Feb. 4, 1936. F. B. FULLER 2,029,919

WEB REGISTERING DEVICE

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Fig. 1.

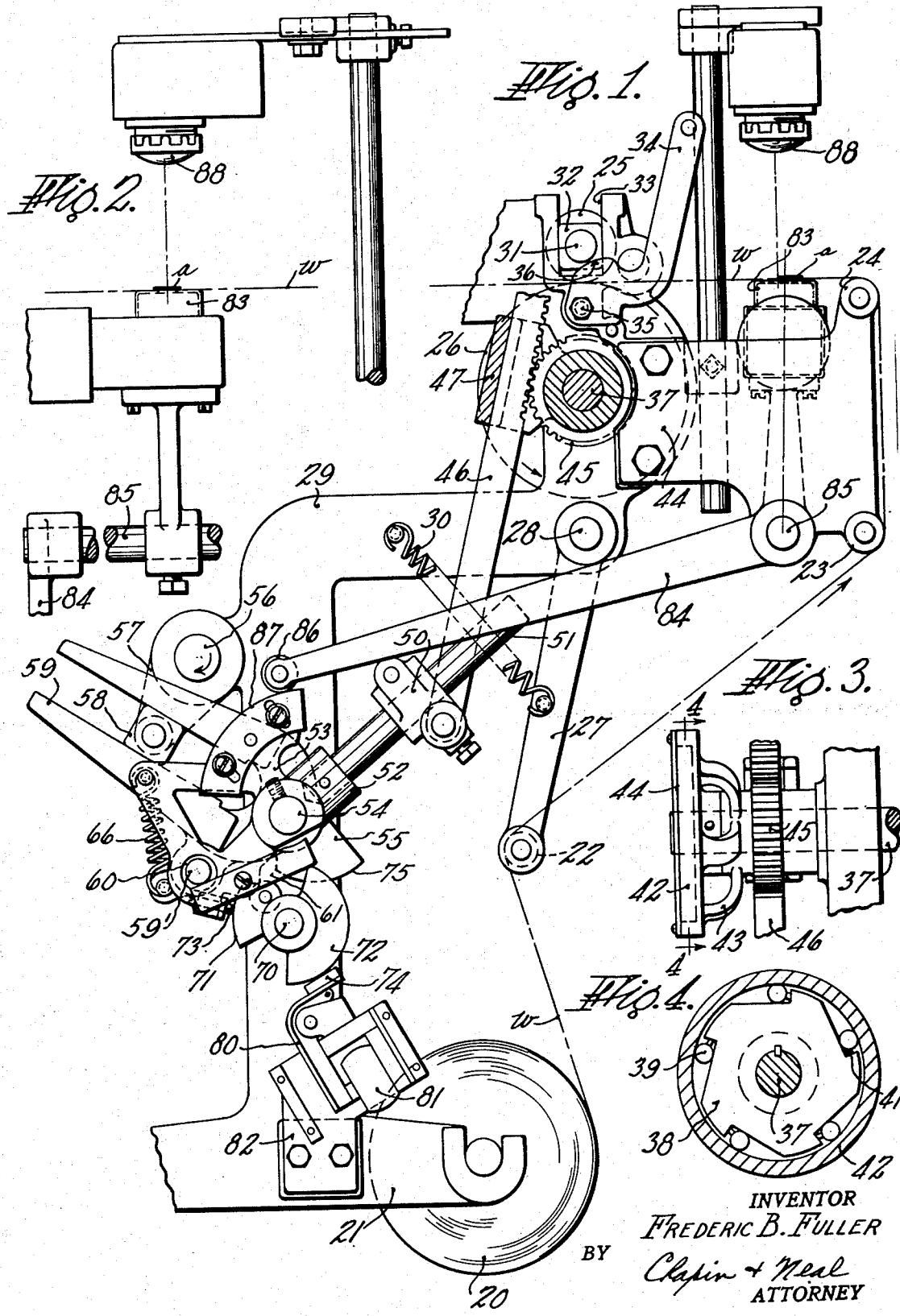


Fig. 2.

Fig. 3.

Fig. 4.

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Fig. 6.

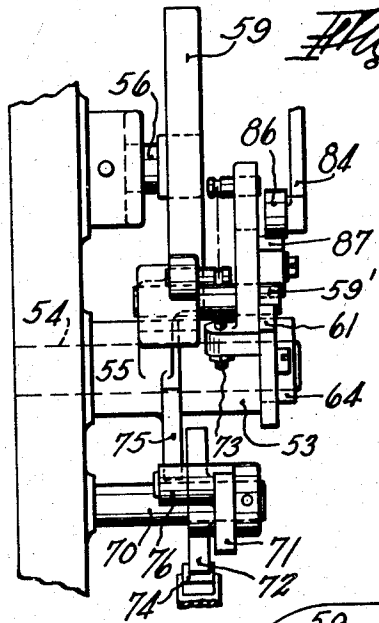
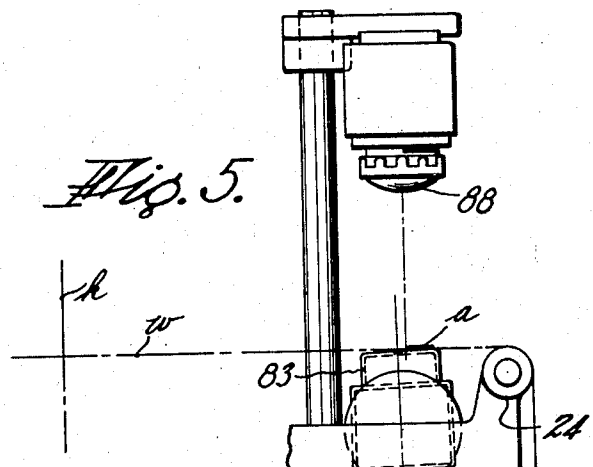


Fig. 5.



