March 10, 1936. E. L. SMITH ET AL 2,033,857

WEB REGISTERING DEVICE

Filed June 16, 1932 3 Sheets-Sheet 1

Fig. 1.

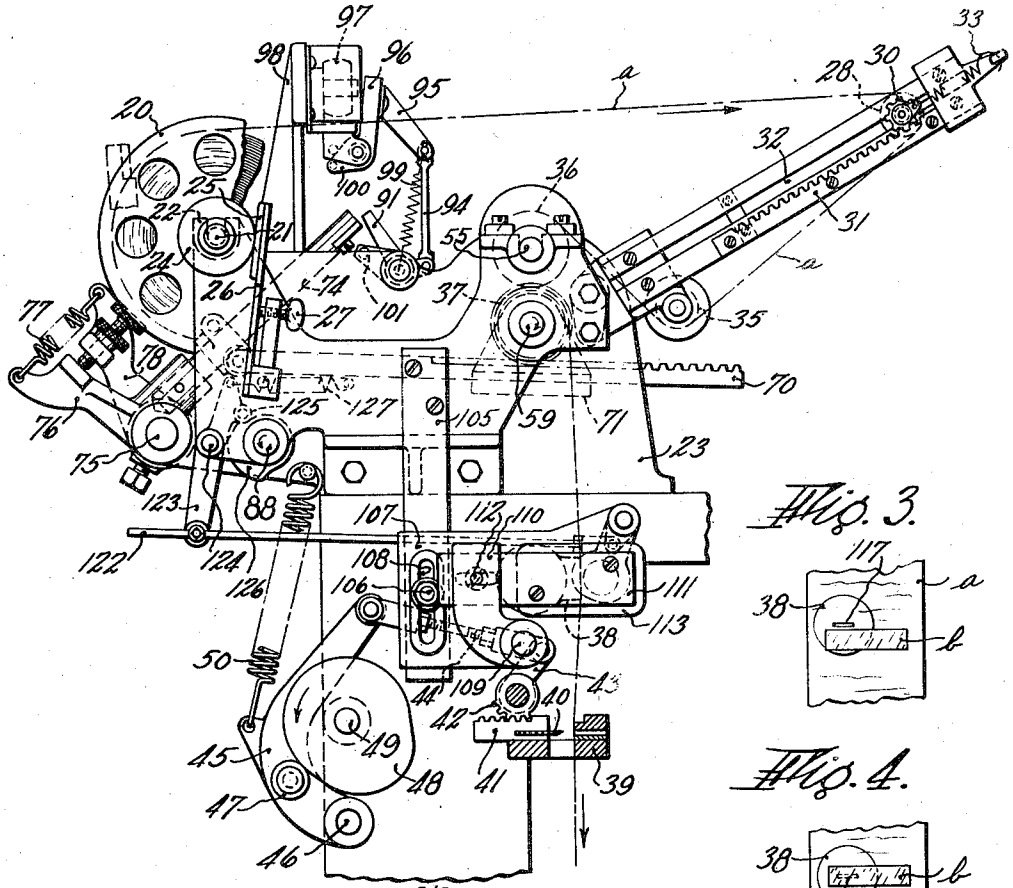


Fig. 3.

Fig. 4.

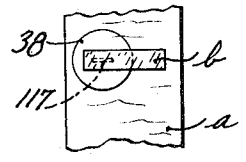
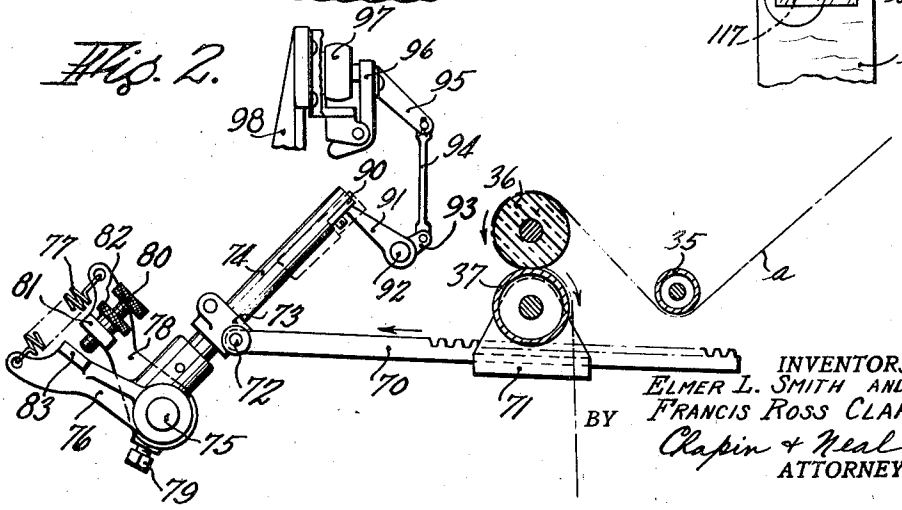


Fig. 2.



