United States Patent [19]

Lee

[11] 3,714,858

[45] Feb. 6, 1973

[54] **STRIP CUTTER**

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[73] Assignee: **Alves Photo Service, Inc.,** Braintree, Mass.

[22] Filed: **Aug. 17, 1970**

[21] Appl. No.: **64,410**

[52] **U.S. Cl.** **83/211,** 83/244, 83/258, 83/264, 83/365, 83/371, 83/444, 83/450, 83/610

[51] **Int. Cl.** **B26d 5/32,** B26d 5/34

[58] **Field of Search**....83/209, 1, 211, 364, 365, 367, 83/371, 264, 263, 244, 245, 258, 450, 444, 610

[56] **References Cited**

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Primary Examiner—Frank T. Yost
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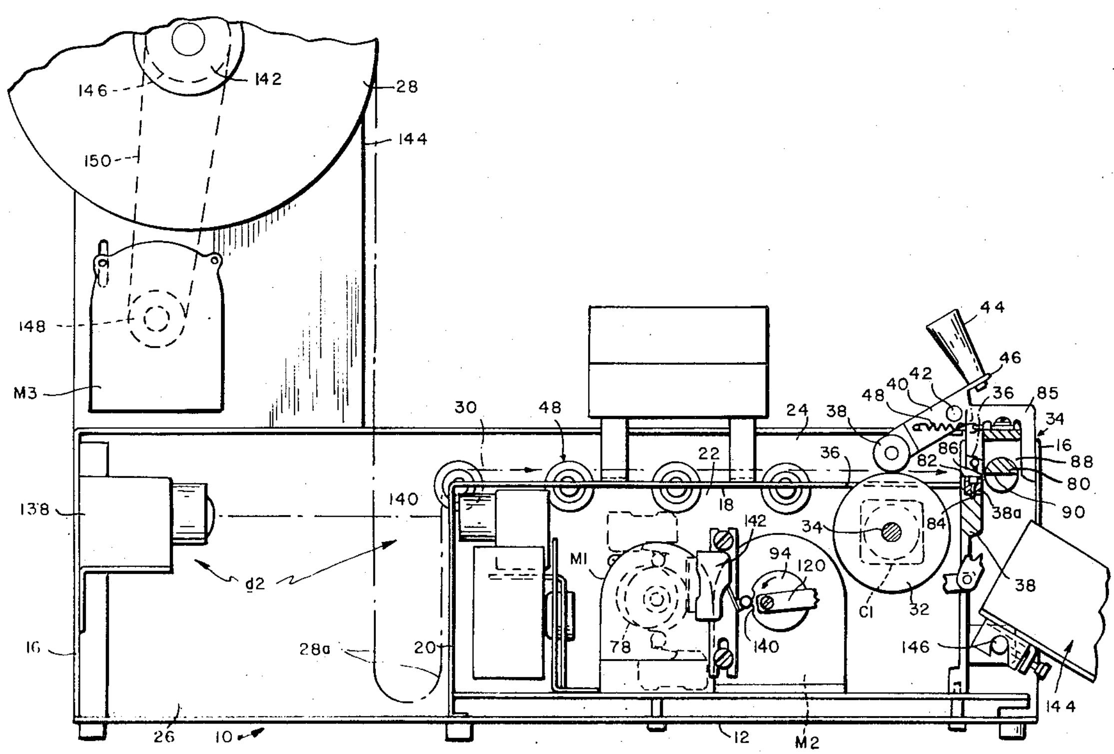
[57] **ABSTRACT**

A rotatable feed roll, mechanism including a one-way clutch for effecting intermittent non-linear rotation of the feed roll through a predetermined angle of rotation to advance strip material to an oscillatable cutter supported beyond the feed roll in the direction of movement of the strip, a detector comprising a lamp and photocell supported adjacent the strip in a position to detect indicia thereon when the strip has slowed to near stop at the end of an interval of non-linear rotation of the feed roll, and means operable by the detector in response to the indicia to effect oscillation of the cutter.

