

May 7, 1940.

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2,199,708

METHOD OF AND APPARATUS FOR FEEDING WEB MATERIAL

Filed May 4, 1938

7 Sheets-Sheet 1

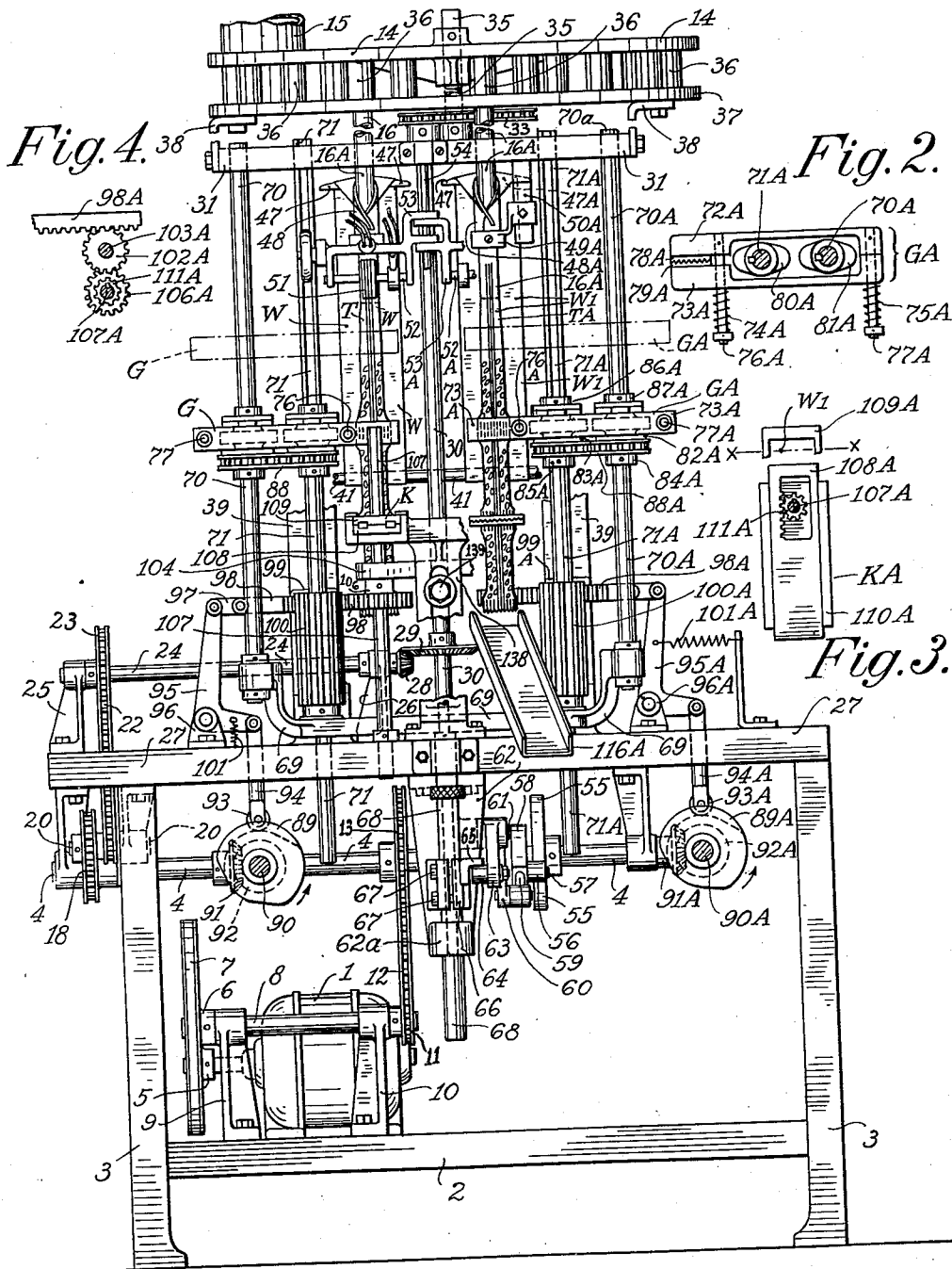


Fig. 1.

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Fig. 5.

Fig. 6.

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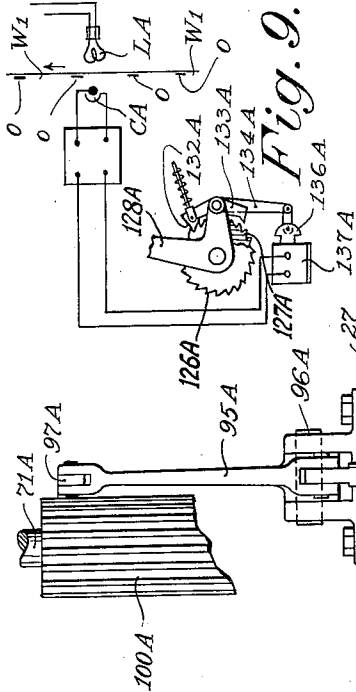


Fig. 9.

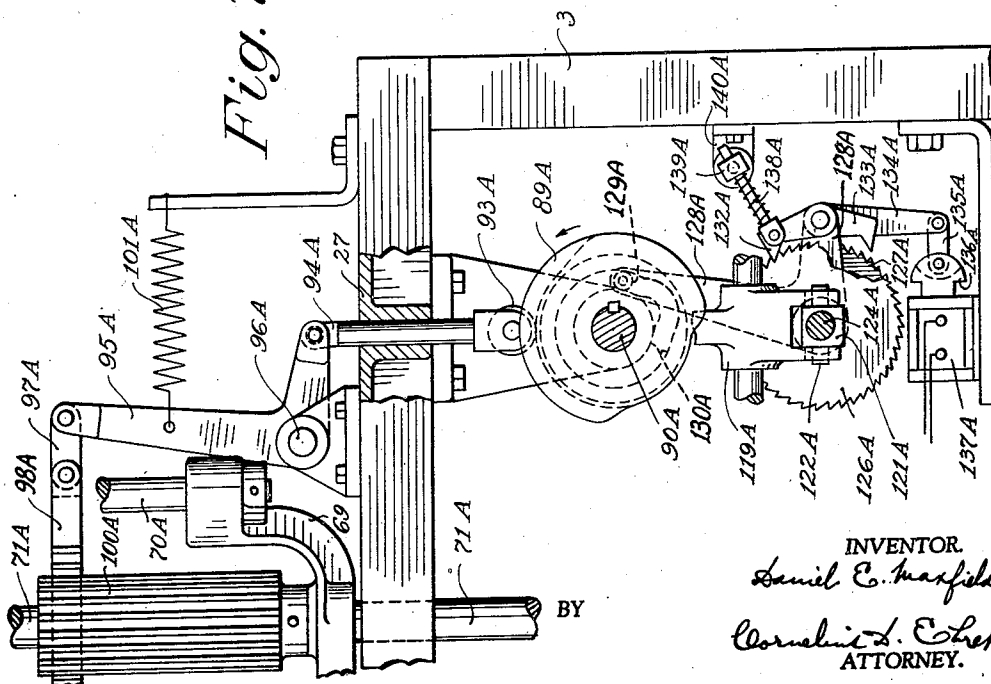


Fig. 8.

