Feb. 21, 1933. F. B. FULLER 1,898,723

METHOD AND APPARATUS FOR REGISTERING PRINTED WEBS OF PAPER

Filed May 15, 1930 4 Sheets-Sheet 1

Fig. 1.

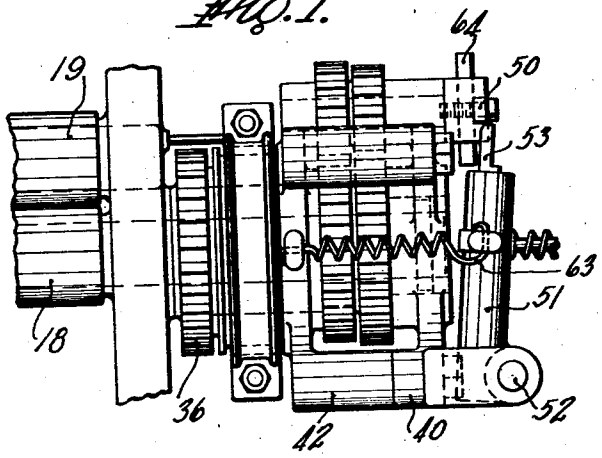


Fig. 2.

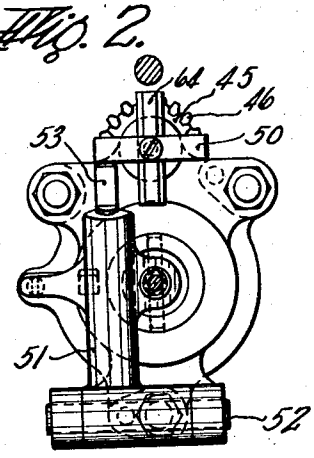


Fig. 3.

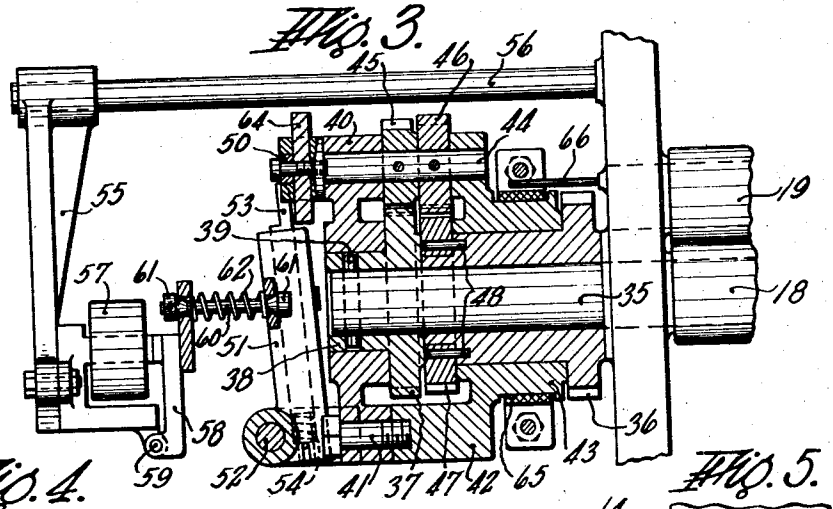


Fig. 4.

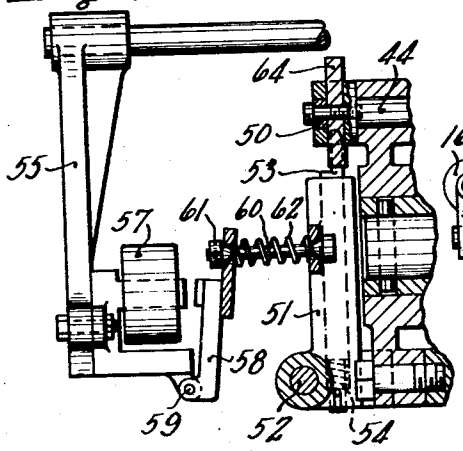
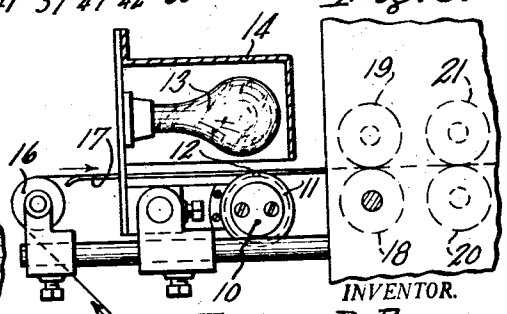


Fig. 5.



INVENTOR.
FREDERIC B. FULLER
BY Chapin & Neal
ATTORNEYS.

