web **15**, being heat-sealed to the pocketed web **11**, and the pocketed web are moved along.

The aforementioned magnetic brake unit may be a commercially available unit, as for example the units available from Vickers, Incorporated, Electronics Product Division of St. Louis, Mo. It is relatively well known that this type of brake has its projecting rotor shaft attached to an inner member enclosed by and rotating with an outer member, both members being independently supported by stator bearings and being separated from each other by a space or gap which remains constant. Said gap contains finely divided dry ferromagnetic particles. A stator coil is included and when said coil is not energized the magnetic particles within the gap have insignificant frictional or binding effect, but when the stator coil is energized, a magnetic film is produced in the gap and produces the bonding or braking action which is proportional to the applied energizing current. Controlling of the degree of energization will, of course, control the degree of braking action which will be applied to the tension roll **60** by the brake unit **82**. It will be apparent that this braking action may also be modified somewhat by the adjustment of the tension springs **77**, and also by the adjustable application of the brake shoe **55** against the braking disk **54**, as best shown in FIG. 2, but this last-mentioned braking action serves principally to prevent overrunning of the roll **28** at the ends of the successively applied stepping movements of the pocketed web **11** with which the cover web **15** is moved along and drawn off the web supply roll **45**.

The cover web **15** has provided thereon a series of markings along the length thereof to be registered with the pockets formed in the pocketed web **11**. Preferably, the markings provided upon the cover web **15** are "printed short." That is, the markings to be registered with the pockets of the web **11** are spaced along the length of the cover web **15** at a spacing normally lesser than the spacing of the pockets along the length of the web **11**. Tensioning of the cover web **15** by means of the magnetic brake unit **82** and the main tensioning roll **60** is employed to provide a stretching of the cover web **15** such that the markings applied thereto may be registered with the

pockets at the point of application of the cover web **15** to the pocketed web **11** adjacent the roll **16**. Preferably, a first tension is insufficient to increase the spacing of the level is applied to the web **15** which tension level markings provided upon the cover web for exact registration with the pockets formed in the web **11**. Thus, application of the cover web **15** while the cover web is tensioned at the first tension level results in an advancement of the markings on the web **15** relative to the pockets of the web **11**. Once the markings upon the cover web **15** have advanced a predetermined amount relative to the pockets, a second higher tension level is applied to the cover web **15** sufficient to stretch the cover such that the markings applied thereon are given a spacing greater than the spacing of the pockets with which such markings are to be registered. Accordingly, application of the cover web **15** under the second higher tension level results in an advancement of the pockets of the web **11** relative to the markings provided upon the cover web **15** until, again, the advancement of the pockets with respect to the markings reaches a predetermined maximum, at which time the first and lower tension level is again applied to the cover web **15**.

Monitoring of the registration of cover web markings with respect to the pockets of the web **11** is provided, as will be more fully discussed hereinafter, through the employment of suitable sensing means, generally referred to by the numeral **90**, which, as shown, may include a suitable light source and photo-electric cell combniation **91, 92** mounted upon the frame super-structure **47** intermediate the tensioning rolls **60, 66** and **67** and the point of application of the cover web **15** to the pocketed web **11** adjacent the idler roll **16**.

The continual intermittent or stepping advancement of the cover web **15** as imparted thereto by the stepping mechanism **25** results in an abrupt tensioning of the cover web **15** at the beginning of each cycle or stepping movement of the cover web and further results in a slackening of the cover web **15** each time the intermittently applied advancing force is terminated. Such abrupt increases and decreases in the tensioning of the cover web **15** will be readily appreciated from a realization that the web supply roll **45** exhibits a relatively large mass when a large quantity of cover web is maintained thereon and, accordingly, each time the cover web **15** is "jerked" forward the static inertia tending to maintain that web immobile must be overcome, while each time the cover web **15** is halted in its advance, the kinetic inertia of that web must again be overcome.