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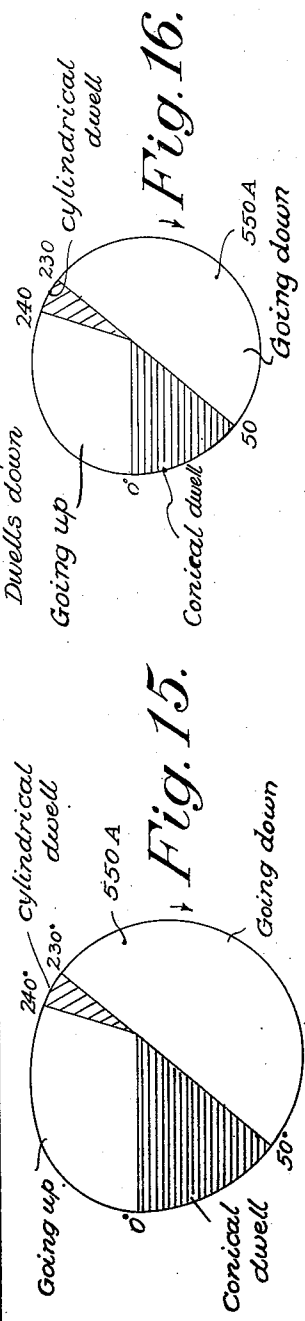
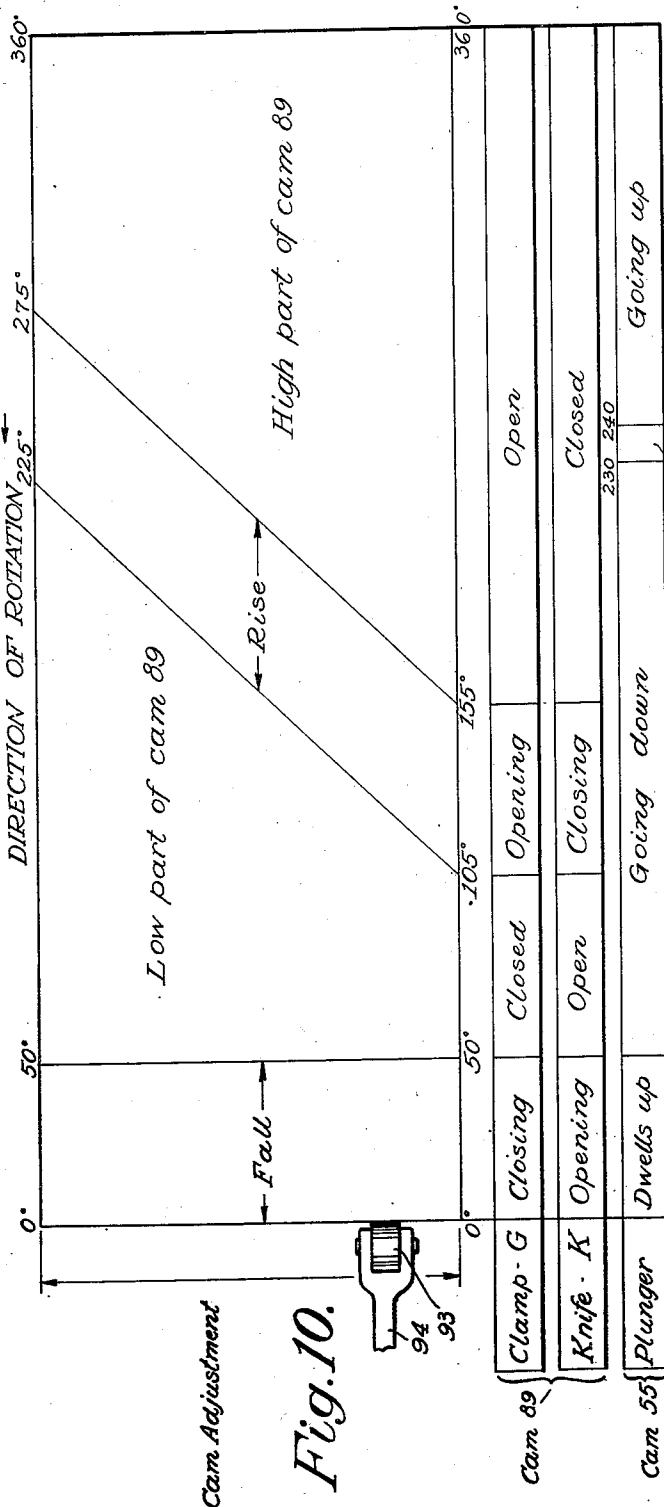
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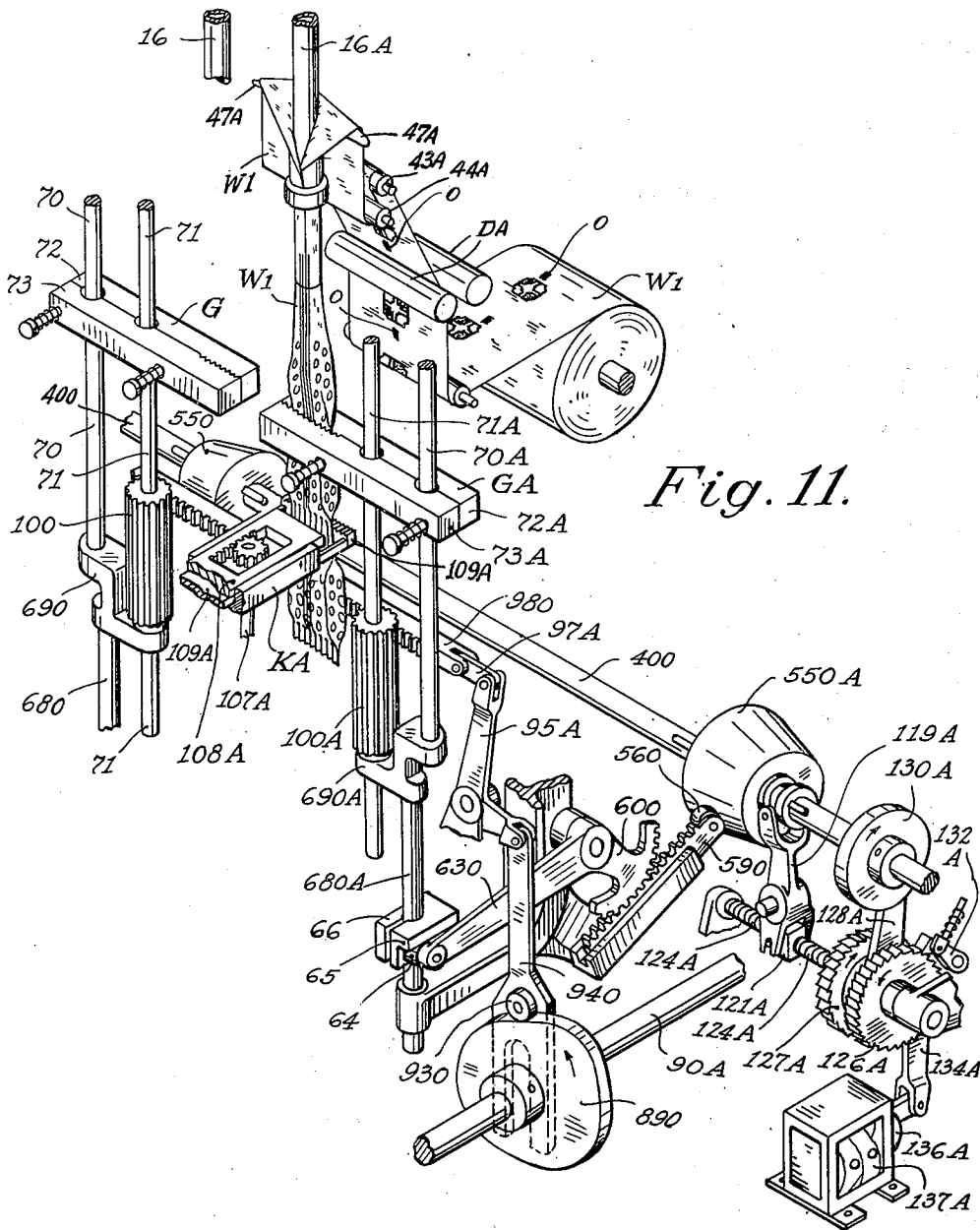


Fig. 11.

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Fig. 14.

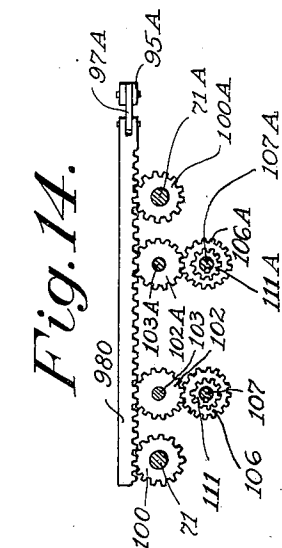


Fig. 12.

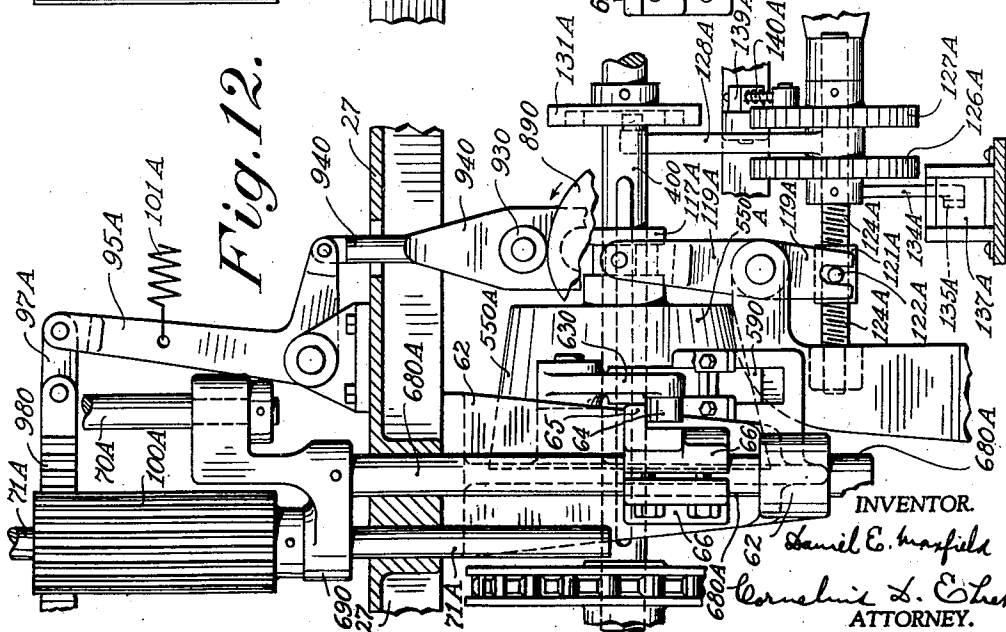
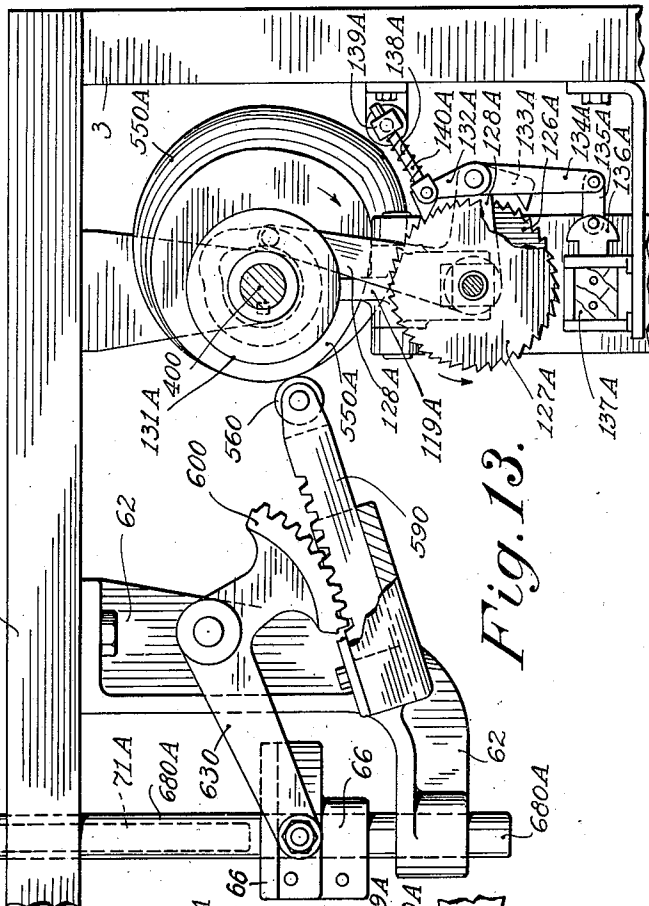


