US005495103A

United States Patent [19]

Utiger et al.

[11] Patent Number: 5,495,103

[45] Date of Patent: Feb. 27, 1996

[54] **OPTICAL MAIL PIECE SENSOR FOR POSTAGE METER**

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[21] Appl. No.: **213,929**

[22] Filed: **Mar. 16, 1994**

[51] **Int. Cl.**[6] **H01J 40/14**; B41L 47/46

[52] **U.S. Cl.** **250/222.1**; 250/559.4; 101/91

[58] **Field of Search** ..... 250/205, 221, 250/222.1, 223 R, 561, 559.4; 101/91, 233, 235

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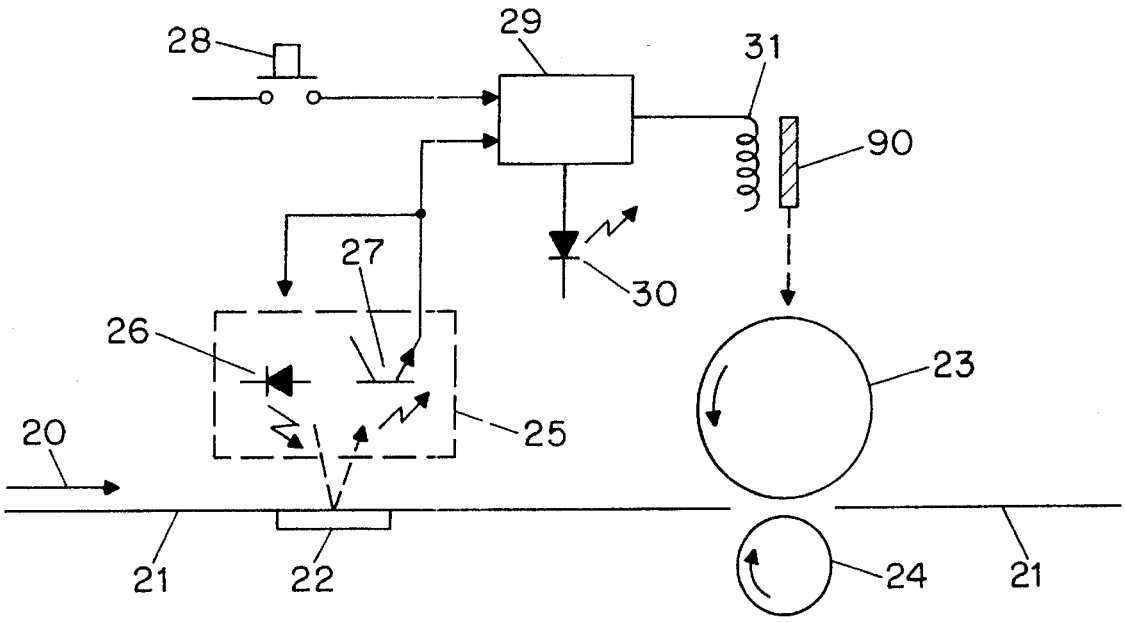
Attorney, Agent, or Firm—Oppedahl & Larson

[57] **ABSTRACT**

An optical trigger is provided for use in a postage meter having a planar paper path. A light source with controllable intensity is mounted above the paper path and shines toward the paper path. A light sensor mounted above the paper path detects the reflected light if any. A dark region is provided below the paper path. More power is supplied to the light source when the sensor detects some light. An actuator is coupled with the printing mechanism of the meter to actuate it for printing of postage. When light is reflected from a mail piece, a timer is started, and when the timer reaches its programmed interval the actuator is actuated. The interval is adjustable by a trimmer adjustment, and two preprogrammed intervals may be selected by a front-panel switch.