13 Claims, 7 Drawing Figures



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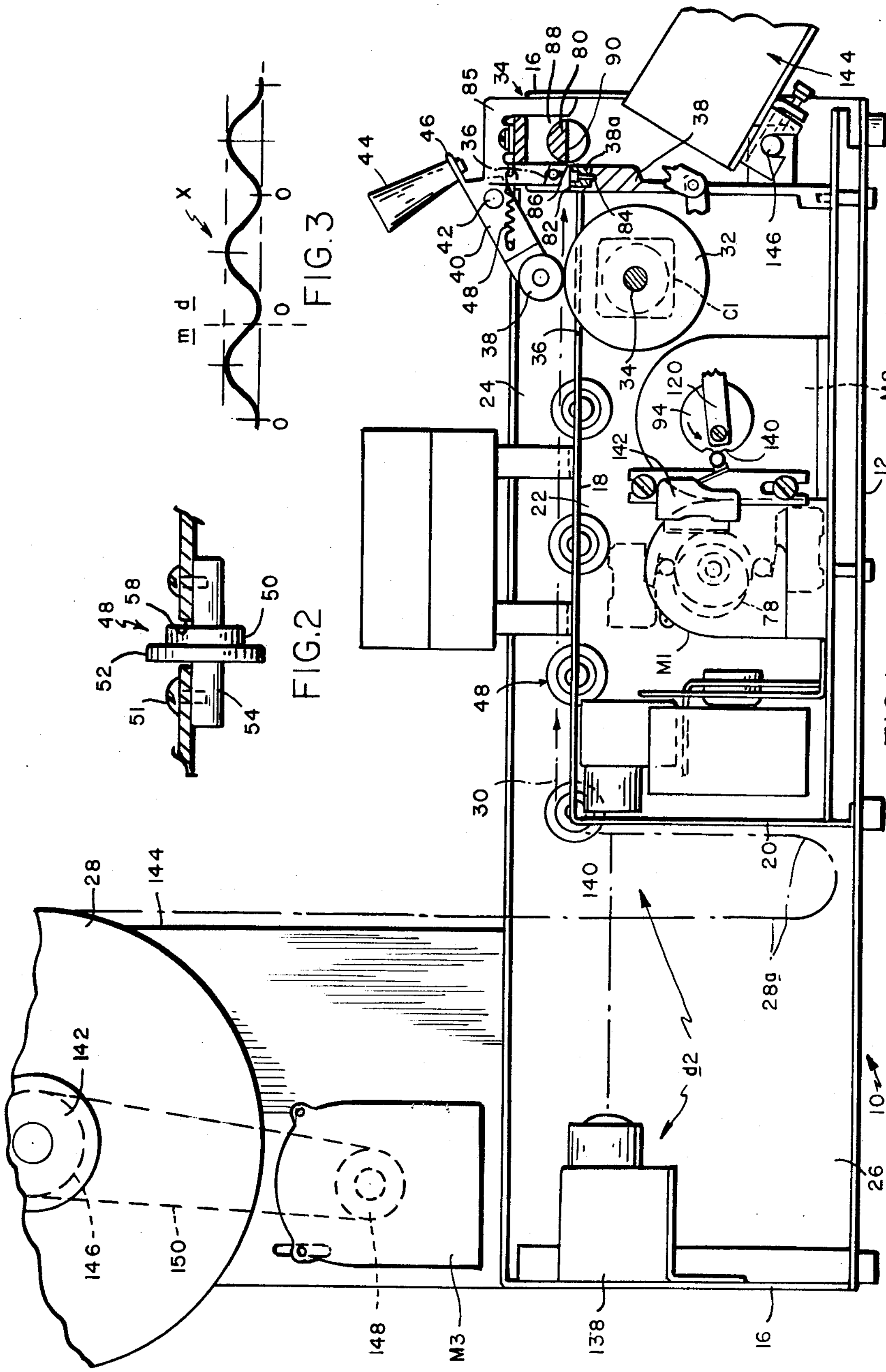
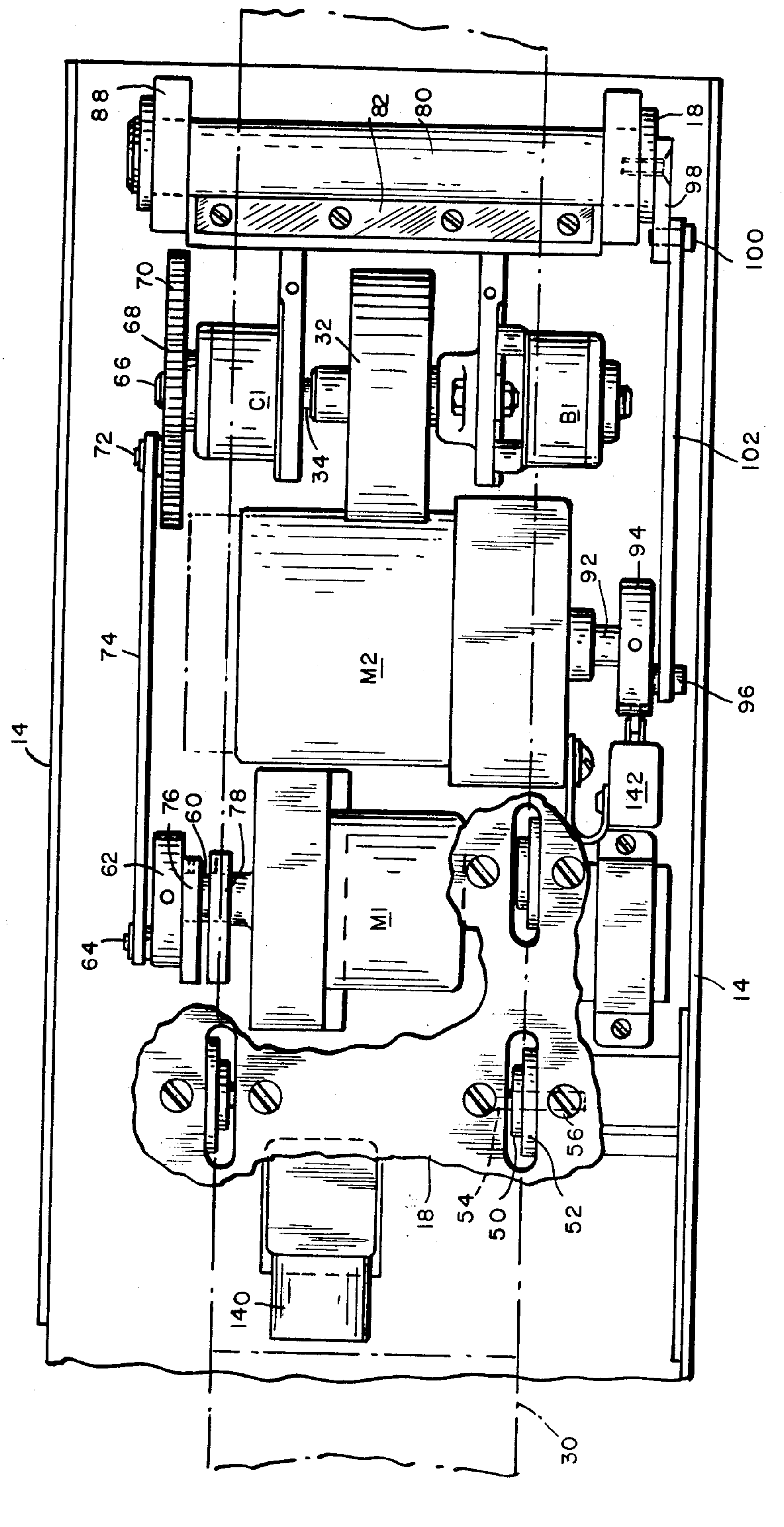