As will be apparent, the abrupt increases and decreases in the tensioning of the cover web present difficulties in the employment of tensioning of the cover web to provide correct registration of markings thereon with the further web **11**. Additionally, distortion and/or wrinkling of the cover web at its point of application to the pockets of the pocketed web must be avoided. A cover web feed means generally referred to by the numeral **93** is provided at a location preceding the application of the cover web **15** to the pocketed web **11**. The cover web feed means **93** positively feeds the cover web **15** in synchronism with the advancing of the over-all package forming machine **10** and at essentially the same speed as that imparted to the cover web via the advancing step-by-step drive provisions of the machine **10**. Thus, abrupt tensioning and slackening of the cover web **15** intermediate the cover web feed means **93** and the point of application of the cover web to the pocketed web is substantially reduced or elimnated inasmuch as the cover web **15** is positively fed into the package forming machine **10** as required during each cycle of that machine, thus allowing no abrupt speed differences in the cover web **15** intermediate the cover web feed means **93** and the location at which such cover web is applied in completing the individually formed packages. Similarly, the monitoring or sensing provisions **90** do not respond to undesirable abrupt tension level alterations but, rather, the sensing or monitoring means **90** respond only to the location of the markings upon the cover web **15** as determined by the tension at which the cover web **15** is fed into the area intermediate the cover web feed means **93** and the point of application of the cover web to the pocketed web.

As shown in FIGS. 1, 2 and 3, the cover web feed means **93** may include a pair of cover web feed rolls **92** and **93** supported upon the frame super-structure **47** intermediate the idler rolls **80** and **16**. A first of the cover web feed rolls **92** is fixedly mounted upon a shaft **94** journaled for rotation, as by the bearing support means **95** mounted upon the super-structure support member **96**. The feed roll **92** engages the cover web **15** and is rotatably driven to positively feed the web **15** by a sprocket **97** mounted upon the shaft **94**, or similarly provided in positive driving relation with the feed roll **92**. An elongate driving chain member **98** is entrained about the sprocket **97** and is driven in step-by-step or intermittent motion by the advancing apparatus of the package forming machine **10**. As best shown in FIG. 1, the elongate chain **98** may be entrained about a further sprocket **100** fixedly mounted upon a shaft **101** which further fixedly supports a sprocket **102** in driven engagement with the web advancing chain **34**.

The second of the cover web feed rolls **93** is freely rotatably journaled adjacent the driven feed roll **92** opposite the path of movement of the cover web **15** as by the shaft **103** supported in suitable movable mount means **104** located upon the support member **96**. The freely rotatable feed roll **93** is biased toward the driven feed roll **92** to firmly engage the cover web **15** in the nip between the two rolls as through the provision of spring bias means **105**. The rolls **92** and **93** may be of suitably selected resilient or semi-resilient material or may be sheathed in rubber such that positive feed engagement with the cover web **15** is effected.

The light source **91** of the monitoring means **90** is supported upon the frame super-structure **47** to project a control means across the path of movement of a series of control marks **107**, best shown in FIG. 2, provided in predetermined spaced arrangement upon the cover web **15** and in predetermined positional relation to the markings provided upon the cover web **15** which are to be registered with the pockets formed in the pocketed web **11**.

The continuously driven shaft **24** which provides an input to the stepper mechanism **25** has affixed thereto a pair of control cams **108** and **109** as best seen in FIG. 1. The cam **108** is disposed to control a normally open signal cut-out switch indicated at **111** in FIGS. 1 and 6 and the cam **109** is disposed to control a normally closed re-set switch indicated at **112**.

Registration of the cover web markings with the pockets provided in the pocketed web will best be understood by reference to FIG. 6 wherein a pair of power supply lines L1 and L2 are shown in association with a mains supply switch or breaker MS.

The cover web monitoring provisions **90** including the light source **91** and the photo cell may include any of a number of suitably chosen commercially available scanner provisions, as for example, the commercially available #341 Dietz Scanner, in association with a suitably chosen control amplifier **113** such as, for example, the readily commercially available Dietz AD 170 amplifier. Because the amplifier **113** is widely commercially available and relatively well known, no detailed reference will be made to the construction thereof, however, reference will be made to the amplifier actuated relay contacts **114**, commonly employed in amplifier-photo-cell combinations of the type shown in FIG. 6.

A circuit relay CR is included across the supply lines L1, L2 in series with the amplifier controlled relay contacts **112** and the relay CR, when energized and de-

energized, will respectively open and close the contacts CR_1 and CR_2.