Feb. 21, 1933. F. B. FULLER 1,898,723

METHOD AND APPARATUS FOR REGISTERING PRINTED WEBS OF PAPER

Filed May 15, 1930 4 Sheets-Sheet 2

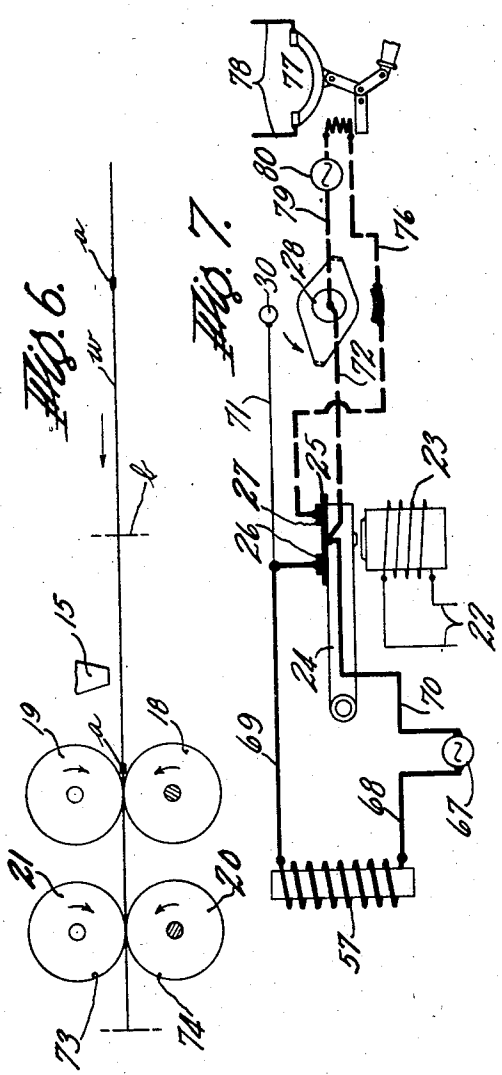


Fig. 6.

Fig. 7.

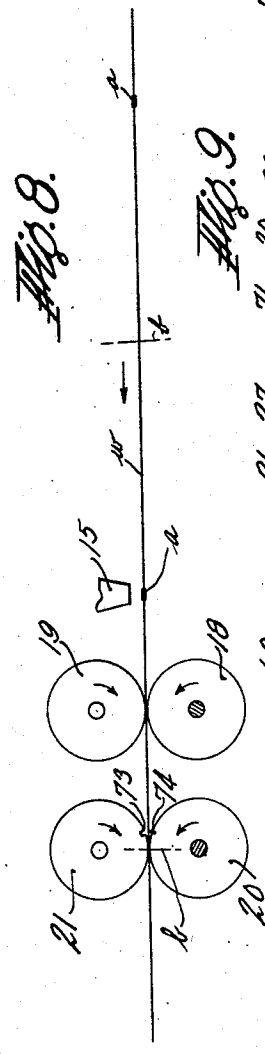


Fig. 8.

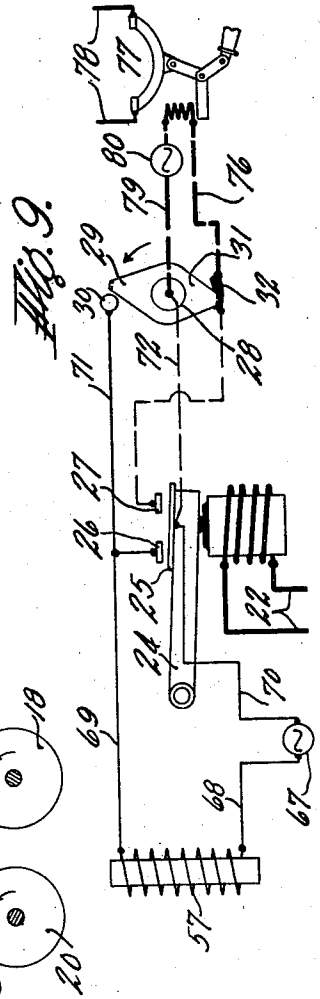


Fig. 9.

INVENTOR.
FREDERIC B. FULLER
BY Chapin + Neal
ATTORNEYS.