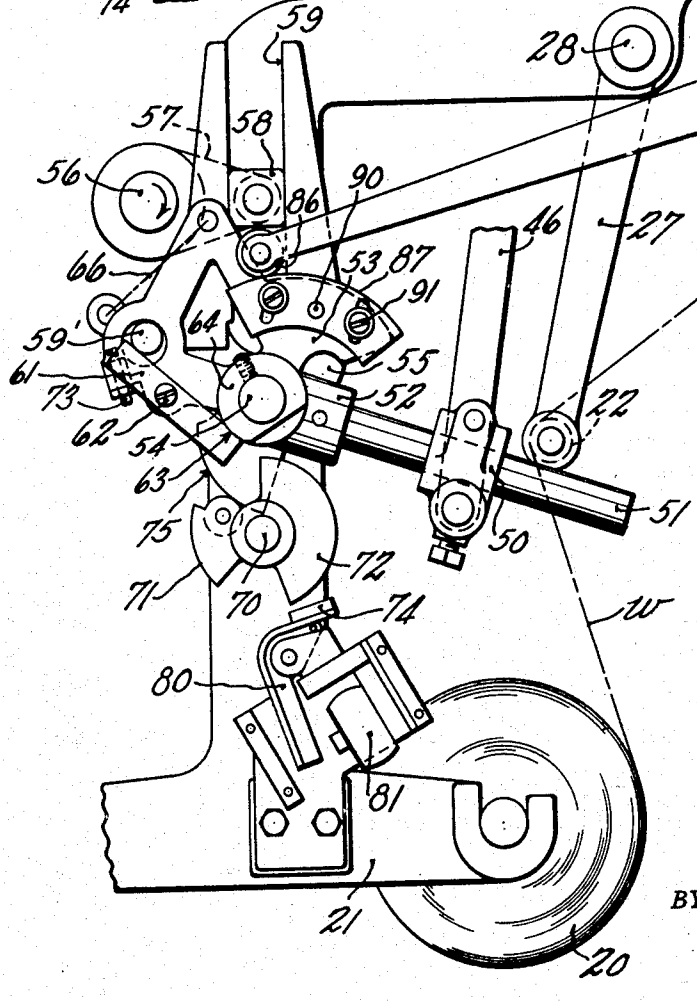


Fig. 7.

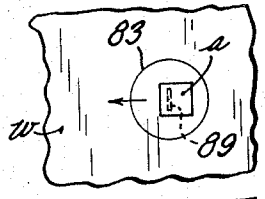
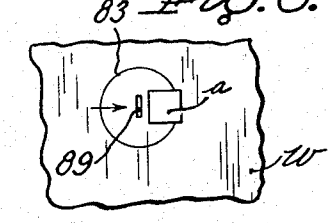


Fig. 8.



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Fig. 9.

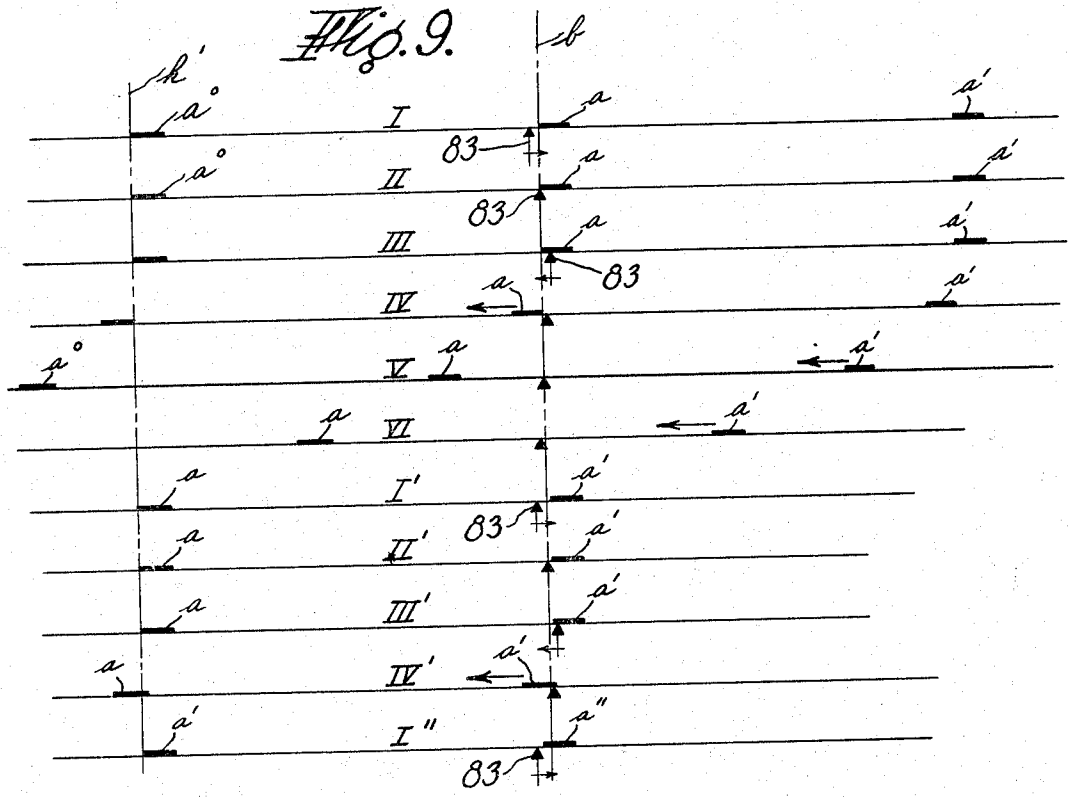


Fig. 10.

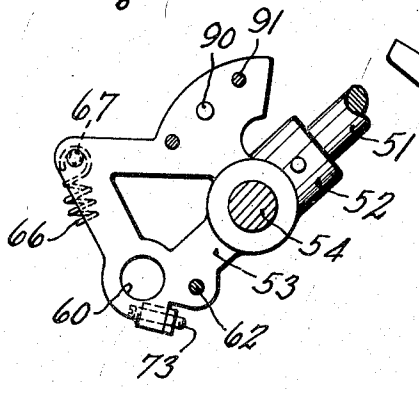


Fig. 11.

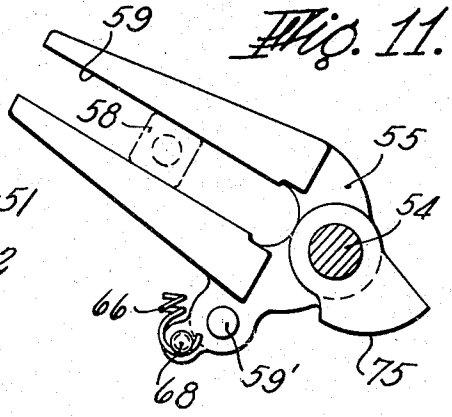


Fig. 12.

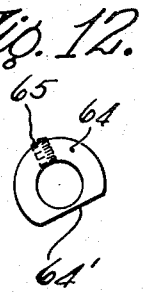
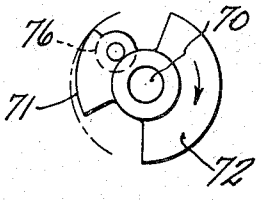


Fig. 13.