Electrical energizing sources T_1 and T_2 are provided in parallel across the lines L1, L2 and may comprise variable transformer means or variable voltage divider means T_1 serving to supply an input for conditioning the magnetic brake **82** for applying the aforementioned desired predetermined definite low tension and stretch to the cover web **15**, and T_2 serving to supply an input at a value for conditioning the magnetic brake **82** for applying the aforementioned predetermined definite higher tension and stretch to the web **15**. It is to be understood that the supply provisions T_1 and T_2 may be suitably selected from any of a number of well known provisions capable of providing predetermined voltage conditions as required by the magnetic brake unit **82** employed.

Closure of the circuit relay CR effects a closing of contacts CR_1 to apply the first predetermined input from T_1 to the magnetic brake **82** via a current limiting resistor **115** and a full wave rectifier arrangement **116**. Similarly, closure of the contacts CR_2 effect energization of the magnetic brake **82** at an input level provided by T_2.

A manual re-set switch **117** is shown in series with the normally closed cam actuated switch **112** for use in setting up and/or testing, or re-establishing normal operation of the web registering provisions.

Preferably, application of an input to the magnetic brake **82** from the input provisions T_1 provides the aforementioned less than sufficient tensioning level in the cover web such that the markings upon the cover web are not stretched sufficiently to obtain an exact registration with the pockets in the pocketed web **11**. Thus, when the brake **82** is energized from T_1, a gradual creeping forward of the markings on the cover web **15** with respect to the pockets of the pocketed web **11** is apparent. Similarly, upon application of a second input from T_2 to the magnetic brake **82**, tension upon the cover web **15** is increased and a gradual retreat of the markings on the cover web **15** with respect to the pockets of the web **11** is apparent.

Each control mark or spot **107** (FIG. 2) preferably cuts or blocks the beam of the sensor **90** during early motion of the web in a given feed cycle. The signal cut-out cam **108** closes its associated switch **111** just as a properly registered given control mark **107** cuts or blocks the scanner beam. Closure of the switch **111** renders the scanner-amplifier combination ineffective, maintaining the relay CR unenergized wherein a low-level input from T_1 is applied to the magnetic brake **82** to maintain the low tension level in the cover web **15**. However, should the mark **107** cut the scanner beam prior to the closure of the switch **111**, disruption of the beam will effect closure of the contacts **114**, thus energizing the relay CR to apply a second T_2 input to the magnetic brake **82** via the now-closed relay contacts CR_2. As will be apparent, attention to the length of the dwell of the cam **108** which effects closure of the normally open switch **111** will determine the acceptable limits of the positioning of the cover web borne marks **107** during each machine cycle.

Upon termination of the stepping motion of the webs **11** and **15**, or after the mark **107** has safely passed the scanner beam, the cam **108** allows reopening of the switch **111** such that the switch **111** will be opened prior to the pulling forward of the webs **11** and **15** during the next succeeding machine cycle.

The cam **109** effects closure of the switch **112** to provide opening of the amplifier relay contacts **114** to allow operation of the contacts **114** through the actuation of the normally open switch **111** and the photo-electric monitoring provisions **90** during the next succeeding machine cycle.

As before stated, the tension applied to the web **15** by the magnetic brake **82** when that brake is energized via T_1 to apply a low tension to the web **15**, should be sufficiently high that some stretching of the web **15** will occur. This lower tension may bring the cover web **15** close to registration such that the tensioning of the cover web **15** at the higher tension level need not be extreme. Preferably, each of the lower and higher tension levels should be applied to the cover web **15** for a number of successive machine cycles rather than having both the lower and higher tensions applied to the cover web **15** during each cycle or during each successive cycle.

Turning to FIG. 7, there is shown therein an alternate tensioning arrangement wherein provisions similar to those discussed hereinabove are given similar reference numerals. A cover web **15'** is supplied from a cover web supply roll **45'** to the over-all package forming machine which may be of the type designated at numeral **10** in FIG. 1. The supply roll **45'** is mounted upon a shaft **50'** journaled for rotation upon a supply roll stand **46'** which, in turn, is supported upon a frame super-structure **47'** affixed to the framework of the over-all machine as discussed hereinabove with respect to the frame super-structure **47**.

