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CUTTING MACHINE HAVING PHOTOELECTRIC MEANS INITIATING A FIRST CUT AND TIMING MEANS INITIATING A SECOND CUT

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FIG. 1.

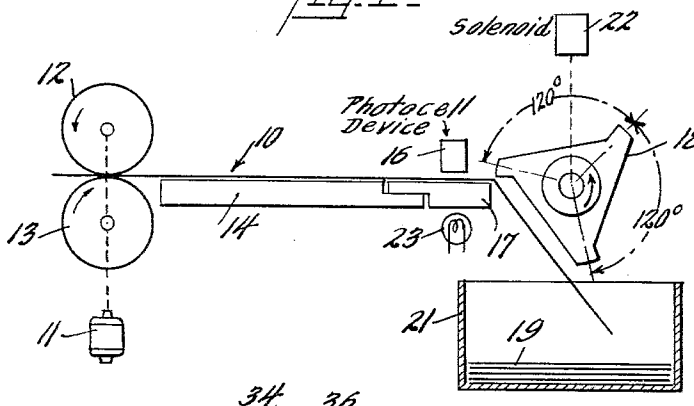
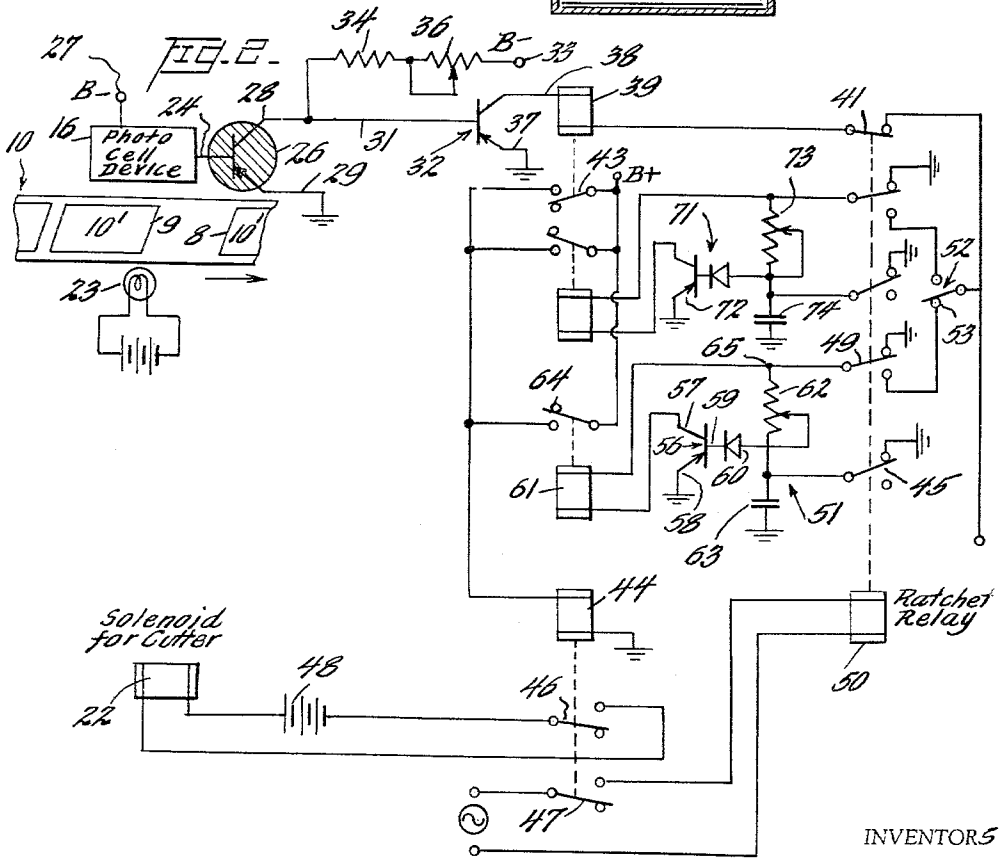


FIG. 2.



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CUTTING MACHINE HAVING PHOTOELECTRIC MEANS INITIATING A FIRST CUT AND TIMING MEANS INITIATING A SECOND CUT

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This invention relates to an automatic cutting machine and more particularly to an automatic cutting machine having a timer control system for severing a continuous strip of material into predetermined lengths.