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Fig. 16.

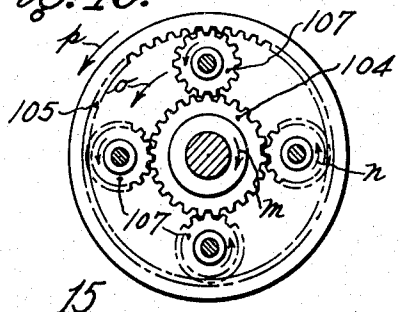


Fig. 15.

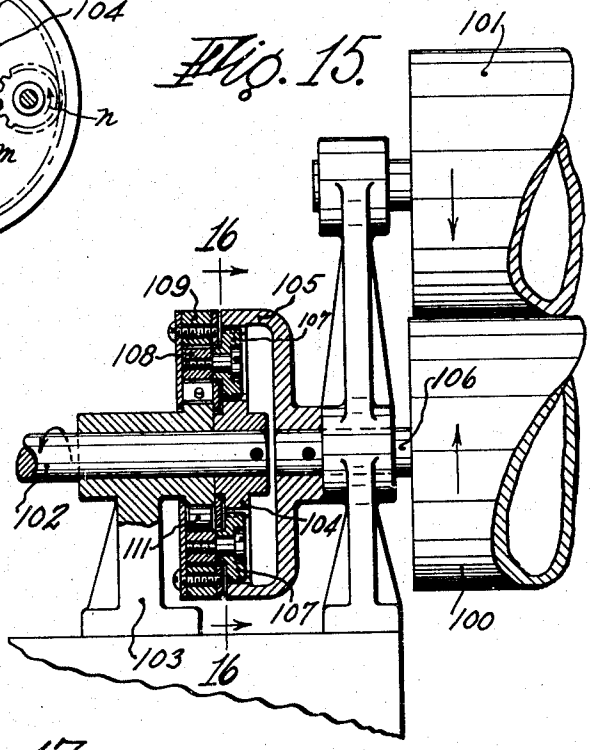


Fig. 14.

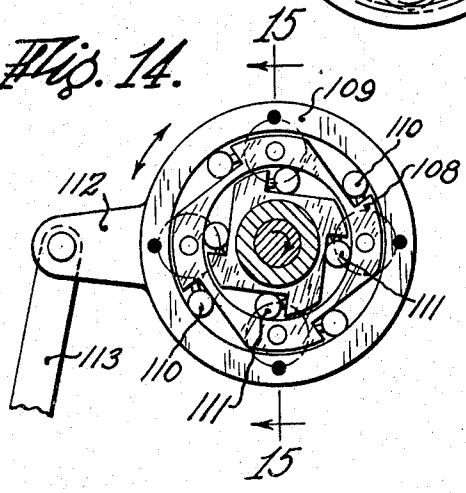


Fig. 17.

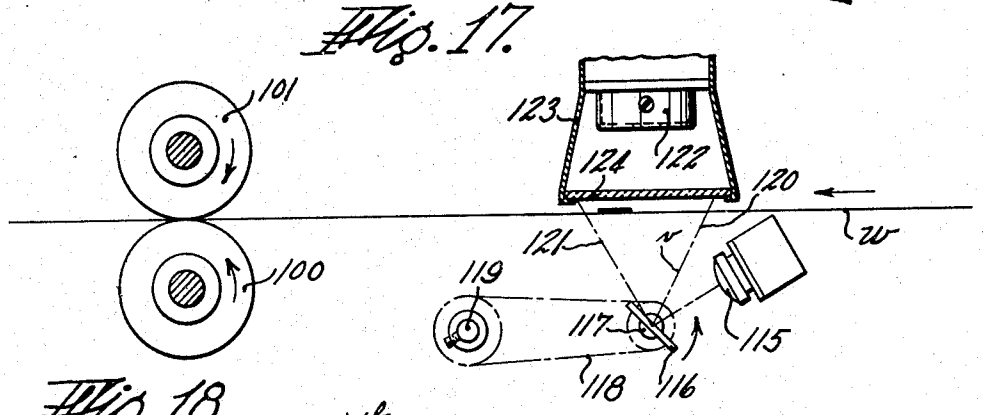
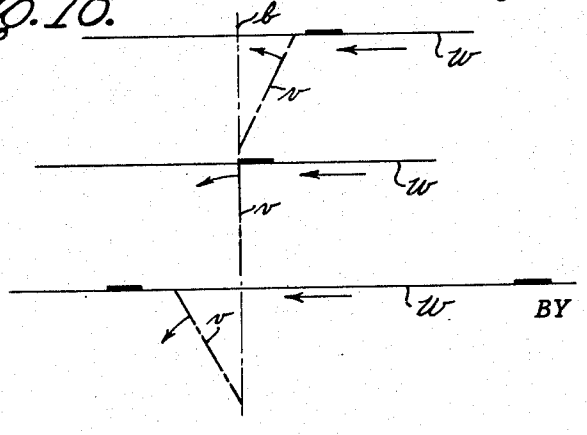


Fig. 18.



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Patented Feb. 4, 1936 2,029,919

UNITED STATES PATENT OFFICE

2,029,919

WEB REGISTERING DEVICE

Frederic B. Fuller, Springfield, Mass., assignor to Package Machinery Company, Springfield, Mass., a corporation of Massachusetts

Application June 16, 1932, Serial No. 617,550

28 Claims. (Cl. 271—2.6)

This invention relates to mechanism for securing accurate registration of a printed web with a web treating mechanism such as a device for cutting the web into sheets. It has been recognized as a problem that a printed web changes in length due to changes in various conditions, such as humidity of the atmosphere, and that unless a correcting mechanism responsive to changes in position of the indicia on the web is employed it is impossible to sever the web into sheets with the lines of cut in proper position. Numerous mechanisms have been proposed for achieving automatic registry, but as far as I am aware none of them capable of use with an imperforate web register the web exactly at each cycle, without itself introducing a permanent change into the rate of feed or the timing which may need to be compensated for later on. With a perforated web it is possible to have the feeding mechanism act directly upon the walls of the perforations to carry the web to its ultimate position, but with imperforate webs this is impossible. Generally an indeterminate correction has been made, as by causing slippage of the feed rolls or by applying a brake, or the correction has been by repeated applications of a shift of definite magnitude; so that in either case the registry of the web is exact only by accident, drifting within limits around the correct point.

