United States Patent

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[31] **P 17 61 538**

[54] **SHEARING DEVICE FOR WEB STRIPS**
9 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **83/355,**
83/262, 83/285, 83/314, 83/315, 83/589, 83/602, 83/611
[51] **Int. Cl.** **B26d 5/16**
[50] **Field of Search** 83/285, 334, 335, 314, 342, 315, 589, 602, 611, 262, 355, 605

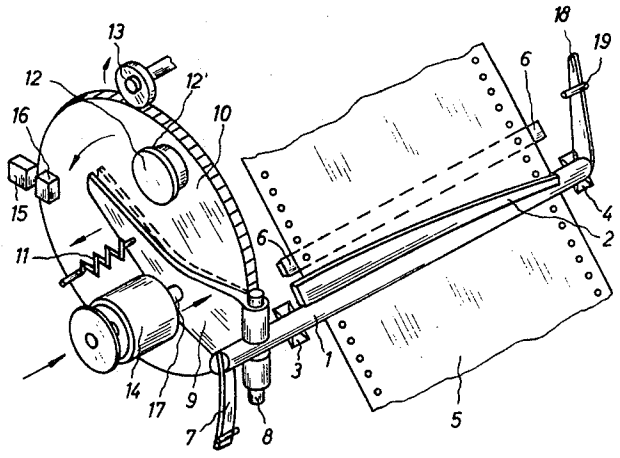
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ABSTRACT: A web cutting device and particularly a device for cutting photographic film strips at predetermined intervals as the strip moves through the cutting device. The apparatus includes a stationary shear blade and a rotatable shear blade which is mounted on a torsion bar. An actuation lever is fixed to the torsion bar and deployed perpendicularly thereof adjacent to the surface of a rotating inertial disk. The actuation lever is pivotable about an axis perpendicular to the axis of the torsion bar, and a solenoid device is used to pivot the actuation level toward and away from the moving disk. A cam member is mounted on the disk so that it contacts the actuation lever and twists the torsion bar when the actuation lever is moved toward the disk. Switch means are provided to assure that the actuation lever is moved toward the disk at the proper time interval with respect to the position of the cam on the rotating disk and means are provided to release the actuation lever once during every cycle of the disk. The torsion bar has an alarm control cam mounted at one end thereof, and a pair of switches are operated by movement of the alarm control cam to trigger an alarm when either the cam does not reach its terminal position or when the cam does not return to its starting position prior to the lapse of a given time interval. This assures that an alarm will be triggered if the web of material is not properly cut or if the device becomes jammed.



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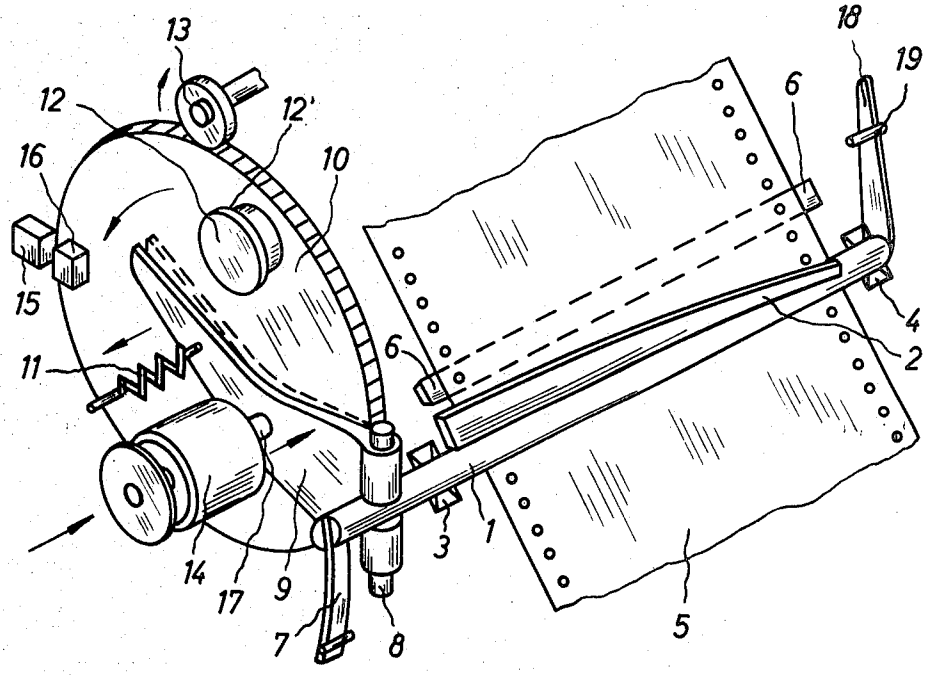


