July 8, 1969 J. H. GREEN 3,453,916

AUTOMATIC PAPER CUTTER

Filed Oct. 6, 1966 Sheet 1 of 4

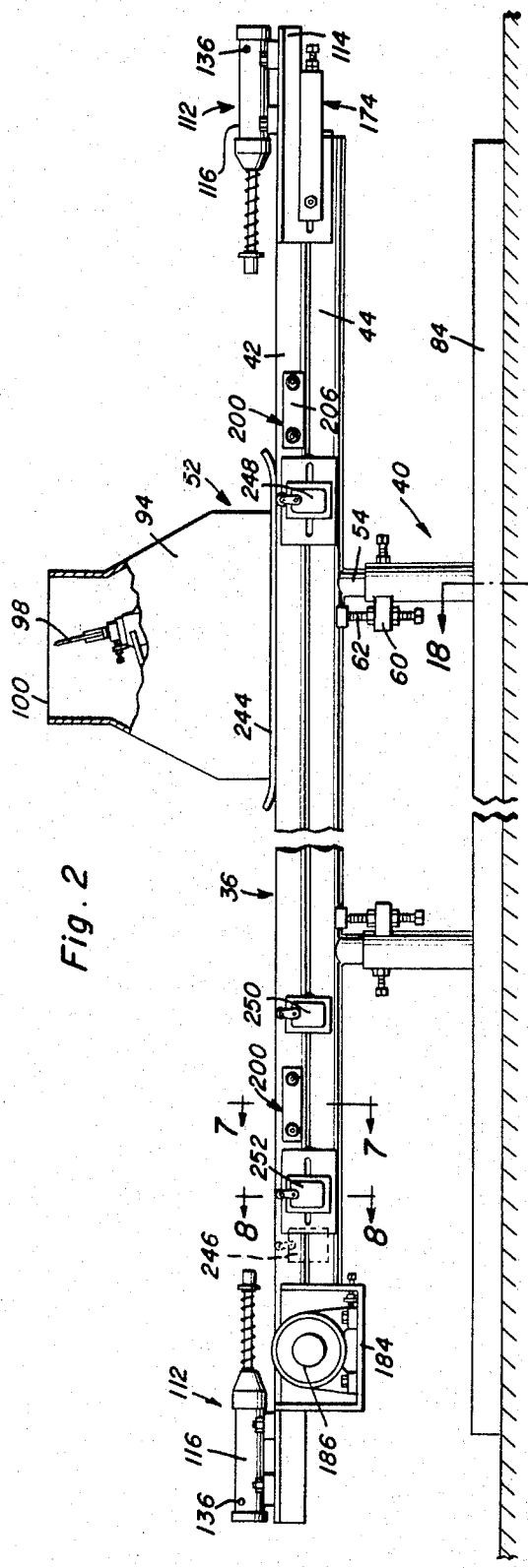


Fig. 2

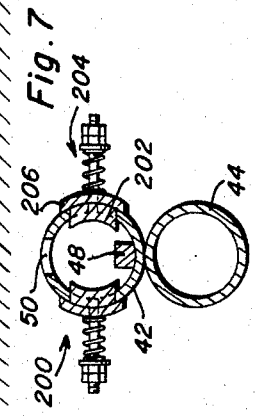


Fig. 7

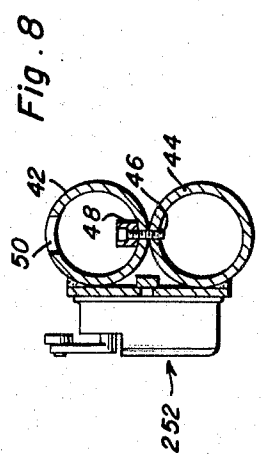


Fig. 8

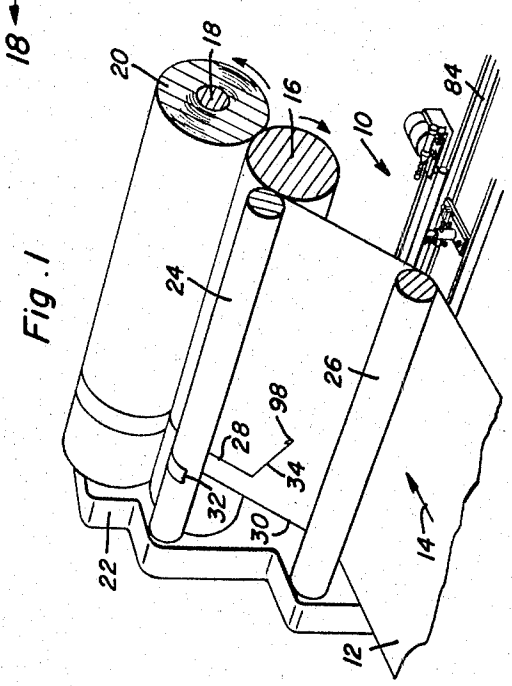


Fig. 1

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AUTOMATIC PAPER CUTTER

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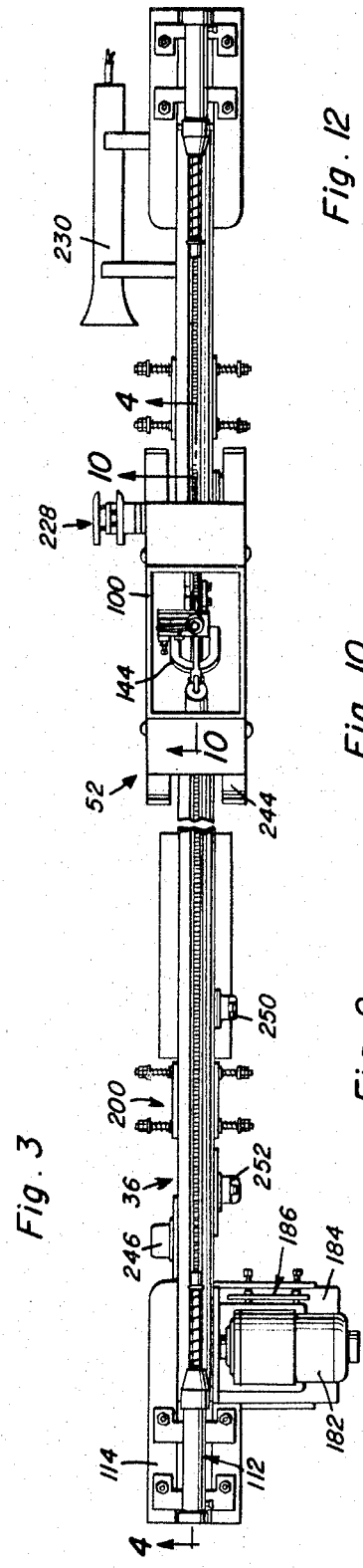