29 Claims, 3 Drawing Sheets



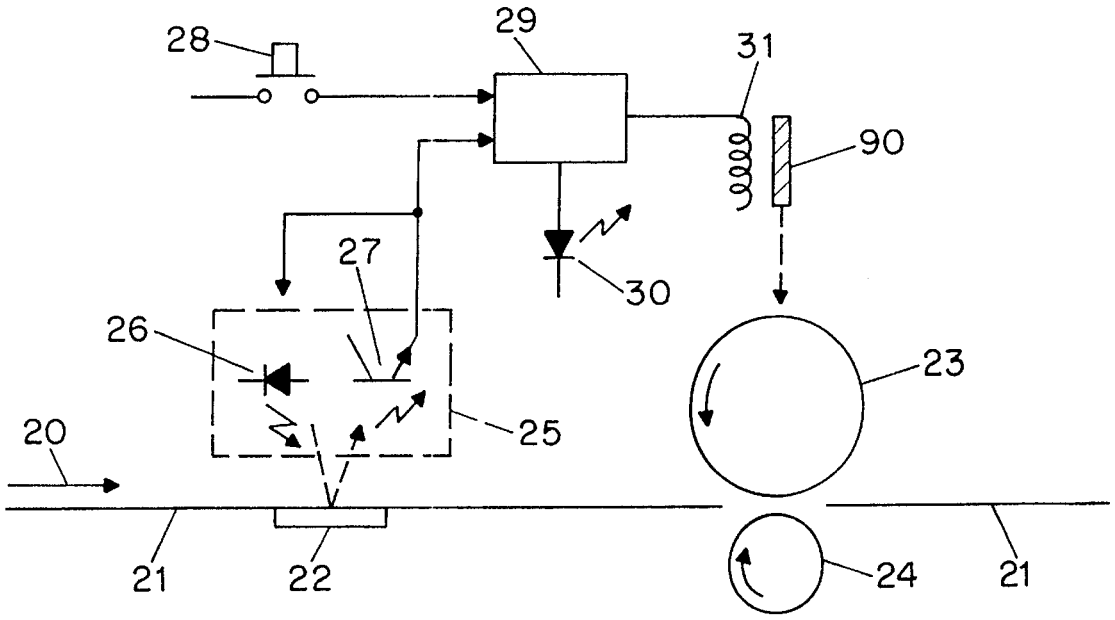

28
29
31
90
27
30
26
23
25
20
21
22
24
21

FIG. 1

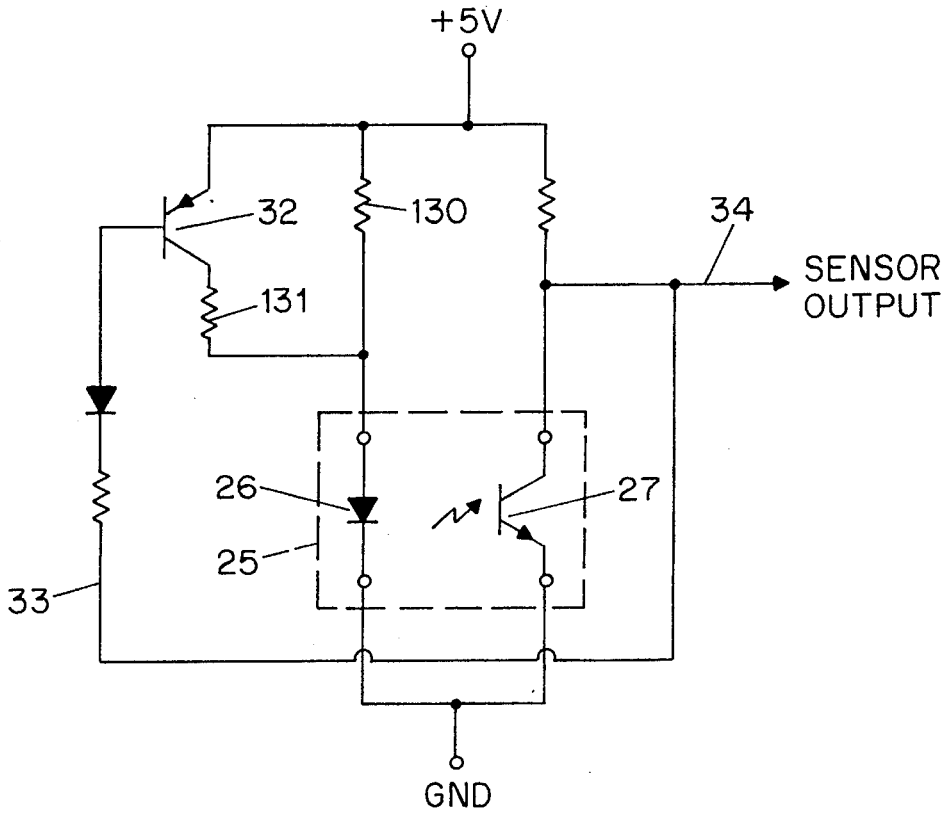

+5V
32
130
34
SENSOR
OUTPUT
131
26
27
25
33
GND

FIG. 2