Fig. 13.



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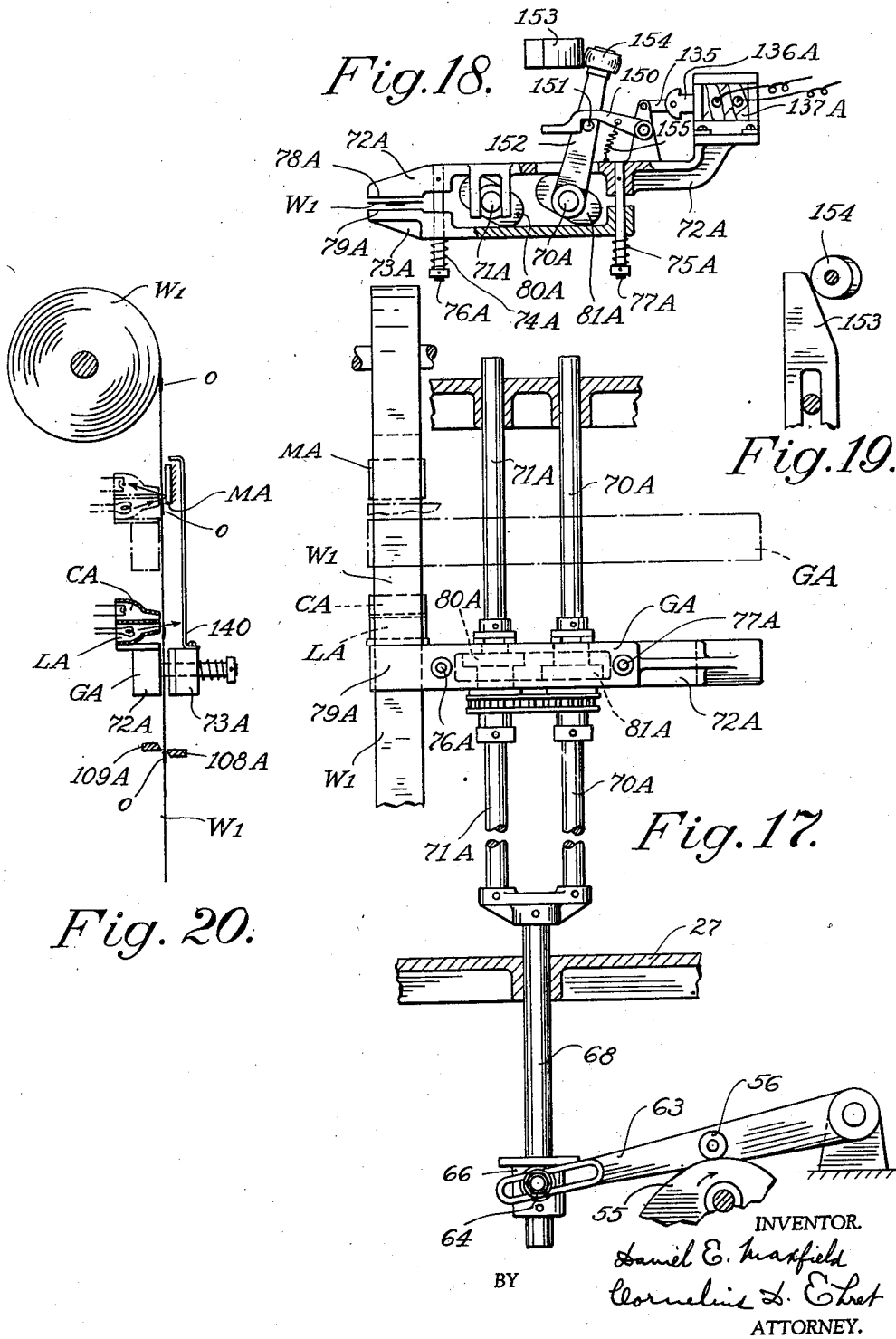
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METHOD OF AND APPARATUS FOR FEEDING WEB MATERIAL

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UNITED STATES PATENT OFFICE

2,199,708

METHOD OF AND APPARATUS FOR FEEDING
WEB MATERIALDaniel E. Maxfield, Philadelphia, Pa., assignor to
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Application May 4, 1938, Serial No. 205,937

16 Claims. (Cl. 164—48)

My invention relates to methods of and apparatus for feeding web material which is formed and severed to constitute packages, containers or the like, or wrappers, labels, or the like.

5 In accordance with my invention control elements are regularly and substantially equally spaced longitudinally of the web, and the feeding of the web is adjusted or controlled, not in accord with nor in response to the spacing between
10 any particular control elements on the web, nor in accord with the arrival of any particular control element at any particular position, but by adjusting the effective length of linear feed of the web by a series of very small and preferably
15 equal increments or decrements of predetermined magnitude so that the operation of registry or positioning of the web is characterized by web-feeding movements either increasing or decreasing in length, but nevertheless each increment
20 or decrement does not, except by occasional coincidence, precisely correct the web-feeding movement but does always correct the movement in the right direction, shortening it when it is too long and lengthening it when too short, all the
25 time hunting the average spacing of the control elements on the web; to obtain substantially similar location on the containers of printing, decorations, or the like, generically termed "designs", recurrently appearing on the web material.

30 In accordance with one form of my invention, exemplified by Figs. 1-10, the extent to which the web is advanced for different feeding movements thereof is varied, in accordance with responses of the detector, by changing the time of release of the web during the forward or feeding
35 strokes of a web-engaging clamp or gripper having a constant length of stroke; in another form of my invention, exemplified by Figs. 11-16, the extent of feed of the web for successive feeding movements is changed by varying the length of stroke of web-clamping mechanism without
40 change in timing of the web-engaging gripper or equivalent; in still another form of my invention, exemplified by Figs. 17-20, the extent of forward or effective feed of the web is predetermined by controlling the time of closure upon the web of the gripper mechanism during each
45 return stroke thereof.

My invention further resides in the methods and in the features of construction and arrangement hereinafter described and claimed.

50 For an understanding of my invention and for illustration of various embodiments thereof, reference is to be had to the accompanying drawings in which:

55 Fig. 1 is a front elevational view of a packaging machine with parts omitted and parts broken away;

60 Fig. 2 is a plan view of web-clamping mechanism shown in Fig. 1;

Fig. 3 is a plan view of web-severing mechanism shown in Fig. 5 and corresponding with a similar mechanism shown in Fig. 1;

Fig. 4 is a plan view of parts appearing in Fig. 5 and corresponding with similar parts shown in Fig. 1;

Fig. 5 is an end elevational view of the packaging machine of Fig. 1 with parts omitted and parts broken away;

Fig. 5a is a face view, on enlarged scale, of one of the webs shown in Fig. 1;

Fig. 6 is a detail view of a modification of parts shown in Figs. 1 and 5;

Fig. 7 is a front elevational view, on enlarged scale, of adjustable control means for mechanisms of Figs. 2 and 3;

Fig. 8 is an end elevational view of parts appearing in Fig. 7;

Fig. 9 diagrammatically illustrates an electric circuit for control of mechanism shown in Figs. 7 and 8;

Fig. 10 is a timing chart referred to in explanation of the operation of the mechanism of Figs. 7 and 8;

Fig. 11 in perspective discloses the significant elements of a modification of the packaging machine of Fig. 1;

Fig. 12 is a front elevational view on enlarged scale of parts appearing in Fig. 11;

Fig. 13 is an end elevational view of parts appearing in Fig. 12;

Fig. 14 is a plan view of parts appearing in Fig. 11;

Figs. 15 and 16 are diagrams referred to in explanation of the construction of cam means shown in Figs. 12 and 13;

Fig. 17 is a front elevational view of significant elements of still another modification of the packaging machine of Fig. 1;

Fig. 18 is a plan view, partly in section, of web-engaging mechanism of Fig. 17;

Fig. 19 is a front elevational view of parts appearing in Fig. 18; and

Fig. 20 is an end elevational view of parts appearing in Fig. 17.