Fig. 3

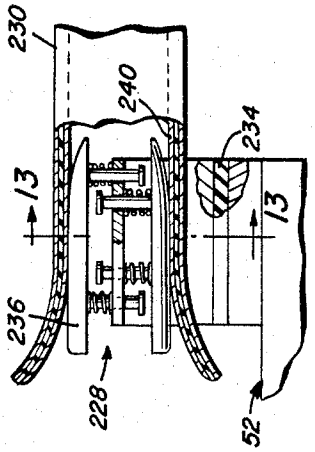


Fig. 12

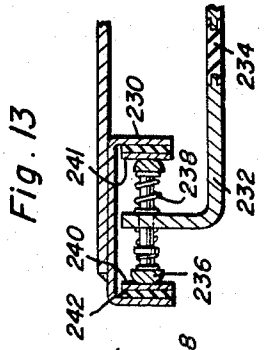


Fig. 13

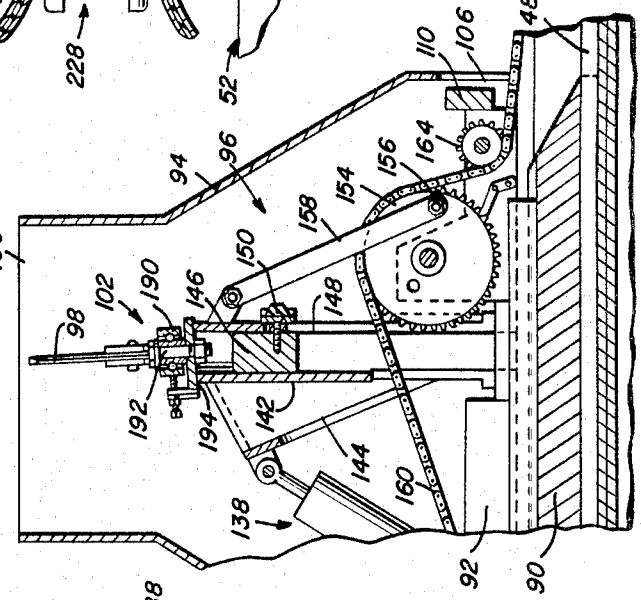


Fig. 10

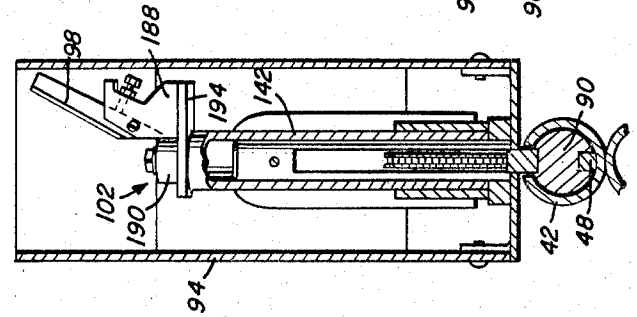


Fig. 9

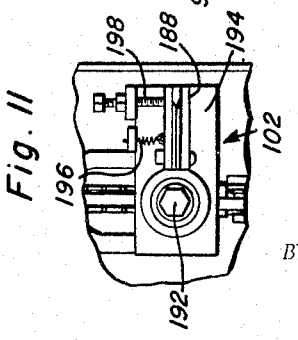


Fig. 11

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AUTOMATIC PAPER CUTTER

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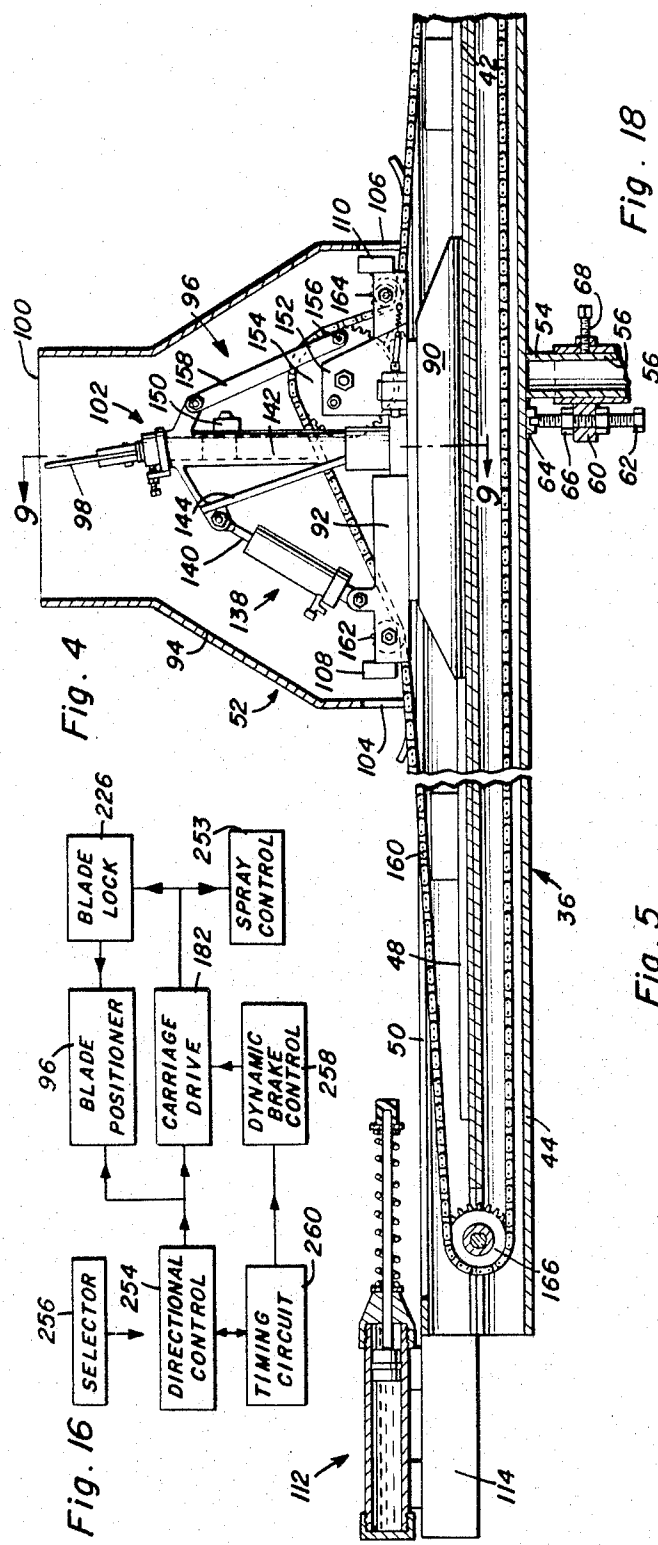