In the automatic cutting of a continuous strip of material into sheets of predetermined lengths, it is frequently desirous or necessary to sever the continuous strip accurately and to be able to program the automatic machine to produce sheets of varied predetermined lengths. As an example, it is desirable to program an automatic paper cutting machine to sever a continuous strip of drawings into sheets of individual drawings and to program the machine to produce different lengths of drawings or groups of drawings.

One object of this invention is to provide an automatic cutting machine for accurately severing a continuous strip of material into predetermined lengths.

Another object is to provide a control system for an automatic cutting machine for severing a continuous strip of material containing a succession of drawings into sheets containing individual drawings.

An addtional object is to provide a control system for an automatic cutting machine for severing a continuous strip of material containing individual drawings wherein the sheets of individual drawings can be randomly spaced on the continuous strip of material.

A further object is to provide a control system for an automatic cutting machine for severing a continuous strip of material having a succession of individual sheets of drawing wherein the machine can be programmed to produce different lengths of drawings or groups of drawings.

A still further object is to provide a control system for an automatic cutting machine wherein a first condition is detected by a sensing device which initiates a first cutting action and a timing circuit, which subsequently initiates a second cutting action.

With these and other objects in mind, the present invention contemplates apparatus and control systems for feeding a continuous strip of drawings through a cutting device which severs the strip into individual sheets of drawings. The strip is fed past a senisng device which ascertains a drawing margin line and initiates a first cutting action through a system of relays. The relay system removes the sensing device from the control system, operates a rotary cutter, and starts a timing circuit. The timing circuit initiates a second cutting action through the relay system at the end of a timing interval. The relay system operates the rotary cutter a second time, removes the timing circuit from the control system, and reinserts the sensing device back into the control system in preparation for another cycle of operation.

Other objects and advantages of the invention will become apparent by reference to the following detailed description and the accompanying drawings wherein:

FIG. 1 is a schematic diagram of a timer controlled cutting machine for severing a continuous strip of material into individual sheets of predetermined lengths, embodying the principles of the invention; and

FIG. 2 is a schematic drawing of the electrical control system for controlling the automatic cutting machine shown in FIG. 1.

With reference to FIGS. 1 and 2, there is shown a continuous strip of material 10 having a succession of individual drawings 10' with leading margin lines 9 and trailing margin lines 8. The drawings 10' may be any type of machine drawing, electrical schematic, etc. The drawings 10' can be of any predetermined length and can be randomly spaced apart from each other on the continuous strip 10.

Referring to FIG. 1, there is shown an automatic paper cutting machine wherein a drive motor 11 drives a pair of feed rollers 12 and 13 to continuously feed a continuous strip 10 having drawings 10' across a support table 14, beneath a photocell device 16, and then beneath a rotary cutter 18 which cooperates with a stationary die 17 to sever the continuous strip into individual sheets of drawings 19. The individual sheets 19 are deposited in a collecting bin 21. A solenoid 22 is selectively energized to operate the rotary cutter 18 to sever the continuous strip 10 of drawings 10' into the individual sheets 19.

The cutter 18 is of the rotary type having three cutting blades spaced 120 degrees apart and extending at least the width of the strip 10. When solenoid 22 is energized, cutter 18 is operated one-third of a revolution through a gear system (not shown) to sever the individual sheet 19 from the continuous strip 10 of drawings 10'. It is to be understood that the rotary cutter 18 could readily be replaced by a reciprocating-type cutter, a pivotal blade cutter, or the like.

With reference to FIG. 2, the relay contacts and other circuit elements are shown positioned at the start of a cycle of operation. There is shown in FIG. 2 the continuous strip 10 of drawings 10' being advanced between a source of illumination 23 and the photocell devide 16. A photocell is normally a high resistance element, but becomes a low resistance element when subjected to increased amounts of radiant energy. Strip 10 is constructed of a transparent or translucent material which allows light rays from the source of illumination 23 to pass through the strip. When the leading margin line 9 of drawing 10' passes between the source of illumination 23 and the photocell 16, the passage of radiant energy is precluded from impinging upon the photocell device 16. The margin line indicia sensed by the photocell could be replaced by an indicia at the edge of the strip 10, or other indicia. A lens system could also be used where the indicia is especially small and not adequate to appreciably change the passage of radiant enery to the photocell. Further, the source of illumination 23 could be placed above the continuous strip 10 to reflect light from the strip back to the photocell device 16.