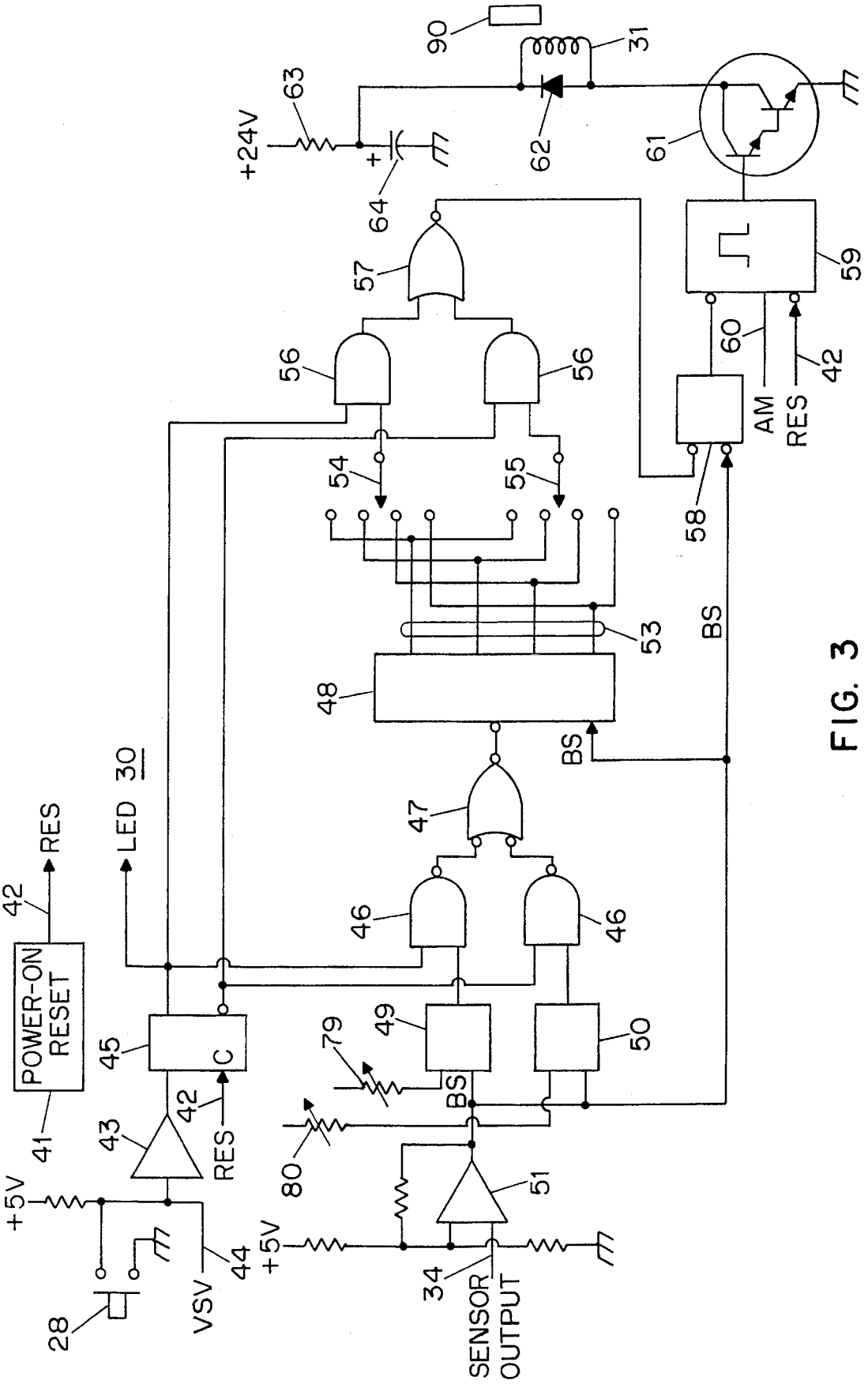

90
31
63
+24V
62
61
64
57
59
56
56
60
AM
RES
42
54
55
58
53
BS
48
BS
47
LED 30
RES
42
46
46
POWER-ON RESET
45
C
49
50
79
BS
41
43
42
RES
80
51
+5V
+5V
44
34
28
VSV
SENSOR OUTPUT

