United States Patent

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[33] **Germany**
[31] **P 17 61 993.1**

[54] **METHOD OF AND APPARATUS FOR EFFECTING SEVERANCE OF WEBS IN RESPONSE TO CHANGES IN TRANSPARENCY ALONG THEIR LENGTH**
8 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** ..... **83/364,** 83/210, 83/365, 83/371, 250/219 FR
[51] **Int. Cl.** **B26d 5/34**
[50] **Field of Search** ..... 83/210, 209, 364, 365, 371; 250/219 WD, 219 LG, 219 TH, 219 FR

[56] **References Cited**
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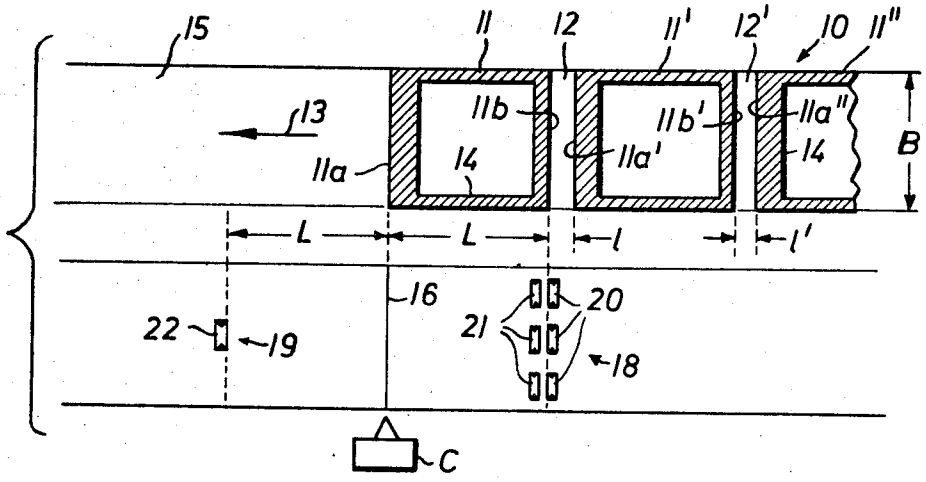
ABSTRACT: In order to automatically cut to size nonuniformly spaced photographs arranged serially to constitute a continuous web, a cutting mechanism to sever the web transversally is operated upon sensing the change in the transparency of the web between a dark margin that frames each photograph and a light strip separating each margin from that of an adjacent photograph. There are provided a first photoelectric sensing station which generates a control signal to stop the web feed and effect cutting when the leading edge of a photograph coincides with the severing path of the cutting mechanism and a second photoelectric sensing station which generates a control signal to stop the web feed and effect cutting when the trailing edge of the same photograph coincides with said severing path.



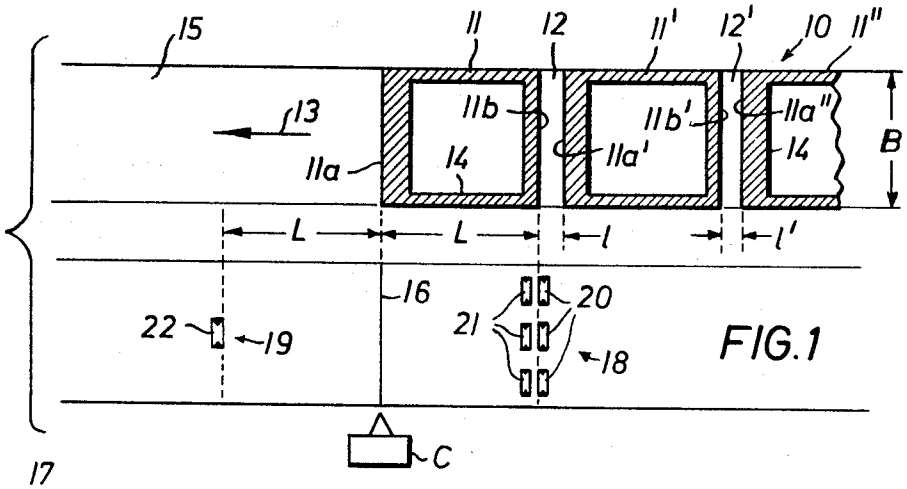

15
11
12
11'
12'
10
11"
13
11b
11b'
11a"
11a
14
11a'
14
B
L
L
l
l'
16
22
19
21
20
18
C