Fig. 4

Fig. 16

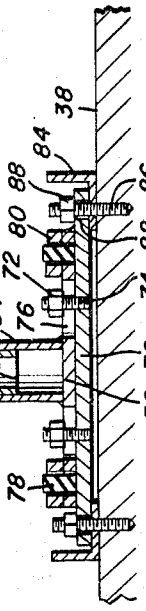


Fig. 18

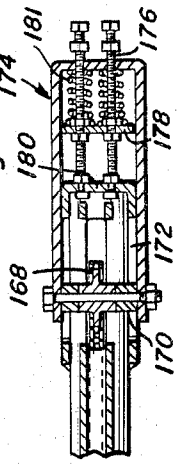


Fig. 6

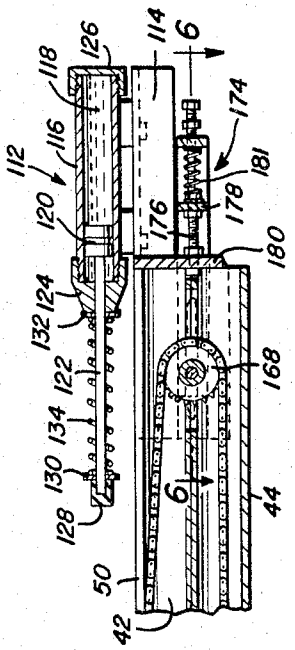


Fig. 5

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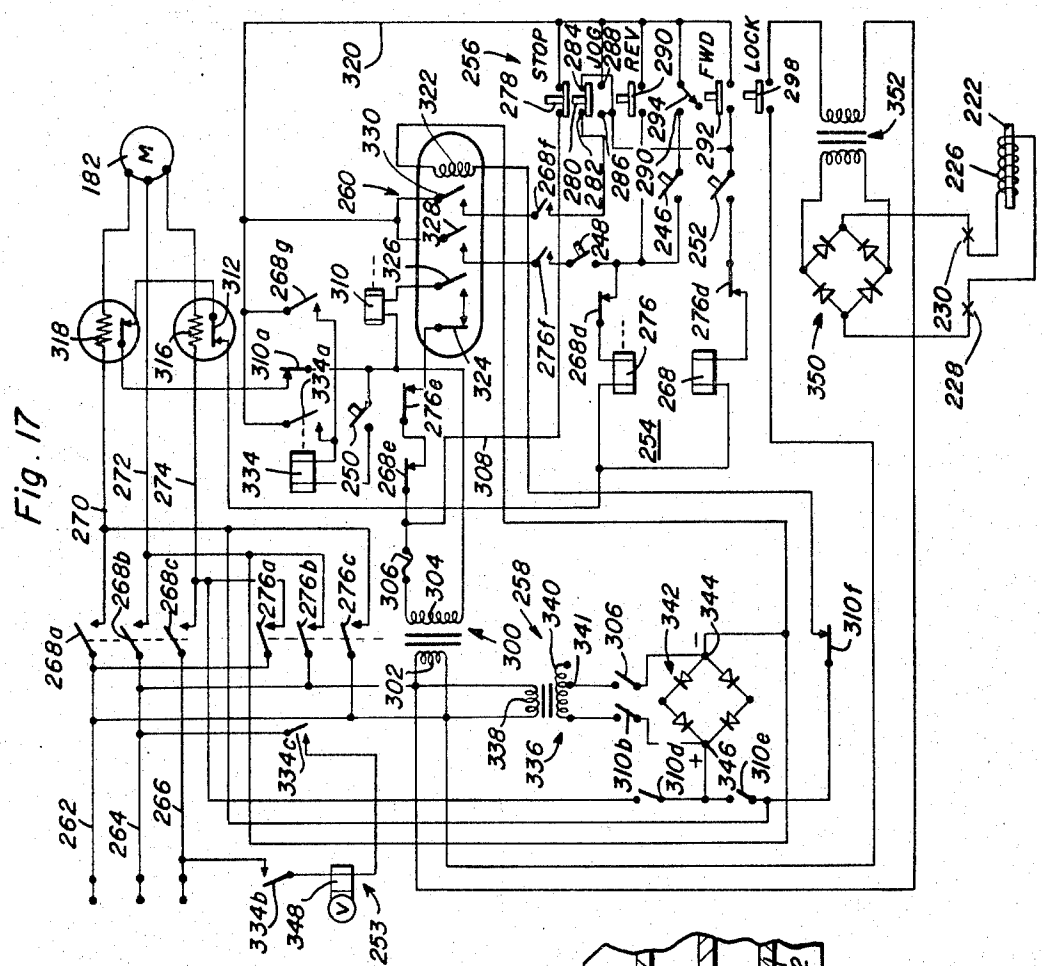


Fig. 17

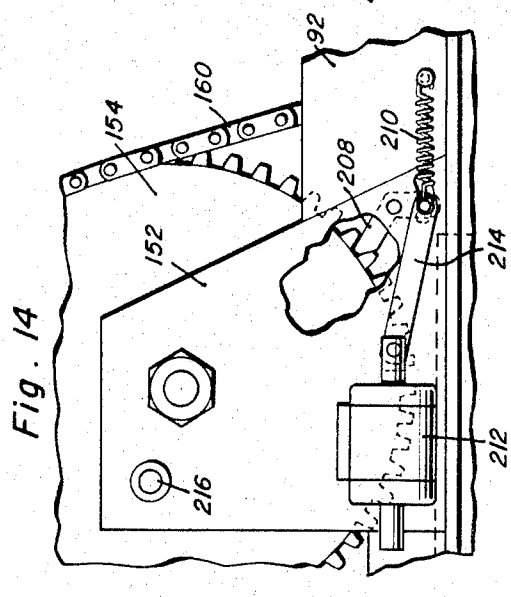


Fig. 14

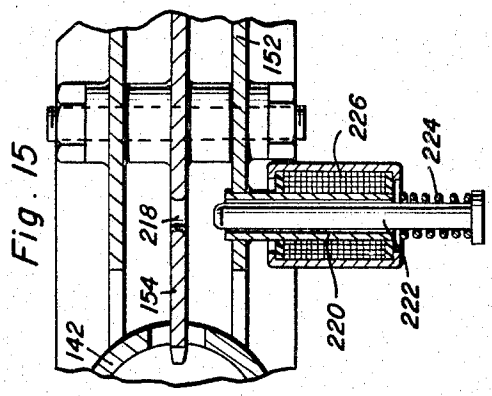


Fig. 15

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3,453,916

AUTOMATIC PAPER CUTTER

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Int. Cl. B26d 5/08, 7/06
U.S. Cl. 83—400 16 Claims

ABSTRACT OF THE DISCLOSURE

The end of web is cut with a tail by a cutter blade mounted on a carriage movable between limits transverse to the direction of web movement. The cutter blade is projected into a cutting position and the carriage moved through an operating stroke by a common drive arrangement to produce a longitudinal tail cut spaced from one edge of the web and a diagonal cut extending across the web to the other edge.

This invention relates to improvements in tail cutting apparatus utilized in connection with a continuously moving web. More particularly, the present invention is an improvement over the tail cutting device disclosed in Patent No. 2,698,662 to Moody, issued Jan. 4. 1955.

An important object of the present invention is to provide a tail cutting device of the aforementioned type which employs a novel drive mechanism through which a paper cutting blade is projected to a position penetrating the web and transverse movement imparted to the carriage on which the blade is mounted. The drive arrangement of the present invention is such as to offer more positive and reliable control over both the displacement of the blade to its web penetrating position and movement of the carriage.