Feb. 21, 1933. F. B. FULLER 1,898,723

METHOD AND APPARATUS FOR REGISTERING PRINTED WEBS OF PAPER

Filed May 15, 1930 4 Sheets-Sheet 3

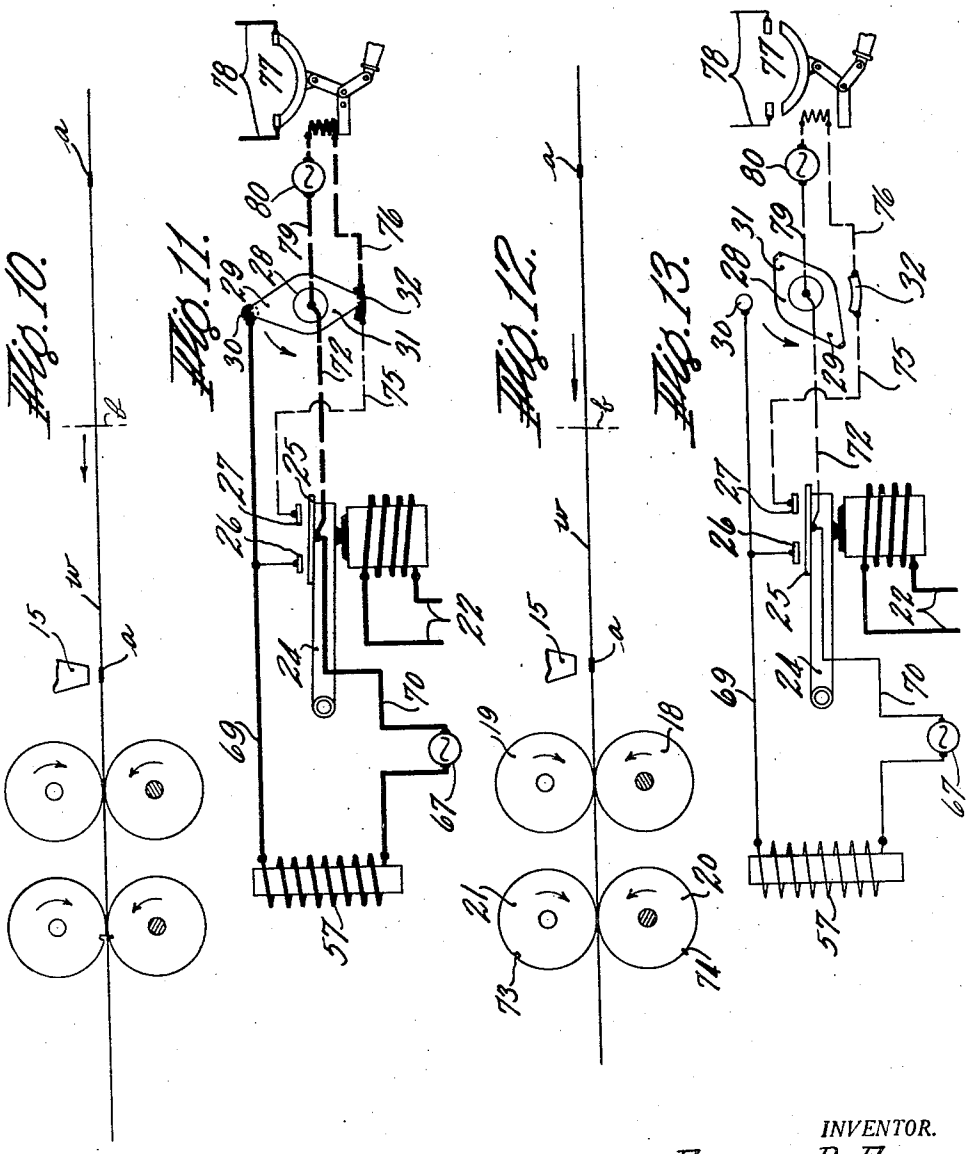


Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

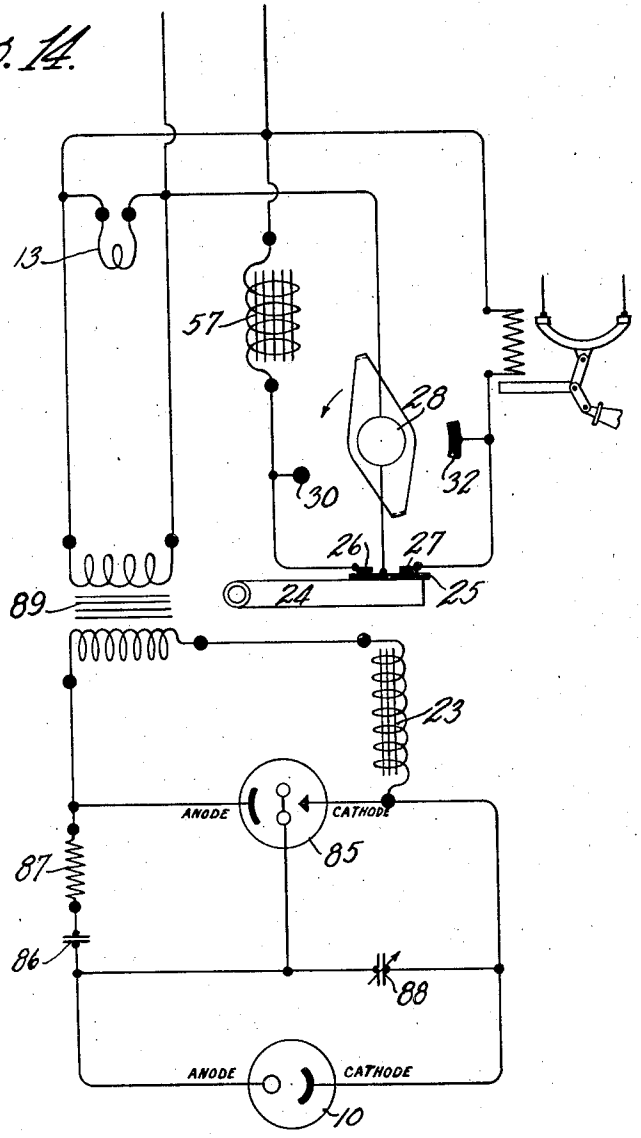
INVENTOR.
FREDERIC B. FULLER
BY Chapin & Neal
ATTORNEYS.

Feb. 21, 1933. F. B. FULLER 1,898,723

METHOD AND APPARATUS FOR REGISTERING PRINTED WEBS OF PAPER

Filed May 15, 1930 4 Sheets-Sheet 4

Fig. 14.



INVENTOR.
FREDERIC B. FULLER
BY Chapin & Neal
ATTORNEYS.

Patented Feb. 21, 1933

1,898,723

UNITED STATES PATENT OFFICE

FREDERIC B. FULLER, OF SPRINGFIELD, MASSACHUSETTS, ASSIGNOR TO PACKAGE MACHINERY COMPANY, OF SPRINGFIELD, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

METHOD AND APPARATUS FOR REGISTERING PRINTED WEBS OF PAPER

Application filed May 15, 1930. Serial No. 452,691.