FIG. 1

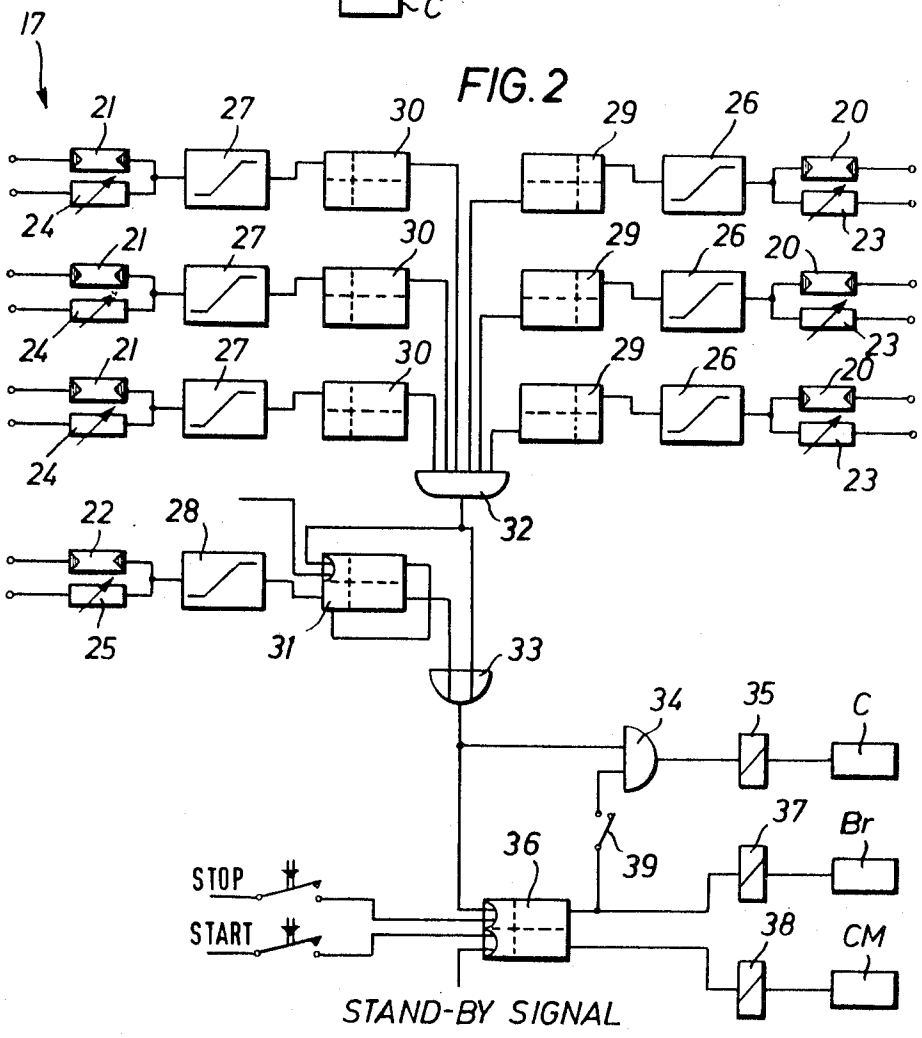

17
21
27
30
29
26
20
24
23
22
28
25
31
32
33
34
35
C
37
Br
36
39
STOP
START
38
CM
STAND-BY SIGNAL

FIG. 2

METHOD OF AND APPARATUS FOR EFFECTING SEVERANCE OF WEBS IN RESPONSE TO CHANGES IN TRANSPARENCY ALONG THEIR LENGTH

BACKGROUND OF THE INVENTION

This invention relates to a method of and apparatus for actuating a cutting device to sever a strip or web of indefinite length into portions of predetermined size. The web is of the type whose transparency regularly and abruptly varies along its length. Such a feature is characteristic, for example, of a web of photographic paper which has, along its length, a series of photographs—such as transparencies or the like—of uniform size. Each such photograph is framed by a peripheral dark margin of small transparency and is separated from one another by a blank (light) strip of great transparency extending transversally of the web. The spacing of the photographs from one another is usually nonuniform and thus the light separating strips are, accordingly, of differing widths. In order to ensure that the transversal cuts correspond to the exact lateral limits of the photographs themselves, the severing operation has heretofore been performed manually. Such manual operation, however, is very time consuming and requires an excessive amount of labor.

OBJECT AND SUMMARY OF THE INVENTION

It is an object of the invention to automatize a cutting operation of the aforenoted type, utilizing the regularly varying transparency of the web along the length thereof.