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Filed June 16, 1932 3 Sheets-Sheet 2

Fig. 6.

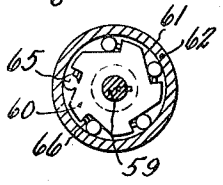
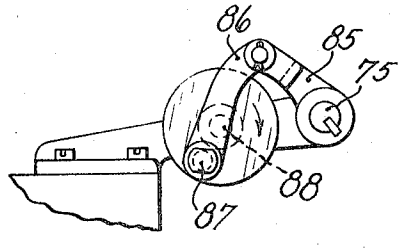


Fig. 5.

Fig. 7.



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Filed June 16, 1932 3 Sheets-Sheet 3

Fig. 8.

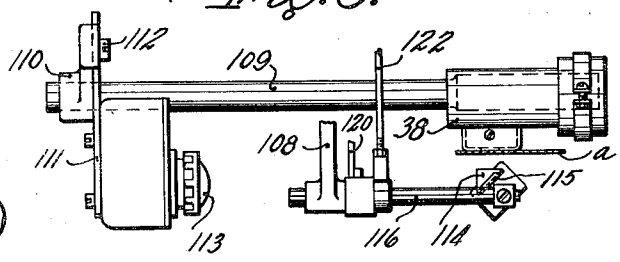


Fig. 12.

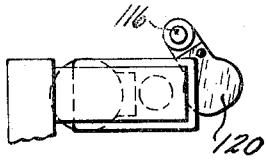


Fig. 13.

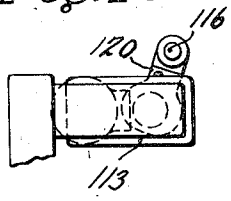


Fig. 9.

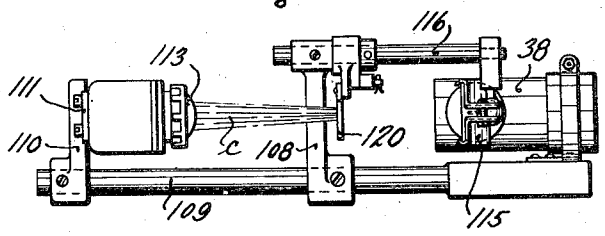


Fig. 10.

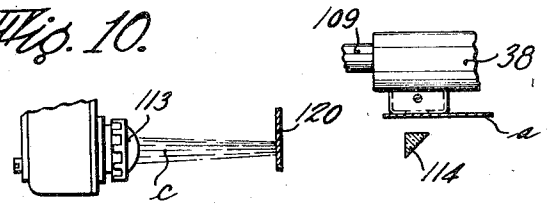
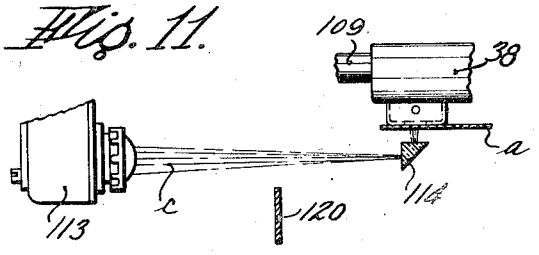


Fig. 11.



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UNITED STATES PATENT OFFICE

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WEB REGISTERING DEVICE

Elmer L. Smith, Longmeadow, and Francis Ross Clark, Springfield, Mass., assignors to Package Machinery Company, Springfield, Mass., a corporation of Massachusetts

Application June 16, 1932, Serial No. 617,534

11 Claims. (Cl. 271—2.6)

This invention relates to mechanism for registering printed webs of paper with a web treating device such as a cutter for severing the web into lengths. It has been recognized that due principally to changes in atmospheric conditions the length of a web will change, causing variations in the distance between the recurrent printed areas upon it; and numerous mechanisms have been proposed for regulating the feed of the web so as to preserve these printed areas in registration with the cutter. It is the object of this invention to improve upon these prior mechanisms in various particulars, including simplicity of construction, adaptability to numerous uses, speed of operation, and reliability in action. Other objects will appear from the following description and claims.