In the use of printed labels or wrappers for packaging articles, it has been customary to employ cut sheets and feed them from a magazine in order to insure accurate registration of the printed matter with the cut edges. For purposes of economy both in the manufacture of the paper and in the construction of the wrapping or labeling machine it is desirable to supply the printed paper in web form. Due to shrinkage or expansion of the paper after it is printed, it is necessary to control the feed of this web so that it will be cut into labels along lines properly registered with the printing which appears on it.

It has heretofore been proposed to perforate the web at the time of printing and to control either the feed of the web or the location of the cut by mechanism operated by the successive passage of these perforations. The use of the perforations, however, increases the cost of manufacture of the web, thus partly defeating the very purpose of supplying the paper in this form; and is further objectionable because the unsightly perforations remain in the cut sheets, destroying its good appearance and often reducing the protection afforded by the wrap. It is the object of the invention to provide a system by which imperforate printed webs may be fed to a cutter at such varying speeds that the lines of severances will always remain within a predetermined range of tolerance relative to the matter previously printed upon the web. A further object is to provide a mechanical speed changing device applicable either to control by a perforate or by an imperforate web. A further object is to form the mechanical embodiment of the invention with such simplicity and of such design that it may be applied to existing wrapping or labeling machines without requiring any material modification of them.

In general the system comprises a printed web formed with periodic areas having light transmitting properties different from those of the body of the web, a photoelectric cell for observing the passage of these areas, a mechanism for varying the speed with which the web is fed, and what may be termed an integrating device for coordinating the reports of the photoelectric cell with the instantaneous position of the machine parts and setting the speed changing mechanism in operation depending upon whether or not the integration of the paper position as shown by the cell with the position of the machine parts shows that correction is necessary. In the preferred form, the web is normally fed at a speed biased to one side of the normally correct feeding speed for a web which has not changed in length since it was printed, so that a correction is applied to the feeding speed even with perfectly dimensioned web material. If the web varies in one direction, the frequency of the correction will be increased; if it varies in the other direction, the frequency of correction will be diminished.

The preferred embodiment of the invention will now be described with reference to the accompanying drawings, in which:

Fig. 1 is a side elevation of a differential gearing or escapement through which the web feed rolls are driven;

Fig. 2 is an end view thereof;

Fig. 3 is a central median section looking in a direction opposite to Fig. 1;

Fig. 4 is a fragmentary view similar to a portion of Fig. 3 but showing the parts in different operative positions;

Fig. 5 is a diagrammatic side elevation of a web feeding and cutting device, illustrating the manner in which the detecting and control mechanism is associated with it;

Fig. 6 is a diagrammatic view illustrating an intermediate stage in the feeding and severing of a web;

Fig. 7 is a diagram illustrating the electric circuits under the conditions shown in Fig. 6

Figs. 8 and 9 form a similar pair of views showing the corrective action of the device when the printed portion of the web arrives at the cutting point ahead of time;

Figs. 10 and 11 form a similar pair of views showing the operation of the device when the printed portion of the web arrives at the cutting points in substantial register or slightly late;

Figs. 12 and 13 form a similar pair of views

showing the action of the device in stopping the entire machine in case the printed portion of the web arrives too far out of register to be susceptible of correction; and

Fig. 14 is a schematic wiring diagram.

The device consists of three groupings of mechanisms, each partly mechanical and partly electrical. The first group comprises a photoelectric cell or electric eye, tending to break a relay circuit whenever an area of the web passes by having light transmitting properties distinctly different from those of the body of the web. The second group comprises a movable contact or commutator mechanism connected in timed relation to the web severing mechanism, and operable to prevent the breaking of the relay circuit by the first group mechanism whenever the printed portion of the web arrives in a predetermined timed relationship to the cutting devices. The third group comprises a drive for the web feeding device and a differential gear or escapement mechanism by which a predetermined change of speed or slip is introduced into the web feed when the relay circuit is broken.

The photoelectric cell 10 is surrounded by a shield 11 having an opening 12 forming the only inlet through which light can fall on the cell. This cell may be of any of the standard types and is provided with an amplifying circuit, preferably embodying a grid glow tube connected as will be described below, constructed to build up the response of the cell to a degree sufficient to actuate a mechanical relay. The cells and amplifying circuits are of standard commercial types, and do not in their specific nature form a part of my invention. Illumination for the cell may be conveniently supplied by an electric lamp 13, preferably encased in a shield 14. The whole electric eye assembly is denoted in Figs. 6 to 9 conventionally by the numeral 15. Referring particularly to Fig. 5, the paper web *w* may be led in the usual manner from a large supply roll (not shown) over a guide roll 16 and a supporting plate 17 to a pair of feed rolls 18, 19 and a pair of cutting rolls 20, 21. The drive for these rolls will be later described. The plate 17, if used, is perforated to correspond with the perforation 12 in the shield 11 so that light may pass from the lamp to the cell unless obstructed by an opaque portion of the paper web. According to the nature of the ornamentation on the paper web, the localized area which affects the cell periodically may be transparent with the body of the web opaque, or opaque with the body of the web transparent. The latter form is preferred, and the opaque spots are denoted at *a* in Figs. 6 to 9. The use of transparent localized areas will require a connection of the photo-electric cell and grid glow tube so that the passage of light to the cell will cause flow of current through the glow tube, as is well understood in that art.