Braking provisions, generally designated **48'**, are provided upon the roll stand **46'** to reduce over-running of the supply roll **45'** and the braking provisions **48'** may be of the type discussed hereinabove with respect to FIG. 2 or may, as shown, include a pair of pivotally mounted shaft engaging brake members **120** and a threaded manually adjustable member **121** threadedly engaging the pivotal members **120** for adjusting the braking force applied to the shaft **50'**.

The cover web **15'** is entrained downwardly and about an idler roll **81'** journaled for rotation by a pair of support plates **122**, one of which is shown in FIG. 7, mounted upon the frame super-structure **47'**. A pair of feed rolls **123**, **124** are mounted upon a pair of shaft **125**, **126**, journaled for rotation by the plates **122** and the feed rolls **123**, **124** engage the cover web **15'** in the nip therebetween and in feeding relation to the cover web. The web **15'** passes from between the nip of the feed rolls **123**, **124** about a further idler roll **80'**, supported for rotation by the frame super-structure **47'** and an additional pair of feed rolls **92'**, **93'** engage the cover web in feeding relation preceding the application of the cover web to the pocketed web **11**.

The feed rolls **92'**, **93'** are similar in nature to the feed rolls **92**, **93** discussed hereinabove, relieving abrupt tensional forces and slackening of the cover web **15** intermediate the feed rolls **92'**, **93'** and the point of application of the cover web **15** to the pocketed web. The feed roll **92'** is driven in synchronism with the web-advance mechanism of the over-all package forming machine through the provision of an elongate chain member **98'**, driven from the advancing provisions of the machine and entrained about a sprocket **97'** affixed to the feed roll **92'** for rotation therewith.

Once again, the feed rolls **124**, **125** and **92'**, **93'** may be of resilient or semi-resilient material or may be rubber sheathed to provide good feeding engagement with the cover web **15'**. The feed roll **93'** is shown biased into engagement with the cover web by a resilient member **105'** and the feed roll **124** may similarly be so biased.

Prior to the application of the cover web **15'** to the pocketed web, the positional relationship of the markings provided upon the cover web **15'** with respect to the pockets of the pocketed web is monitored by a monitoring means **90'**, including a light source **91'** and a photo-electric cell **92'** positioned to scan across the path of movement of marks **107'** provided upon the cover web **15'**.

The feed roll **123** is driven from a sprocket **126**, mounted upon the shaft **125** and in driven engagement with a drive chain **127**. The drive chain **127** is entrained about a sprocket **128** fixed to an output shaft **130** of a speed differential drive unit **131**. A first input to the speed differential unit **131** is provided by a shaft **132** having a sprocket **133** affixed thereto. An input drive chain **134** engages the sprocket **133** to impart input drive rotation

thereto and the chain **134** is entrained about a further sprocket (unnumbered) affixed to the driven feed roll **92'**. Thus, the speed differential unit **131** receives an input synchronized with the advancing of the webs **11** and **15'** by the step-by-step advancing mechanism of the over-all package forming machine.

Speed differential units of the type shown in FIG. 7 are readily commercially available, as for example from Fairchild-Hiller Corporation, Industrial Products Branch, West Babylon, Long Island, N.Y. The speed differential unit **131** shown in FIG. 7 includes a suitably chosen commercially available differential gear box having, in addition to the input shaft **132** an output shaft **130**, a further input shaft **134** to which is coupled a suitably selected commercially available motor **135** for providing a second input to the gear box to determine the driven speed of the output shaft **130**. Application of an input to the shaft **132** via the input drive chain **34** and its associated sprockets provides an output at the shaft **130** to provide feeding of the cover web **15'** via the chain **127** and the driven feed roll **123**. As will be apparent to ones skilled in the art, the dimensions of the sprockets **126** and **128** and the diameter of the feed roll **123** may be selected to provide a web feed speed from the feed roll **123** identical to the feed speed provided by the feed roll **92'** and the feed roll **123** may be driven at a slightly lesser speed than the feed of the feed roll **92'** by application of an input at **134** to impart the higher than normal level of tensioning to the cover web **15'** in which case the web **15'** will be stretched sufficiently to provide registration of the markings thereon with the pockets of the pocketed web in a fashion similar to that discussed hereinabove with respect to the utilization of first and second, lower and higher levels of cover web tensioning. Application of an input to the second input shaft **134** of the speed differential unit **131** in a reverse direction may also be provided by the motor **135** to increase the web feeding speed of the feed roll **123** to provide a relaxation of the tension level in the cover web **15'** intermediate the feed rolls **123** and **92'** such that the spacing of markings is reduced from a predetermined maximum. It will, of course, be apparent to ones skilled in the art that the motor **135** may be coupled to the input shaft **134** to provide an increase in speed of the feed roll **123** such that the motor **135** would normally be energized when the lower tension level is to be applied to the cover web **15'** and the motor **135** would be deenergized to result in a slowing of the feed rate applied to the feed roll **123** from the differential unit **131** when the second, higher tension level is desired.