Briefly stated, according to the invention, as the web is advanced into a position in which the severing path of the cutting device coincides with a line along which the web is to be cut, the change of transparency of the web is photoelectrically sensed and the generated signal is utilized to control the feed of the web and the cutting operation. The web is thus automatically and intermittently advanced; the length of each incremental advancement is dependent of the linear intervals at which severing cuts are to be effected.

The apparatus for practicing the afore-outlined method is designed in such a manner that adjacent one web face there is provided a light source, while adjacent the opposite web face there is disposed a photocell cooperating with the light source. The intensity of the latter, as sensed by the photocell, is controlled by the transparency of the interposed, traveling web. The photocell, in turn, controls flip-flop circuits, the outputs of which correspond to different values of light transparency.

The invention will be better understood, as well as further objects and advantages will become more apparent, from the ensuing detailed specification of a preferred, although exemplary, embodiment taken in conjunction with the drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a schematic plan view of one part of the embodiment, wherein, for the sake of clarity, the web is displaced transversally to expose components disposed thereunder; and

FIG. **2** is a circuit diagram of the embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, the web **10** to be severed is formed of serially arranged individual, successive photographs **11**, **11'**, **11''**, etc. spaced from one another by blank strips **12**, **12'**, etc. The dimension L of each photograph measured in the direction of the web travel indicated by arrow **13**, is identical, whereas the dimensions **1**, **1'** of strips **12**, **12'**, respectively (also taken in the direction of the web travel), usually differ from one another. Each photograph has a dark peripheral margin **14**. Thus, the blank (light) strips **12**, **12'**, etc., on the one hand, and the margins **14**, on the other hand, have values of light transparency which substantially differ from one another.

The web **10** is advanced in the direction of arrow **13** on a table **15** on which there is mounted a cutting device schematically shown at C, adapted to sever the web **10** along a linear, transversal cutting path **16**. The dimension B of the web **10** measured transversely to the direction **13** of the web travel remains unchanged by the severing operations.

In order to obtain a uniform size of L×B as a result of the sequential cutting operations, each photograph **11**, **11'**, **11''**, etc. has to be cut out from the web **10** by severing along respective leading edges **11***a*, **11***a'*, **11***a''*, etc. and respective trailing edges **11***b*, **11***b'*, etc.

The control of the web feed in the direction of arrow **13** and the control of the cutting operation is effected by an electronic circuitry (generally indicated at **17** in FIG. **2**) which senses the aforenoted "light" and "dark" conditions of the web **10** at predetermined locations on table **15**. For sensing said "light" and "dark" conditions of the web **10**, there is arranged thereabove a number of light sources (not shown) with each of which there is associated a photocell disposed beneath the web **10**. This embodiment, as shown in FIG. **1**, comprises two sensing stations generally indicated at **18** and **19**, respectively, disposed upstream and downstream of the severing path **16**, at a distance L therefrom. The sensing station **18** comprises a first group of three photocells **20** and an immediately adjacent second group of three photocells **21**. Photocells within each group are arranged in a series extending transversally of the direction of web feed, and are thus disposed parallel with the cutting path **16**. The two groups of photocells are spaced from the cutting path **16** in such a manner that when the leading edge **11***a* of the leading photograph **11** coincides with the cutting path **16**, as shown in FIG. **1**, the photocells **20** of the first group are immediately upstream of, and the photocells **21** of the second group are immediately downstream of, the trailing edge **11***b* of the first photograph **11**. Stated in different terms, the first and second groups of photocells of the sensing station **18** are disposed on opposite sides of the trailing edge **11***b* which forms the borderline between the dark margin **14** of the leading photograph **11** and the immediately following light strip **12**. It is thus seen that in order to ensure that the web **10** assumes a correct position for the execution of a severing operation along the leading edge **11***a*, the photocells **21** have to sense a "dark" condition and the photocells **20** have to sense a "light" condition.

The provision of a plurality of photocells (each having its own associated light source) in each group instead of a single one, is advantageous in practically eliminating the possibility of generating false signals, since a signal from any of said groups is emitted only if each photocell in one group senses a transparency of identical value.

The sensing station **19** disposed at a distance L downstream of the cutting path **16** comprises only a sole light source (not shown) and photocell **22**, which is, in general, sufficient to emit an unambiguous signal since at this station merely the change from "light" to "dark" has to be sensed. This event occurs when the leading edge **11***a* of the leading photograph **11** reaches the second sensing station **19** and passes over photocell **22**. In this position of web **10**, the dark marginal portion **14** disposed immediately upstream of the leading edge **11***a*, is located between photocell **22** and its associated light source and the trailing edge **11***b* of the first photograph **11** coincides with the severing path **16** of the cutting device.