FIG.1

FIG.2

FIG.3


88
82
80
18
98
100
70
68
66
72
32
34
C1
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102
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92
M2
74
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14
76
60
78
62
64
M1
142
14
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54
50
52
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140
30

FIG.4

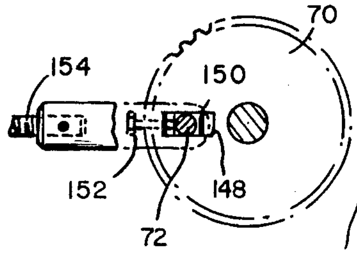

FIG. 7

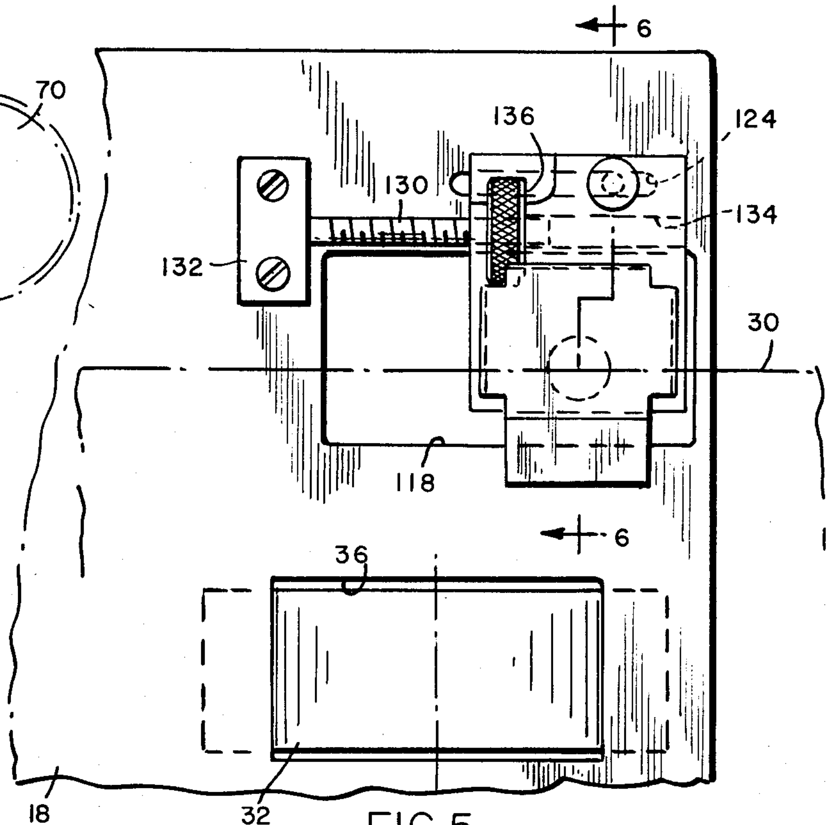

FIG. 5

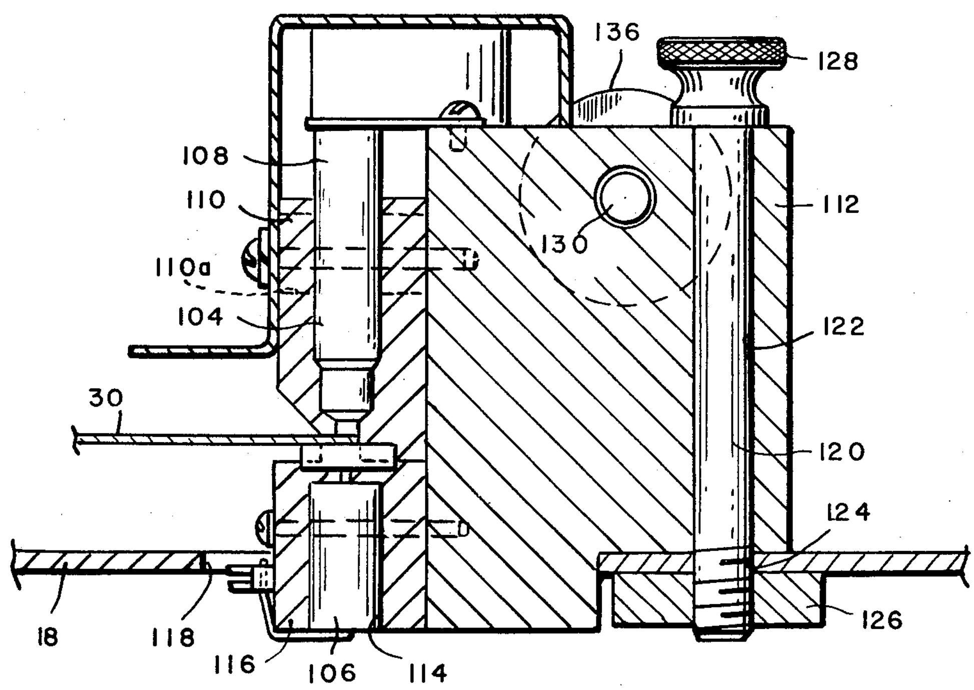

FIG. 6

STRIP CUTTER

BACKGROUND OF THE INVENTION

Apparatus for cutting strip material into predetermined lengths such as photographic film into individual transparencies or prints is disclosed in each of U.S. Pat. Nos. 3,203,293, 3,345,911 and 3,469,482 and also in pending application Ser. No. 836,253, filed June 25, 1969, U.S. Pat. No. 3,599,521. In the aforesaid patents and application photoelectric means is employed to stop the feed and effect operation of a cutter. Provision is made in some of the patents to compensate for the overrun between the time the photoelectric means detects the indicia on the strip and the operation of the cutter to assure precision and in the pending application there is disclosed means for running the strip feeder at two different speeds, a high speed throughout the major portion of the length of each print to insure high output and a low speed near the end to insure detection and cutting with a high degree of precision from print to print. This is accomplished by the use of two motors operated at high and low speed and arranged so that first one and then the other drives the feed roll.

The present application is for the purpose of obtaining the advantage of the high and low speed drive without employing two motors.

SUMMARY

As herein illustrated, the invention comprises a rotatable feed roll, means for effecting intermittent non-linear rotation of the feed roll through a predetermined angle of rotation, a cutter to which the strip is advanced by rotation of the feed roll and a detector situated adjacent the strip in a position to detect indicia on the strip as the latter slows to a stop near the end of an interval of non-linear rotation of the feed roll to actuate the cutter. The means for effecting the intermittent non-linear rotation of the feed roll comprises a constant speed motor and kinematic linkage connecting the motor to the clutch for effecting oscillation of the clutch. The kinematic linkage comprises a crank fixed to the motor shaft, a pinion fixed to a clutch on the drive roll, a gear meshing with the pinion and a link connecting the crank to the gear. The clutch is electrically operable and is disengaged in response to the detector and a brake is provided on the shaft which is operable upon disengagement of the clutch to stop the drive shaft, and upon re-engagement of the clutch to release the drive shaft.