FIG. 3

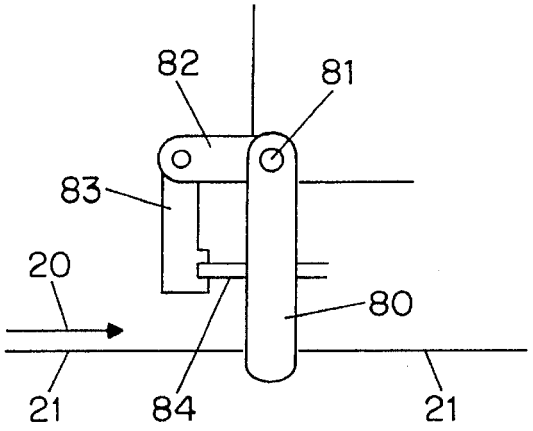


FIG. 4
PRIOR ART

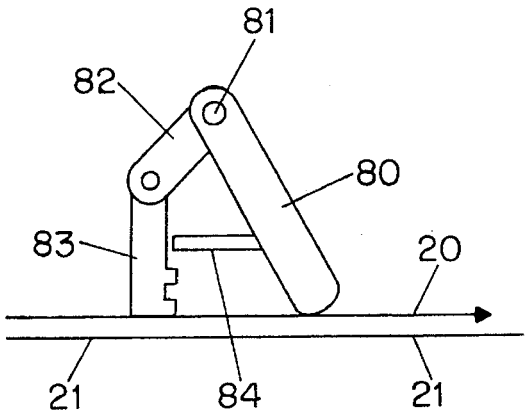


FIG. 5
PRIOR ART

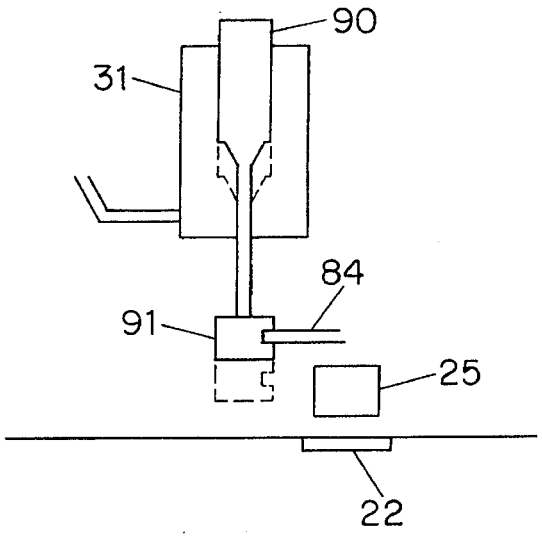


FIG. 6

OPTICAL MAIL PIECE SENSOR FOR POSTAGE METER

BACKGROUND

In a typical postage meter, also called a franking machine, a horizontal surface defines a paper path along which travels a mail piece such as an envelope. As the mail piece moves along the paper path toward the print rotor, it trips a mechanical trigger. The trigger causes the print rotor to turn and the mail piece is received and printed upon. The mail piece passes between a print rotor and a platen roller to receive an imprint of postage.

Those familiar with postage meters will appreciate that the rotor does not rotate continuously, but performs single revolutions in keeping with the arrival of mail pieces. Even if the mail pieces move continuously, the rotor movement is discontinuous. The rotor is motionless, at least briefly, between each printing cycle. From the point of view of the rotor and its trigger, mail pieces may arrive uninterruptedly for some time and then may stop abruptly. The trigger is a crucial part of the system that causes the rotor to rotate at the right times, and lets the rotor remain motionless at the right times.

A descending register keeps track of the amount of postage available for printing, and when the descending register shows a too-small amount the meter locks up and cannot print any more postage. Each rotation of the rotor causes postage value to be deducted from the descending register, and for that reason it is highly desirable that the rotor only be actuated for rotation when a mail piece is in place to receive the postage imprint. Errors in either direction are troublesome. If the rotor rotates with no mail piece is place, then the user of the postage meter loses money. If a mail piece arrives and the rotor does not move, then this constitutes a jam that will have to be cleared.

The range of printing problems to be guarded against is much greater than simply printing postage when it is not needed, or failing to print postage. If a postage imprint is mispositioned this is also a serious problem. Relative to the right edge of an envelope, if the imprint is too far to the right then part of the imprint may be off the paper and result in a spoiled piece of mail. If the imprint is too far to the left, the imprint may overlap printed portions of the envelope such as the return address, or in an extreme case may stray past the left edge of the envelope. These problems are, at the very least, aesthetically displeasing, and can also result in loss of postage value or jams.

These problems present themselves in any postage meter, but are particularly troublesome in meters that are intended for high-speed use with as many as 10,000 pieces per hour receiving postage imprints. With such meters it is desired to have a trigger mechanism for the printing of postage that consistently prints postage in the desired position on the mail piece, and that can easily be set to predetermined configurations to accept different types of mail pieces. A traditional prior-art mechanical trigger does not work well with thin pieces, for example, air mail envelopes, and it can degrade mechanically and abrade.

One prior-art example of a trigger mechanism for use in a postage meter is U.S. Pat. No. 5,203,263, assigned to the same assignee as the present application and incorporated by reference. Another prior-art example is U.S. Pat. No. 4,523,523 to Abellana et al. A few other prior-art references

mention postage meters and optical sensors, namely U.S. Pat. Nos. 4,840,696, 4,571,925, and 4,310,755.

SUMMARY OF THE INVENTION

An optical trigger is provided for use in a postage meter having a planar paper path. A light source with controllable intensity is mounted above the paper path and shines toward the paper path. A light sensor mounted above the paper path detects the reflected light if any. A dark region is provided below the paper path. More power is supplied to the light source when the sensor detects some light. An actuator is coupled with the printing mechanism of the meter to actuate it for printing of postage. When light is reflected from a mail piece, a timer is started, and when the timer reaches its programmed interval the actuator is actuated. The interval is adjustable by a trimmer adjustment, and two preprogrammed intervals may be selected by a front-panel switch.

DESCRIPTION OF THE DRAWING

The invention will be described with reference to a drawing in several figures, of which:

FIG. **1** shows in simplified form the trigger mechanism according to the invention;

FIG. **2** shows in schematic detail the circuitry surrounding the sensing electronics thereof;

FIG. **3** shows in schematic detail the timer circuitry thereof;

FIG. **4** shows in side view a pure-mechanical trigger of the prior art arrangement;

FIG. **5** shows in side view the prior art trigger of FIG. **4**, with a mail piece passing past the trigger; and

FIG. **6** shows in side view corresponding to FIG. **4** the solenoid actuator arrangement according to the invention.

DETAILED DESCRIPTION

FIG. **1** shows in simplified form the trigger mechanism according to the invention. The mail piece approaches as shown by arrow **20** along a paper path defined by surface **21**. The mail piece passes between print rotor **23** and platen roller **24**, but only after passing and triggering a trigger mechanism.

Turning now to FIG. **4**, what is shown in cutaway side view is a pure-mechanical trigger such as is used in the prior art. The mail piece **20** enters the postage meter from the left in FIG. **4**, and approaches the trigger lever **80**. Lever **80** rotates relatively freely on shaft **81** which is rotates within a bearing, not shown in FIG. **4**, that is fixed to the main body of the meter. At the other end of shaft **81** is arm **82**, which rotates in fixed relationship with trigger **80**. Arm **82** is also connected with arm **83**, which engages member **84**. Member **84** triggers a single revolution of rotor **23** (see, for example, FIG. **1**) by a single-revolution mechanism well known in the prior art and omitted for clarity from FIG. **4**.