Referring to Figs. 1 and 5, the packaging machine there disclosed is suited to join the margins of webs of material thus to form tubes, each of which is transversely flattened and sealed at intervals longitudinally of the tube to form packages each of which is filled while still attached to the web, and is thereafter detached from the web by severance of the web material through a sealing section joining adjacent packages. In general, the machine is of the type disclosed in United States Zwayer Patent #1,986,422.

Referring to Figs. 1 and 5, the motor 1, mounted upon the shelf 2 extending between the legs 3 of the machine, drives the main shaft 4 through pulley 5 on the motor shaft, belt 6 which passes 60

over pulley 5 and the pulley 7 on the jack shaft 8, supported as by brackets 9, 10 from shelf 2, and sprocket 11, on shaft 8, connected by a chain 12 to the sprocket 13 on shaft 4. The turret 14 at the top of the machine which, by means of measuring tubes 36, feeds the material with which the packages are to be filled from the hopper or supply duct 15 to the filling tubes 16 and 16A, is continuously driven from shaft 4 by the train of mechanism comprising sprocket 17 on shaft 4, chain 18, sprocket 19 on jack shaft 20, sprocket 21 on shaft 20, chain 22, sprocket 23 on shaft 24 supported, as by brackets 25, 26 from the frame member 27 of the machine, pinion 28, on shaft 24, which engages the bevel gear 29 on the vertical shaft 30 which extends through and beyond the frame member 31 and to whose upper end is secured the sprocket 32 connected by chain 33 to sprocket 34 on shaft 35 to which is secured the turret head or plate 14.

From the under side of the turret plate 14 there extend a plurality of cylinders or measuring tubes 36 each in register with openings through plate 14 to receive a charge of material as it passes beneath the open end of the stationary supply hopper 15 or equivalent. The plate 37, suitably secured as by brackets 38 to the frame member 31 of the machine, serves to close the open bottoms of the cylinders 36 as they revolve with the turret head 14 except when each, in turn, passes over openings in plate 37 which are in register with the filling tubes 16 or 16A.

During each cycle of the package-forming mechanism hereinafter described, a pair of tubes 36 pass over and discharge their contents into the filling tubes, and thereafter pass beneath the hopper 15 for refilling.

From the rear of the upright frame members 39 of the machine there extend the U-shaped bearing members 40 for receiving a bar or rod 41 which supports the rolls or reels R, R1 of packaging material, which, for purposes of explanation, is assumed to be moisture-proof Cellophane, Pliofilm, or other material consisting of, impregnated with, or otherwise surfaced with a material which is adhesive or plastic when subjected to heat.

The web W1 from roll R1, Fig. 5, is threaded through the machine to pass beneath the idler bar or roll 42, thence upwardly between the elements of a registration-detector DA, hereinafter more fully described, thence over and under the tensioning rolls 43A, 44A on the spring-biased arm 45A (biasing spring not shown) pivotally mounted upon the extension 46A of frame member 39, and then upwardly and over the spreader 47A. Beyond the spreader web W1 is formed into a tube TA about the filling tube 16A by the forming tool 48A attached to the bracket 49A which is adjustably secured to the bar 50A (Fig. 1) extending downwardly from the frame member 31.

The web W from the other roll R of packaging material is similarly threaded through the machine and is formed into a tube T about the filling tube 16; the elements for guiding and forming web W are identified in Fig. 1 by the same reference characters, but with omission of the suffix "A", utilized to identify the corresponding elements associated with web W1.

The forming tools 48, 48A, which may be of construction more clearly shown in the aforesaid Zwoyer Patent #1,986,422, each shapes the associated web into the form of a tube and also effects overlap of the web margins at the front

of the filling tubes 16, 16A. The margins of each web are joined by application of heat and pressure to form a closed tube; specifically, the overlapping margins of web W are pressed together by the roll 51 in the core of which are disposed several turns of wire electrically heated so as to raise roll 51 to temperature sufficient to soften the thermo-plastic or adhesive material of the overlapping web margins and so effect their union.

The roll 51A, Fig. 5, similarly operates upon the margins of the web W1 to form a closed or circumferentially continuous tube of web material about the filling tube 16A. The sealing rolls 51, 51A are respectively mounted upon shafts 52, 52A individually supported by the frames 53, 53A pivotally mounted for angular movement in a horizontal plane upon the rod 54 extending downwardly from the frame member 31 of the machine.

During each cycle of the machine, the webs W, W1 are individually flattened below the lower ends of their respective filling tubes, and are drawn downwardly, by heated clamping tools G, GA which seal the tubes of web material transversely thus to form containers closed at their lower ends but whose upper ends are open and in communication with the filling tubes 16, 16A for filling purposes. The feeding movement of each web also brings a previously formed package beyond a knife mechanism, hereinafter described, which cuts the web to detach a filled and sealed package from the web material. A brake member, such as pivoted member B, Fig. 5, prevents the inertia of each roll of web material from producing slack in the web material fed therefrom.

Because the mechanisms for feeding the webs W, W1 and for severing them to form individual packages are substantially identical, it is necessary specifically to describe only the mechanism for feeding and cutting one of the webs; the corresponding elements of the feeding and cutting mechanisms for the two webs will be identified by the same reference characters but the mechanism associated with the web W1 will have added thereto the suffix A.

Upon the main shaft 4 is mounted the cam 55 which effects reciprocation of the web-grippers G, GA downwardly from and back to their broken line positions indicated in Fig. 1. The periphery of cam 55 is engaged by the roller 56 on pin 57 which extends from the yoke member 58 whose forked end straddles shaft 4 and which is connected by bar 59 to one arm 60 of a bell crank lever pivoted at 61 to bracket 62 secured to the under side of the frame member 27. The other arm 63 of the bell crank lever is slotted adjustably to receive the supporting stud for a roller 64 which engages the under side of the horizontal extension 65 of member 66 adjustably secured as by the bolts 67 to the plunger 68 whose lower end passes through the bearing 62a afforded by bracket 62, and whose upper end passes beyond the top of the table or frame member 27. Attached to or integral with the upper end of the plunger 68 is a cross arm 69 whose opposite ends provide bearings for the lower ends of the shafts 70, 70A which extend through the web-gripping devices G, GA. The shafts 71, 71A extending parallel to and closely adjacent the shafts 70, 70A respectively pass through the cross member 69 and the top 27 of the machine frame; the upper ends of the shafts 70, 71 and 70A, 71A pass

through and are guided by the frame member 31 below the feeding turret 14 of the machine.

As more clearly appears in Fig. 2, the shafts 71A, 78A pass between the two halves of the web-gripper device GA. The two gripper members 72A, 73A are biased toward each other by the springs 74A, 75A which respectively encircle the pins 76A, 77A extending through member 73A and attached to member 72A. When the shafts 78A and 71A are in the angular position shown in Fig. 2, the springs 74A, 75A are effective to hold the corrugated, web-engaging jaws 78A, 79A in clamping engagement with web W1. The jaws 78A, 79A are heated, preferably electrically, as in aforesaid Zwoyer patent, to soften the thermoplastic or adhesive surface of the web and so form, during their clamping engagement with the tube TA, a flattened sealing section extending transversely thereof.

When the shafts 70A and 71A are concurrently moved in the same direction through a substantial angle, as hereinafter described, the cam members 80A, 81A secured respectively to shafts 70A and 71A effect separation of the gripper jaws and so release the web or tube TA.

The under surface of gripper members 72A, 73A engage the spacer members 82A, 83A supported respectively by the sprockets 84A, 85A on the shafts 70A, 71A. The upper surfaces of the gripper members are engaged by the flanged members 86A, 87A suitably secured to shafts 71A and 70A. The sprockets 85A and 84A are connected by chain 88A to effect rotation of the shafts in unison when one of them is actuated as hereinafter described.

The shafts 70 and 71 support the similar web-clamping device G whose jaws are moved toward and from web-clamping position by angular movements of the shafts 70, 71.

During rotation of shaft 4 the cam 55 effects reciprocation of the cross member 69 to effect vertical reciprocation of the two web-clamping devices G, GA. Substantially at the top of the stroke of the cross member 69, the shafts 71 and 71A are rotated as hereinafter described to effect closure of the jaws of the two grippers G, GA so that during their downward movement both webs are pulled downwardly with respect to their associated filling tubes 16, 16A. The flattening and sealing action of grippers G, GA completes the sealing of a pair of filled containers and seals the bottom of a pair of containers whose upper ends are open for filling through tubes 16, 16A.