FIG. 8 indicates generally the geared relation of the input and output shafts of a suitably selected differential gear box employable as the speed differential unit **131**. An input applied to the shaft **132** is transmitted to the output shaft **130** inasmuch as the shafts **132** and **130** are coupled together via the gearing provisions **136** diagrammatically illustrated in FIG. 8. An input applied to the second input shaft **134** from the motor **135** is applied to the output shaft **130** in addition to the rotation imparted thereto by the input shaft **132**. Thus, the rotational output speed at shaft **130** will be increased or decreased by the application of a further input at the shaft **134**, dependent upon the direction of rotational input at **134**.

FIG. 8 further shows the utilization of control provisions, similar to those shown in FIG. 6 as discussed hereinabove, suitable for controlling the input applied to the secondary input shaft **134** of the speed differential unit **131**. A pair of supply lines L1' and L2' are connected to suitably chosen supply provisions by a mains supply switch MS' and a source T_1' is connected across the lines L1', L2' to provide an input to the motor **135** via a pair of relay uontrolled contacts CR_1' to impart rotation to the input shaft **134** upon a determination that an increased tension level is required of the cover web **15'**. The photocell light source combination of the scanner or monitoring means **90'** is essentially similar to those provisions as discussed in relation to FIG. 6 and the amplifier **113'**, amplifier relay contacts **114'**, circuit relay CR' and the switches **111'**, **112'** and **117'** are also similar to the similarly referenced provisions of FIG. 6. The cam actuated switch **111'** is cyclically driven from a cam of the type shown in FIG. 1 at **108** and interception of the light beam provided by the light source **91'** by the registering mark **107'** prior to the closure of the cam actuated switch **111'** effects closure of the amplifier relay contacts **115'** to energize the relay CR', whereupon the motor **135** will be energized via the relay contacts CR_1'.

Where as in FIG. 8, the secondary input to the differential unit **131** at **134** is unidirectional, the feed speed at rolls **123** and **124** provided normally by application of a sole input at **132** may be equal to or less than the feed speed at rolls **92'** and **93'** depending upon the degree of relaxation of the web prior to its entrance between the first feed rolls.

Additionally, it will be apparent the motor **135** may be normally driven in a first direction to provide a first feed speed at rolls **123** and **124** equal to or greater than the feed speed at rolls **92'** and **93'**, in which case reversing of the motor may be employed to decrease the feed speed at rolls **123** and **124**.

The switch **117'** is manually operable for use in setting up automatic registration control and the cam actuated switch **112'** is driven from a cam of the nature of the cam **109** shown in FIG. 1 to re-set the amplifier relay contacts **115'** preceding the beginning of each machine cycle.

Once again, the cover web **15'** is, preferably, "printed short" and the feed roll **92'** may be driven in synchronism with and at the same speed as the speed imparted to the joined web via the machine-included web advance mechanism. Tensioning of the cover web **15'** is imparted to the web in the portion of the web intermediate the feed means including the feed rolls **92'** and **123**. A feed speed imparted to the feed roll **123** which is equal to or slightly greater than the feed speed of the driven roll **92'** will result in a moving forward of the web borne markings away from registration with the pockets in the associated pocketed web. As the cover web markings creep forward with respect to the associated pockets, a point will be reached wherein the cutting of the beam from the light source **91'** by one of the marks **107'** will effect energization of the motor **135** to decrease the speed of the feed roll **123** driven from the output of the differential gear box. Thus, a tensioning will be applied to the cover web **15'** at a higher level, increasing the markings provided thereon to a spacing greater than the spacing of the associated pockets and the markings applied to the pockets will gradually tend toward perfect registration.