When light from the source of illumination 23 impinges upon the photocell device 16, a base 24 of a PNP transistor 26 is connected through a low resistance circuit to a negative D.C. potential source 27 which biases the transistor 26 into a normally conductive state. When the leading margin line 9 of an individual drawing 10' passes between the source of illumination 23 and the photocell device 16, the resistance of the photocell device increases, and thereby presents a high resistance circuit between the negative D.C. source of potential 27 and the base 24 of the transistor 26. Thus, the negative bias potential on the base 24 of the transistor 26 is reduced, biasing the transistor into a less-conducting state.

The PNP transistor 26 has an emitter 29 connected to ground potential, and a collector 28 connected to a base 31 of a PNP transistor 32. Connected to the collector 28 of transistor 26 and the base 31 of transistor 32 is a resistive network connected to a negative D.C. potential source 32. The resistive network consists of a

fixed resistor 34 and an adjustable resistor 36. An emitter 37 of the transistor 32 is connected to ground potential and a collector 38 is connected to one side of a relay 39. The other side of the relay 39 is connected through a normally closed relay contact 41 to a source of negative D.C. potential 42.

When the transistor 26 is conducting, the transistor 32 is non-conducting. Current flow is from ground through normally conducting transistor 26, resistances 34 and 36, to the D.C. negative supply source 33. The junction of the collector 28 of transistor 26 and the base 31 of transistor 32 is at near ground potential due to the low resistance of conducting transistor 26. This action biases transistor 32 into an off condition. When normally on transistor 26 is turned off, the D.C. negative potential source 33 is applied to the base of normally off transistor 32 to bias transistor 32 into a conducting state. A circuit is then completed from negative D.C. potential source 42, relay 39, transistor 32, to ground.

When the relay 39 is energized, a contact 43 is closed to complete an obvious circuit through a relay 44 and a source of power. Energization of the relay 44 closes contacts 46 and 47. Upon the closure of the contact 46, a circuit is completed through a source of D.C. energy 48 to energize the solenoid 22 which operates the rotary cutter 18 through one-third of a revolution to cut the continuous strip 10 of drawings 10' near the margin line 9. In FIGS. 1 and 2 the strip 10 is continuously advancing towards the right, approaching the rotary cutter 18. The strip is severed just before the leading margin line 9 of drawing 10'.

The closing of contact 47 completes a circuit through a ratchet relay 50 to a source of alternating power potential. A ratchet relay is characterized in that when the coil is de-energized, the operating arm does not return a relay contact to a normal position. The contact stays in place until the coil is energized a second time to return the contact to a normal position. The completion of this circuit energizes the ratchet relay 50 which closes contact 49 and opens the contacts 41 and 45.

When the relay contact 41 is opened, the D.C. potential source 42 is disconnected from the collector circuit of the transistor 32. The relay 39 is de-energized and the contact 43 is restored to the normally open position, disconnecting the relay 44 from the source of power. When the relay 44 is disconnected from the energizing circuit, the contact 46 is restored to the normally open position, thereby removing the D.C. power source 48 from the solenoid 22. The ratchet relay 500 is also disconnected from its source of alternating power potential due to the relay 44 being de-energized and the contact 47 being restored to the normally open position. The contacts 41, 45, and 49 remain open, open, and closed, respectively, and are not returned to a normal position when the ratchet relay 50 is de-energized.

After the initial operation of ratchet relay 50 to open contact 41, the photocell device 16 is removed from the control system; therefore, any lines on the drawings 10 or other margin lines 8 ond 9 passing between the photocell device 16 and the source of illumination 23 will not affect the sequence of operations of the relay system to inadvertently sever the strip 10 a second time. As mentioned above, the initial energization of the ratchet relay 50 also closes the contact 49 to initiate the operaion of a timing circuit 51. The timing circuit 51 consists of a PNP transistor 56 having a collector 57 connected through a relay 61, through the contact 49, to ground potential. An emitter 58 of the transistor 56 is connected to ground potential. A base 59 of transistor 56 is connected through a Zener diode 60, through a junction point, to an adjustable resistor 62 and a capacitor 63. The other end of the resistor 62 is connected to a junction point 65. One side of the capacitor 63 is connected to ground, and the other side is also connected to ground

through a normally closed contact 45 of relay 50. A manually operated selector switch 52 is shown connected to a contact 53.