Before the cross arm 69 reaches the bottom of its stroke, the web-feeding devices G, GA are individually controlled, as hereinafter described, to release the webs W, W1.

The length of the stroke of the cross member 69 and the parts movable therewith is adjustable to suit the machine for making packages of different lengths. Referring to Fig. 5, when the roll 64 is clamped near the outer end of the slot in the oscillatory arm 63, the vertical stroke of the cross member 69 which carries the grippers G, GA is substantially longer than when the adjusted position of roller 64 on the slotted arm 63 is nearer the pivot 61. With the arrangement shown in Fig. 5, a change in position of roller 64 with respect to the axis of rotation of the lever arm 63 not only changes the length of the stroke of member 69 but also affects its position at the bottom of its stroke; the shorter the stroke, the higher the lowermost position of cross-arm 69 unless member 66 on plunger 68 is readjusted. By recourse to the construction

shown in Fig. 6, the length of stroke may be varied to suit different lengths of the package without change of the position of the cross arm 69 at the bottom of its stroke. The advantage of the modification will become more apparent after subsequent description of the severance of the webs to detach packages therefrom.

In the construction shown in Fig. 6, the slot 63b, instead of being radial like the slot 63A, Fig. 5, is substantially parallel to the end face of the member 65 when plunger 68 is at the bottom of its stroke; therefore, adjustment of roller 64 to various positions along slot 63b to obtain various lengths of stroke of the plunger 68 does not change the lowermost position of the plunger or of the grippers G, GA movable therewith.

The opening and closing movements of the gripper mechanism G are controlled by barrel cam 89, Fig. 1, rotatable with shaft 90 driven from main shaft 4 of the machine by the bevel gears 91, 92 secured, respectively, to shaft 4 and shaft 90. The periphery of cam 89 continuously engages the roller 93 at the lower end of the vertically reciprocable member 94 whose upper end is pivoted to one arm of a bell-crank lever 95 supported by bracket 96 on the upper surface of the table member 27 of the machine. The other arm of the bell-crank lever is connected by link 97 to the rack member 98 slidable within a guide member 99 attached to or integral with the frame member 39 of the machine. The rack 98 is continuously in mesh with the elongated gear 100 attached to shaft 71. Throughout the vertical reciprocation of the gripper frame 69, the gear 100 remains in engagement with the rack in order that cam 89 may effect opening and closing of the gripper jaws at desired times in a cycle of reciprocation of the gripper.

Similarly, the cam 89A through the bell-crank lever 95A and rack 98A effects rotation of gear 100A at different times in the cycle of rotation of gripper frame 69 to effect opening and closing movements of the gripper GA.

The bell-crank levers 95, 95A are biased, as by the springs 101, 101A, to maintain engagement of the cam followers 93, 93A with cams 89, 89A respectively.

The motion of the racks 98, 98A is also utilized to effect operation of the knife mechanisms K, KA which sever the completed packages from the webbing; rack 98A, in addition to maintaining continuous engagement with gear 100A on the reciprocable gripper frame, is continuously in mesh with gear 102A, Fig. 4, on shaft 103A, whose upper end is received by a bearing in the extension 104, Fig. 5, of the standard 105 which is suitably attached to the top of frame member 27 near the front of the machine. Gear 102A is continuously in engagement with gear 106A on shaft 107A extending parallel to shaft 103A and whose lower end is received by a bearing in the frame member 27. Above gear 106A, Fig. 5, shaft 107A extends through the standard extension 104 and through the web-cutting mechanism KA which comprises two knives 108A and 109A guided for reciprocation in a horizontal plane by the structure 110A. The gear 111A on shaft 107A engages a rack integral or attached to the upper blade 108A and gear 112A, also on shaft 107A, engages a rack on the opposite side of the lower blade 109A. Therefore, for rotation of the shaft 107A in one direction the upper and lower knives move toward each other to sever web W1 and for reverse rotation of shaft 107A the knives move from their web-severing position. As more

clearly appears in Fig. 3, the web W1 passes downwardly through an aperture defined by the cutting or shearing edge at the forward end of the lower blade 108A and the cutting or shearing edge of the upper blade 109A. Consequently, as shaft 107A, Fig. 3, rotates in clockwise direction, both blades move toward the "cutting line" X—X, Fig. 3, to sever the web W1. The mechanism for cutting the web W is similar and the corresponding parts are identified by the same reference characters with omission of the suffix A.

The two cutting heads K and KA are carried by a common member 138 adjustably secured to the standard 105 as by the bolt 139 which extends through an elongated slot in member 138. As indicated in Fig. 5, the cutting heads are adjustable in unison by the hand-wheel 113 at the lower end of a threaded shaft 114 which extends through the stationary frame member 27 and is threadably received by the extension 115 of the support 138 for the two cutting heads.

Provision for vertical adjustment of the cutting heads is not necessary when there is utilized the modified arrangement shown in Fig. 6, which, as previously explained, insures that the frame 69 always has a definite lower position regardless of the adjustment of roller 64 to procure different lengths of package by adjustment of the stroke of frame 69.

As thus far described, the cams 55, 89 and 89A make one revolution per cycle of the machine; the cam 55 effects, during one revolution thereof, one upward and downward stroke of the gripper frame 69; and during one revolution of cams 89, 89A, the grippers are opened and closed, and the knives are closed and opened. As hereinafter more fully described, the webs W and W1 are fed during the downward movement of the gripper frame 69, and at or somewhat before the end of the downward movement of the grippers their jaws are opened to release the webs and the knives sever the webs to detach completed packages which are discharged from the machine by chutes 116, 116A.

The webs W and W1 are often provided with recurrent printing or decorative matter which it is desired shall appear in the individual packages at a definite position similar for all of packages. For various reasons, such as the effect of atmospheric conditions upon the web material during the printing or while in the packaging machine, it is ordinarily not possible to attain exact or substantially exact registration of the printing or decorative matter, exemplified in Fig. 5A, as appearing upon the individual packages, by forming or cutting all packages to exactly the same length.

In the packaging machine shown in Figs. 1-9, there are provided detectors D, DA for inspecting the registration of the printed matter or design on the webs and for advancing or retarding the gripper opening and web-severing operations effected in the next cycle of the machine, thus to correct for inaccuracies of register of the recurrent designs or equivalent as they appear on the web and so avoid cumulation of variations in the spacing between the designs.

In Figs. 7 and 8 there is disclosed a control mechanism responsive to detector DA for shifting the timing of the gripper GA and of the cutting mechanism KA in the cycle of reciprocation of plunger 68; it is to be understood a similar mechanism is utilized to vary the timing of the gripper G and web-severing mechanism K in accordance with the response of a registra-

tion detector D (not shown). The cam 89A is slidably keyed to shaft 90A, Figs. 7 and 8, and is provided with a grooved collar 117A for receiving rollers carried by the yoke 118A at the upper end of arm 119A pivoted intermediate its ends on the bracket 120A attached to the frame of the machine. The lower forked ends 121A of the lever 119A embrace pins 122A extending from the member 123A threadably received by the shaft 124A whose ends are supported respectively by aforesaid bracket 120A and bracket 125A. To shaft 124A are attached the spaced ratchet members 126A, 127A. The bell-crank lever 128A mounted upon shaft 124A for angular reciprocation with respect thereto is provided at its upper end with a roller 129A for engaging the groove 130A of cam member 131A secured to shaft 90. The cam groove is so cut and the cam is so positioned on shaft 90A that while the web-feeding plunger 68 is at rest, and therefore while the webs W and W1 are stationary, the bell-crank lever 128A is swung toward and from the position shown in Fig. 7 to effect rotation of shaft 124A in one direction or the other by engagement of one or the other of pawls 132A, 133A, carried by the lower arm of the bell-crank lever 128A with ratchet 126A or ratchet 127A. The arm 134A, secured to the same shaft to which the pawls 132A and 133A are attached, is connected at its lower end, as by link 135A, to the core or armature 136A of a solenoid or equivalent electromagnetic device 137A. The spring 138A compressed between the pawl 132A and the block 139A rotatably mounted in the stationary support 140A biases the pawl 132A into engagement with the ratchet 127A, and concurrently biases the pawl 133A out of engagement with ratchet 127A; therefore, if solenoid 137A is not energized during the aforesaid to and fro movement of the bell-crank lever 128A, the shaft 124A is moved in counterclockwise direction, Fig. 7, during the return stroke of the bell-crank lever to the position of Fig. 7. If, on the other hand, the solenoid 137A is energized during the angular reciprocation of the bell-crank lever, the pawl 133A is pulled by core 136A to engage the ratchet 127A, and during the forward stroke of the bell-crank lever from the position of Fig. 7 effects rotation of the shaft 124A in clockwise direction, Fig. 7.

Upon each of the webs W, W1 is a series of opaque spots or marks O each having the same position with respect to printed or other matter on the web which is to appear in the packages successively cut therefrom; the spacing between adjacent spots, therefore, corresponds to the nominal average length of the packages to be cut from that web. The marks or control elements O may be part of the designs or printing on the web or they may be in addition thereto and, in any event, they possess a distinguishing characteristic suited for the selected type of detector; in the particular arrangements herein disclosed, the light transmission characteristic of the registration marks is different from that of adjacent web portions; for another type of detector, the control elements O may be of electrical conductivity different from that of adjacent web portions; for example, they may be dabs or strips of conductive substance or, less desirably, perforations in the web; in all modifications the detector observes the web while stationary.