It is the object of the present invention to provide a web registering mechanism in which the required length of web is measured before each feeding operation, and the feeding mechanism is set so that exactly the required amount will be fed. Another object is to provide a web registering mechanism which will of itself introduce no cumulative change in the length of web fed at each cycle, but will on the contrary deal with each length to be cut as a problem by itself and will not carry over into successive lengths the result of a deviation in one. Another object is to avoid the effect of an oscillating drift from one side to the other of the desired standard, as is the result of many of the mechanisms heretofore proposed for this purpose. Additional objects will appear from the following description and claims.

Referring to the drawings:

Fig. 1 is a side elevation of one form of web feeding mechanism embodying the invention, the parts being shown in the positions they occupy at the start of the web-feeding part of the cycle;

Fig. 2 is an end elevation of certain parts shown in Fig. 1;

Fig. 3 is an end elevation of a portion of the feed roll drive;

Fig. 4 is a section on line 4—4 of Fig. 3;

Fig. 5 is an elevation similar to Fig. 1 but showing the parts in the positions they occupy at the end of the web feeding part of the cycle and the start of what may be called the scanning part of the cycle;

Fig. 6 is a side elevation of certain parts shown in Fig. 5, looking from the left in that figure;

Figs. 7 and 8 are details illustrating the manner in which the indicia on the web coact with the photoelectric scanning device;

Fig. 9 is a diagram illustrating the operation of the form of the device shown in Figs. 1 to 8 inclusive;

Figs. 10, 11, 12 and 13 are details of certain elements of the mechanism shown in Figs. 1 and 5;

Fig. 14 is a detail of a modification employed to adapt the device to a continuous web feed mechanism;

Fig. 15 is a side elevation of the form shown in Fig. 14, showing also the web feeding rolls, the view being partly in central section on the line 15—15 of Fig. 14;

Fig. 16 is a section on line 16—16 of Fig. 15;

Fig. 17 is a diagram showing the arrangement of photoelectric cell and light source preferably used with the modification of Figs. 14, 15 and 16; and

Fig. 18 is a diagram showing the operation of that modification.

The device is adaptable for maintaining exact register in either intermittent or continuous web feeds. In either form the device includes a web scanning mechanism, preferably involving a photo-electric cell, which determines the position of spots or other indicia on the web relative to a fixed reference line during each cycle; and a feeding device which adds or subtracts from the normal feeding movement of the web just the amount required to bring the spots into exact register with a second reference line upon the next feeding cycle. The correction, within the range of deviation for which the mechanism is set, is exact; thereby differing from previous devices in which the correction introduced was of a magnitude independent of the deviation from register, or itself introduced a cumulative error into the feed.

The web w is provided at regular intervals with indicia a of a transparency contrasting with the rest of the web and preferably forming a part of the design or type matter printed on it. Other forms of spots could be used in case the web is to be viewed by reflected light. In the present case

it will be assumed that the web is relatively transparent and the indicia or spots *a* are opaque. The web is supplied on a roll 20 rotatable in a bracket 21, and is led from the supply roll over a tension roll 22 and guide rolls 23 and 24 between upper and lower feed rolls 25 and 26. The tension roll may be mounted on a swinging arm 27 pivoted at 28 to the frame 29 and having a spring 30 stretched between it and the frame. Roll 25 is driven only by contact with the web and is preferably cork surfaced. It is mounted on a shaft 31 carrying blocks 32 at its end adapted to slide vertically in ways 33 rising from the frame. A lever 34 is pivoted to the frame at 35 and has a cam portion 36 adapted to contact with the shaft 31 so that the roll may be raised for convenience in inserting a web under it.

The lower feed roll 26 is, in the form of apparatus used with an intermittent web feed, driven through a one-way clutch shown in Figs. 3 and 4. On the shaft 37 of this roll is keyed the ratchet portion 38 of a ball or roller clutch or free wheeling unit. Balls or rollers 39 are located in the recesses formed by the cut-away portions 40 of the ratchet, and are pressed outwardly by springs 41. Surrounding this mechanism is the cylindrical flange 42 of a spider 43 freely rotatable on the shaft 37. A cover plate 44 is secured to the flange 42 to enclose the balls. Fixed to the spider 43 is a pinion 45 with which a rack 46 meshes. To preserve the rack in proper mesh with the pinion irrespective of changes in its angular position, it slides in a guide 47 pivoted to the shaft 37.

Rack 46 is pivoted to a clamp 50 adjustably mounted on a rod 51. The rod is secured in a socket 52 in a driven member 53 (Fig. 10) freely rotatable upon a stub shaft 54. The member 53 is coupled at times rigidly and at times flexibly to a driving member 55 (Fig. 11) also freely pivoted upon the stub shaft. The driving member 55 is oscillated back and forth once during each cycle through a constant angle by a constantly rotating shaft 56 carrying a crank 57 which bears at its end a pivoted block 58 running in ways 59 formed by a forked projection of the member. Driving connection between the two members 53 and 55 is for the most part positive and is obtained by a pin 59' extending laterally from the driving member through a hole 60 in the driven one. When the members are moving clockwise, as viewed in Figs. 1 and 5, the pin 59 rests against what is in Fig. 5 the upper side of the hole 60. During the major part of their counter-clockwise motion the pin 59 presses against one end of a bar 61 pivoted at 62 to the member 53 and having a curved recess 63 in its other end.

In the position of Fig. 5 the curved recess rests upon the cylindrical surface of a collar 64 (Fig. 12) fixed to the end of shaft 54 as by a set screw 65. In this position the bar acts as a rigid part of the member 53. As the rotation of the members continues the bar passes over a slabbed off part 64' of the collar. When, as in Fig. 1, the rotation of the members 53 and 55 has progressed to a point where the bar no longer bears on the collar it ceases to act as a rigid part of the driven member, and the pin 59 cannot continue to serve as the driving connection. From this point on in the counter-clockwise rotation of the members, coupling between them is obtained by a spring 66 stretched between a pin 67 on the member 53 and a pin 68 on the member 55. The spring is strong enough to cause the two members to move as a unit unless the member 53 is stopped by mechanism to be described, and in the absence of such stoppage the rack 46 would reciprocate through a constant distance in each cycle dependent upon the adjustment of the clamp 50.