When the selector switch 52 is in the position shown in FIG. 2, and the relay contact 49 is closed by the initial operation of the ratchet relay 50, the negative D.C. potential source 42 is connected to the timing circuit 51. As contact 45 is opened by the ratchet relay 50, the capacitor 63 will charge negatively. After a time delay, a predetermined negative charge accumulates on the capacitor 63 to bias the Zener diode 60 into conduction, whereupon the capacitor potential is applied to the base 59 and places the transistor 56 in a conducting state. The Zener diode 60 precludes the application of the capacitor voltage to the base 59 until the proper voltage necessary to bias the diode into conduction builds up on the capacitor 63. Current flow in the collector circuit of the transistor 56 then energizes the relay 61.

The time required to build up the predetermined negative charge on the capacitor 63 is selected so that the drawing 10' passes the rotary cutter 18 prior to the second operation of the cutter. This time interval is determined by the resistance value of the adjustable resistor 62 and the capacitance value of capacitor 63. When the relay 61 is energized, the contact 64 is closed, connecting the relay 44 to the source of power. The closure of contact 46 again energizes the solenoid 22, which operates the rotary cutter 18 a second time to cut the strip 10 just after the trailing margin line 8. The relay 44 also closes the relay contact 47 which connects the ratchet relay 50 to the source of alternating potential.

This second operation of the ratchet relay 50 restores the contacts 41 and 45 to the normally closed position and the contact 49 to the normally open position. When the contact 41 is restored, the negative D.C. potential source 42 is reconnected to the collector circuit of the transistor 32; thus, the photocell device 16 and the associated transistors 26 and 32 are connected back into the overall control system.

When the contact 49 is restored to the open position, the negative D.C. potential source 42 is disconnected from the collector circuit of the transistor 56. The collector circuit of transistor 56 is now reconnected through the relay contact 49 to ground potential. Closure of contact 45 allows the negative charge which had built up on the capacitor 63 to rapidly leak off to ground, and thus the capacitor is fully discharged at the start of a timing cycle. In this manner, the base 59 of the transistor 56 becomes less negative and is biased into a non-conductive state. The relay 61 is de-energized, and the contact 64 is restored to its normally open position, removing the relay 44 from the source of power. The contact 46 is then restored to the normally open position, disconnecting the solenoid 22 from the energizing circuit. The relay 44, on becoming de-energized, also restores the relay contact 47 to its normally open position, disconnecting the ratchet relay 50 from its source of alternating potential.

A timing circuit 71 comprises a PNP transistor 72, an adjustable resistor 73, and a capacitor 64. Timing circuit 71 is similar to timing circuit 51 except that it can be adjusted to have a different time interval than timing circuit 51. It will be appreciated that when it is desired to sever different lengths of drawings 10' or to collect groups of drawings 10', as many timing intervals as are desired can be attained by introducing additional timing circuits.

It is to be understood that the above-described arrangements of apparatus and construction of elemental parts are simply illustrative of an application of the principles of the invention, and many other modifications may be made without departing from the invention.

What is claimed is:

1. In a system for controlling a cutter to sever a continuous strip having randomly spaced control indicia marks thereon,

a photocell device for sensing the surface of said strip for indicia marks,
means for advancing the strip past said photocell device,
a cutter for severing the strip,
means actuated by said photocell device ascertaining an indicia mark for operating said cutter to sever the strip, and
a time delay device initiated into a cycle of operation by said photocell device sensing an indica mark for actuating said cutter a second time after a predetermined time delay to sever said strip into a predetermined length.

2. In an apparatus for severing individual sheets of drawings from a continuous strip of drawings wherein margin lines are placed on the strip to separate the drawings,
a photosensing device,
means for advancing the strip past said photosensing device,
a cutter for severing the advancing strip,
means actuated by the photosensing device ascertaining a margin line for actuating said cutter to sever the strip,
a normally unoperated timer for actuating said cutter after a predetermined time delay, and
means actuated by said photosensing device ascertaining a margin line for initiating said timer into a cycle of operation.