FIG. **5** shows in side view the prior art trigger of FIG. **4**, with a mail piece **20** passing past the trigger **80**. As may be seen, trigger **80** rotates, causing arm **82** to rotate. This forces arm **83** to move downward, which momentarily deflects member **84**, causing the rotation of the print rotor (omitted for clarity in FIG. **5**).

Returning now to FIG. **1**, the inventive optical trigger is shown in simplified form. LED **26** directs light toward a nonreflective (dark) area **22**. If a mail piece **20** is received along the paper path defined by surface **21** (and if the mail

piece is sufficiently reflective) then it will arrive at the area **22**, and will reflect light to phototransistor **27**. LED **26** and phototransistor **27** make up integrated assembly **25**.

As shown in FIG. **1**, the output from phototransistor **27** reaches electronics **29**, and also feeds back to the LED **26**. Another input to electronics **28** is a pushbutton **28** which, as described in more detail below, permits the user to select either of two timing relationships in activating the print rotor **23**. Electronics **29** actuates solenoid **31**, which moves core **90**, which activates the mechanism that rotates the print rotor **23**.

Turning now to FIG. **2**, what is shown in schematic detail is the circuitry surrounding the sensing electronics of the optical trigger according to the invention. The pertinent electrical connections are power and ground, and a sensor signal output **34**.

Output line **34** is generally at a high (+5 V) level due to the pullup resistor shown, but phototransistor **27** pulls the output line **34** to a low level in the event light is detected at the phototransistor **27**. Light-emitting diode **26** gets its power through resistor **130**. When the phototransistor **27** turns on due to detection of light, the output **34** is also supplied via line **33** to transistor **32**, turning it on. When transistor **32** turns on a second current path supplies current to LED **26** through resistor **131**. Thus the LED **26** gets a little brighter. In this way there is some hysteresis in the response of the sensor to changing light levels, which helps to provide some noise immunity. The practical result is that when a mail piece is at the area **22**, the output **34** is low, and otherwise the output **34** is high.

It will be appreciated that the light source **26** is shown as a light-emitting diode, but could be other technologies such as incandescent. The light sensor **27** is shown as a phototransistor, but other technologies such as photodiode or photocell could be used. The particular circuitry shown whereby the sensing of light causes the light source to get brighter is thought to be preferable but one skilled in the art could readily devise other circuitry arrangements bringing about the described result. The voltages used and the sense associated with them (e.g. low voltage on line **34** means light is sensed) are of course quite arbitrary, although what is shown is preferred; one could employ other voltages and could invert the sense without departing in any way from the invention. Preferably the photons emitted by the LED are infrared, and the phototransistor is selected to detect infrared, but other wavelengths could be used as well.

FIG. **3** shows in schematic detail the timer circuitry **29** (see FIG. **1**). Inputs to the circuitry electronics **29** will now be discussed. The user pushbutton **28** is shown in FIG. **3** (also shown in FIG. **1**) providing a signal to gate **43** to toggle the state of flip-flop **45**. The flip-flop **45** may also be toggled by a signal from line **44**, called USV. Signal USV is a remote control line that permits other circuitry to toggle the flip-flop **45**. As will be discussed further below, the state of the flip-flop **45** selects either of two delay gates and either of two clock delay times.

Another input is the sensor signal **34** from the phototransistor **27** (see FIG. **2**). That signal is compared with a threshold by comparator **51**, and the output BS of the comparator starts both delay gates **49**, **50**. Each of the delay gates **49**, **50** has a respective potentiometer **79**, **80** that is adjustable by the user.

Yet another input is the power-on-reset circuitry **41** of conventional design. Its output RES **42** sets initial states for many of the gates of the electronics **29**.

The electronics **29** has several outputs, most notably the energizing current output to solenoid **31**. Another output is from flip-flop **45**, which provides a signal to LED **30** (see also FIG. **1**).

Gates **46**, **47** comprise a multiplexer or selector determining which of delay gates **49**, **50** will provide an input to counter **48**, the selection of which is determined by the outputs of flip-flop **45**. In a similar way gates **56**, **57** comprise a multiplexer or selector determining which of switch outputs **54**, **55** will provide an input to gate **58**, the selection of which is also determined by the outputs of flip-flop **45**.

Counter **48** starts counting when started by the input from gate **47**. As the count increases, the four outputs **53** successively turn on. The switches **54**, **55** together with the selector of gates **56**, **57** determine which of the four outputs **53** will be an input to gate **58**.

The output from gate **58** is an input to one-shot **59**, which provides an output of a predetermined duration to activate the solenoid **31**. A signal AM **60** is received from other circuitry, and permits the other circuitry to prevent postage printing activity even if a user causes a mail piece to trigger the optical sensor.