The spring alone could be used to couple the two members together for counter-clockwise rotation if desired, but in that case the spring would have to be made of much increased strength. The inertia of the parts carried by the driven member 53 is considerable, and when the counter-clockwise rotation is started there would be a heavy pull on the spring. To avoid the necessity of using a spring strong enough to overcome this inertia,—a strong spring being undesirable from the standpoint of avoiding shock when the driven member is stopped suddenly,—the bar 61 is preferably used. This gives a positive connection between the members at all times except during the portion of their movement when the operation of the control mechanism requires that they yield relative to each other.

Freely pivoted on a stub shaft 70 is a correcting cam or adjustable abutment 71, provided at one side with a weight 72 which overbalances the cam and hence constantly seeks to move the latter clockwise as viewed in the drawings into a position above its pivot shaft. At best shown in Fig. 13, the periphery of the cam is eccentric to its pivot; and thus acts as an abutment, adjustable by a change in its angular position, against which a stop screw 73 on the member 53 is adapted to contact. The counter-clockwise rotation of member 53 will be stopped short of the full rotation of its driving member by an amount dependent upon the position in which the stop screw 73 finds the eccentric cam. The cam is held in adjusted position by a brake shoe 74 operated by the web scanning mechanism in a manner to be described below. It is reset in the position of Fig. 5 at every web feeding stroke of the mechanism by a cam 75 carried by the member 55 and contacting with a roll 76 on the correction cam.

The brake shoe 74 is carried on a bent lever 80, the lower end of which acts both as a weight which tends to hold the brake out of contact with the correction cam as in Fig. 5, and as an armature by which the brake may be swung into the active position of Fig. 1 by an electromagnet 81 mounted in a suitable bracket 82 on the frame. This electromagnet is in the circuit of a standard amplifier or relay unit controlled by a photo-electric cell 83. Since these cells and their amplifier units are standard articles of manufacture, and since the detailed discussion of the necessary wiring would add great complexity to the description, the amplifier unit will not be shown. It may, however, be pointed out that there are two standard types of amplifier circuit used with photo-electric cells, one sending a current through its external circuit when light falls on the cell, and the other sending current through the external current when the light rays are eclipsed. In the form of the invention now being considered the second form is assumed to be used, although the mechanism could readily be adapted for the other if desired. Any form of amplifier, mechanical relay or electronic valve, may be used; the latter being preferable on account of the greater speed of response.

The photo-electric cell 83 is mounted on one arm of a bell crank 84 pivoted at 85 to the frame. The other arm bears a cam roll 86 bearing on a cam segment 87 carried for convenience by the driven member 53. As the member 53 is oscil-

lated the cell will be moved back and forth between the position of Fig. 1 and that of Fig. 5, always within range of a beam coming from a light source 88 and entering the cell through a small slit 89 (Fig. 8) in its cover. In order to vary the amplitude of the oscillation of the cell 83 to accommodate webs in which the variations in spot spacing are large or small, and to change the timing of the cell to secure exact correction, the cam 87 is made adjustable. As shown, the cam is pivoted to the member 53 by a pin 90, and is formed with arcuate slots through which pass screws 91 extending into the member 53. By loosening the screws the cam may be turned on its pivot to vary its eccentricity with respect to the shaft 54 and thus the swing that is given to the bell crank 84. In practice the swing of the bell crank is kept as small as possible consistently with the variations that exist in spot spacing on the web, as this increases the accuracy with which the device works.

Before considering the modifications of the device which accommodate it to the registration of continuously moving webs the operation of the form already described will be gone over in detail. The fundamental operation is the action of the photo-electric cell at the instant of eclipse in clamping the brake 74 against the cam 71, fixing the cam in the position it then occupies. When the counter-clockwise rotation of member 53 brings the stop screw 73 against the cam the driven member 53 is arrested, while the driving member 55 continues the full movement imparted to it by the crank 57. This continued movement is accompanied by a stretching of the spring 66. When the driving member 55 starts its return motion the spring holds the screw 73 against the cam 71 until the pin 59' strikes the upper side of the hole 60, whereupon the two members 53 and 55 begin to move in unison. It will be seen that the driven member 53, which operates the feed rolls, loses an amount of the initial clockwise or web feeding movement dependent upon the angular position in which it was stopped by the cam 71. The less the rotation permitted to the driven member 53 on its counter-clockwise or return stroke, the less the rotation it can have on the succeeding clockwise or feeding stroke; and since the rotation of the feed rolls is directly dependent on the amount of clockwise rotation of the driven member 53, the length of web fed will be dependent on the setting given to the cam 71.

The scanning action of the photo-electric cell, by which the cam 71 is controlled, will now be described with particular reference to Fig. 9. In that figure, *b* represents the reference line at which the leading end of the spot *a* will stop if the web is in correct register. This line has no fundamental position relative to the line *k* (Fig. 5) of the knife or other web treating device, the distance between them depending wholly upon the manner in which the web is printed. When the machine is once set up for a particular form of web the relation between the lines *b* and *k* remains constant, and if a spot *a* is in register at *b* another portion of the web (assuming it to be of standard length) is in correct register with the cutting device at *k*. Fig. 9 is divided into sections numbered I, II, etc. representing successive stages in the scanning action. In position I, which corresponds to Fig. 5, the web has just come to rest in correct register. The leading edge of the spot *a* is on the line *b*. The photo-electric cell 83 (shown diagrammatically only in Fig. 9) is at the left hand limit of its oscillation, and thus receives light from the source 88 through the transparent web. As stated above, the amplifier unit is in this embodiment chosen so that there is no current flowing through the magnet 81 as long as light falls on the cell.

With the web still at rest the continued rotation of crank 57 starts the driving member 55 on its counter-clockwise rotation. Bar 61 is at this time locked by collar 64, so that the driven member 53 moves with the driving member as a rigid part of it. Cam 87 of course partakes of this motion, constantly elevating the roll 86 so that the cell 83 is shifted slowly to the right. At the position marked II the cell just passes under the spot *a* and is cut off by it from receiving light from the source 88. Magnet 81 is instantly energized and the brake 74 is clamped against the cylindrical weight 72 carried by the cam 71, which was carried around by the resetting cam on the preceding stroke and is now following the resetting cam back under the influence of the weight 72. The cam 71 of course stops as soon as the brake strikes it, while the resetting cam 75 leaves it as shown in Fig. 1. The rotation of the parts 53 and 55 continues until the screw 73 strikes cam 71, when the driven member (now released by the bar 61) stops as described above. Upon the return stroke an amount of web is fed sufficient to feed out one normal unit of web.