The methods of providing web registration and the structures and structural relationships employed in such methods as disclosed herein represent preferred forms of the invention, however, it will be readily apparent that variations may be made in the structures set forth without departure from the scope and spirit of the invention as defined by the appended claims.

I claim:

1. In a machine for forming filled packages from a filled pocket containing web having spaced pockets along the legnth thereof, web advance means for step-by-step advancing a first web having spaced pockets formed along the length thereof, means for applying to said web a cover web having thereon repeated marking patterns along the length thereof for registration with the pockets, the patterns being spaced apart less than the spacing apart of the pockets, means for applying tension to said cover web to increase the spacing of said patterns to a spacing greater than the spacing of the pockets, tension controlling feed means for engaging the cover web prior to the application thereof to the first web for step-

by-step advancing the cover web in synchronism with the step-bystep advancing the cover web in synchronism with the step-by-step advancing of the first web to reduce abrupt tensioning of the cover web intermediate said feed means and the point of application thereof to said first web and drive means interconnecting said web advance means and said feed means for driving said feed means from and in synchronism with said advance means.

2. A machine according to claim 1 wherein said feed means comprises a pair of web feed rolls engaging the cover web in the nip therebetween at a location spaced from the point of application of the cover web to the first web, said rolls insulating the cover web at the point of application from abrupt inertial tension changes resulting from the step-by-step movement of the cover web.

3. A machine according to claim 1 wherein said drive means interconnecting said web advance and feed means comprises means for driving said feed means at substantially the same web-feed speed as the feed speed of said web advance means.

4. A machine according to claim 1 further comprising registration sensing control means responsive to the disposition of the patterns on the cover web with respect to the pockets of the first web for controlling said means for applying tension.

5. A machine according to claim 1 wherein said means for applying tension comprises second web feed means for engaging said cover web at a location spaced from said tension controlling feed means, said drive means comprising speed differential drive means connected in driving relation to said tension controlling feed means and said second web feed means for providing differing web-feed speeds to both said tension controlling feed means and said second web feed means to increase and decrease the tension on the cover web.

6. A machine according to claim 5 wherein said speed differential drive means comprises input means, means interconnecting said input means, said web advance means and said tension control feed means, output means connected to said second web feed means for driving said second web feed means and means for varying the output speed of said output means.

7. A machine according to claim 6 further comprising registration sensing control means responsive to the disposition of the patterns on the cover web with respect to the pockets of the first web for controlling said means for varying the output speed of said output means of the speed differential drive means.

8. In a machine for forming filled packages from a first filled pocket containing web having spaced pockets along the length thereof and a cover web having thereon repeated markings to be registered with the pockets, web advancing means for step-by-step advancing said first and cover webs in a continual series of abrupt movement, means for applying said cover web to said first web, means for applying tension to said cover web to stretch said cover web to provide spacing of the repeated markings thereon at least as great as the spacing of the filled pockets of said web, tension controlling feed roll means for engaging said cover web in feeding relation at a location preceding the application of said cover web to said first web and drive means interconnecting said web advancing means and said feed roll means for driving said feed roll means in step-by-step synchronism with said web advancing means, said advancing means and feed roll means being spaced apart along the length of said cover web for driving said cover web at substantially equal feed speeds to reduce inertial tenison changes in the cover web portion extending between said advancing means and said feed roll means.

9. A machine according to claim 8 wherein said means for applying tension comprises electrically controlled magnetic brake means engaging said cover web preceding the engagement of said cover web with said feed roll means.

10. A machine according to claim 9 wherein said means for applying tension further comprises mark sensing means electrically connecting to said brake means for controlling said brake means in response to the relative disposition of the cover web markings with the filled pocket containing portions of the first web.