Fig. 1

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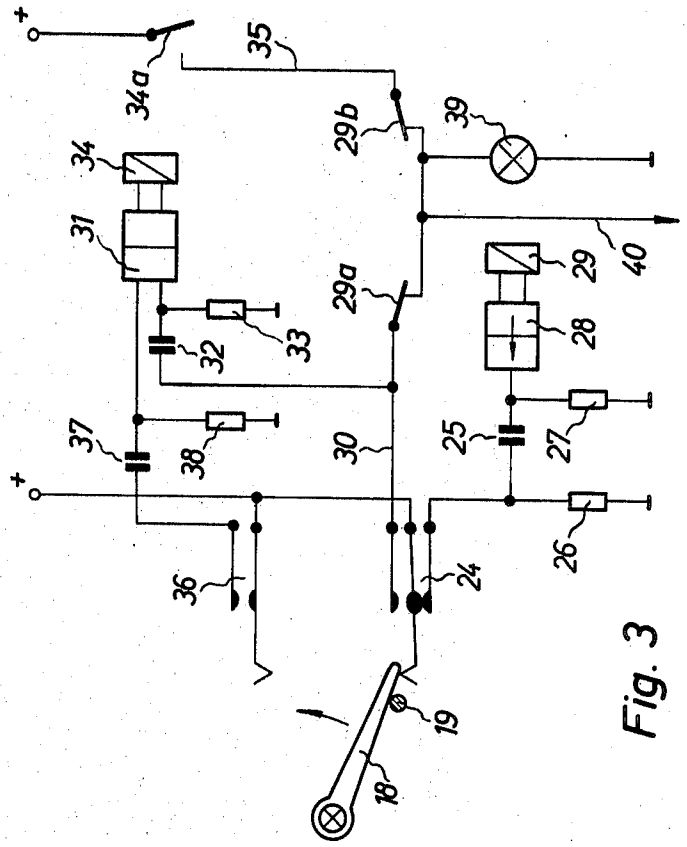


Fig. 3

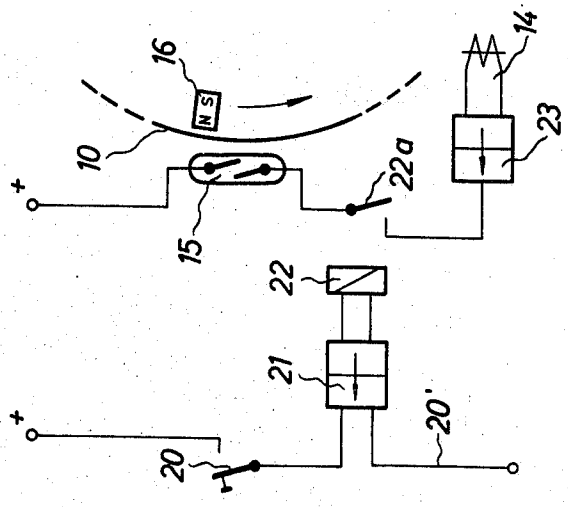


Fig. 2

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SHEARING DEVICE FOR WEB STRIPS

BACKGROUND OF THE INVENTION

The present invention relates to a device for shearing a photographic strip of material. Due to the relatively strong material used in film strips, cutting devices having a high power requirement have been used in the past. The fact that such a cutting device must operate at high speeds also increases the power requirement of any cutting apparatus. Accordingly, attempts have been made to reduce the power required to operate cutting apparatus for film strips.

For instance, a device has been developed which utilizes a fixed counterknife which is passed over the width of the web. The movement of this knife is controlled by a screw drive mechanism or threaded spindle. Since the threaded spindle must be driven in both directions to perform the cutting action, the device requires reverse gears and end-position changeover switches for an electric drive motor. Accordingly, such devices are quite expensive and also too massive for the high-speed operations desired from such apparatus.