Now let us suppose that the web has stretched slightly, so that the next succeeding spot *a'* does not quite reach the reference line *b* (Fig. 9, I'). The cell 83 is not eclipsed in the position II', as it was in the corresponding position II, but must move further toward the position III' before eclipse. Expressed in other words, the phase of the cycle of the machine at which registration between the spot and the scanning device occurs is different in the two cases. The cam 71 is thus allowed in the second case to move further in a clockwise direction before it is clamped, bringing a portion of its surface of lesser diameter (Fig. 13) within range of the stop screw 73. The member 53 is thus permitted a greater counter-clockwise travel before being stopped, and moves the web a greater distance on the next succeeding active stroke. The travel of the cell 83 can be adjusted readily by the screws 91 so as to correspond with the contour of cam 71, whereby the web will be fed into register with the line *k* at each stroke irrespective of variations in the spacing between successive spots *a*. It can easily be seen that a similar although opposite correction occurs if the web shrinks (Fig. 9, I''), bringing the edge of spot *a''* beyond the registry line *b*. Throughout Fig. 9 the spots *a°*, *a*, and *a'* have been shown as fed in accurate alinement with a registry line *k'*, which may or may not coincide with the cutting line *k* depending upon whether or not the web is to be cut along the forward edges of the spots. This is indicative of the fact that the web is measured at each cycle and an amount fed which is just sufficient to bring the indicia into absolute register, this amount having a proportional relation to the phase of the cycle at which eclipse occurred.

The modification shown in Figs. 14–17 will now be described. Most of the mechanism is identical with that previously described, and only the web feeding and scanning mechanism will be considered. The web in this instance is to be fed continuously, without the interval of rest during which scanning took place in the previous form. The driven feed roll 100 and the idle feed roll 101

are preferably geared together in the usual manner, and derive their fundamental motion from a continuously rotating shaft 102. This shaft is journaled in a bracket 103 and carries at its inner end a pinion 104. Surrounding the pinion is an internal gear 105 fixed to the end of the shaft 106 of roll 100 and driven from the pinion by a series of planet gears 107 rotatably mounted on a carrier 108. An auxiliary rotation is given to the feeding rolls through the carrier 108 by an oscillating driving ring 109 surrounding the carrier and coupled to it by a one-way silent ratchet 110, while a second silent ratchet 111 prevents the carrier from following the driving ring on its return stroke. The auxiliary rotation of the roll 100 is here shown as being given in the same direction as the rotation given it by the shaft 102, although with appropriate changes in other mechanism a reverse motion could be used. The relation between the various rotations will be understood best from Fig. 16, in which the arrows *m*, *n*, *o*, and *p* represent the direction of rotation of the shaft 102, the planet gears 107, the carrier 108, and the internal gear 105. Rotation of the shaft 102 is continuous, that of carrier 108 is intermittent, and that of the planet gears and the internal gear is a compound of the two.

The driving ring 109 has an extension 112 by which it is coupled to a link 113 which replaces the rack 46 in the previous form and, like it, is moved by the driven member 43 under the control of the cam 71. When the member 43 oscillates counter-clockwise in the scanning part of the cycle the driving ring 109 will produce no effect on the carrier 108 due to the interposition of ratchet 110. Upon its clockwise or feeding stroke, however, the member 43 will move the ring 109 through an arc dependent on the setting of cam 71, and will impart to the feed rolls an increase in rotation over that which would normally be given to the rolls by shaft 102 in exact accordance with the requirements of the web as determined by the scanning device.

Since the web is in continuous motion at a rather high speed it is necessary to alter somewhat the scanning mechanism used where the web was stationary during the scanning cycle. In order to avoid the necessity of moving the photo-electric cell at a speed corresponding to that of the web it is preferable to invert the previous structure and move the light beam instead. One convenient way of doing this is shown in Fig. 17. The light source 115 used in this instance has been placed below the web, and directs its light onto a rotating mirror 116 fixed to a shaft 117. This shaft is preferably coupled by a chain and sprocket connection 118 to a shaft 119 rotating continuously in timed relation to the remainder of the machine. The light beam will be reflected by the mirror in its rotation in a path including as its active portion the range between the lines 120 and 121, so that the beam (which is confined to a small pencil *v* of light by reducing the aperture of the light source) sweeps across this active zone once during each scanning cycle at a linear speed along the web dependent upon the vertical position of the shaft 117. Arranged on the other side of the web *w* is a photo-electric cell 122, enclosed within a light-proof box 123 having a ground glass screen 124 overlying the path of the spot *a*. Due to the diffractive power of the ground glass the cell will receive the light rays practically equally whether the light pencil impinges at one point or another along the screen 124. If the pencil strikes the spot *a*, however, the light will be cut off from the cell.

The operation of this form of the device will now be considered. The speed of the light pencil *v* along the web is preferably slightly less than that of the web although in the same direction, so that the spot catches up to it at a relatively slow rate. Normally the machine is set so that when the light pencil is at the reference line *b* the leading edge of the spot has just arrived at the same place. If the spot lags behind this correct register it will not catch up to and eclipse the light pencil until a later time, or a later phase in the machine cycle, giving the cam 71 a greater rotation than normal before it is stopped exactly as in the case of the intermittent feed previously described. The web is accordingly fed out a length greater than normal by the amount necessary to bring the registration of the lagging spot to normal at the reference line *k'*. A reverse action of course takes place when the web is contracted so that the spot leads instead of lags. The accuracy with which the registration is corrected in this form of the device is not impaired by the high speed of the web, since the speed of the light pencil and the web relative to each other can be kept slow and the correcting clutch needs only a small motion at each cycle. It is desirable to keep the motion of the clutch down as much as possible, as in this form the main feed is not derived from the crank 57 but only the surplus necessary for correction. When the apparatus is used for handling a continuously fed web, therefore, the clamp 50 is preferably shifted closer to the shaft 54 to cut down the throw given to link 113; and a higher eccentricity given to the cam 71. If the device were designed for continuous feeding alone the throw of crank 57 could conveniently be reduced so that the major part of the travel of link 113 would be subject to correction. These changes are, however, only desirable refinements, and the same operating mechanism can be used on both types of feed if desired.