11. In a machine for forming filled packages from a first filled pocket containing web having spaced pockets along the length thereof and a cover web having thereon repeated markings to be registered with the portions, web advance means for step-by-step advancing said first and cover webs in a continual series of abrupt movements, means for applying said cover web to said first web, means for applying tension to said cover web to provide spacing of the repeated markings thereon at least as great as the spacing of the portions of said first web, tension controlling first feed roll means for engaging said cover web in feeding relation at a location preceding the application of said cover web to said first web, drive means interconnecting said web advance means and said first feed roll means for driving said feed roll means, said means for applying tension comprising second feed roll means for feeding said web at a location spaced from said first feed roll means, and speed differential drive means interconnecting said first and second feed roll means for controlling differences in the feed speed of said first and second feed roll means to vary the tension in said cover web intermediate said first and second feed roll means.

12. A machine according to claim 11 wherein said speed differential drive means comprises an input shaft driven from said web advance means, an output shaft in driving connection with said second feed roll means and means for varying the output speed of said output shaft.

13. A machine according to claim 12 wherein said first feed roll means is driven from said web advance means for feeding said cover web in synchronism and at the same speed at said web advance means, said means for varying the speed of the speed differential means output shaft comprising means for decreasing the feed speed of said second feed roll means to a feed speed lesser than the feed speed of said first feed roll means to increase tension on said cover web intermediate said first and second feed roll means.

14. The machine according to claim 13 wherein said means for varying the output speed has electrically connected thereto mark sensing means for controlling the feed speed of said second feed roll means in response to the relative disposition of the cover web markings with the fill accommodating portions of said first web.

15. The method of registering cover web markings with filled pockets of a further web during the joining together of the webs in a package producing process comprising the steps of advancing step-by-step the cover and further webs by the application of repeated abrupt forces thereto at a first location, joining the webs, applying variable tension to the cover web and to stretch the cover web and increase the spacing between the markings thereon, continually feeding the cover web in synchronism with the step of advancing and at a further location removed from the first location in a direction opposite the direction of web advance and said step of feeding comprises imparting a web feed speed to the cover web at the further location substantially equal to the feed speed provided by said step of advancing step-by-step to reduce inertial tension changes in the web intermediate the first and second locations.

16. The method according to claim 15 wherein said step of feeding comprises providing a cover web feed roll, engaging the roll with the web at the further location and driving the roll step-by-step in synchronism with and at substantially the same feed speed as the step of advancing.

17. The method according to claim 16 wherein the

step of tensioning comprises applying a braking force to the cover web prior to the joining of the webs.

18. The method according to claim **17** further comprising the step of monitoring the position of the markings on the cover web with respect to the positions of the pockets of the further web and altering the tensioning applied in said step of tensioning to effect registrations of the markings and the fill portions.

19. The method according to claim **15** comprising the additional step of feeding the cover web at a third location and varying the feed speed applied at the third location to provide variations in web tension intermediate the third and further locations.

20. The method according to claim **19** wherein the step of feeding the cover web at the further and third locations each comprise providing a feed roll, engaging the feed roll with the cover web at the further and third locations, said step of applying variable tension comprising driving the feed rolls at differing speeds to apply tension to the cover web intermediate the feed rolls.

21. The method according to claim **20** further comprising the step of monitoring the position of the markings on the cover web with respect to the positions of the fill portions of the further web and altering the feed

speed of the feed roll at the third location to alter the tensioning applied in said step of tensioning to effect registration of the markings and the pockets.

References Cited

UNITED STATES PATENTS

3,411,767	11/1968	Moser	93—35(PCO)
Re. 25,736	3/1965	Willbrandt	53—51
2,214,593	9/1940	Mustin (sheet 1)	53—51X
3,238,691	3/1966	Miller	53—3
3,267,639	8/1966	Ollier (sheet 1)	53—51
3,276,183	10/1966	Carlisle	53—51
3,294,301	12/1966	Richter	53—51X
3,405,501	10/1968	Edelberg	53—64X
3,427,778	2/1969	McCluskey	53—3
3,453,799	7/1969	Cloud (last page)	53—51X

WAYNE A. MORSE, JR., Primary Examiner

U.S. Cl. X.R.

53—51, 64, 329; 93—35