The present invention consists of a shearing device for cutting these film strips or other web materials which include one fixed shear blade and one movable shear blade. The movable shear blade is mounted to a torsion bar and is reciprocated by a continuously rotatable disc.

The rotating disc has a high inertia, and when used in conjunction with the rotatable shear knife, requires a very small drive motor.

FIELD OF THE INVENTION

The field of art to which this invention pertains is web cutting apparatus and particularly to apparatus for cutting photographic film strips. More particularly the invention relates to apparatus which uses a stationary cutting blade and a rotatable cutting blade in connection with an inertial disc.

SUMMARY OF THE INVENTION

It is an important feature of the present invention to provide an improved shearing device for cutting photographic strips of material into segments.

It is another feature of the present invention to provide a shearing device utilizing a stationary blade and a rotatable blade to perform a cutting action.

It is an important object of the present invention to provide a shearing device for cutting photographic film strips which utilizes an inertial disc to control the reciprocating action of a rotatable cutter blade.

It is another object of the present invention to provide a shearing device for cutting photographic film strips which utilizes a rotatable cutter mounted on a torsion bar and which has an actuation lever deployed perpendicularly to the torsion bar to be contacted by a cam which is continuously rotated on an inertial disc.

It is another object of the present invention to provide an improved apparatus for converting a continuously rotating motion into a reciprocating motion for a shear-type cutting device.

It is also an object of the present invention to provide a circuit and apparatus for pivoting an actuating lever about an axis perpendicular to the axis of a rotating cutter blade in order to move the actuation lever into and out of the path of travel of a rotating cam.

It is an additional object of the present invention to provide a circuit to control the timing of the movement of the actuation lever into and out of the path of the moving cam as described above.

It is another object of the present invention to provide a control circuit to signal an alarm when a cutting action is not performed on a moving web in a cutting device as described above.

It is another object of the present invention to provide a control alarm cam for a torsion bar of a cutting device as described above and switch means which are actuated at the start and terminal positions of the cam movement together with circuit means for actuating an alarm when either the control alarm cam does not reach the terminal position or does not reach the start position within a predetermined time interval.

These and other objects, features and advantages of the present invention will be understood in greater detail from the following description and the associated drawings wherein reference numerals are utilized to designate an illustrative embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a cutting apparatus according to the present invention showing the rotating cutting blade and the continuously rotating inertial disc together with the actuating lever and cam means for operating the same.

FIG. 2 is a control circuit for regulating the timing of the pivotal action of the actuation lever with respect to the angular position of the cam on the rotating disc.

FIG. 3 is a control circuit for signaling an alarm when a malfunction of the cutting apparatus occurs.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The mechanical parts of the shearing device of the present invention are shown in FIG. 1.

A torsion bar 1 is mounted for rotation to perform the cutting action. The torsion bar 1 carries a movable shear cutting blade 2 which is mounted in the form of a helix along the length of the torsion bar. 1. The torsion bar 1 is carried in bearings 3 and 4 which are mounted adjacent to the surface of a moving web of material 5. The web of material 5 may be a film strip as described above.

A fixed counterblade 6 is spaced adjacent to the torsion bar 1 so that rotation of the torsion bar brings the helical cutting blade 2 into a cutting relationship with the fixed blade 6. In this way, the web 5 may be divided into a plurality of segments as it is fed between the blades 2 and 6.

The torsion bar 1 is biased into a given position by a leaf spring 7. In this way, if the torsion bar is rotated through a given angle, the leaf spring 7 will return the torsion bar to its starting position once the rotating force is released.

The torsion bar 1 carries a pivot 8 for an actuation lever 9. The actuation lever 9 extends generally perpendicularly of the torsion bar 1 may be pivoted about the axis 8 as shown by the dotted position of the actuation lever 9. It can be understood, then, that if the actuation lever 9 is moved downwardly as shown in FIG. 1, that the torsion bar 1 will be rotated through a given angle to perform the required cutting action.