The two modifications chosen for illustration have been described with considerable attention to detail. It will be understood, however, that the invention is not restricted to these details, as will be pointed out clearly in the following claims, and that numerous changes may be made in the apparatus while remaining within the scope of the invention. In particular, the type of photo-electric cell may be changed; both the selenium or varying resistance type and the electronic type being suitable for use. Indeed, in some of the aspects of the invention the photo-electric cell could be replaced by some form of mechanical or electrical contact operating through holes in the paper or coacting with conducting or embossed areas in the general manner that they have been used in prior devices; the feeding and correcting mechanism being in some aspects broadly independent of the particular scanning device used. The use of a photo-electric cell is preferred, however, on account of its reliability, absence of moving parts, and speed of response.

What I claim is:

1. In a web feeding device of the type in which the rate of feed of the web is controlled by the phase relation or position of indicia on the web relative to a detecting device, that construction of detecting device which comprises means movable at a speed different from the surface speed of the web and in the line of the web's motion.

and mechanism responsive to variations in the phase in the cycle of the machine at which coincidence between said means and the indicia on the web occurs for varying the rate of feed of the web.

2. In a web feeding device of the type in which the amount of feed of the web is controlled by the phase relation or position of indicia on the web relative to a detecting device, that construction of detecting device which comprises a photo-electric cell, means for moving the cell along the web while the latter is stationary, and means controlled by the phase at which coincidence between the cell and the indicia on the web occurs for varying the rate of feed of the web.

3. In a web feeding device of the type in which the amount of feed of the web is controlled by the phase relation or position of indicia on the web relative to a detecting device, that construction of detecting device comprising a light source, a photo-electric cell, and means for causing relative movement between the light source and the photo-electric cell along the path line of the web-borne indicia.

4. In a web feeding device of the type in which the amount of feed of the web is controlled by the phase relation or position of indicia on the web relative to a detecting device, that construction of detecting device comprising means for emitting a light beam, means for causing the light beam to move along the path line of indicia on the web, a photo-electric cell positioned to receive the light beam unless the latter is eclipsed by the indicia, and a web feed varying device controlled by said cell.

5. In a web feeding device of the type in which the amount of feed of the web is controlled by the phase relation or position of indicia on the web relative to a detecting device, that construction of detecting device comprising means for emitting a light beam, a rotatable mirror positioned to reflect the light beam along the path line of indicia on the web, a photo-electric cell, and a light-proof box enclosing the cell and having a ground glass screen adjacent the web.

6. A web feeding device comprising a pair of feed rolls, a power shaft, a three-element epicyclic gear train of which one element is connected to the shaft and a second element to one of the rolls, means for rotating the shaft at a rate differing by a constant amount from the required normal when the third element of the gear train is held stationary, and means responsive to deviations in web register from normal to shift the third element of the gear train at each cycle by the amount required to bring the web into registry.

7. A web feeding device comprising a pair of feed rolls, a power shaft, a three-element epicyclic gear train of which one element is connected to the shaft and a second element to one of the rolls, means for rotating the shaft at a rate differing by a constant amount from the required normal when the third element of the gear train is held stationary, a stationary one-way clutch preventing movement of the third element in one direction, a movable one-way clutch adapted to move the third element in the opposite direction, means to oscillate the movable one-way clutch through a variable angle, and means responsive to deviations in web registry from normal to vary the arc of oscillation of the movable one-way clutch.

8. A web feeding device comprising a pair of feed rolls, a power shaft, a three-element epicyclic gear train of which one element is connected to the shaft and a second element to one of the rolls, means for rotating the shaft at a rate differing by a constant amount from the required normal when the third element of the gear train is held stationary, a stationary one-way clutch preventing movement of the third element in one direction, a movable one-way clutch adapted to move the third element in the opposite direction, a member oscillating through a fixed angle, a second member yieldingly connected to the first, an eccentric cam interposed in the path of the second member to limit its rotation, a connection between the second member and the movable one-way clutch, and means responsive to deviations in web registry from normal for setting the eccentric cam.

9. A web feeding device comprising a member oscillating through a constant angle, a second member yieldingly connected to the first, an eccentric cam interposed in the path of the second member to limit its rotation, a web forwarding mechanism, a device connecting the second member and the web forwarding mechanism whereby said mechanism will be operated at each cycle an amount dependent upon the oscillation permitted to the second member by the cam, and means responsive to deviations in register of the web from normal for setting the cam.

10. A web feeding device comprising a member oscillating through a constant angle, a second member yieldingly connected to the first, an eccentric cam interposed in the path of the second member to limit its rotation, a web forwarding mechanism, a device connecting the second member and the web forwarding mechanism whereby said mechanism will be operated at each cycle an amount dependent upon the oscillation permitted to the second member by the cam, means for moving the cam progressively during the web scanning portion of the cycle, web scanning mechanism, and means controlled by the scanning mechanism for holding the cam stationary.

11. A web feeding device comprising a member oscillating through a constant angle, a second member yieldingly connected to the first, an eccentric cam interposed in the path of the second member to limit its rotation, a web forwarding mechanism, a device connecting the second member and the web forwarding mechanism whereby said mechanism will be operated at each cycle by an amount dependent upon the oscillation permitted to the second member by the cam, means for moving the cam progressively during the web scanning portion of the cycle, an electromagnetic brake, a light source, a photo-electric cell, means for causing relative movement between the light source and the photo-electric cell along the path line of indicia borne by the web, and connections between the photo-electric cell and the electromagnetic brake to apply the brake when light passing from the source to the cell is eclipsed by the passage of one of the indicia.

12. A web feeding device comprising a member oscillating through a constant angle, a second member yieldingly connected to the first, means coupling said members rigidly together during their movement in one direction and the first portion of their movement in the other direction, an eccentric cam interposed in the path of the second member to limit its rotation in the second named direction, a web forwarding mechanism, a device connecting the second member and the web forwarding mechanism whereby said mecha-

nism will be operated at each cycle an amount dependent upon the oscillation permitted to the second member by the cam, and means responsive to deviations in register of the web from normal for setting the cam.

13. A web feeding device comprising a member oscillating through a constant angle, a second member yieldingly connected to the first, means coupling the members rigidly together during their motion in one direction and the first portion of their movement in the other direction, a shiftable abutment adapted to limit the rotation of the second member in the second named direction, means responsive to deviations in register of the web from normal to control the position of the abutment, and web feeding devices actuated by the second member.

14. A web feeding device comprising a member oscillating through a constant angle, a second member yieldingly connected to the first by a tension spring, a pin on one of the members extending loosely through a hole in the other, a bar pivoted on the member not bearing the pin, and a stationary cam holding the bar wedged against the pin during motion in one direction and the first portion of their movement in the other direction, a shiftable abutment adapted to limit the rotation of the second member in the second named direction, means responsive to deviations in register of the web from normal to control the position of the abutment, and web feeding devices actuated by the second member.