The invention will now be described in greater detail with reference to the accompanying drawings wherein:

FIG. 1 is a side elevation of the machine broken away in part and partly in section;

FIG. 2 is a fragmentary view, partly in elevation and partly in section, taken on the line 2—2 of FIG. 4;

FIG. 3 diagrammatically illustrates the non-linear feed and the detector means positioned to effect cutting off at a point in the feed where the strip has slowed to near stop condition;

FIG. 4 is a plan view of the machine;

FIG. 5 is a fragmentary plan to much larger scale showing the detector means; and

FIG. 6 is a section taken on the line 6—6 of FIG. 5; and

FIG. 7 is a fragmentary elevation of means for adjusting the angle of oscillation of the drive gear.

Referring to the drawings, the machine comprises a box-like structure **10** having a bottom wall **12** side walls **14—14** and end walls **16—16**. Within the structure there are horizontally and vertically disposed partitions **18** and **20**. The partition **18** is situated below the top of the structure, extends from side wall to side wall and from the front end toward the rear end and terminates short of the rear end. The partition **20** is vertically disposed and extends from the terminal end of the partition wall **18** to the bottom. In conjunction, the partition walls **18** and **20** provide internally of the structure an enclosure **22** for the driving means for the apparatus as will appear hereinafter. Above the partition wall **18** there is a shallow way **24** along which strip material to be cut into pieces of equal length is moved to cutting means as will be described hereinafter and to the left of this enclosure there is a well **26** into which a loop of the strip is dropped from a coil **28** (FIG. **1**).

The strip indicated at **30** is advanced in a horizontal plane along the way by a feed roll **32** to cutting means **34**, the latter including vertically spaced guide bars **36** and **38**. The The feed roll **32** is supported within the enclosure **22** on a shaft **34** with its upper side projecting upwardly through a slot **36** in the partition wall **18**. A hold-down roll **38** for holding the strip against the feed roll is pivotally mounted between a pair of transversely spaced arms **40—40**, the latter being pivotally supported on pins **42—42** for elevation about a horizontal axis parallel to that of the feed roll to enable lifting the hold-down roll **38** away from the feed roll so as to permit threading the strip into the machine preparatory to operation. Spring means **44** connected to the arms **40** and to the structure normally hold the hold-down roll engaged with the feed roll. A handle **44** secured to a cross-bar **46** joining the upper ends of the arms **40—40** provides for lifting the hold-down roll away from the feed roll.

The strip **30** is led from the coil **28** to the feed roll over a plurality of guide rolls **48—48** rotatably mounted in longitudinally spaced pairs in the partition wall **18**. Each guide roll (FIG. **2**) comprises a hub **50** and a flange **52** and is rotatably mounted on a short stub shaft **54** which is secured to the underside of the partition wall **18** by screws **56—56** with the upper part of the roll projecting upwardly through a slot **58** in the partition wall. The guide rolls **48** are mounted so that the tops of the hubs **50** lie in a plane tangent to the top of the feed roll **32** and the flanges **52** are disposed outwardly with respect thereto for engagement with the edges of the strip to guide the strip toward the feed roll.