Whether or not the solenoid 137A is energized or deenergized at that portion of each cycle of

the machine during which the bell-crank lever 128 is angularly reciprocated, depends upon the position of a registration mark or control element, specifically an opaque spot O, on the web W1 then stationary, with respect to a beam of light, or other radiation, emitted by the lamp LA, Fig. 9, or equivalent source of radiation, such as an electrically heated resistor, and directed toward a radiation responsive device CA such as a photo-cell, thermocouple, or the like. The photo-cell CA and lamp LA, Figs. 5 and 9, are preferably disposed in individual housings which are closed except for narrow slits in alignment with each other and between which the web W1 passes. The radiation may be concentrated by a suitable optical system comprising one or more mirrors or lenses. If the web W1 at the end of a feeding stroke comes to rest with an opaque spot O, in alignment with the slots or apertures in the two housings, the photo-cell does not receive radiation from the transmitter lamp LA or equivalent and, consequently, in the particular system disclosed, the solenoid 137A is not energized with the result the shaft 124A during oscillation of arm 128A is moved in counterclockwise direction to move cam 89A to the right with respect to the position shown in Fig. 8. Because of the shape of the cam, which is hereinafter described, the result of this change in position is to effect release of the web and severance thereof earlier than before in the next downward stroke of the gripper frame with the results that the package severed from the web is slightly shorter than the preceding package and that a succeeding opaque spot on the web may to greater or lesser extent intercept the path of the radiation from LA to CA. For every subsequent cycle of the machine, the time of release of the grippers will be still further advanced, still further reducing the distance between successively formed seals, until, when the web comes to rest at the end of a feeding stroke, the beam from the lamp LA is not obscured or is sufficiently less obscured by one of the series of registration marks or control elements O on the web. Thereupon the solenoid 137A is energized during the oscillation of the bell-crank lever 128A with the result that the shaft 124A is rotated in clockwise direction to move cam 89A to the left along shaft 90A and therefore effect release of the grippers and web-severing movement of the knives of cutting head KA later in the downward stroke of plunger 68 with the result the distance between successively formed seals is increased and the package cut in the subsequent cycle of the machine is slightly longer than before; and for every subsequent cycle of the machine, the time of release of the web by gripper GA is more and more retarded still further increasing the distance between successively formed seals until eventually, when the web is at rest at the end of a feeding stroke, an opaque spot O on the web again intercepts sufficient radiation from LA to CA to cause deenergization of the solenoid 137A.

For every cycle of the machine, each of the webs W, W1 is inspected by its respective registration detector D or DA and, in accordance with the position of a registration index or control element O on each web, it is predetermined whether in the next feeding stroke of the individual web, the time of release of the web from its feeding gripper and the time of operation of its individual severing means is made to occur earlier or later in the web-feeding stroke of plunger 68 in effect to shift the location of the con-

tainers formed by the sealing operations of the gripper mechanism with respect to the designs on the web between the seals. Thus the proper positioning of the designs on the containers is effected by control of the package-forming mechanism itself and not by any additional mechanism operating upon the web prior to package-forming operations thereon. Although both grippers G and G1 are carried by one and the same reciprocating frame 68, the extents to which the webs W and W1 are fed in any particular cycle of the machine may differ depending upon the prior responses of the detectors D, DA individual to the webs; for example, the response of detectors D and DA while the webs W and W1 are concurrently stationary may be such that in the next downward stroke of the gripper frame the extent of feed of web W is less than in the prior cycle, whereas the extent of feed of web W1 is greater than in the prior cycle, and, in all cases, the extent to which each of webs W, W1 is fed in a particular cycle of the machine is greater or less than the extent of feed in the prior cycle and in the subsequent cycle. The vertical distance from the cutting of each cutting head to the uppermost position of the associated gripper device remains constant for any given adjustment of cutting-head support 138.

In the particular packaging machine shown in Figs. 1-9, the cam 55 is so constructed that, as appears from the timing diagram, Fig. 10, the plunger 68 is at rest in its uppermost position from about zero degrees to about 50° of the machine cycle; consequently, during that part of the cycle the web-clamping devices G, GA, are at rest in their dotted line positions of Fig. 1. During that interval the cam followers 93, 93A ride from the high part of cams 89, 89A, respectively, allowing the springs 101, 101A, to move the racks 98, 98A to the right, Fig. 1, to effect rotation of shaft 70, 71, 70A and 71A, in such direction that the jaws of the clamping devices G, GA close upon the tubes T, TA of web material below the lower ends of the filling tube 16, 16A, thus, as previously described, to seal the upper ends of filled packages and concurrently to form and close the bottoms of containers about to be filled; this same movement of the racks 98, 98A, effects rotation of shafts 107, 107A, in direction to separate the knives of the two cutting heads K, KA, to permit the filled packages as yet unsevered from the web to pass between the knives during the subsequent downward movement of the web-feeding devices G, GA.

The downward movement of plunger 68 and therefore of the web-clamping devices G, GA, begins at about 50° of the machine cycle and continues to about 230° thereof; the length of the plunger stroke, and therefore the maximum possible extent of feed of the webs W, W1, depends upon the setting of the member 64, as previously described.

Each of the barrel cams 89, 89A, is so constructed that during the downward movement of the plunger 68 the cam followers 93, 93A rise from the low part of cams 89, 89A to the high part thereof to effect movement of the racks 98, 98A to the left, Fig. 1, thus individually to effect release of the webs W, W1 from the feeding devices G, GA; and substantially concurrently with release of each web the knife mechanism K or KA operated by the same rack which effects web release severs the web to detach therefrom a filled package. Although both webs W, W1 are concurrently clamped, the time at which each web is

released and severed during descent of the plunger 68 depends upon the response of the registration-detecting device associated with that particular web, as previously herein described. For example, and again referring to Fig. 10, when the responses of the registration detector D or DA have been such that the cam follower 93 is at the lower end of cam 89 as viewed in Fig. 10, or cam follower 93A near the right edge of cam 93A as viewed in Fig. 8, the cam follower 93 or 93A, as the case may be, meets the rise of the cam early in the downward stroke of the plunger, for example, at about 105° of the machine cycle, thus to effect release of the web and severance of the end package early in the downward movement of plunger 68. To take the other extreme condition, when the prior responses of the registration detector D or DA have been such that the cam follower 93 or 93A is near the other edge of the associated cam 89 or 89A—upper extent of cam adjustment, Fig. 10—the cam follower does not meet the rise of the cam until about 225° of the machine cycle, or just before the bottom limit of the downward stroke of the plunger 68. For intermediate positions of cams 89, 89A, the times of release of the grippers G, GA and of the operations of cutting mechanisms K, KA are correspondingly predetermined. Thus, the extent of feed of each of the webs W, W1, in a particular cycle of the machine, depends upon the positions of the cams 89, 89A with respect to cam followers 93, 93A which positions are subject to individual control by the registration detectors D, DA.

Reverting to Fig. 10, the plunger 68 remains at its lowermost position for a brief time, for example, from about 230° to 240° of the machine cycle, and then returns at accelerated rate to its uppermost position in from about 240° to 360° of the cycle. During the upward movement of the plunger, both sets of gripper jaws are open to clear the filled containers whose upper ends are to be closed by the next clamping movement of the jaws.

In each cycle of the machine two packages are filled and two packages are cut from the webs W, W1; although all packages cut from the webs are approximately of the same length, each package from each of the webs is slightly longer or shorter than the immediately preceding or immediately following package, and the length of a package cut from one web may be either shorter, longer or equal to the package severed from the other web in the same cycle of the machine.

In the modification of my invention shown in Figs. 11-14, packages are formed from two webs of packaging material by mechanism similar to that of Figs. 1-9 and for convenience and brevity the corresponding elements of both modifications are identified by the same reference characters. In the modification of Figs. 11-14, there are provided individual feeding plungers for each of the web clamping devices G, GA and the length of stroke of each of these feeding plungers is capable of being adjusted independently of the other in accordance with the response of its associated registration detector D or DA. Moreover, it is also characteristic of the modification of Figs. 11-14, unlike the modification of Figs. 1 to 9, that the time at which each web is clamped, the time at which it is released, and the time at which it is severed all remain the same in all cycles of the machine and are the same for both webs.