In summary, the sensing station **18** serves to determine the position of the leading edge of each photograph along the cutting path **16**, whereas the sensing station **19** is actuated when the trailing edge of the same photograph is in a cutting position.

It is to be noted that the arrangement of sensing stations **18** and **19** upstream and downstream of the cutting path **16** is particularly advantageous to secure a uniform L×B size of cut photographs despite nonuniform spacings **1**, **1'**, etc.

Further, the provision of two adjacent groups of photocells within sensing station **18** to sense, respectively, a dark and a light field separated by a trailing edge **11***b*, ll*b'*, etc. is advantageous for particularly accurately sensing the separating line between the last-named dark and light fields.

It is to be understood that any other arrangement of the sensing stations with respect to the severing path **16** is feasible within the scope of the invention.

FIG. **2** illustrates the circuitry generally indicated at **17** which processes the signals from photocells **20, 21** and **22** and, accordingly, controls the web feed and the cutting device. Each photocell **20, 21** and **22** is connected in series between two voltages, with a matching potentiometer **23, 24** and **25**, respectively. The output of each photocell sets, through a Schmitt-trigger **26, 27** and **28**, respectively, a flip-flop circuit **29, 30** and **31**, respectively. Each flip-flop circuit, as known per se, is adapted to assume two stable positions (hereinafter called "L"- and "O"-positions; with each position there is associated an output (hereinafter called "L"- and "O"-outputs), one of which signals the "dark" condition, while the other indicates the "light" condition.

In case of a "light" condition, a voltage appears at the L-outputs of the flip-flop circuits **29**, and in case of a "dark" condition, a voltage appears at the O-outputs of the flip-flop circuits **30** and **31**. All outputs of the flip-flop circuits **29** and **30** are applied to an AND-gate **32**. To the output side of the latter there is connected the flip-flop circuit **31** associated with the sensing station **19** and an OR-gate **33**. Further, the O-output of the flip-flop circuit **31** is connected to the input side of the OR-gate **33**.

To the output side of the OR-gate **33** there is connected, on the one hand, through an AND-gate **34** a relay **35** controlling the cutting device and, on the other hand, a further flip-flop circuit **36**. The O-output of the latter is connected with a relay **37** actuating a breaking mechanism schematically indicated at *Br* preferably of the attracting magnet-type, while the L-output of the flip-flop circuit **36** is connected with a relay **38** for controlling the conveying mechanism schematically indicated at CM which advances the web **10**. Further, across a switch **39**, which is controlled by the relay **37**, the O-output of the flip-flop circuit **36** is connected to a second input of the AND-gate **34**.

Further, means may be provided to apply start and stop pulses to the inputs of the flip-flop circuit **36**. Also, to a further input of the flip-flop circuit **36** a "standby" signal may be applied.

OPERATION OF THE EMBODIMENT

First, by means of a starting pulse, the flip-flop circuit **31** is readied and the flip-flop circuit **36** is set into its L-position. Thereby, through relay **38**, the conveying mechanism CM for the web **10** is set into motion. As soon as the web **10** has reached its position shown in FIG. **1**, the flip-flop circuits **29** connected to the output of the photocells **20** are set into their L-position and the flip-flop circuits **30** connected to the output of the photocells **21** are set into their O-position. At the L- and O-outputs, respectively, of the two aforenoted groups of flip-flop circuits, a voltage appears which generates a voltage at the output of the AND-gate **32**. The last-named voltage, on the one hand, readies the flip-flop circuit **31** for the successive sensing step in which the leading edge **11***a* of the photograph **11** will cover the photocell **22**, and, on the other hand, generates a voltage at the output of the OR-gate **33**. This last-named voltage, on the one hand, readies the AND-gate **34** and, on the other hand, sets the flip-flop circuit **36** into its O-position. Thereby, the relay **37**, associated with the braking mechanism *Br*, is energized and through relay **38** the conveying mechanism CM for the web **10** is deenergized. The relay **37** closes the switch **39** so that a second voltage is applied to the input side of the AND-gate **34**. By virtue of the latter occurrence, the relay **35** is energized and thus actuates the cutting mechanism C which severs the web **10** along the leading edge **11***a* of the photograph **11**. Upon completion of the cutting operation, a standby signal, which may be triggered by the cutting mechanism, resets the flip-flop circuit **36** into its L-position whereby the relay **38** is again energized and thus the conveying mechanism CM restarted to again advance the web **10**. This conveying operation ends when the leading edge **11***a*, precedingly severed along line **16**, reaches the sensing station **19** and there passes beyond the photocell **22**. At that moment, the photocell **22** senses "dark" and the flip-flop circuit **31** is set into its O-position and another cutting operation is effected by a sequence as described hereinbefore. At this time, the trailing edge **11***b* of the photograph **11** coincides with the cutting line **16**, so that during the aforenoted second cutting operation, the web **10** is severed transversally along trailing edge **11***b*. As a result of the two cutting operations, the photograph **11** is, in exact L×B size, separated from the web **10**.