Referring to the drawings:

Fig. 1 is a side elevation of a web feeding device embodying the invention;

Fig. 2 is a fragmentary similar view showing the parts in different positions of operation;

Figs. 3 and 4 are details showing the web in different positions of register;

Fig. 5 is a top plan view of the device;

Fig. 6 is a detail section, taken on line 6—6 of Fig. 5;

Fig. 7 is a detail of the driving mechanism for the paper feed;

Fig. 8 is a detail plan of the photo-electric cell and the mechanism by which it inspects the register of the web;

Fig. 9 is a side elevation thereof;

Fig. 10 is a detail showing the mechanism of Fig. 8 with certain parts removed;

Fig. 11 is a similar view with the parts in another position;

Fig. 12 is an end elevation of certain parts in the position of Fig. 11; and

Fig. 13 is a similar view with the parts in the position of Fig. 10.

The web *a*, having a series of printed areas *b* thereon, is supplied to the machine on a spool **20**, supported for feeding purposes on a shaft **21** mounted in open journals **22** in the frame **23**. The shaft preferably has a disk **24** adjacent one end, against which bears a pad **25** carried by a spring arm **26** provided with an adjusting screw **27** by which its effective tension may be varied. A suitable drag is thus introduced so that the web is always delivered from the spool under some tension. From the spool the web passes over a slack take-up roll **28** freely mounted on a shaft **29** which has fixed to it at each end a pinion **30** meshing with a stationary rack **31**. The shaft is guided in ways **32** and is constantly drawn in a direction away from the spool **20** by tension springs **33**. By means of the rack and pinion connection the axis of the roll **28** is maintained always parallel, irrespective of any inequalities of tension in the two edges of the web.

The web passes from the take-up roll **28** under a freely rotatable flanged guide roll **35**, over and around an upper feed roll **36**, and then between it and a lower feed roll **37**. Beyond this point the web may be held by suitable feeding conveyers or, as in the case shown, it may be permitted to hang freely. Below the feed rolls the web passes across the window **117** of a photo-electric cell **38** of any desired type and then past the stationary plate **39** of a cutting mechanism. The movable cutting element **40** is here shown as mounted on a rack slide **41**, engaged by a gear segment **42** adapted to be rocked by a lever **43**. This lever is connected by a link **44** with an arm **45** pivoted at **46** to the frame and bearing a roll **47** riding on a cam **48** rotated by a shaft **49**. A spring **50** holds the roll against the cam.

Returning to the feed rolls **36**, **37**, the upper roll **36** is carried by a shaft **55** preferably seated in open journals formed on the frame so that it may be raised readily to permit the web to be threaded around it. Endwise shifting of the roll is prevented by a collar **56** and a gear **57** which straddle one of the frame members as shown in Fig. 5. The gear **57** meshes with a similar gear (not shown) on the shaft **59** of the lower roll **37**, so that the two rolls always turn in unison. Shaft **59** is suitably journaled in the frame, and projects at one end so that it may have keyed to it the driven member **60** (Fig. 6) of a ball clutch or free wheeling unit. Surrounding the member **60**, which is provided with the usual slanting driving surfaces **61**, is the cylindrical flange **62** of the driving spider **63** freely rotatable on the shaft **59** and bearing a pinion **64**. Balls or rollers **65** are mounted in the spaces formed between the driving surfaces **61** and the flange **62**, being pressed into engagement at all times by the usual spring plungers **66**. This arrangement has the advantage over a driving ratchet of permitting adjustment of the feed with any desired degree of fineness; not being limited, as is a ratchet, by the necessary spacing of teeth.

Meshing with the pinion **64** is a rack **70** having sliding bearing in a guide **71** pivoted to the shaft **59** and serving to permit angular movement of the rack without altering its relation to the pinion. The rack is pivoted at **72** (Fig. 2) to a slide **73** which can be clamped in any desired position upon a rod **74** forming one arm of a bell crank freely swinging upon a shaft **75**. The second arm **76** of this bell crank is joined by a tension spring **77** to the end of an arm **78** fixed to the shaft **75** as by a set screw **79**. A screw **80** is threaded through a lug **81** on the arm **78**, being held in any desired adjusted position by a lock nut **82**. This set screw contacts with a lug **83** on the arm **76**, driving this arm counter-clockwise

(as viewed in Fig. 2) upon oscillation of the shaft 75. Motion of the arm 76 in a clockwise direction is obtained by the spring 77. Shaft 75 is oscillated periodically, once for each cycle, by any suitable mechanism, such for example as that shown in Fig. 7. In that figure, which is taken from the opposite side of the machine from Figs. 1 and 3, the shaft 75 is shown as carrying an arm 85 connected by a link 86 to a crank 87 fixed to a constantly rotating shaft 88.