In order to accomplish the foregoing, the tail cutting apparatus of the present invention features an endless drive element through which displacing force is simultaneously transferred to the blade positioning mechanism and the carriage. A stop mechanism is provided under selective control in order to prevent projection of the blade and produce a limited amount of forward movement of the carriage in order to vary the location spaced from one longitudinal edge of the web from the blade serves the web.

Operational stability for the apparatus is also achieved by use of friction brakes to resist movement of the carriage and thereby insure that the cutter blade penetrates the web before any transverse movement is imparted to the carriage. Dynamic braking means is also provided which cooperates with shock absorbers to stop and limit movement of the carriage between the ends of its stroke as well as to facilitate automatic control over the movement of the carriage during an operational cycle.

The apparatus of the present invention also embodies additional structural improvements over tail cutting devices heretofore utilized including a novel mounting for the web piercing blade by means of which the blade is reorientated in response to transverse movement of its carriage in order to smoothly sever the paper web.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a simplified perspective view showing the installational environment for the paper cutter apparatus of the present invention.

FIGURE 2 is a side elevational view of the apparatus.

FIGURE 3 is a top plan view of the apparatus shown in FIGURE 2.

FIGURE 4 is an enlarged partial side sectional view through the apparatus.

FIGURE 5 is a side sectional view through another portion of the apparatus.

FIGURE 6 is a sectional view taken substantially through a plane indicated by section line **6—6** in FIGURE 5.

FIGURE 7 is a transverse sectional view taken substantially through a plane indicated by section line **7—7** in FIGURE 2.

FIGURE 8 is a transverse sectional view taken substantially through a plane indicated by section line **8—8** in FIGURE 2.

FIGURE 9 is a partial transverse sectional view taken substantially through a plane indicated by section line **9—9** of FIGURE 4.

FIGURE 10 is an enlarged partial sectional view taken substantially through a plane indicated by section line **10—10** of FIGURE 3.

FIGURE 11 is an enlarged top plan view of a portion of the apparatus shown in FIGURE 3.

FIGURE 12 is an enlarged partial side elevational view of a portion of the apparatus with parts broken away and shown in section.

FIGURE 13 is a sectional view taken substantially through a plane indicated by section line **13—13** of FIGURE 12.

FIGURE 14 is an enlarged side elevational view of a portion of the apparatus showing the selectively controlled stop mechanism.

FIGURE 15 is an enlarged transverse sectional view through the apparatus showing a modified form of selectively controlled stop mechanism.

FIGURE 16 is a schematic block diagram illustrating diagrammatically the control system associated with the paper cutter apparatus of the present invention.

FIGURE 17 is an electrical circuit diagram corresponding to the control system.

FIGURE 18 is a partial sectional view taken substantially through a plane indicated by section line **18—18** in FIGURE 2.

The automatic paper cutter apparatus of the present invention generally denoted by reference numeral **10** in FIGURE 1, is associated with a continuous paper web **12** to which movement may be imparted in one direction indicated by arrow **14** by means of the drum **16** so as to wind the web upon the core **18** of a reel **20** shown substantially full in FIGURE 1. The full reel is accordingly mounted by its core **18** on a suitable frame **22** in spaced relation to an empty core **24**. The paper web extends upwardly from the idler drum **26** and between the empty core **24** and the drum **16**. The paper cutter apparatus **10** is therefore operative to sever the web between the drums **16** and **26** so that the forward severed end of the web may then be wound upon the empty core **24**. Toward this end, the web is longitudinally cut along the line **28** transversely spaced from the edge **30** of the web and then torn off to form a starting edge **32** that is wound about the empty core. Severing of the web then proceeds from the line **28** along a diagonal line **34** until the web is completely severed. The apparatus **10** is therefore operative to sever the web as illustrated in FIGURE 1 in a semi-automatic fashion or under operator control, as will be hereafter explained.

Referring now to FIGURES 2 and 4 in particular, it will be observed that the apparatus **10** incuding a horizontally elongated track assembly generally referred to by reference numeral **36** which is supported in a vertically adjusted position above the floor surface **38** by two or more supporting leg assemblies **40**. The track assembly in-

cludes an upper tubular member **42** and a lower tubular member **44**, the tubular members being fastened to each other at longitudinally spaced locations by means of screw fasteners **46** for example which extend through a longitudinal track element **48** as shown in FIGURE 8. The track element **48** extends therefore along the bottom of the upper tubular member **42** opposite the upper longitudinal slot **50** formed in the upper tubular member **42** in order to accommodate the slidable mounting of the carriage assembly **52** above the track assembly.

Proper positioning of the apparatus and the carriage **52** below the paper web is made possible by the adjustable leg assemblies **40** aforementioned. Each leg assembly includes therefore a downwardly extending tubular member **54** secured as by welding to the bottom tubular member **44** of the track assembly as more clearly seen in FIGURE 4, the tubular member **54** being received within a tubular standard **56** extending upwardly from a mounting plate **58** as more clearly seen in FIGURE 18. An adjustment block **60** is secured to the standard **56** and threadedly mounts an adjustment screw **62**, the upper end of which is received in a bearing projection **64** secured to the bottom tubular member **44** of the track assembly. Lock nuts **66** are threadedly mounted on the adjustment screw member on either side of the adjustment block **60** in order to lock the screw member in an axial position to which it is adjusted. It will therefore be apparent that the adjustment screw member may be utilized to vary the height of the track assembly above the floor **38**, a lock screw element **68** also being provided in order to lock the tubular member **54** to the standard **56** in its adjusted position. The mounting plate **58** is supported on a base plate **70** and locked in an adjusted position thereon by means of the lock nuts **72** threadedly mounted on the screw studs **74** projecting through adjustment slots **76** formed in the mounting plate **58**. Accordingly, the guide slots **76** will accommodate a limited amount of longitudinal displacement of the mounting plate in one direction relative to the base plate. A shock absorbing element **78** is also mounted on the base plate and projects through openings in the mounting projections **80** formed on the mounting plate. The base plate is also provided with slots **82** perpendicular to the slots **76** so as to adjustably mount the base plate on the floor **38** between the angle irons **84**. Accordingly, screw studs **86** are mounted in the floor and project upwardly through the slots **82** and threadedly receive the lock nuts **88** through which the base plate is clamped in an adjusted position.