The electric circuit from the photoelectric amplifier is shown at 22, passing through the coil of an electromagnet 23. When the circuit is energized by the passage of a spot *a* past the electric eye, the electromagnet attracts its armature 24, causing various circuit changes which can be considered best after a discussion of the remaining groups of mechanisms. The armature is provided with a contact piece 25 which in the normal position of the relay (Fig. 6) electrically connects two stationary contacts 26 and 27. In the arrangement illustrated, the relay magnet is activated and its armature moved each time a spot *a* passes the electric eye. The effect of the breaking of the relay contacts varies in accordance with the position of other parts of the machine.

Fast upon the shaft of the cutting roll 20, or otherwise rotated in timed relation with it, is a two-armed rotating contact member or commutator 28. One arm 29 of the commutator makes electric contact at each revolution with a stationary contact member 30 of small area. The other arm 31 makes contact at each revolution with a stationary contact member 32 having a length greater than that of the contact member 30. The two arms are offset from each other so that each makes contact only with its own stationary contact member. The arm 29 serves to restrict the web correcting action of the electric eye to conditions when a predetermined limit of tolerance of registration of the web is exceeded. This is done by an electric circuit to be described below, by means of which the effect of actuation of the electric eye is nullified whenever such actuation occurs at a time when the arm 29 and the member 30 are in contact. The purpose of the arm 31 is to break the operating circuit of the entire machine whenever the actuation of the relay occurs so far outside its normal relation with the commutator that correction within a reasonable number of cuts would be impossible.

The escapement or differential gear mechanism by which the web feed rolls are driven and by means of which the speed corrections are periodically introduced will now be described. The shaft 35 of the feed roll 18 passes freely through a gear 36 driven by any suitable mechanism in timed relation to the web cutting rolls. A gear 37, having a hub 38, is pinned to the shaft at 39 so that it normally rotates therewith at a constant speed. A member 40, freely rotatable on the hub 38 is connected at 41 with a member 42 freely rotatable upon a hub portion 43 formed upon the gear 36. A short shaft 44, journaled for rotation in the members 40 and 42, has pinned to it two pinions 45 and 46, meshing respectively with gear 37 and a

companion gear 47 having a dowel connection 48 with the hub 43 of gear 36.

The gears 37 and 47 are arranged to differ in the number of teeth they bear, preferably by one tooth, and their pinions 46 and 45 are similarly formed. The shaft 44 is arranged as will be described to be locked against rotation in the rotatable member 40 or to be free to turn therein. When the shaft is locked, the pinions fast to it serve as a key connecting the gears 37, 48, so that the gear 36, gear 47, gear 37, member 40, and shaft 35 all rotate together as a rigid unit. When the shaft 44 is free and the member 40 is held against rotation, the gear 37 is driven at a lower speed than the gear 36 by means of the differential gearing provided by the two different size pinions and their related gears, the shaft 44 in this case serving merely as a countershaft.

In order to lock or release the shaft 44 in the member 40, it is provided on its free end with a cross piece 50 rigidly held in position. An arm 51 is pivoted at 52 to the member 40, and has slidably mounted in it a stop 53 yieldably pressed outwardly by a spring 54. When the arm is in the position of Fig. 3, the end of the stop is in position to strike one side of the cross piece 50 and thus prevent the shaft 44 from turning. Connected by a bracket 55 with an arm 56 extending from the frame of the machine is an electromagnet 57, the armature 58 of which is pivoted at 59. A rod 60, having conical collars 61, loosely joins the armature with the arm 51, a spring 62 keeping these parts normally spaced apart at the limit determined by the collars. This spring serves also as a shock absorber to prevent jar. The rod joins the arm 51 in line with the axis of shaft 35, so that the connection with armature 58 is independent of the angular position of member 40 and the latter is free to rotate without interference by reason of its connection with the stationary magnet 57.

In the normal running of the machine, current flows continuously through the magnet, holding the parts in the position of Fig. 3 with the shaft 44 locked. The feed roll shaft 35 is then continuously driven at the same speed as the constant speed gear 36. At intervals, the frequency of which depends upon the coordination of the passage of the spots *a* past the electric eye with the angular position of the commutator, the electric circuit through the magnet is broken, and a spring 63 (Fig. 1) draws the arm 51 and the armature 58 to the positions of Fig. 4. In the latter position the stop 53 is out of the path of the cross piece 50 and the shaft 44 is freed for rotation. Until again stopped by the striking of cross piece 50 by the stop 53, the pinion shaft 44 will continue its rotation and the shaft 35 will be driven at a lower speed than the constant speed gear 36.