The feed roll **32** is rotated intermittently to advance successive lengths of the strip to the cutter for cutting and as each predetermined length of the strip is advanced to its position for cutting a detector actuates the cutting means to sever the strip. Previously the feed roll has been driven at a constant speed and the detector has operated in response to indicia on the rapidly moving strip to effect actuation of the cutter. In the pending application referred to above there is provided a control embodying two motors, one for driving the feed roll at a high rate of speed and another for driving the feed roll at a lower rate of speed. In the aforesaid machine the detector is disposed in a position to detect indicia on the strip during the period when the strip is being moved forwardly by the low speed motor. In accordance with this invention in place of two motors a single motor is employed and kinematic means is provided for connecting the single motor to the feed roll so as to impart non-linear rotation to the feed roll, that is, to initate rotation of the feed roll at a relatively slow speed, quickly bring it up to high speed and then slow it down to a stop, and, in conjunction therewith, means operable in response to indicia on the strip located at a position where the strip is slowed to near stop to initiate operation of the cutter. This is shown diagrammatically in FIG. 3 by the sine wave curve X which represents the intermittent movement of the strip from a standstill at **0** to a maximum at *m* and then back to **0** for each interval of rotation of the feed roll. As there indicated a detector *d* is positioned at the down side of the curve close to the place where the strip is coming to a stop so that detection takes place when the strip is nearly stopped and the cutter in response thereto will make its cut precisely without error. This is accomplished herein by a constant speed drive motor M1 (FIG. 4), an electrically operable clutch C1 and an electrically operable brake B1. The motor M1 has a drive shaft **60** on which there is mounted a crank disc **62** on which there is eccentrically mounted a pin **64**. The clutch C1 is mounted on the feed roll shaft **34** and embodies a shaft **66** which is adapted to be connected to the shaft **34** by engagement of the clutch and to be disconnected therefrom by disengagement of the clutch C1. A pinion **68** is fixed to the shaft **66** and this pinion meshes with a large gear **70** mounted on a shaft (not shown) parallel to the shaft **66**. A pin **72** is fixed eccentrically to the gear **70** and the pins **64** and **72** are connected by a link **74**. Rotation of the crank disc **62** through the link **74** will oscillate the gear **70** and oscillation of the gear **70** in turn will oscillate the pinion **68** so as to drive the shaft **66** first in one direction and then in the other. When driven in one direction the shaft **66** through the clutch C1 will rotate the feed roll **32** forwardly to advance the strip and when rotated in the other direction the clutch will disconnect the shaft **66** from the shaft **34** so that the feed roll is idle during the reverse rotation of the shaft **66**. To make sure that the feed roll does not rotate in the reverse direction during the reverse rotation of the shaft **66**, the brake B1 is applied to fix the shaft during this period. The clutch C1 and brake B1 as indicated above are electrically operated and there are cams **76** and **78** on the motor shaft **60**, the one being operable to effect actuation of the clutch and the other of the brake so that when the clutch is actuated to engage the shaft **66** with the shaft **34** the brake is de-actuated and when the clutch is actuated to disengage the shaft **66** from the shaft **34** the brake is applied.

The motor M1 is driven at a constant speed and so the strip is advanced by the feed roll intermittently at intervals corresponding to the length of the prints which are to be cut therefrom until the entire strip is processed. Cutting the strip is effected by advancing the strip between the vertically spaced guides **36** and **38** (FIG. 1) to a cutter bar **80** disposed transversely of the path of movement of the strip at the forward side of the guides **36** and **38**. The guide **38** embodies a hardened steel insert **38***a* having an upper flat surface **82** situated in a plane which is tangent to the top of the feed roll **32** and is removably attached by screws **84** to enable replacement should it become worn or damaged. The upper guide **36** is mounted on the structure above the guide **38** and has a downwardly and forwardly inclined flat surface **86** which converges toward the surface **82** and provides a throat for receiving the leading end of the strip and guiding it to the cutter bar **80**. The upper guide **36** is mounted by means of screws **85** to the frame so as to enable adjusting its heightwise position with respect to the insert **38***a*. The cutter bar **80** is rotatably mounted in transversely spaced bearings **88—88** and intermediate the bearings **88—88** is half-round in cross-section as indicated in FIG. 1, having a cylindrical surface **88** and diametrical surface **90**. The cutter bar is mounted so that in its inoperative position the diametrical surface **90** is situated in a plane above and parallel to the surface **82** of the bar **38** substantially at the lower edge of the bar **36**. The cutter bar is oscillated from a position shown in FIG. 1 counterclockwise through a small angle with respect to the bar **38** to sever the strip where it protrudes through the gap between the bars **36** and **38**. As illustrated, the cylindrical surface **88** is substantially tangent to the plane of the forward edge of the guides **36** and **38**.

Oscillation of the cutter bar is initiated by the detector *d* and effected by a motor M2. The motor M2 (FIG. 4) is provided with a shaft **92** on which there is a crank disc **94** to which there is eccentrically fixed a pin **96**. The cutter bar in turn is provided with a crankarm **98** and pin **100**. A link **102** connects the pins **96** and **100** so that rotation of the shaft **92** imparts oscillation to the cutter bar.

The detector *d* which effects oscillation of the cutter bar shown diagrammatically in FIG. 3 comprises, as shown in FIGS. 5 and 6, a light source **104** located above the strip and a cell **106** located below the strip adjacent one edge. Optionally, a reflective system may be employed. The light source **104** is a conventional lamp mounted in a tube **108** set into a block **110** which in turn is fastened to a block **112**. The cell **106** is a photosenstive element mounted in a tube **114** set into a block **116** which is also secured to the block **112**. The block **112** is mounted in an opening **118** (FIG. 5) in the partition wall **18** so as to be movable longitudinally of the strip and is adapted to be clamped at any predetermined position by a clamp screw **120** extending through a hole **122** in the block **112** and through a hole **124** in the partition wall **18** into threaded engagement with a nut **126** at the lower side thereof. A knurled head **128** at the upper end of the bolt provides for tightening and releasing it. Adjustment of the block **112** longitudinally is provided for by a screw **130** parallel to the direction of feed of the strip, one end of which is fixed in a block **132** screwed to the upper side of the partition wall **18**. The other end of the screw **130** extends into a hole **134** in the block **112** and a recess **136** is formed in the top of the block for receiving an internally threaded knurled nut **138** threaded onto the screw **130**. Rotation of the nut **138** will accordingly move the block **112** forwardly and rearwardly in the direction of feed of the strip. The hole **124** is of the elongate construction to enable the clamp screw to move forwardly and rearwardly with the block.