Darlington transistor **61** switches the relatively high current provided through the solenoid **31**, and diode **62** protects the transistor **61** against back EMF in the solenoid **31** when it is turned off. The solenoid **31** receives a filtered DC that is stored in electrolytic capacitor **64**.

In this way the trigger signal **34** from the sensor starts a delay gate **49** or **50**, which starts a counter **48**, which defines a delay interval before solenoid **31** is activated. The total delay time is selected by the position of switches **54**, **55**, of potentiometers **79**, **80**, and by the state of flip-flop **45**, which is shown by LED **30** and is toggled by the pushbutton.

The output BS from comparator **51** is, as described above, an input triggering the delay gates **49**, **50**. Thus it might appear that the entire control path is simply a delay that carefully links a signal at the sensor input **34** with the energizing of the solenoid **31** at a predetermined later time. But if the circuitry were that simple there is the possibility that the user could take actions selecting a time delay that was far too long (for example by mistaken adjustment of the potentiometer **79**, **80** or the switch **54**, **55**) in which case there is the possibility of a mail piece passing beyond the print rotor before the solenoid is energized. The result is postage being printed not on the mail piece but on the platen roller. This wastes money and requires manual operations to send the mail piece through the meter again.

In the system according to the invention the output BS from comparator **51** reenters the control path at two locations—at the counter **48** and again at the gate **58**. The reason for having the signal BS enter the control path at three locations is to reduce the likelihood of such printing of postage on the platen roller. For the solenoid to be energized it is necessary not only that the phototransistor be receiving light, but also that the phototransistor continue to be receiving light at the time when counter **48** receives the signal from the delay gate **49**, **50**, and that the phototransistor continue to be receiving light at the time when the output selected by switch **54**, **55** is asserted.

One way to describe this embodiment is that first and second timers are provided. The first timer, composed of elements **49**, **50**, **46**, and **47**, starts timing upon assertion of the sensor output and generates its output at a selected delay time after the assertion of the sensor output. The second timer, composed of elements **48**, **54**, **55**, **56**, and **57**, starts timing upon the concurrent assertion of the sensor output and of the output of the first timer. At the output of the

second timer yet another logical operation is performed, namely that the actuator is actuated only if, concurrently, the sensor output is asserted and the second timer's output is asserted.

In the preferred embodiment the delay times of the two timers are user-adjustable only together, that is, the output of the flip-flop **45** changes both of the delays at once. Those skilled in the art can appreciate that it would be possible to allow user selection of the two delays independently if desired.

Several benefits come from the arrangement embodied in FIG. **3**. First, as mentioned above, inadvertent adjustment by the user that results in too long a delay (so that postage would be printed on the platen roller instead of the mail piece) is guarded against. Second, a nuisance triggering of the comparator **51**, due to any of several possible mechanical or electrical causes, is guarded against.

Those skilled in the art will appreciate that while the embodiment of FIG. **3** is preferred, many other embodiments would accomplish the benefits just described. For example, instead of random logic as set forth in the figure, a microcontroller could be used, executing a stored program. The stored program would implement one or both of the delays in software, introducing the phototransistor logic level at one or both of the points in the sequential calculation. Stated differently, the microcontroller would activate the solenoid at a time T only if the phototransistor signal were asserted at time T, and at time T–I2 and at time T–(I1+I2), where I1 and I2 are delays conforming to those of the hardware logic of FIG. **3**. I1 corresponds to the delay of elements **49**, **50**, **46**, and **47**, while I2 corresponds to the delay of elements **48**, **54**, **55**, **56**, and **57**. In the microcontroller embodiment the delays I1 and I2 would, of course, be user-adjustable through appropriate user inputs.

Those skilled in the art will also appreciate that the delays associated with triggering the solenoid could also be accomplished in a general-purpose processor running a suitable stored program, with user inputs to permit adjusting the delays.

FIG. **6** shows in side view corresponding to FIG. **4** the solenoid actuator arrangement according to the invention. It will be recalled from the discussion of FIGS. **4** and **5** that deflection of member **84** is what causes the print rotor to rotate through a single revolution. Solenoid **31** has core **90** which is capable of moving up and down, and which is generally in the upwards position shown. When the solenoid **31** is energized, magnetic flux tends to draw the core **90** downwards, to the position shown in dotted lines. The core **90** is connected with member **91** which engages member **84**. Movement of the core **90** downwards thus actuates the single-revolution mechanism (omitted for clarity in FIG. **6**) so that the print rotor rotates once to print postage.

Also shown in FIG. **6** are the LED-phototransistor assembly **25**, located above the paper path and juxtaposed with dark region **22**.

From the user's point of view the operation of the optical trigger is much better than the operation of the prior-art mechanical trigger. Depending on the intrinsic mechanical delays in the postage meter, and depending on the speed at which mail pieces move through the meter, the postage imprint is printed more or less close to the front edge of the mail piece. Adjustment of the imprint location is in two steps. First, a coarse adjustment is made by changing the position of switch **54** or **55**. Second, a fine adjustment is made by changing the position of potentiometer **79** or **80**. The two-step adjustment, coarse and fine, is repeated for the other user-selectable delay time, after pressing the pushbutton **28** and noting that the LED **30** is in its other state (on or off).