While the magnet is strong enough to hold the arm 51 against the pull of spring 63 as long as the armature is in contact with the magnet pole piece, its strength is insufficient to draw the armature back through the intervening air gap after it has once been pulled away. The circuit conditions which cause the breakage of the current through the magnet are but of momentary duration, and in order to secure a definite connection in the rate of web feed it is necessary to lock the pinion shaft again after it has completed a predetermined angular movement (180° in this case) about its own axis. Advantage is taken of the inability of the magnet to return the armature to accomplish this result, the re-closure of the magnet circuit being itself without any effect and the return of the armature being accomplished mechanically by the rotation of the pinion shaft. For this purpose the shaft 44 is provided with a second cross piece 64 which is beveled on its side so as to coact with the beveled end of the stop 53 to return it to the position of Fig. 3. As will be apparent from an examination of Fig. 2, the pinion shaft will be released for rotation upon the movement of the stop to the position of Fig. 4, and the cross piece 64 will return the stop (and consequently the armature 58) to the position of Fig. 3 after the shaft has rotated ninety degrees. This return is, however, without effect upon the continued rotation of the pinion shaft, which continues to turn until the second end of the cross piece 50 has contacted with the now repositioned stop.

It will be observed that when the pinion shaft is free the motion of the mechanical system shown in Fig. 3 is theoretically indeterminate; that is, the speed of the driving gear 36 is not necessarily transmitted in fixed ratio to the shaft 35. The member 40 is also free to turn and if the shaft were firmly held all the motion of the driving gear would be translated into rotation of the member 40. Any such motion of the member would, however, be at a speed much higher than the rotation of the shaft. A comparatively light braking action is, therefore, sufficient to hold it stationary. This is provided in the case shown by a band brake 65 encircling the hub 43 and held against rotation by a pin 66 extending from the machine frame. The very indeterminacy of the mechanical system serves a useful purpose in preventing undue jar in the operation of the machine and in avoiding rapid changes in the speed of the web feed rolls, which would tend to produce slippage. According to the construction shown, the limit of displacement between the adjacent gears 37 and 47 is that represented by a half revolution of the pinion shaft, and it is immaterial in what time this is accomplished so long as it is completed within a cycle of the machine's operation. As the

pinion shaft is freed it starts to rotate with an acceleration dependent upon the rapidity with which the rotating carrier members are decelerated by the brake, the two effects balancing each other so that they accommodate themselves automatically to the easiest operating condition. A similar but reverse effect occurs when the pinion shaft is again stopped, the spring bumper 54 permitting it to come to rest slowly.

The operation of the device will now be considered in connection with Fig. 6 to 13, inclusive. These figures are arranged in pairs, one view of each pair representing the position of the printed portion of the web relative to the electric eye and the web cutting devices, and the other view representing the condition of the electric circuits with the other elements in the relative positions shown by the first view of the pair. In each of the electric diagrams those portions of the circuits which are carrying current at the moment are shown with heavy lines, and those which are temporarily inactive are shown light. Full lines represent the speed controlling section of the circuit and dotted lines represent the control section which stops the feeding of the web (and preferably the entire connected machine) when the registration is so far from normal that correction is impossible.

The position of the parts shown in Fig. 6 is without any special significance, an intermediate point in the feeding of a web having been selected at random. The corresponding electric diagram shown in Fig. 6 illustrates what may be referred to as the normal condition of the circuits. The electromagnet 57 receives current from a source 67 through a wire 68. A wire 69 extends from the electromagnet to the stationary contact piece 26, with which the armature contact piece 25 is in contact in this position of the parts; there being no spot *a* passing the electric eye and, therefore, no current flowing through the circuit 22 and the relay magnet 23. A wire 70 joins the armature contact 25 with the current source 67. Either direct or alternating current may be used in activating the various electric elements, the latter being generally preferred on account of the frequency with which it is met in practice.

When a spot *a* passes the electric eye, the magnet 23 is activated in every case, attracting the armature 24 and breaking the contact between members 25 and 26. The effect that this has on the electric circuit varies with the position of the commutator arm 29 with respect to the contact button 30. A wire 71 joins the button 30 with the wire 69, and a wire 72 joins the hub of the commutator with the armature contact member 25. In Fig. 8 the spot *a* and the line *b* upon which the web should be cut arrive at the cutting rolls ahead of the cooperating cutting members 73 and 74 which sever the web. This may be due either to the speed of the feed rolls 18, 19 being too fast or to the paper having contracted so that the printing occupies a smaller length on the web than it should. For whatever cause, the arrival of the spot *a* too early causes the breakage of the contacts 25, 26 before the commutator arm 29 has reached the button 30. There is no chance for the circuit through magnet 57 to be completed through the parallel circuit 71, 30, 29, 72, and it is accordingly deenergized.

With the attractive power of the magnet 57 gone, the main spring 63 pulls the arm 51 and the armature 58 away from it, pulling the stop 53 out of the path of the cross piece and releasing the pinion shaft 44 for free rotation. Where previously the gears 37, 47 were locked together, they are now joined by pinions on a countershaft, and gear 37 is, therefore, driven at a lower speed during the half revolution of the pinion shaft that is necessary to bring the opposite arm of the cross piece 50 against the stop 53. The gearing thus operates not so much as a reduction gearing as an escapement which introduces a predetermined lag into the web feed rolls. The feed rolls are so geared as to feed at a rate slightly greater than what is required for feeding a normally dimensioned web, so that even under perfect web conditions lag will be introduced periodically into their drive. If the web is contracted it will increase the frequency with which a quantum of lag is introduced; if it is extended it will decrease this frequency. The control of web speed is maintained by varying the frequency with which definite quanta of lag are introduced into the drive gearing, rather than by varying the length of the individual periods of abnormal speed relationship or by governing the actual speed of the web in accordance with the web condition.