The carriage assembly **52** aforementioned, includes an anchor member **90** slidably mounted over the track element **48**. The anchor member extends upwardly through the slot **50** formed in the upper tubular member **42** so as to mount thereabove the carriage block **92**. The carriage block is enclosed within an outer housing **94** which also encloses a blade positioning mechanism **96** through which a cutter blade **98** is displaced from a retracted position as shown in FIGURES 2, 4 and 10 to a projected position projecting through the open top **100** of the carriage housing **94** so as to penetrate the paper web as shown in FIGURE 1. The blade **98** is movably mounted on the positioning mechanism **96** by means of a blade holder generally referred to by reference numeral **102** so that the blade may automatically orientate itself from one direction along line **28** to the other direction along line **34** as shown in FIGURE 1 when movement is imparted to the carriage assembly. The carriage housing is also provided with openings **104** and **106** adjacent the bottom thereof in alignment with stop blocks **108** and **110** adapted to be engaged by identical shock absorber devices **112** mounted by longitudinal extensions **114** at the opposite longitudinal ends of the track assembly.

Each of the shock absorber devices includes a horizontal cylinder **116** as shown in FIGURES 2, 4 and 5 partially filled with the shock absorbing fluid **118** such as oil. A piston element **120** having a vent hole is slidably mounted within the cylinder **116** and is connected to a piston rod **122** which extends out of a forward slide bearing cap **124** opposite the rear cap **126** associated with the cylinder. The forward end of the piston rod **122** is provided with a resilient bumper **128** and a bearing disk **130** spaced from the bearing disk **132** abutting the forward cap **124**. A spring **134** is mounted about the piston rod **122** and reacts between the disks **130** and **132** so as to yieldably hold the piston rod in its extended position as shown. The shock absorber devices will therefore project into the openings **104** and **106** of the carriage housing for engagement with the stop blocks **108** and **110** as the carriage approaches its opposite limit position. Each cylinder **116** is filled with oil to a level below the filling plug **136** through which the oil is introduced, the retarding action of the oil on the piston **120** being regulated by the vent hole (not shown) in the piston.

A one-way pneumatic type of shock absorber **138** is provided within the carriage housing to provide down stroke resistance only and is pivotally mounted on the carriage block **92** so that its piston rod **140** may be pivotally connected to the blade positioning device **96**. The blade positioning device as shown in FIGURES 4, 9 and **10** includes a tubular slide member **142** having a horseshoe extension **144** projecting from one side thereof through which the tubular slide member is pivotally connected to the piston rod **140** of the shock absorber **138**. The slide member **142** is mounted for vertical displacement on an upwardly extending rod **146** connected to the carriage block **92**. Mounted on the rod **146** and extending through a slot **148** formed in the tubular slide member **142**, is a limit bumper stop **150** through which upward displacement of the slide member and the blade **98** is limited. The carriage block is also provided with upwardly extending mounting plates **152** adjacent to the tubular slide member **142** on a side opposite the shock absorber through which a driven sprocket wheel **154** is rotatably mounted. The sprocket wheel **154** is provided with a crank pin **156** to which a connecting rod **158** is pivotally connected so as to drivingly connect the sprocket wheel **154** to the tubular slide member **142**. It will be apparent therefore, that oscillatory movement imparted to the sprocket wheel in opposite directions will slidably displace the tubular slide member between the lower retracted position as shown to an upper projected position wherein the connecting rod **158** engages the limit bumper stop **150**. The shock absorber **138** will of course prevent damage to the parts from impact forces on the downstroke.

Movement is imparted to both the positioning mechanism **96** and the carriage by means of a driven mechanism which includes an endless sprocket chain **160**. The sprocket chain is entrained about the sprocket wheel **154** and the idler sprocket wheels **162** and **164** rotatably mounted by the carriage block adjacent to the stop blocks **108** and **110**. The sprocket chain extends in opposite directions from the carriage assembly into the upper tubular member **42** along its upper run. Drive sprocket wheel **166** and sprocket wheel **168** are respectively mounted between the upper and lower tubular members of the track assembly adjacent the opposite longitudinal ends thereof as shown in FIGURES 4 and 5 so that the endless sprocket chain **160** may be entrained thereabout with its lower run extending through the lower tubular member **44** of the track assembly. As shown in FIGURES 5 and 6, the idler sprocket wheel **168** is rotatably mounted on a spindle **170** which slidably extends through guide slots **172** formed in a guide member **180** connected to the end of the track assembly. A chain tightener frame **174** is provided with a pair of adjustment screws **176** threadedly mounting the floating plate **178** in adjustably spaced relation to the guide member **180**. Springs **181** are mounted on screws **176** and bear against the plate **178** to yieldably urge the frame **174** and the sprocket wheel **168** carried thereon in a chain tightening direction. It will be apparent therefore, that the position of the idler sprocket **168** may be ad-

justed in order to obtain the proper tension for the endless sprocket chain **160** as well as to absorb shock forces imposed on the chain. The sprocket wheel **166** is connected to a reversible electric motor **182** supported on a mounting frame **184** which extends laterally from the track assembly. The motor **182** is also adjustably positioned on its mounting frame **184** by the adjustable positioning device **186** as shown in FIGURE 3.