At the end of rod 74 is fixed an abutment plate 90. An arm 91 is pivoted upon a shaft 92, which is rocked by mechanism under the control of the photo-electric cell whenever the web has departed more than a predetermined amount from exact registry. A second arm 93 is attached to the shaft 92, and is coupled by a link 94 to a bracket 95 secured to the armature 96 of an electromagnet 97 mounted upon a bracket 98 rising from the frame. When the electromagnet is energized the shaft 92 will be rocked, carrying the arm 91 from the position of Fig. 1 to that of Fig. 2 in which it is in the path of the abutment 90. The armature is given a normal tendency away from the magnet, so as to hold the arm 91 out of the path of the abutment, by a spring 99 stretched between the bracket 95 and the shaft 92. In order to limit the motion of the arm 91 to the positions shown, a stop arm 100 is secured to the pivot shaft of the armature 96 and a stop arm 101 to the shaft 92; these stop arms bearing pins adapted to strike against portions of the machine frame.

When the magnet-controlled parts are in the position of Fig. 1, as is the case whenever the magnet is not energized, the oscillation of rod 74 is unrestrained by the arm 91 and the arms 76 and 78 move as a unit. The rack 70 is thus reciprocated a constant distance, regulable by the position of block 73 on the rod 74. Motion of the rack to the right in Figs. 1 and 2 is idle, producing no effect on the feeding rolls by reason of the interposition of the clutch mechanism shown in Fig. 6. When the rack moves to the left the feed rolls are rotated. If now the magnet 97 is energized so as to swing the arm 91 into the path of abutment 90, the idle stroke of the rod 74 will be arrested in the full line position of Fig. 2. The normal termination of the idle stroke of the rod is indicated in dotted lines in this figure for comparison. Stoppage of the arm 74 causes stoppage of the arm 76, but has no effect on the driving arm 78; this arm being fixed to the oscillating shaft 75 and being permitted its normal movement by the yielding of the spring connection 77. On the return stroke the arm 76, rod 74, and rack 70 will remain stationary until the screw 80 contacts with the lug 83. The arm 76 will then be picked up by the already oscillating arm 78 and the rack 70 will start its web feeding movement. The function of this mechanism is to give to the feed rolls 36 and 37 a normal web feeding movement which is reduced an amount determinable by the setting of screw 80 each time the magnet 97 is energized.

The web inspecting devices which energize the magnet periodically in accordance with the condition of register of the printed areas *b* will now be considered. Mounted on a vertical support 105 by a stud 106 is a bracket 107 slotted at 108 to permit vertical adjustment. Carried by this bracket is a rod 109. A second bracket 110 on this rod bears a plate 111 mounted for horizontal adjustment by a screw and slot connection 112. A light source 113, preferably of the type commercially available for photo-electric cell work, is mounted on the plate 111 and during the operation of the machine emits light steadily as indicated by the beam *c* shown in Figs. 9, 10, and 11. This beam is directed against a reflecting device preferably formed of a prism 114 carried in a holder 115 depending from a rod 116 supported in turn by the bracket 108; and is by the reflection from this prism turned at right angles (Fig. 11) towards the slot-like window 117 of the photo-electric cell 38. A prism is preferable to a mirror for this purpose on account of the tendency of the ordinary mirror to reflect from both surfaces of the glass.

The beam of light between the light source 112 and the prism is normally cut off by a shutter 120 swinging on the supporting shaft 116 and connected by a link 122 to an oscillating lever 123 pivoted at 124 to the frame 23. A roll 125 on the lever is engaged by a cam 126 on the shaft 88, the roll being held against the cam by a spring 127. Periodically the cam moves the shutter to allow light to fall on the prism and thus be reflected towards the window of the cell 38. The cell is provided with the usual amplifying devices so that the feeble current emitted under the influence of the light beam will be strong enough to energize the electromagnet 97. These devices may be of any commercial type, and as they do not in their details form a part of the invention they are not specifically described.