3. A system for controlling a cycle of operation of a cutter to sever a continuously advancing strip, having randomly spaced control indicia, into predetermined lengths, comprising:
a light-sensitive device,
means for advancing said strip within the area of influence of said light-sensitive device,
a cutter for cutting said strip,
means actuated by said light-sensitive device ascertaining said indicia for operating said cutter to cut the strip,
a timer means initiated by said light-sensitive device ascertaining said indicia for actuating said cutter a second time after a predetermined time interval, and
means actuated by said light-sensitive device upon ascertaining said indicia for precluding subsequent operations of said cutter operating means until said timer means actuates said cutter.

4. A system for controlling a cycle of operation of a cutting apparatus to sever a continuously advancing strip having control indicia into predetermined lengths wherein the indicia are randomly spaced on the strip, comprising:
a cutter for cutting said strip,
means for advancing said strip to said cutter,
means for operating said cutter a first time to cut said strip,
a timer means for actuating said cutter operating means a second time after a predetermined time interval,
facilities for precluding said second operation of said cutter operating means during said predetermined time delay,
a photocell device for sensing said indicia, and
means operated by said photocell device sensing said indicia for actuating said cutter operating means, said timer means, and said precluding facilities.

5. A system for controlling a cycle of operation of a cutter to sever a continuously advancing strip having randomly spaced control indicia into predetermined lengths, comprising:
a light-sensitive device for sensing said strip for said indicia,
a cutter for severing said strip,
means for advancing said strip within the sphere of influence of said light-sensitive device to said cutter,

means operated by said photosensing device sensing said indicia for operating said cutter,
a normally inactive time delay device for operating said cutter a second time after a predetermined time delay, and
means operated by said photosensing device sensing said indicia for removing said light sensitive device from said system and for activating said time delay device.

6. In a system for controlling a cycle of operations of an automatic cutting machine to sever a continuously advancing strip of drawings having leading and trailing margin lines into individual drawings wherein the drawings are randomly spaced on the strip, comprising:
a photocell device for sensing said strip for said leading margin line,
a cutter for severing said strip,
means for advancing said strip past said photocell device to said cutter,
a solenoid actuated by said photocell device sensing said margin line for operating said cutter to sever the strip as the margin line approaches the cutter,
a relay operated by said photocell device sensing a leading margin line for removing said photocell device from the control system, and
a timing circuit initiated by said relay for actuating said solenoid a second time after a predetermined time interval.

7. In a system for controlling a cycle of operations of an automatic cutting machine to sever a continuously advancing strip of drawings into individual sheets of drawings wherein said drawings have leading and trailing margin lines and said drawings are randomly spaced on said strip,
a stationary die,
a cutter cooperating with said stationary die to sever said advancing strip,
a photocell device for sensing the surface of said advancing strip to ascertain said leading margin line of a drawing,
means for advancing said strip within the area of influence of said photocell device to said cutter and die,
a solenoid actuated by said photocell ascertaining a leading margin line for operating said cutter to sever the strip as said leading margin line approaches the cutter,
a timing circuit, having a transistor and a resistance-capacitance network for establishing a predetermined time delay, initiated by said photocell device ascertaining a leading margin line for actuating said solenoid a second time to operate said cutter at the end of said time delay, and
a relay means for removing said photocell device from said control system to preclude a second operation of said cutter during said time delay.

8. In an apparatus for severing individual sheets of drawings from a continuous translucent strip of drawings wherein transverse opaque margin lines are placed on the strip to separate the drawings,
a photosensitive device,
means for advancing the strip past the photosensitive device,
means for projecting light through said strip onto said photosensitive device,
a cutter spaced from the photosensitive device in the direction of movement of the advancing strip for severing the strip,
means actuated by the photosensitive device ascertaining a margin line for actuating said cutter,
means operated by said photosensitive device ascertaining a margin line for precluding a repeat operation of said cutter actuating means,
a plurality of normally unoperated timers for actuating said cutter after different predetermined time delays,

means within each of said timers for adjusting each predetermined time delay,

means for selectively connecting one of said timers to actuate said cutter,

means actuated by said photosensitive device ascertaining a margin line for initiating said selected timer into a cycle of operation, and

means actuated by said timer completing a cycle of operation for rendering said precluding means ineffective.

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