In order to accomplish the desired movement of the actuation lever 9, an inertial disc 10 is provided to be continuously rotated adjacent to the actuation lever 9. Generally, the actuation lever 9 is biased away from the surface of the rotating disc by a tension spring 11.

The rotating disc 10 carries a cam which projects from the surface of the disc in the direction of the actuation lever 9. The cam has a projecting or overhanging edge 12' so that when the cam contacts the lever 9, the overhanging edge 12' will grip the lever and prevent its accidental movement outwardly therefrom.

The inertial disc 10 is continuously rotated by a pinion 13 which may be driven by a suitable gear drive from an electric motor.

It is desired to move the actuation lever 9 toward the disc to be engaged by the cam 12, and then to be moved away from the disc after engagement so that the actuation lever and torsion bar can be released to return to its starting position. The movement of the actuation lever toward the rotating disc is controlled by a solenoid device 14 which is operated in conjunction with an electric switch 15 and a permanent magnet

16 which is mounted to the disc 10. When the permanent magnet 16 passes adjacent to the switch 15, the switch is closed, and the solenoid device is energized causing an armature 17 to move the actuation lever 9 into an engaging position with the oncoming cam 12. After engagement, the solenoid device is released according to a timing action which is performed by a control circuit shown in FIG. 2.

The control circuit shown in FIG. 2 includes a control key 20 which is used to initiate the operation of the cutting device shown in FIG. 1. When the key 20 is closed, power is connected from the associated power source to a bistable flip-flop 21 which energizes a relay 22.

The function of the key 20 can also be performed by a computer or the like from a line 25.

When the relay 22 is energized, its contacts 22*a* are closed. This enables a circuit to control the solenoid 14.

A pair of switches 15 are shown adjacent to the magnet 16 in FIG. 2, and when the magnet approaches the switches, the switches are closed thereby connecting power directly to a monostable flip-flop which in turn temporarily energizes the solenoid 14. The monostable flip-flop is well known in the art and may employ a selectable time constant which will cause the solenoid 14 to be energized for a specified brief time interval before the flip-flop returns to its initial state.

It may happen that the cutting blades become dull or for a number of other reasons, the cutting action which is expected of the shear blades shown in FIG. 1 does not in fact occur. In such instance, it is desired to detect this malfunction immediately and sound an alarm or stop the feed of the web material to the device.

To accomplish the detection of malfunction an alarm control cam 18 is provided at the end of the torsion bar 1. The cam 18 is normally held against a boss or pin 19 by the biasing action of the leaf spring 7. This may be referred to as the start position.

Referring to FIG. 3, a control circuit is shown which is used in conjunction with the alarm control cam 18 to sound the alarm when malfunction occurs.

In FIG. 3 the alarm cam 18 is shown in its start position and holds a switch 24 downwardly so that power from the power source is coupled through the switch to a differentiating circuit consisting of a pair of resistors 26 and 27 and a capacitor 25.

When the cam is moved from its starting position as shown in FIG. 3 in the direction of the arrow, the contact of the switch 24 moves upwardly thereby generating a pulse from the differentiating circuit to a monostable flip-flop circuit 18. The flip-flop circuit 28 then changes state and energizes a relay 29 which opens a pair of contacts 29*a* and 29*b*. This operation disconnects an alarm 39 from the circuit.

At the same time, the switch 24, by moving upwardly, connects the power source directly to the switch 29*a* so that if the switch 29*a* were closed, the alarm would be given. This coupling of the power switch to the switch 29*a* will not be broken until the cam 18 removes to its start position to move the switch 24 downwardly again. Accordingly, if the monostable flip-flop does not deenergize the relay prior to the return of the cam to the starting position, the alarm will be sounded. The time constant of the monostable flip-flop can be regulated to assure that the cam will return to its start position within a normal time interval. If the cam should be jammed, then the triggering of the relay will precede the breaking of the contacts at 24 and the alarm will be sounded.

Another function is performed by the moving of the cam from its start position. That function is the coupling of power through the line 30 to differentiating circuit consisting of a capacitor 32 and a resistor 33. A pulse is then generated and coupled to a bistable flip-flop circuit 31. This energizes a relay 34 which closes contacts 34*a* and couples power directly to the switch 29*b*. The switch 29*b* of course, is open at that time, and the relay is not triggered. However, unless means are provided to deenergize the relay 34 before the switch 29*b* is closed by the monostable circuit 28, the alarm will be sounded.