Fig. 10 shows another position of the printed portion of the web relative to the cutting elements, in this case the proper line of cut *b* arriving late or approximately on time. This may be due either to the occurrence of an over-correction by the mechanism described, or to a stretching of the web whereby the feed rolls will not feed the web fast enough to give the usual excess speed. As no correction is necessary if the printed portion of the web arrives on time and as the normal excess speed of the web will take care of any stretching of the web within the limits for which the machine is designed, no correction is desired in this case. The circuit through magnet 23 is of course completed as the spot *a* passes under the electric eye, depressing the armature 24 and breaking the contact between the members 25 and 26. In this instance, however, the commutator arm 29 is on the button 30 during the brief activation of magnet 23 and the circuit through magnet 57 is

completed through the parallel path 71, 30, 29, 72. The magnet 57 is thus continuously energized and the feed rolls continue to rotate steadily at their normal speed.

It remains only to consider the provision which has been made for stopping the operation of the whole machine when the lack of registration between the printed matter on the web and the cutting members is so pronounced that it cannot be corrected by the usual control. Such a condition may arise when an operator takes insufficient pains in securing initial registration at the time of placing a fresh web in the machine, or when a web has been spliced so that there is a break in the continuity of its printed matter. The normal excess feed of the rolls is preferably of the order of magnitude of one-tenth of an inch, and the magnitude of the quantum of lag introduced as a correction about double this, although the exact values are not of particular importance. It can readily be seen that the gross inaccuracy introduced by defective initial register or by a web splice will be so far beyond the range of correction that many inaccurate wrappers would be cut before the correction would be made up. Furthermore, the device loses, so to speak, its sense of direction when the error is over a certain amount, as the web will be slowed down by the introduction of a quantum of lag during each cycle whether the arm 29 misses the contact 30 on the right as in Fig. 9 or on the left, although these conditions represent diametrically opposed conditions of web registration. Both of these reasons make it desirable to stop the machine automatically and then start afresh after the operator has corrected the faulty registration.

To this end, the commutator 28 is provided with the second arm 31 making contact at each cycle with a relatively wide contact piece 32. This contact piece is connected by a wire 75 with the contact 27, and by a wire 76 with a circuit breaker 77 located in the control circuit 78 of the motor which operates the entire machine. The return circuit 79 passes through a current source 80. The commutator itself is joined to the armature contact 25 by a wire 72 common to the two control systems. Provided the arm 31 is on the contact 32 at the time the magnet 23 is energized by the passage of a spot *a* under the electric eye, the circuit breaker 77 will be unaffected; the current in its control coil flowing through the parallel path 76, 32, 31, 79 instead of through the normal path 76, 32, 75, 27, 25, 72, 79. If the web registration is so far from normal that the contacts 31, 32 are out of range, as in Fig. 13, at the time a spot *a* passes the electric eye there will be no alternative circuit ready to take the current when the contacts 25, 27 are separated, the circuit breaker will be deenergized and tripped, and the machine will stop.

The circuits chosen for illustration, the individual pieces of apparatus shown, and the magnitudes referred to, all represent merely the form in which I prefer at present to embody the invention, and can of course be changed to fit different installations.

In Fig. 14 I have shown a wiring diagram illustrating both the arrangement of the apparatus for alternating current operation from a single source and the preferred circuit arrangement for the photoelectric cell. The photoelectric cell 10 is in this instance joined to the relay magnet 23 through the intervention of a grid glow tube which acts as a very sensitive amplifier. Neither the photoelectric cell nor its circuit relationship with the grid glow tube are in themselves my invention, and they will be described only briefly in order to complete the disclosure of the improved combination into which they enter as elements. The constants given, as well as the specific circuit, are illustrative only, and can be varied as will be understood by those skilled in that art.

Preferably the circuit is arranged with what is commercially known as a reverse connection, in which no current flows through the relay magnet 23 while illumination above a predetermined threshold falls upon the photoelectric cell, and the magnet is energized when the cell is eclipsed by the passage of a spot between it and the light source. The cathode of the cell is connected directly to the cathode of the grid glow tube 85, and to one terminal of the relay magnet 23. The anode of the cell is connected to the grid of the tube 85. This grid is also connected to the anode of the same tube through a condenser 86 (of say 0.00005 mfd.) and a resistance 87 (of say 10 megohms) joined in series; and is joined to its own cathode through a path of variable conductance, here provided by a variable condenser 88 (of say 0.00015 mfd.). Alternating current of about 440 volts is applied to the anode of tube 85 from one terminal of the secondary of a transformer 89, the other terminal of which is connected to the relay magnet 23.

During the normal travel of the paper web past the cell the light transmitted to the latter through the paper causes the cell to be conductive, and the resulting unidirectional current flow through the cell causes the grid of the tube 85 to become negative, blocking any flow of current through the tube. This application of a negative potential is due to the relatively high impedance of the path 86, 87 and the path 88. When, however, the cell is eclipsed it can pass no current, and the negative charge on the glow tube grid passes off through the paths mentioned. Current then flows through the glow tube and actu-

ates the relay magnet 23. The remainder of the operation has been set forth above.