15. A web feeding device comprising a power means having a constant cycle, a web forwarding mechanism adjustably connected to said power means, a scanning device adapted to coact with indicia on the web by relative movement between the scanning device and the web in the direction of the length of the web, so as to bring successive indicia into register with the scanning device at phases of the cycle of the power means dependent upon the displacement of the indicia along the line of the length of the web, and means responsive to the phase at which registration between the indicia and the scanning device occurs for adjusting the web forwarding mechanism by amounts having a proportional relation to the phase of the cycle at which registration occurs.

16. In a web handling device of the type controlled by the coaction of indicia on the web with a detecting device, that construction of detecting device which comprises a light source, a photoelectric cell, a slotted member shielding the photoelectric cell from light from said source except that admitted through the slot, and means for moving the slotted member about an axis extending transversely of said line of travel to cause the slot to move along the line of travel of the web in a path whose projection on the web is coincident with the line of movement of the indicia.

17. A web feeding device comprising a pair of feed rolls, a continuously rotating power shaft, a three element epicyclic gear train of which one element is connected to the shaft for continuous rotation thereby and a second element is connected to one of the rolls, means for rotating the shaft at a rate differing by a constant amount from the required normal when the third element of the gear train is held stationary, a scanning device periodically operable to detect the condition of registry of indicia on the web with respect to a predetermined normal, and means controlled by the scanning device to shift the third element of the gear train in a direction to give an auxiliary rotation to the feed rolls.

18. A web feeding device comprising a pair of feed rolls, a power shaft, a three element epicyclic gear train of which one element is connected to the shaft and a second element to one of the rolls, means for rotating the shaft at a rate differing by a constant amount from the required normal when the third element of the gear train is held stationary, a stationary one-way clutch preventing movement of the third element in one direction, a movable one-way clutch adapted to move the third element in the opposite direction, and means responsive to deviations in web registry from normal to cause said movable one-way clutch to shift said third element in said opposite direction to give an auxiliary rotation to the feed rolls.

19. A continuous web feeding device comprising a pair of feed rolls, a constant speed drive for said rolls operating at such a speed that the rate of web feed given by the feed rolls will be less than that required for a normal web, a device for superimposing upon the feed rolls an auxiliary rotation in the same direction as and in addition to that given by the constant speed drive, and means responsive to deviations in web registry from normal to govern the operation of said device.

20. A continuous web feeding device comprising a pair of feed rolls, a constant speed drive for said rolls, a one-way coupling device joining the feed rolls with said drive so that the speed of the feed rolls can never fall below that imparted by the drive but may be raised above it, an auxiliary drive for the feed rolls, a second one-way coupling device interposed between said auxiliary drive and said rolls and adapted to impart to the feed rolls intermittent increments of speed greater than that given to them by the constant speed drive, and means responsive to deviations in web registry from normal to govern the operation of said auxiliary drive during the continued motion of the web.

21. In a web feeding device of the type in which the rate of feed of the web is controlled by the phase relation or position of indicia on the web, a detecting device, means for actuating the detecting device to cause it to scan the web along the path line of the indicia thereon at a rate relative to the indicia on the web substantially less than the normal feeding speed of the web, and means responsive to the position in said scanning movement at which coincidence occurs to control the operation fo the web feeding device.

22. A continuous web feeding device comprising a pair of feed rolls, differential gearing having one element connected to said rolls, a constant speed drive connected to a second element of said differential gearing and operated continuously to impart to the feed rolls a speed biased in one direction from the required normal by an amount in excess of the maximum variation to be corrected, means to actuate the third element of the differential gearing at regular intervals and in a single direction to give the feed rolls substantially the amount of rotation desired for normal operation, and mechanism responsive to variations in registry of the web for varying the amount of actuation given to the third element of the differential by said means.

23. A continuous web feeding device comprising a pair of feed rolls, differential gearing having one element connected to said rolls, a constant speed drive connected to a second element of said differential gearing and operated continuously to impart to the feed rolls a speed biased in one

direction from the required normal by an amount in excess of the maximum variation to be corrected, a one way clutch connected to the third element of the differential gearing, a member for operating said clutch, positive means for moving the member in its clutch operating direction, yielding means for moving the member in its inactive direction, an abutment positioned to engage and stop said member in its inactive motion, and mechanism responsive to variations in registry of the web for varying the relative positions of the abutment and the member and hence the amount of motion given to the third element of the differential gearing through the one way clutch on the next succeeding active movement of said member, whereby the feed rolls will be given substantially the amount of rotation desired for normal operation.

24. A web feeding device comprising means for forwarding the web, web scanning mechanism operative to detect quantitatively the magnitude of the deviation of indicia on the web from register, a member movable through a course in each cycle of the operation of the device, means controlled by the scanning mechanism to arrest the member in its course in a position having a quantitative relation to the deviation of the indicia from register, and mechanism controlled by the position of said member for varying the forward movement given to the web.

25. A web feeding device comprising means for forwarding the web, web scanning mechanism operative to detect quantitatively the magnitude of the deviation of indicia on the web from register, a movable member controlling by its position the magnitude of web feeding movement of said web forwarding means, and mechanism controlled by the web scanning mechanism for varying the position of said movable member in accordance with the magnitude of deviation of said indicia.

26. A web feeding device comprising means for forwarding the web, web scanning mechanism operable to detect quantitatively, and with unbroken continuity throughout the range of the device, the magnitude of deviation of the indicia on the web from register, and means controlled by the web scanning mechanism and controlling the web forwarding means to alter the magnitude of the web feeding movement of said forwarding means quantitatively in proportion to the magnitude of the deviation of said indicia from register.

27. In a web feeding device of the type in which the rate of feed of a continuously moving web is controlled by the phase relation or position of indicia on the web, a detecting device comprising a light source and a photoelectric cell, means for causing said detecting device to scan the web along the path line of the indicia thereon in the same direction as the travel of the indicia but at a different speed, and means controlled by said detecting device to control the operation of the web feeding device.

28. In a web feeding device of the type in which the rate of feed of a continuously moving web is controlled by the phase relation or position of indicia on the web, a detecting device comprising a light source and a photoelectric cell, means for causing said detecting device to scan the web along the path line of the indicia thereon in the same direction as the travel of the indicia but at a different speed, and means responsive to the position in said scanning movement at which coincidence occurs to control the operation of the web feeding device.

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