As previously related the detector *d* is adjusted longitudinally with respect to the strip so that it will detect indicia on the strip at about the time that the strip comes to a stop. Detection initiates operation of the motor M2 to effect cutting and a cam **140** on the motor shaft **92** stops the motor by engagement with a switch **142**.

As the cuts are made the severed portions of the strip drop down into the bottom of an inclined chute **144** (FIG. **1**) pivotally supported on a transversely extending bar **146** and are discharged thereby for collection into a suitable receptacle.

It is desirable to have the strip supplied to the feed roll without any restriction, that is, without being subjected to the drag imposed in unwinding it from the coil and this is accomplished herein by positively rotating the coil **28** to feed the strip off into the well **26** into the form of a loop **28***a*. To maintain the loop **28***a* a detector *d***2** is provided comprising a light source **138** and a cell **140**, the light source being mounted in the end wall opposite one side of the loop and the photocell being mounted in the enclosure **22** at the other side of the loop. The coil **28** is mounted on a spool **142** supported above the frame between spaced parallel uprights **144—144** which has on one end a sprocket **146**. A motor M3 is mounted on the structure and has on its shaft a sprocket **148**. A chain **150** entrained about the sprocket **146** and **148** provides for rotating the spool **142** and hence feeding the strip from the coil **28** into the well. If the strip is used up faster than the coil is rotated so that the bottom of the loop in the well rises above the line of sight between the light source and the cell, the cell will be actuated to start the motor M3 so as to unwind the strip from the coil until the loop drops down and cuts off light from the cell. When this occurs the motor M3 is stopped. In this way it is possible to keep a free loop available at all times from which the strip can be drawn without dragging.

Optionally, there is means for varying the oscillation of the drive gear **70** to thereby increase or decrease the length of strip advance for each cutting operation and this means comprises, as shown in FIG. **7**, a radial slot **148** in the gear in which there is mounted a block **150** to which the pin **72** is fixed. A screw **152** provides for adjusting the block and hence the pin radially with respect to the gear. Additionally, the link **74** is divided intermediate its ends and the adjacent ends joined by a screw **154** which enables lengthening the link when the block **150** is moved toward the center of the gear and shortening it when it is moved away from the center of the gear.

In operation the machine runs continuously, the strip being advanced intermittently and each movement being non-linear in that movement of the strip is initiated at a relatively slow speed, quickly increased to maximum speed and then slowed down to a stop whereupon cutting takes place following immediately by initiation of movement of the next length to the cutter until the entire length of the strip on the coil is used up.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. Strip feeding and cutting mechanism comprising a rotatable feed roll, drive means for effecting intermittent rotation of the feed roll predetermined distances with intervals of non-rotation therebetween, means embodied in the drive means for slowing the rate of rotation of the feed roll to a stop as it nears the end of said predetermined distance, a cutter operable to cut the strip during the interval of non-rotation and a detector device situated adjacent the strip in a position to detect indicia thereon as the strip slows to a stop to effect actuation of the cutter.

2. Apparatus according to claim **1**, wherein said detector device comprises a lamp and cell supported adjacent an edge of the strip, and means for adjusting the lamp and cell relative to the cutter.

3. Apparatus according to claim **1**, wherein said detector device comprises a lamp and cell supported adjacent an edge of the strip with a lamp at one broad side and the cell at the other broad side, providing a gap through which the edge moves.

4. Apparatus according to claim **1**, comprising a hold-down roll and means supporting the hold-down roll above the feed roll for tangential engagement with a strip resting on the feed roll, said means being operable to lift the hold-down roll away from the feed roll to enable threading the strip.

5. Apparatus according to claim **1**, comprising a hold-down roll, spaced parallel arms rotatably supporting the hold-down roll, and means pivotally supporting the arms for rotation about an axis parallel to the axis of the feed roll, said axis being situated above and forwardly of the axis of the hold-down roll in the direction of movement of the strip.

6. Apparatus according to clam **5**, comprising means for effecting rotation of the arms to lift the hold-down roll from the feed roll.