The usual method is to set the rotor to print a zero postage amount, and then to print several sample mail pieces. If necessary the potentiometer is adjusted clockwise or counterclockwise to cause the imprint to land on the desired portion of the mail piece.

The first of the two user-selectable delays is in effect when the machine is turned on (because of the power-on circuitry **41** which resets flip-flop **45**). To alternate between the two delays, the user presses pushbutton **28**. This turns the LED **30** on and off.

Advantages of optical release or trigger include that thin papers such as air mail envelopes are not damaged by impact with a mechanical release or trigger. The optical system does not abrade or wear, so it ages much more gracefully.

The invention is not, of course, meant to be limited to the particular embodiments set forth in detail above. Rather, those skilled in the art will have no difficulty devising alternative embodiments deviating in no way from the invention, which is defined by the following claims.

We claim:

1. An optical trigger for use in a postage meter defining a planar paper path having a first side and a second side, the postage meter having printing means actuable for printing postage, the trigger comprising:

a light source mounted on a first side of the planar paper path and directing its output toward the paper path;

a light sensor mounted on the first side of the paper path having a sensor output indicative of sensed light received from the paper path, the positions of the light source and light sensor selected so that the light sensor does not receive light in a direct path from the light source;

a dark region on the second side of the paper path positioned opposite the light source and the light sensor;

an actuator coupled with the printing means actuating the printing means for printing of postage;

a user input means generating a user signal; and

a timer means responsive to the user signal and to assertion of the sensor output for actuating the actuator at a time that follows the sensor output by at least one delay interval determined by the user signal.

2. The trigger of claim **1** wherein the light source and light sensor comprise a light-emitting diode and phototransistor both mounted above the paper path and directed downwards toward the dark region located below the paper path.

3. The trigger of claim **1** further comprising a control means powering the light source and responding to the sensor output by supplying more power to the light source when the sensor output is indicative of sensed light; wherein the light source comprises a light-emitting diode having first and second terminals, wherein is further provided a power supply having first and second power supply terminals, the second terminals of the light source and the power supply connected together, and wherein the control means comprises a first resistor connected between the first terminals of the light source and power supply and, in parallel with the first resistor, a second resistor and a transistor in series combination, the base of the transistor connected with the sensor output; whereby the sensor output turns on the transistor.

4. The trigger of claim **1** wherein the actuator comprises a solenoid mechanically coupled to the printing means.

5. The trigger of claim 1 wherein the user input means is a pushbutton, and wherein the timer means further comprises a flip-flop toggled by the pushbutton, the timer means further characterized in that the at least one delay interval comprises first and second delay intervals, the timer means selecting either of the first and second delay intervals in response to the state of the flip-flop, the timer means further comprising a light visible to a user and indicative of the state of the flip-flop.

6. The trigger of claim 5 wherein the timer means further comprises first and second trimmer adjustments accessible to the user, the first and second trimmer adjustments adjusting the first and second delay intervals.

7. The trigger of claim 1 wherein the timer means actuates the actuator only at such time as the delay interval has passed and the sensor output continues to be asserted.

8. An optical trigger for use in a postage meter defining planar paper path having a first side and a second side, the postage meter having printing means actuable for printing postage, the trigger comprising:

a light source mounted on a first side of the planar paper path and directing its output toward the paper path;

a light sensor mounted on the first side of the paper path having a sensor output indicative of sensed light received from the paper path, the positions of the light source and light sensor selected so that the light sensor does not receive light in a direct path from the light source;

a dark region on the second side of the paper path positioned opposite the light source and the light sensor;

an actuator coupled with the printing means actuating the printing means for printing of postage;

a timer means responsive to the user signal and to the sensor output for actuating the actuator at a time that follows the sensor output by a first at least one first delay interval; and

a first user-accessible trimmer adjusting the first at least one delay interval.

9. The trigger of claim 8 wherein the light source and light sensor comprise a light-emitting diode and phototransistor both mounted above the paper path and directed downwards toward the dark region located below the paper path.

10. The trigger of claim 8 further comprising a control means powering the light source and responding to the sensor output by supplying more power to the light source when the sensor output is indicative of sensed light; wherein the light source comprises a light-emitting diode having first and second terminals, wherein is further provided a power supply having first and second power supply terminals, the second terminals of the light source and the power supply connected together, and wherein the control means comprises a first resistor connected between the first terminals of the light source and power supply and, in parallel with the first resistor, a second resistor and a transistor in series combination, the base of the transistor connected with the sensor output; whereby the sensor output turns on the transistor.

11. The trigger of claim 8 wherein the actuator comprises a solenoid mechanically coupled to the printing means.

12. The trigger of claim 8 wherein is further provided a user input comprising a pushbutton, and wherein the timer means further comprises a flip-flop toggled by the pushbutton, the timer means further characterized in that the at least one delay interval comprises first and second delay intervals, the timer means selecting either of the first and second delay intervals in response to the state of the flip-flop, the timer means further comprising a light visible to a user and indicative of the state of the flip-flop.