Referring to Fig. 11, the two racks 98, 98A of Fig. 1 are replaced by a single rack 980 which engages the gear 100 which controls the opening

and closing of the web-clamping device G and also engages gear 100A which controls the opening and closure of the gripper GA; the movements of the rack 980 are controlled by a single non-adjustable cam 890 which replaces the two adjustable cams 89 and 89A of Fig. 1. The periphery of the cam 890 is in continuous engagement with the cam follower 930 carried by arm 940 pivotally connected to the bell-crank lever 95A connected by link 97A to the aforesaid rack 980. The cam 890 is so cut that the jaws of the grippers G and GA close upon the respective webs W, W1 by movement ending at about 50° of the machine cycle and are concurrently opened near the bottom of the strokes of their respective plungers 680, 680A which, in the particular construction shown, are at rest at the bottom of their stroke from about 230° to about 240° of the machine cycle. The rack 980 is also in mesh with gears 102, 102A, Fig. 14, for operating the knives of the web-cutting heads K, KA, as in the modification of Figs. 1-9, so that concurrently with closing movement of the gripper jaws, both sets of knives open to avoid obstruction to the packages about to be fed therebetween, and so that concurrently with opening of the grippers G, GA, the two sets of knives in the heads K, KA, are concurrently operated to sever packages from the webs W, W1.

With the webs W, W1 are associated the individual registration detectors D, DA, similar to those described in connection with Figs. 1-9, each of which control the energization of an electromagnetic device such as solenoid 137A which determines which of the pawls 132A, 133A, is effective during an oscillation of the arm 128A which oscillation is timed to occur in each cycle of the machine while the webs are stationary. If solenoid 137A is energized during oscillation of arm 128A, the cam 550A is moved in one direction along shaft 400, and conversely if the solenoid 137A is not energized during oscillation of arm 128A, the barrel cam 550A is moved in opposite direction axially of its shaft. In like manner, the detector D controls the position of cam 550 longitudinally of shaft 400. The control of the positions of each of barrel cams 550 and 550A of Fig. 11, in accordance with the alignment or misalignment of successive opaque spots or control elements O on the webs W, W1, is effected by an arrangement identical with that shown in Figs. 7 and 8 and previously explained. In the modification of Figs. 11-14, the rotation or angular adjustment of shaft 124A is utilized to shift the position of cam 550A which, as will hereinafter appear, controls the stroke of the gripper GA, whereas, in the modification of Figs. 1-9 the angular adjustment of shaft 124A controls the setting of cam 89A to vary in a cycle of the machine the time of release of the jaws of the web-clamping mechanism GA.

Reverting to Figs. 11, 12 and 13, the periphery of cam 550A is engaged by the cam follower 560 carried by the rack member 590 which is in mesh with the gear sector 600 integral with or attached to the lever 630 to whose free end is connected the roller 64 for engagement with the under surface of the member 66 suitably secured to the feeding plunger 680A. For each revolution of cam 550A the plunger 680A makes one complete cycle of its vertical rectilinear reciprocation; therefore, for each revolution of the cam 550 the web-clamping device G moves to and from its lowermost position from which to the cutting plane of head KA the distance is fixed or predetermined. The length of the stroke of each of

the plungers 680, 680A depends, in the particular cycle of the machine, upon the axial adjustments of the cams 550, 550A. When cam 550A, for example, is moved to the right from its position shown in Fig. 11, the length of stroke of the plunger 680A, and therefore the feed of the web W1, is increased and conversely, when cam 550A is moved to the left of its position shown in Fig. 11, the stroke of plunger 680A is shortened to decrease the length of package cut from the web. Although both sets of grippers G and GA open and close at the same time in the cycle of the machine, the extent to which they feed their respective webs depends upon the settings of the cams 550, 550A. The length of stroke of each of the plungers 680, 680A is always either increasing or decreasing, depending upon the responses of the associated registration detectors so to vary the distance between successively formed seals and thus shift the location of the containers formed by the sealing operations with respect to the designs between the seals. In the particular arrangement shown, the length of stroke of each of the plungers is progressively increased for successive cycles of the machine until the registration detector associated with the web observes an opaque spot O on the web while stationary at the end of a feeding stroke; thereupon, the length of stroke is incrementally decreased in the following cycles until, in a subsequent cycle, the registration detector is actuated by partial or complete absence of a control element to effect energization of the solenoid associated with stroke-controlling mechanism for that web, whereupon the length of stroke is again increased.

The construction of cams 550 and 550A is best understood from Figs. 12, 13, 15 and 16. Because these cams are identical in construction, only one of them, cam 550A, needs to be specifically described. Cam 550A throughout its length within the angle between 223° and 240°, corresponding to the bottom dwell of the plunger 680A, is of constant radius, thus insuring that regardless of the axial position of cam 550A the lowermost position of the gripper device GA is always the same; otherwise stated, that segment of the cam corresponding to the portion of the machine cycle between 230° and 240° is a segment of a cylinder. Within the angle between 0° and 50° of the machine cycle for which the plunger 680A is at rest in its uppermost position, the radius of cam 550A progressively decreases from the large end of the cam, Fig. 15, to the small end of the cam, Fig. 16, thus providing for different uppermost positions of gripper device GA in accordance with the responses of the detector DA; this segment of the cam may therefore be considered as a segment of a truncated cone whose maximum radius determines the maximum stroke of plunger 680A and whose minimum radius determines the minimum stroke of the plunger. For each intermediate position of cam 550A with respect to its follower 560, the stroke of plunger 680A is correspondingly predetermined within the aforesaid limits. In the machine described, the ratio of the maximum to the minimum stroke is about two to one; specifically, the maximum stroke is about 6" and the minimum stroke about 3".

From 50° to 230° of every machine cycle, the plunger 680 is moving downwardly but the average speed at which the plunger moves downwardly in a particular cycle depends upon the axial position of cam 550A with respect to the cam follower 560 during that cycle. From 240° to 360° of every cycle of the machine, the plunger 680

is moving upwardly, but the average speed of the plunger during this part of a particular cycle depends upon the axial position of cam 550A with respect to its follower 560 during that cycle.

The timing relations of cams 550 and 550A to cam 880 are similar or identical so that both grippers G, GA and both knife mechanisms K, KA operate concurrently in all cycles of the machine. But because of the independence of the axial positions of cams 550, 550A, the lengths of the packages cut from the webs W, W1 in any particular cycle of the machine may be and usually are different.

In the modification whose significant components are shown in Figs. 17 to 20, the web W1, from which packages, labels or wrappers are to be cut, is intermittently fed by a gripper mechanism having a constant length of stroke, and proper registry of printed or other matter with respect to the packages or wrappers cut from the web is maintained by shifting the time at which the web is clamped by the gripper mechanism during its return or non-feeding stroke. For brevity and clarity, elements having the same purpose or function as elements of the modification of Fig. 1 are identified by the same reference characters.

For each revolution of cam 55, which rotates once for each cycle of the machine, the plunger 68 carrying the web-gripping mechanism GA makes one cycle of reciprocation. The length of stroke of the plunger, and therefore the maximum feed of web W1 for making packages or labels of desired average or nominal length, is predetermined by the setting of roller 64 in the slotted oscillatory arm 63.

For purpose of explanation of a specific embodiment of this modification, it is assumed that the web W1 is of Cellophane or other transparent or translucent webbing material, and that the recurrent registration marks or control elements O on the webbing are opaque spots.

In front of web W1, adjacent the uppermost position of the web-gripping device GA, indicated by dotted lines in Fig. 17, there is disposed a mirror MA or equivalent for reflecting light from source LA to the photo-cell CA or equivalent, under conditions hereinafter specified, as also does shroud 140 which is to prevent stray light, other than from lamp LA, actuating photo-cell CA. The shroud may either be fixed or reciprocable with the gripper structure GA. The lamp and photo-cell are carried by and move with the gripper mechanism GA during its reciprocation. There is also mounted upon or carried by the gripper mechanism GA and electromagnet 137A, Fig. 18, whose armature 136A is connected by link 135A to a latch 150 whose hooked end engages the pin 151 on arm 152 to restrain the gripper jaws 78a, 79a out of engagement with the web W1. When the solenoid 137A is energized, latch 150 is moved in clockwise direction, as viewed in Fig. 18, to release the arm 152, whereupon the springs 74A, 75A effect closure of the gripper jaws upon the web.

As the gripper mechanism GA approaches the lower limit of its feeding movement, the adjustably fixed cam 153, Figs. 18 and 19, engages the roller 154 on arm 152, causing the arm to move in clockwise direction to the position shown in Fig. 18. Because of the attachment of arm 152 to shaft 70A and of the connection between shaft 70A and 71A effected by the chain 88A and sprockets 84A and 85A on shafts 70A, 71A, the gripper jaws are separated by the cams 80A, 81A 75

on shafts 70A, 71A to release the web W1. This movement of arm 152 also permits the spring 155 to reset the latch 150 to the position indicated in Fig. 18.