Referring now to FIGURES 9, 10 and 11, it will be observed that the blade holder **102** includes a blade mounting element **188** from which the cutter blade **98** extends upwardly at an angle as shown in FIGURE 9. The element **188** is rotatably mounted by the bearing race **190** about an axis which extends at an angle to the vertical displacement axis along which the tubular slide member **142** is displaced. Toward this end, the outer bearing race **190** is rotatably mounted by ball bearings about the shank portion of a bolt **192** which extends upwardly from the plate **194** secured at an angle to the top of the slide member **142**. The blade mounting element **188** may be angularly displaced against the bias of the spring element **196** which urges it against the adjustable stop screw **198**. As a result of the foregoing arrangement, the blade **98** will be angularly displaced by the paper web it penetrates when transverse movement is imparted to the carriage. Such angular displacement of the blade holder will further upwardly displace the cutter blade **98** by a small amount in order to insure continued severing of the web.

It will be apparent from the foregoing that energization of the reversible motor **182** in a forward direction will be operative through the sprocket chain **160** to angularly displace the sprocket wheel **154** in a counterclockwise direction as viewed in FIGURE 10 in order to impart upward displacement to the slide member **142** thereby projecting the blade **98** upwardly. When the slide member reaches its upward position, further counterclockwise displacement of the sprocket wheel **154** is prevented because of the engagement of the connecting rod **158** with the limit bumper stop **150**. Continued movement of the sprocket chain **160** will then cause forward displacement of the entire carriage assembly with the blade in its projected position. It will be appreciated, however, that upward projection of the blade is assured only when the carriage assembly is held stationary. Toward this end, movement of the carriage is initially resisted when the carriage is in either of its limit positions by means of a pair of friction brake assemblies **200** mounted in spaced relation to the opposite longitudinal ends of the track assembly as shown in FIGURES 2 and 3. These friction brakes will also retard movement of the carriage assembly as it approaches the limit positions to reduce the load on the shock absorber devices **112** and the dynamic brake for the motor **182** to be described hereafter. Each friction brake assembly includes a pair of friction elements **202** as shown in FIGURE 7 mounted for yieldable engagement with the sides of the carriage anchor member **90** by adjustable tension devices **204** on the mounting plates **206**.

After the blade **98** has been projected, it is also desirable that the cutter blade be held in this position while the carriage assembly is moved forwardly. However, before any return movement of the carriage, retraction of the blade **98** must be assured in order to prevent any undesired severing of the web. The latter two objectives are achieved by means of a one-way brake mechanism associated with the sprocket wheel **154**. As more clearly seen in FIGURE 14, the carriage block **92** pivotally mounts a holding pawl **208**, which engages the sprocket wheel between the teeth thereof. The holding pawl is biased by spring **210** in a counterclockwise direction as shown in FIGURE 14 to ordinarily urge the sprocket wheel **154** clockwise to insure retraction of the blade before return movement of the carriage assembly occurs. On the other hand, angular displacement of the sprocket wheel **154** in a counterclockwise direction from a position corresponding to the retracted position of the blade will angularly displace the holding pawl clockwise against the bias of spring **210** to subsequently prevent clockwise movement thereof. Retraction of the blade is thereby prevented as long as there is forward driving torque applied to the sprocket wheel overcoming the bias of spring **210**.

The one-way brake could also be utilized to hold the blade retracted during forward movement of the carriage by means of the power operated solenoid **212**, the armature of which is connected by the link **214** to the holding pawl **208** preventing any counterclockwise displacement thereof under the bias of spring **210**. Alternatively, angular displacement of the sprocket wheel **154** from its retracted position may be prevented by means of a lock pin manually inserted through an aperture in the sprocket wheel aligned with an aperture **216** in the mounting plate **152** for the sprocket wheel. An alternative power operated locking mechanism may be utilized in lieu of the arrangement illustrated in FIGURE 14. Referring therefore to FIGURE 15, it will be observed that the sprocket wheel **154** is provided with the aperture **218** aligned with a tubular member **220** projecting laterally from the mounting plate **152**. A lock pin **222** in the form of a solenoid armature is slidably mounted within the tube **220** and held in the retracted position shown in FIGURE 15 by the spring **224**. A power operated solenoid winding **226** is mounted on the tube **220** so that when energized it will project the lock pin **222** into the aperture **218** aligned with the lock pin only in the retracted position of the cutter blade.