13. The trigger of claim 8 wherein the timer means further comprises a second trimmer adjustment accessible to the user, the second trimmer adjustment adjusting the second delay interval.

14. An optical trigger for use in a postage meter defining a planar paper path having a first side and a second side, the postage meter having printing means actuable for printing postage, the trigger comprising:

a light source with controllable intensity mounted on a first side of the planar paper path and directing its output toward the paper path;

a light sensor mounted on the first side of the paper path having a sensor output indicative of sensed light received from the paper path, the positions of the light source and light sensor selected so that the light sensor does not receive light in a direct path from the light source,

a dark region on the second side of the paper path positioned opposite the light source and the light sensor;

a control means powering the light source and responding to the sensor output by supplying more power to the light source when the sensor output is indicative of sensed light;

an actuator coupled with the printing means actuating the printing means for printing of postage; and

a timer means responsive to the sensor output for actuating the actuator at a time that follows the sensor output by a first at least one first delay interval.

15. The trigger of claim 14 wherein the light source and light sensor comprise a light-emitting diode and phototransistor both mounted above the paper path and directed downwards toward the dark region located below the paper path.

16. The trigger of claim 14 wherein the light source comprises a light-emitting diode having first and second terminals, the control means comprising a power supply having first and second power supply terminals, the second terminals of the light source and the power supply connected together, and wherein the control means further comprises a first resistor connected between the first terminals of the light source and power supply and, in parallel with the first resistor, a second resistor and a transistor in series combination, the base of the transistor connected with the sensor output; whereby the sensor output turns on the transistor.

17. The trigger of claim 14 wherein the actuator comprises a solenoid mechanically coupled to the printing means.

18. The trigger of claim 14 wherein is further provided a user input comprising a pushbutton, and wherein the timer means further comprises a flip-flop toggled by the pushbutton, the timer means further characterized in that the at least one delay interval comprises first and second delay intervals, the timer means selecting either of the first and second delay intervals in response to the state of the flip-flop, the timer means further comprising a light visible to a user and indicative of the state of the flip-flop.

19. The trigger of claim 18 wherein the timer means further comprises first and second trimmer adjustments accessible to the user, the first and second trimmer adjustments respectively adjusting the first and second delay intervals.

20. A method of operation of a postage meter defining a planar paper path having a first side and a second side, the

postage meter having printing means actuable for printing postage, the method comprising the steps of:

directing light toward the paper path;

detecting light reflected from the paper path;

responding to the detection of light by starting a timer timing a predetermined interval; and

actuating the printing means upon the expiration of the predetermined interval only if light is still detected.

21. The method of claim **20** further comprising a second responding step of responding to the detection of light by starting a second timer timing a second predetermined interval;

wherein the first responding step comprises starting the timer only if light is detected and if the second timer's interval has expired.

22. An optical trigger for use in a postage meter defining a planar paper path having a first side and a second side, the postage meter having printing means actuable for printing postage, the trigger comprising:

a light source mounted on a first side of the planar paper path and directing its output toward the paper path;

a light sensor mounted with respect to the paper path having a sensor output indicative of sensed light received from the paper path;

an actuator coupled with the printing means actuating the printing means for printing of postage;

a first timer means responsive to the sensor output generating a delayed signal delayed by an at least one delay interval, and actuating the actuator at such time as the delayed signal and the sensor output are both asserted.

23. The trigger of claim **22** wherein the light source and light sensor comprise a light-emitting diode and phototransistor both mounted above the paper path and directed downwards toward a dark region located below the paper path.

24. The trigger of claim **22** further comprising a control means powering the light source and responding to the sensor output by supplying more power to the light source when the sensor output is indicative of sensed light; wherein the light source comprises a light-emitting diode having first and second terminals, wherein is further provided a power supply having first and second power supply terminals, the second terminals of the light source and the power supply connected together, and wherein the control means comprises a first resistor connected between the first terminals of the light source and power supply and, in parallel with the first resistor, a second resistor and a transistor in series combination, the base of the transistor connected with the sensor output; whereby the sensor output turns on the transistor.

25. The trigger of claim **22** wherein the actuator comprises a solenoid mechanically coupled to the printing means.

26. The trigger of claim **22** wherein is further provided a user input means, and wherein the first timer means is further responsive to the user input means for varying the length of the delay.

27. The trigger of claim **26** wherein the user input means is a pushbutton, and wherein the first timer means further comprises a flip-flop toggled by the pushbutton, the first timer means further characterized in that the at least one delay interval comprises first and second delay intervals, the first timer means selecting either of the first and second delay intervals in response to the state of the flip-flop, the first timer means further comprising a light visible to a user and indicative of the state of the flip-flop.

28. The trigger of claim **27** wherein the first timer means further comprises first and second trimmer adjustments accessible to the user, the first and second trimmer adjustments adjusting the first and second delay intervals.

29. The trigger of claim **22** further comprising a second timer means, the second timer means responding to the sensor output for generating a second delayed signal delayed by a delay interval, further characterized in that the first timer means starts only at such time as the second delayed signal and the sensor output are both asserted.

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