The grid glow tube possesses a sort of trigger action, instigating a current flow whenever the current through the cell drops below the predetermined threshold. In the discussion above it has been considered that the cell was completely eclipsed by the passage of a spot. Strictly this may not be true, some light reaching the tube even during eclipse. The grid glow tube is preferably adjustable so that its threshold of operation is very close to the current value induced by the normal quantity of light which passes through the paper and falls on the cell, so that the eclipse of the tube by the passage of a spot will shift the current value well beyond the threshold and insure positive operation of the device. This adjustment can be made by means of the variable condenser 88. It is of great utility in case the machine is to operate on paper of different grades or thicknesses, resulting in differing amounts of transmitted light, taking the place of a light source at a variable distance from the paper or of variable intensity. A further utility of this adjustment is found where the light-transmitting properties of the paper are varied by a design printed on it, in which it may be desirable to move the threshold further towards the value of current at eclipse.

What I claim is:

1. Mechanism for controlling the register of an indicia bearing web relative to a web treating machine, comprising a pair of web feeding rolls in constant engagement with the web and rotating continuously in a single direction, means for rotating the rolls at such a speed that they will deliver normally a slight excess of web length, an escapement mechanism operative on the rotating means to introduce at each actuation a definite and predetermined lag into the rotation of the rolls, and mechanism responsive to deviations in the positional relationship of the indicia on the web with respect to the operative elements of the web treating machine in excess of a predetermined minimum for actuating the escapement mechanism.

2. Mechanism as claimed in claim 1, having mechanism operable to stop the web feeding rolls if the deviation from normal of the positional relationship of the indicia on the web with respect to the operative elements of the web treating machine exceeds a predetermined maximum.

3. Mechanism for controlling the register of an indicia bearing web relative to a web treating device comprising web feeding rolls, mechanism responsive to deviations in register between the indicia on the web and the web treating device for varying the travel of the web feeding rolls, and mechanism responsive to deviations in register beyond a predetermined maximum for stopping the feed rolls.

4. Mechanism for controlling the register of an indicia bearing web with a web treating device comprising a pair of web feed rolls; a drive for said rolls including a shaft, a sleeve surrounding the shaft, a pair of gears mounted side by side, one on the sleeve and one on the shaft, a carrier rotatable about the shaft, a pinion shaft journaled on the carrier, a pair of pinions fixed to said shaft and meshing respectively with the two gears, the ratio between the two gear and pinion sets being slightly different, an escapement operative to release the pinion shaft for limited rotation, and mechanism controlled by deviation of the indicia on the web from registry with the web treating device for releasing the escapement.

5. Mechanism for controlling the register of an indicia bearing web with a web treating device comprising web feeding devices, a photoelectric cell trained on the web so as to be affected by the indicia thereon, a relay actuated by the cell each time one of the indicia passes it, means including a circuit opened by the actuation of the relay for introducing a predetermined correction into the web feeding devices, and a contact operable in timed relation to the web treating device for presenting an alternative path for the current flowing in the relay circuit to prevent the actuation of the correcting means when the indicia are in predetermined timed relationship with the web treating device.

6. Mechanism for controlling the register of an indicia bearing web relative to a web treating machine comprising a pair of feed rolls, a constant speed drive positively coupled to the rolls to cause them to feed in each cycle a length of web having a normal deviation from the distance between indicia on an undistorted web, mechanism interposed between the drive and the rolls for introducing between them at each actuation an angular displacement of predetermined amount and of an order of magnitude generally corresponding to the normal deviation of roll speed, and means responsive to an excess departure of the indicia from normal registry for actuating said mechanism.

7. Mechanism for controlling the register of an indicia bearing web relative to a web treating machine comprising web feeding devices, a photoelectric cell trained on the web so as to be affected by the indicia thereon, a member having timed relation with the web treating machine, mechanism controlled jointly by said cell and said member for introducing a correction into the web feeding devices when the departure of the indicia from registry is within a predetermined range, and mechanism controlled jointly by said cell and said member for stopping the

feed rolls when the departure of the indicia from registry exceeds said range.

8. Mechanism for controlling the register of an indicia bearing web relative to a web treating device comprising a pair of feed rolls, a constant speed member, a pair of gears one coupled to the rolls and the other to said member, a pair of pinions meshing respectively with the two gears and secured together for simultaneous rotation, the ratio between the two gear and pinion sets being slightly different, a mounting for the pinions whereby they may be locked to the gears for rotation with them as a unit or may be released to rotate relative to the gears with a planetary action, and mechanism controlled by deviation of the indicia on the web from registry with the web treating device for releasing the pinions for limited rotation.

9. Mechanism for controlling the register of an indicia bearing web relative to a web treating device comprising a pair of feed rolls, a constant speed member, a pair of gears one coupled to the rolls and the other to said member, a pair of pinions meshing respectively with the two gears and secured together for simultaneous rotation, the ratio between the two gear and pinion sets being slightly different, a mounting for the pinions whereby they may be locked to the gears for rotation with them as a unit or may be released to rotate relative to the gears with a planetary action, a brake restraining the freedom of bodily movement of the pinions about the gears whereby the pinions are constrained to rotate upon their own axes when so released, and mechanism controlled by deviation of the indicia on the web from registry with the web treating device for releasing the pinions for limited rotation upon their axes.

In testimony whereof I have affixed my signature.

FREDERIC B. FULLER.