The subsequent conveying operation ends at the moment when the trailing edge **11***b* of the second photograph **11′** reaches the sensing station **18** and is disposed between the two groups of photocells **20** and **21**. Thereafter, the above-described cycle is repeated for cutting out the second photograph **11′** and then the third photograph **11″**, etc. It is thus seen that the web **10** of indefinite length is cut alternately, on the one hand, into portions of identical size L×B corresponding to the individual photographs and, on the other hand, into waste strips of the size 1×B, 1′×B, etc.

That which I claim is:

1. An apparatus for actuating a cutting mechanism to effect, along a cutting path, a transversal severance of a web of indefinite length advanced in the longitudinal direction thereof, said web including along its length alternately repetitive adjacent fields of two types having two substantially differing values of transparency, the border line between two adjoining fields of said two types extending transversally of the length dimension of said web, said apparatus comprising,

A. at least one sensing station including at least one first photocell and at least one second photocell; said first and said second photocells being disposed adjacent one face of said web and juxtaposed with respect to one another in the longitudinal direction of said web; said first and second photocells being spaced from said cutting path to such an extent in said longitudinal direction as to be located at different sides of said border line when the desired line of severance on said web coincides with said cutting path, and

B. electronic circuit means adapted to receive transparency-responsive signals from said sensing station and to actuate said cutting mechanism when a change of transparency is sensed, said electronic circuit means including a flip-flop circuit associated with each sensing station, each flip-flop circuit adapted to receive said signals and deliver two outputs corresponding to said two substantially differing values of transparency.

2. An apparatus as defined in claim **1**, wherein a plurality of said first photocells forms a first group of photocells arranged in a juxtaposed series extending parallel to said cutting path and a plurality of said second photocells forms a second group of photocells arranged in a juxtaposed series extending parallel and immediately adjacent to the series of photocells of said first group, said first and second groups are located at different sides of said border line when the desired line of severance on said web coincides with said cutting path of said cutting mechanism.

3. An apparatus as defined in claim **1**, wherein fields of one type have identical predetermined lengths in the longitudinal direction of said web, including

A. a first sensing station disposed upstream of said cutting path at a distance therefrom corresponding to said predetermined length to sense a change from the transparency of one type of field to the transparency of the other type of field when a desired first line of severance on said web coincides with said cutting path, and

B. a second sensing station disposed downstream of said cutting path at a distance therefrom corresponding to said predetermined length to sense the passage of the leading edge of said web when a desired second line of severance on said web coincides with said cutting path; said leading edge is formed by a cut coinciding with said first line of

severance; the distance between the first and second lines of severance is identical to said predetermined length.

4. An apparatus as defined in claim 1, including an AND-gate to which the output of each of said flip-flop circuits is applied, the output voltage of said AND-gate is adapted to effect the interruption of the web feed and the actuation of said cutting mechanism.

5. An apparatus as defined in claim 3, including an AND-gate to which the output of at least one flip-flop circuit associated with said first sensing station is applied, the output of said AND-gate is coupled with the input of the flip-flop circuit associated with said second sensing station; the output of said AND-gate is also coupled with an input of an OR-gate, another input of the latter is connected to an output of the last-named flip-flop circuit; the output of said OR-gate is adapted to effect the interruption of the web feed and the actuation of said cutting mechanism.

6. An apparatus as defined in claim 5, wherein the output of said OR-gate is applied to an additional flip-flop circuit, one output of which is connected with a control means of a braking mechanism, the other output of which is connected with a control means associated with a conveying mechanism for the web feed.

7. An apparatus as defined in claim 6, wherein the output of said OR-gate is also applied to an additional AND-gate, the output of which is connected with a control means associated with said cutting mechanism.

8. An apparatus as defined in claim 7, wherein an input of said additional AND-gate is connected through a circuit breaker switch to that output of said additional flip-flop circuit which is connected to the control means of said braking mechanism; said circuit breaker switch is adapted to be closed by the last-named control means upon energization thereof by said additional flip-flop circuit.