Such a means is provided at the terminal position of he cam 18 in the form of the switch 36. When the cam reaches its terminal position, the switch 36 is closed coupling power to further differentiating circuit consisting of a capacitor 37 and a resistor 38. This applies a further pulse to the bistable flip-flop circuit 31 and deenergizes the relay 34. Accordingly, if the cam reaches its terminal position, the switch 34*a* will be open prior to the closing of the switch 29*b* by the monostable flip-flop circuit 28.

Accordingly, it can be seen that the start of movement of the cam 18 performs two functions. First, it opens the switches 29*a* and 29*b* and simultaneously couples power directly to the switches. The power which is coupled to the switches 29*a* and 29*b* must then be broken before the switches are closed by the flip-flop circuit 28. This coupling of power is broken first by the closing of switch 36 when the cam reaches its terminal position and second by the movement of the contact of the switch 24 to its lower position when the cam returns to its start position. In this way, an alarm is triggered whenever the cam either does not reach its terminal position or when the cam does not return to its start position before the expiration of a predetermined time interval as selected by the flip-flop circuit 28.

At the same time that the alarm is sounded, the voltage which is generated, can be used at a line 30 for operating further relays to discontinue the feed of material to the cutting apparatus.

We claim:

1. A shearing device for cutting a moving web comprising:
   - a substantially stationary blade;
   - a torsion bar mounted for rotation relative to said stationary blade;
   - a movable shear blade carried on said torsion bar for corotation therewith;
   - means biasing said torsion bar and said movable shear blade into a nonengaging position with said stationary blade;
   - an inertial body and means for rotating the same;
   - means periodically coupling said torsion bar to said inertial body for rotating said movable shear blade into a cutting relationship with said stationary blade, said means including a cam on said inertial body;
   - a lever arranged on said torsion bar to be swingable about an axis which is perpendicular to the axis of said torsion bar and to be corotatable with said torsion bar;
   - said lever being normally spaced away from said cam during rotation of said inertial body; and
   - a servomotor periodically moving said lever into the path of said cam when operation of said shearing blades is desired.

2. A shearing device in accordance with claim 1, wherein said servomotor comprises a solenoid.

3. A shearing device in accordance with claim 2, wherein means are provided to release said lever after engagement thereof with said cam and following a swinging movement which is sufficient to effect a cutting operation.

4. A shearing device in accordance with claim 3, wherein said cam has an overhanging edge for preventing an undesired release of said lever during the cutting sequence.

5. A shearing device for cutting a moving web comprising:
   - a substantially stationary shear blade;
   - a torsion bar having a second shear blade mounted thereon to be moved with the bar into a cutting action with the stationary blade;
   - an actuation lever secured to the torsion bar to be corotative therewith;
   - said actuation lever being pivotally movable about an axis generally perpendicular to the axis of the torsion bar;
   - an inertial disc having a surface mounted for rotation adjacent to a surface of the actuation lever;
   - a cam mounted on the inertial disc so as to be carried into an arcuate movement thereby;
   - said cam being engageable with the actuation lever when the lever is pivoted toward the disc and otherwise traveling in a path of movement which is free of interference with the lever; and

means for periodically pivoting the actuation lever toward the disc when a cutting action is desired.

6. A shearing device in accordance with claim 5 wherein said means for periodically pivoting the actuation lever comprises a solenoid, switch means for operating the solenoid, said switch means being mounted adjacent to the disc to trigger the switch means when the cam achieves a desired angular position with respect to the actuation lever.

7. A shearing device in accordance with claim 6 wherein a pair of series-connected switches are provided to couple power to the solenoid, one of said switches being selectably operable to prepare the circuit for automatic sequencing and wherein the other of said switches comprises said switch means which is operable by said moving magnetic means on the disc.

8. A shearing device in accordance with claim 7, wherein the magnetic means is positioned on the disc to operate the switch means just prior to engagement of the cam with the actuation lever.

9. A shearing device in accordance with claim 8, wherein a monostable switching circuit is used to control the duration of operation of said solenoid.