7. Apparatus according to claim **1**, wherein said cutter means comprises spaced parallel guide bars, providing a gap of approximately the thickness of the strip through which the strip is advanced by said feed roll, and a cutter bar supported at the forward side of the guide bars, said guide bar having an edge substantially parallel to the plane of the lower edge of the upper cutter bar and movable tangentially by one of the cutter bars relative to said edge.

8. Apparatus according to claim **1**, wherein the cutter means comprises vertically spaced parallel guide bars between which the strip is advanced, and a cutter bar at the far side of the guide bars with respect to the direction of movement of the strip, the lower one of said guide bars having a flat upper surface constituting an anvil against which the cutter bar operates to sever the strip, and a plurality of longitudinally spaced pairs of transversely spaced support rollers preceding the feed roll, said support rollers being supported in tangential relation to a plane containing the flat upper surface of the lower guide bar and tangent to the feed roll, said support rolls having radially extending shoulders providing edge guides for maintaining the course of the strip at right angles to the cutter bar.

9. Apparatus according to claim **1**, wherein the cutter means comprises a bar having a cutting edge comprising a motor and means for operably connecting the motor to the cutter bar to effect its reciprocation, said means comprising a crank on the motor shaft, a crank on the cutter bar shaft and a link connecting the two cranks, a switch adapted to be closed by the detector device operable to start the motor, a cam on the motor shaft and a switch operable by the cam on the motor shaft to stop the motor when the cutter has completed its cutting cycle.

10. Apparatus according to claim **9**, wherein the detector is supported adjacent and edge of the strip substantially abreast the feed roll and there is means for adjusting the detector longitudinally with respect to the strip and means for locking it in a selected position.

11. Strip feeding and cutting means comprising a rotatable feed roll, drive means for effecting intermittent rotation of the feed roll through predetermined angles of rotation to successively advance and stop the strip with intervals of non-rotation therebetween, said drive means being operable to slow the rate of rotation of the feed roll to a stop as it nears the end of each period of rotation and comprises for this purpose a constant speed motor, a shaft supporting the feed roll for rotation, a clutch on said shaft having fixed and movable parts adapted to be engaged and disengaged to effect by engagement rotation of the feed roll in a direction to advance the strip and by disengagement to permit the movable part to be rotated in a reverse direction to the fixed part, linkage drivably connecting the motor to the movable part of the clutch to effect reciprocation thereof, electrically operable means for engaging and disengaging the clutch, a cam on the motor shaft operable to actuate the switch to engage the clutch and disengage the clutch in consonance with the reciprocation of the movable part of the clutch, a cutter, means for effecting operation of the cutter, and a detector situated near the place of slow-down of the strip operable by indicia on the strip to initiate operation of the cutter.

12. Apparatus according to claim **11**, comprising an electrically operable brake on the shaft of the feed roll, a switch for effecting operation of the brake and a cam on the motor shaft for effecting operation of the switch, said cam being located with respect to the cam which actuates the clutch to apply a brake simultaneously with disengagement of the clutch and release the brake simultaneously with engagement of the clutch.

13. Strip feeding and cutting means comprising a frame embodying horizontally and vertically disposed partitions spaced respectively between the top and bottom and between the ends, said horizontal and vertical partitions providing an enclosure within the structure, a track for the strip and at one end a well, feed roll supported within the enclosure for rotation with its top side projecting through a slot in the horizontal partition to a predetermined height thereabove, said feed roll being rotatable to draw the strip along the horizontal partition from a spool on which the strip is wound mounted above the well, with the strip depending gravitationally into the well, a plurality of longitudinally spaced pairs of transversely spaced support rolls mounted within the enclosure at the underside of the horizontal partition with their upper portions extending through slots therein to a level corresponding to that of the top of the feed roll, upon which the strip is adapted to rest as it is drawn forwardly along the partition by the feed roll, said support rolls being free to turn as the strip is moved forwardly, said strip being drawn forwardly by the feed roll over the rollers from a loop at the lower end of the depending strip situated in a well, cutting means situated forwardly of the feed roll comprising vertically spaced guide bars having a flat horizontal surface in a plane of tangency with the feed roll and the upper one having a flat inclined surface sloping downwardly and forwardly and providing, in conjunction with the horizontal surface of the lower bar, means for guiding the leading end of the strip into the space between the bars, said cutting means comprising a cutter bar rotatably supported at the forward side of the guide bars, said cutter bar having a cutting edge and being supported for oscillation of its cutting edge in a circle tangent to said horizontal surface of the lower guide bar at approximately the lower edge of the upper guide bar, and power-operable means in the enclosure below the horizontal partition for effecting intermittent non-linear rotation of the feed roll and during the interval between rotation of the feed roll oscillation of the cutter bar.

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