The manner in which the device acts to inspect the register of the paper web and varies the length of feed in accordance with its findings can now be considered. As a start we can assume that the web is neither expanded nor contracted; that is, that the printed areas *b* are their normal distance apart, and that the slide 73 is set to give to the feed rolls exactly the required feed at each oscillation of shaft 75. The light source, prism, and cell are set so that when the paper is in its rest position (while the cut is being made by the blade 40) the window 117 of the cell is covered by the printed area *b*; and the shutter cam 126 is set so that the light source is uncovered only during the period of rest of the web. Under these ideal conditions no light will ever reach the photo-electric cell from the source 113; since the window 117 is covered by an opaque area *b* whenever the web is at rest, and the light beam is cut off by the shutter whenever the web is in motion.

This condition is of course seldom realized in practice, and if it were there would be no necessity for the mechanism described. Let us first assume that atmospheric or other conditions decrease the length between printed areas *b* of a portion of the web. The disparity in length of each individual section as contrasted with the standard length fed by the rolls 36 and 37 is not great, but the error introduced is cumulative. The web will be displaced at each cycle so that successive printed areas will come to rest in more and more advanced positions relative to a fixed location such as the window 117. After a time, depending upon the amount of deviation of the web from standard, an area *b* will come to rest just beyond the window as shown in Fig. 3, permitting light to reach the cell when the light source is uncovered by the shutter 120. The effect of the light is to permit the flow of current through the cell, and through the relay or ampli-

fier to energize the electromagnet 97. At this time the web is at rest and the rack 70 is moving to the right in Fig. 2 upon its inactive stroke. Due to the action of the magnet the arm 91 is interposed in the path of the abutment 90, decreasing the inactive travel allowed the rack while permitting full motion of the oscillating shaft 75 as previously described. When the shaft 75 starts its reverse swing the first part of its motion will be lost to the rack, resulting in a smaller active travel and a corresponding decrease in the rotation given to the feed rolls. The amount of this decrease can be regulated by means of screw 80, but it is preferably such as to cut down the next web feed enough to position the next area *b* well over the window 117, as shown in Fig. 4. Matters now proceed as in the assumed ideal case until one of the areas *b* once again misses the window in its rest position.

Let us suppose now that the conditions affecting the web operate to increase the distance between successive printed areas instead of to decrease it. The feed per cycle remaining constant, as in the assumed ideal case, it cannot deliver the added length necessary to obtain register of the stretched web. In this case the area *b* would gradually appear above the window 117 instead of below it as in Fig. 3. Were this permitted to occur the apparatus would make the only form of correction permitted to it by its construction; that is, decreasing still further a feed that is already too small. In order to avoid this undesirable condition the initial feed is adjusted by slide 73 so that the rolls always tend to feed too much. This prevents the printed areas ever appearing on the wrong side of the window, and its only effect is to cause the introduction of a correction into the web feed at more frequent intervals. This manner of adjustment greatly simplifies the mechanism by eliminating the necessity for providing two separate correcting devices, one for shortening and the other for lengthening the feed.

The apparatus described has particular applicability to adaptations, such as some types of wrapping machines, where the web is fed intermittently, as it is capable of operation at materially higher speeds than has been possible with previously proposed web registering devices. Considerable detail has been given in regard to the construction of various parts of the mechanism. It will be understood, however, that the design and arrangement of the parts will be determined in a large measure by the design of the machine to which the registering device is to be applied.

What we claim is:

1. A feeding mechanism for an indicia bearing web comprising web feed rolls, a one-way drive for said rolls, an oscillatory power means acting on the rolls through the one-way drive so that the motion of the power means in one direction produces feeding movement of the rolls, and motion in the other direction is idle, and devices actuable in accordance with the condition of register of the web during a period of rest of the web for determining the amount of feeding movement given to the rolls on the next active stroke of the power means.

2. A feeding mechanism for an indicia bearing web comprising feed rolls engaging the web, a one-way drive for said rolls, an oscillatory power means acting on the rolls through the one-way drive so that the motion of the power means in one direction produces feeding movement of the rolls, a movable abutment adapted to limit the extent of idle motion of said power means and hence decrease the next succeeding feeding movement of the rolls, and mechanism controlled by a departure of the indicia on the web from normal registry for interposing said abutment in the path of the power means.