5 The gripper jaws remain open during the subsequent upward movement of the plunger 68 until radiation from the lamp LA or equivalent is reflected by the mirror MA into the photo-cell, whereupon the electromagnet 137A is energized to effect closure of the gripper jaws upon the web, as above described. The mirror MA should be so located with reference to the nominal normal position of the opaque spot as to overlap it but not to extend below it. For any particular return stroke of the gripper mechanism GA, the time at which the photo-cell receives light from the lamp is dependent upon the position of opaque spot O on the then stationary web with respect to the reflector MA. Because the web is gripped before the end of the return stroke, at least that part of it adjacent the grippers is reversely fed to an extent dependent upon the remaining distance to be travelled by the gripper in its return stroke; with the net result, the actual or forward feed of the web is less than the constant distance in the forward stroke for which the web remains gripped by an amount corresponding with the variable distance, in the immediately prior return stroke, for which the web was, in a sense, reversely fed. For example, if the lower edge of an opaque spot O is approximately at the same level as the lower edge of the mirror, the gripper mechanism must return substantially to its uppermost position before the mirror MA is capable of reflecting light from the lamp into the photo-cell, and accordingly, under this circumstance, the amount of webbing fed or actually advanced by the gripper mechanism in its next downward stroke is appreciably greater than when, for example, the upper edge of an opaque spot O registers with the lower edge of the mirror, in which event the mirror reflects light to the photo-cell substantially before the gripper mechanism GA reaches its uppermost position. In the latter case, the net result of the early closure of the gripper mechanism during its return stroke is that of reduced extent of feed of the web in the next downward stroke of the gripper mechanism. The severing of the web may take place at or within the particular web spacing adjacent the opaque spot observed or at or within a web spacing removed therefrom a predetermined number of spacings.

The variations in the timing of the closure of the gripper mechanism are always such as to maintain an approximately correct register of the printed matter on the packages or wrappers cut from the webbing by web-severing mechanism generally similar to or identical with web-severing mechanism KA of Fig. 1. The length of the opaque spot with the web must obviously be greater than the maximum variations in the length of web spacing.

If desired, the movement of the plunger 68 may, as in the modification of Fig. 1, be utilized to effect feed of more than one web, and in such case, it is to be understood that with each gripper mechanism, there is to be associated an individual control arrangement such as disclosed and described in connection with the single gripper mechanism GA of Figs. 17 to 20.

With the web-feeding mechanism of Figs. 17 to 20 there may be utilized apparatus for forming the web into containers which are filled and sealed before the webbing is cut to detach the

filled packages, all as disclosed in the modifications previously described herein; and conversely, it is to be understood the web-feeding arrangements shown in Figs. 1 to 10, and Figs. 11 to 19 may be utilized to cut individual wrappers from the webbing for subsequent use as in a wrapping or packaging machine. For brevity in the appended claims, the term "wrapper", unless inconsistent with the context, is used to comprehend wrappers, labels, or the like, which are applied either before or after their severance from the web.

What I claim is:

1. The method of feeding a plurality of webs having substantially regularly spaced control elements thereon which comprises intermittently and concurrently feeding the webs, while the webs are at rest between successive feeding movements inspecting the positions of control elements thereon, and varying the extents of feed of the individual webs for successive feeding movements thereof each in accordance with the position of the previously observed control element thereof.

2. In web-feeding apparatus comprising reciprocal web-feeding structure, the method of operation which comprises effecting intermittent concurrent feed of a plurality of webs by successive movements of said structure in one direction, between said successive movements of said structure inspecting the positions of control elements on the webs, and predetermining the extents of feed of the individual webs for each movement of said structure in said direction in accordance with the previously observed control elements on the respective webs.

3. In web-feeding apparatus comprising reciprocal web-feeding structure, the method of operation which comprises effecting intermittent concurrent feed of a plurality of webs by successive movements of said structure in one direction, between said successive movements of said structure inspecting the positions of control elements on the webs, and releasing the webs individually from said structure in each of said successive movements thereof each in accordance with the position of the previously observed control element thereon.

4. In web-feeding apparatus comprising reciprocal web-feeding structure, the method of operation which comprises effecting intermittent concurrent feed of a plurality of webs by successive movements of said structure in one direction, between said successive movements of said structure inspecting the positions of control elements on the webs, and varying the times of connection of said structure to the different webs during each of its movements in reverse direction in accordance with the positions of the observed control elements thereon.

5. In web-feeding apparatus comprising reciprocal web-feeding structures, the method of operation which comprises effecting intermittent concurrent feed of a plurality of webs by successive movements of said structures in forward direction, while said webs are at rest inspecting the positions of control elements thereon, and varying the extents of concurrent forward movements of said structures in accordance with the previously observed control elements on their respective webs.

6. In the art of making wrappers from webs having substantially regularly spaced control elements thereon, the method which comprises intermittently and concurrently feeding the webs

toward a web-cutting station, at said station concurrently cutting the webs while they are at rest between successive feeding movements thereof, inspecting the webs while at rest between successive feeding movements thereof to detect changes in the positions of successively observed control elements, progressively increasing the extent of feed of each web in successive feeding movements thereof after a control element thereon has been observed at one predetermined position and until a control element thereon is observed at another predetermined position, and thereafter progressively decreasing the extent of feed of each web in successive feeding movements thereof until a control element thereon is observed at said first predetermined position.

7. Mechanism for feeding webs each having thereon substantially regularly spaced control elements comprising feeding means for each of said webs, means cyclically operative intermittently to effect concurrent operation of the several web-feeding means, and registration detectors responsive to control elements upon the different webs for predetermining the extents to which each individual web is advanced during successive cycles of said means.

8. Mechanism for feeding webs each having thereon substantially regularly spaced control elements comprising web-clamping devices for the individual webs, cyclically operated means for reciprocating said devices in unison to effect intermittent feed of the webs, and registration detectors responsive to control elements upon different webs for controlling the timing of the individual web-clamping devices to predetermine the extents to which the individual webs are advanced during successive reciprocations of said devices.

9. Mechanism for feeding webs each having thereon substantially regularly spaced control elements comprising web-clamping devices for the individual webs, cyclically operated means for reciprocating said devices in unison to effect intermittent feed of the webs, and registration detectors responsive to control elements upon different webs for individually varying the extents of movement of said devices during successive cycles of reciprocation thereof.

10. Mechanism for feeding a web having thereon substantially regularly spaced control elements comprising a web-clamping device, means for effecting reciprocation of said device including a rotatable barrel cam and a member engaging the periphery thereof, means for effecting clamping and release of the web by the jaws of said device including a rotatable barrel cam and a member engaging the periphery thereof, and a detector responsive to said control elements for varying the position of one of said cams with respect to its associated member along the axis of rotation of the cam.

11. Mechanism for feeding a web having thereon substantially regularly spaced control elements comprising web-clamping device, mechanism for reciprocating said device, means for effecting operation of said device alternately to clamp and release the web including a rotatable barrel cam and a member engaging the periphery thereof, and a detector responsive to said control elements for varying the position of said cam with respect to said member along the axis of rotation of said cam.

12. Mechanism for feeding a web having thereon substantially regularly spaced control elements comprising a web-clamping device, means for

effecting reciprocation of said device comprising a rotatable barrel cam and a member engaging the periphery thereof, mechanism for effecting operation of said device to clamp or release the web, and a detector responsive to said control elements for varying the axial position of said cam with respect to said member to change the extent of reciprocation of said device.

13. Apparatus for making wrappers from a web having thereon substantially regularly spaced control elements comprising a web-clamping device including relatively movable gripper members, a web-cutting device including relatively movable cutting members, mechanism for reciprocating said web-clamping device intermittently to feed the web toward said web-cutting device, a common operating mechanism for said devices effecting web-clamping movement of said gripper members concurrently with separation of said cutting members and web-releasing movement of said gripper members concurrently with web-severing movement of said cutting members, a detector responsive to said control elements, and means controlled in accordance with the responses of said detector when said web is at rest for controlling one of said mechanisms to vary the extents to which the web is fed by successive reciprocations of the web-clamping device.

14. Apparatus for making wrappers from a web having thereon substantially regularly spaced control elements comprising a web-clamping device including relatively movable gripper members, a web-cutting device including relatively movable cutting members, mechanism for reciprocating said web-clamping device in a path of constant length intermittently to feed the web toward said web-cutting device, mechanism for effecting operation of said devices in fixed timed relation to each other during the successive cycles of reciprocation of said web-clamping device, a detector responsive to said control elements, and means controlled in accordance with the responses of said detector when said web is at rest for varying the timing of said second-named mechanism with respect to the reciprocation of said web-clamping device in the successive cycles thereof.

15. Mechanism for making wrappers from a web having thereon substantially regularly spaced control elements comprising a web-clamping device, a web-cutting device, means for reciprocating said web-clamping device intermittently to feed the web toward said web-cutting device, means for effecting operation of said web-cutting and web-clamping devices at fixed times in successive cycles of reciprocation of said web-clamping device, a detector responsive to said control elements, and means controlled in accordance with the responses of said detector when said web is at rest to vary the stroke of said web-clamping device in its successive cycles of reciprocation.

16. Mechanism for making wrappers from webs having thereon substantially regularly spaced control elements comprising web-clamping devices for the individual webs, web-cutting devices for the individual webs, means for reciprocating said web-clamping devices in unison intermittently to feed the webs toward their respective web-cutting devices, and detectors responsive to control elements of the individual webs for controlling the times of operation of the clamping and cutting devices of the individual webs in each cycle of reciprocation of said cutting devices.

DANIEL E. MAXFIELD.

CERTIFICATE OF CORRECTION.

Patent No. 2,199,708.

May 7, 1940.

DANIEL E. MAXFIELD.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, first column, line 11, for "suffix A" read --suffix "A"--; page 9, second column, line 38, claim 14, after the word "said" insert --the relatively movable members of said--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of March, A. D. 1941.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.