3. A feeding mechanism for an indicia bearing web comprising feed rolls engaging the web, a one-way drive for said rolls, an oscillating arm, a connection between the arm and said one-way drive, means for oscillating said arm positively during the web feeding portion of the cycle and yieldingly during the idle portion of the cycle, a movable abutment adapted to limit the extent of movement of said arm during its idle swing, and mechanism controlled by a departure of the indicia on the web from normal registry for varying the interposition of said abutment in the path of the arm.

4. A feeding mechanism for an indicia bearing web comprising feed rolls engaging the web, a one-way drive for said rolls, an oscillatory arm, a connection between the arm and the one-way drive, a constantly oscillating shaft, an adjustable abutment carried by the shaft, a cooperating abutment carried by the arm, a spring normally holding said abutments in engagement, a movable abutment adapted to limit the extent of movement of said arm during its idle swing, this interruption of movement of the arm being permitted by the spring joining it to the oscillating shaft, and mechanism controlled by a departure of the indicia on the web from normal registry for interposing the abutment in the path of the arm.

5. A feeding mechanism for an indicia bearing web comprising feed rolls engaging the web, a one-way drive for said rolls, an oscillatory power means acting on the rolls through the one-way drive so that the motion of the power means in one direction produces feeding movement of the rolls, a movable abutment adapted to limit the extent of idle motion of the power means and hence decrease the next succeeding feeding movement of the rolls, an electromagnet, an armature attractable by the electromagnet and connected to the abutment so that when the magnet is energized the abutment will be moved into the path of the power means, and means controlled by a departure of the indicia on the web from normal registry for energizing the electromagnet.

6. A feeding mechanism for an indicia bearing web comprising feed rolls engaging the web, a one-way drive for said rolls, and oscillatory power means acting on the rolls through the one-way drive so that the motion of the power means in one direction produces feeding movement of the rolls, a movable abutment adapted to limit the extent of idle motion of the power means and hence decrease the next succeeding feeding movement of the rolls, an electromagnet, an armature attractable by the electromagnet and connected to the abutment so that when the magnet is energized the abutment will be moved into the path of the power means, a photo-electric cell viewing the web through a limited aperture, a constant light source, a shutter normally cutting off the beam of light between the light source and the cell, means for operating the shutter to permit the passage of light during the period of rest of the web, and connections between the photo-electric cell and the electromagnet so that the

magnet is energized whenever light falls on the photo-electric cell.

7. A web feeding device including web feed rolls, an oscillating member, a one-way clutch receiving the motion of the oscillating member and translating its motion into rotation of the feed rolls in one direction, mechanism for varying the throw of the oscillating member, and means responsive to the condition of registry of the web for controlling the operation of said mechanism.

8. A web feeding device comprising a member oscillating through a constant angle, a second oscillating member yieldingly connected to the first, a shiftable abutment adapted to be moved from a position out of the path of the second member to a position in said path in order to limit the motion of the second member in one direction, a web forwarding device, a connection between the second member and the web forwarding device so that the latter will be actuated at each cycle an amount dependent upon the oscillation of the second member permitted by the abutment, and means responsive to deviations of register of the web for actuating the abutment.

9. A web feeding device comprising a member oscillating through a constant angle, a second oscillating member yieldingly connected to the first for movement in one direction and rigidly connected for movement in the other direction, a shiftable abutment adapted to be moved from a position out of the path of the second member to a position in said path in order to limit the motion of the second member in the direction of movement in which it is yieldingly coupled, and means responsive to deviations in register of the web for actuating the abutment.

10. A web feeding device comprising an oscillatable member, means driving said member positively in one direction and yieldingly in the other, a web forwarding mechanism, connections between the web forwarding mechanism and the oscillating member operable to cause web feeding movement of the mechanism upon the positively driven stroke of said member, an abutment shiftable relatively to the oscillating member to interrupt its motion near the end of the yieldingly driven portion of its path, and means responsive to deviations of register of the web for actuating the abutment.

11. A web feeding device comprising an oscillable member, means driving said member positively in one direction and yieldingly in the other, a web forwarding mechanism, connections between the web forwarding mechanism and the oscillating member operable to cause feeding movement of the mechanism upon the positively driven stroke of said member, an abutment shiftable relatively to the oscillating member to interrupt its motion near the end of the yieldingly driven portion of its path, an electromagnet, connections between the electromagnet and the abutment whereby the position of the abutment is determined by the electromagnet, and a photo-electric cell controlling the electromagnet in accordance with the condition of register of the web.

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