The blade lock mechanism whether it be the form illustrated in FIGURE 14 or the form shown in FIGURE 15, is designed to hold the blade retracted so that forward movement may be selectively imparted to the carriage assembly within limits before the blade lock mechanism is released. Toward this end, the carriage assembly is provided with a laterally mounted contact device **228** as shown in FIGURE 3 received by a cooperating contact portion **230** mounted in fixed space relation to the track assembly adjacent the starting end thereof. With continued reference to FIGURES 12 and 13, it will be observed that the contact device **228** includes a right angled arm portion **232** non-conductively connected to the carriage assembly by the non-conductive spacer **234**. A pair of contact elements **236** are slidably mounted by the arm **232** and urged in opposite directions by the springs **238** into contact with the conductive strips **240** which are mounted by the non-conductive adhesive strips **242** on the downwardly extending sides of the channel member associated with the contact portion **230**. Thus, an electrically conductive path is established between the contact strips **240** and **241** during travel of a limited distance from its start position. The blade lock mechanism is therefore inoperative only after the carriage has moved a predetermined distance away from the starting position.

As shown in FIGURES 2 and 3, the carriage assembly is provided with switch actuating extensions **244** by means of which limit switches **246**, **248**, **250** and **252** are actuated by the carriage in different positions along the track assembly. The limit switches may therefore be adjustably mounted on opposite sides of the track assembly in order to adjust proper operation of the apparatus. These limit switches are actuated by the carriage assembly in order to perform various functions in connection with the automatic operational cycle of the apparatus as will be hereafter explained.

As diagrammatically shown in FIGURE 16, movement is imparted to both the carriage assembly and the web severing blade by means of the carriage drive **182** and the blade positioner **96**. A directional control component **254** is therefore associated with the control system and connected to the carriage drive and blade positioner, to control operation thereof in accordance with an automatic cycle or manual control determined by the selector component **256**. During the severing action, a water spray

is applied to the web, the water spray being cut off at the proper position of the carriage assembly by the spray control **253** which includes one of the limit switches **250** aforementioned mounted in proper position on the track assembly. The other limit switches form part of the directional control component through which an automatic cycle is effected. Accordingly, the spray control is controlled by the carriage drive which also is operative to release the blade lock solenoid **226**. The blade lock is operative on the blade positioner to temporarily prevent projection of the blade from the carriage assembly during forward movement of the carriage assembly from the start position. A dynamic brake control **258** is also provided in the control system and is operative on the carriage drive to stop movement of the carriage assembly either at its limit positions or at any position therebetween under selective control of the operator. A timing circuit **260** is accordingly associated with the dynamic brake control and the directional control movement **254** in order to preset the duration of dynamic braking.

Referring now to FIGURE 17, the electrical control system is shown in the form of a circuit diagram. The reversible motor **182** is connected to a three phase, 440 v. A.C. power supply by means of the power phase lines **262**, **264** and **266**. The motor is energized to produce rotation in a forward direction when the power lines are connected to the appropriate motor terminals through the normally opened relay switches **268***a*, **268***b*, **268***c* associated with a forward relay coil **268** forming part of the directional control component **254**. The normally opened relay switches associated with the forward relay coil **268** are therefore provided with contacts connected to the motor terminals through the motor load lines **270**, **272** and **274**. The motor **182** may also be energized to produce rotation in a reverse direction by connecting the power lines to the load lines through the normally opened relay switches **276***a*, **276***b*, and **276***c* associated with the reverse relay coil **276** in the directional control component. The directional control component is also provided with a relay interlock arrangement to prevent simultaneous energization of the forward and reverse relay coils. Thus, whe never the forward relay coil is energized, in addition to closing the normally opened relay switches that connect the motor terminals to the power lines, it also opens the normally closed relay switch **268***d* connected in series with the reverse relay coil **276** in order to prevent energization thereof. On the other hand, when ever the reverse relay coil **276** is energized, it opens its normally closed relay switch **276***d* in series with the forward relay coil **268** in order to prevent energization thereof.

The selector component **256** includes a plurality of operator controlled switches including a normally closed stop switch **278**, adapted to be momentarily opened in order to deenergize the relay circuits of the directional control component so as to interrupt the supply of power to the drive motor **182**. The selector component also includes a jog switch **280** displaceable from a position bridging a pair of contacts **282** and **284** with which it is normally engaged to another operative position bridging the contacts **286** and **288**. Normally opened reverse and forward selector switches **290** and **292** are provided in order to selectively initiate movement of the carriage assembly in either a reverse or forward direction. An automatic return switch **294** is also available for displacement between an inoperative position as shown in FIGURE 17 to an operative position engaging a contact **296**. Finally, a normally opened lock switch **298** is provided through which the cutter blade may be selectively held in its retracted position until the carriage assembly has moved a desired distance from its start position.

Power for energizing the forward and reverse relay coils is supplied through transformer **300** having a primary **302** connected to the power lines **262** and **264** and a secondary **304**. One terminal of the secondary winding **304** is connected by the fuse **306** and conductor **308** to the operator controlled switches of the selector component through which an electrical connection is established to one or the other of the relay coils **268** and **276**. The other terminal of the secondary winding **304** is connected in parallel to both of the relay coils **268** and **276** through three series connected switches consisting of a normally closed relay switch **310***a* associated with the dynamic braking control **258**, and the normally closed overload sensing switches, **312** and **314**. Thus, whenever there is any dynamic braking opertion, the relay switch **310***a* is opened to deenergize the forward or reverse relay coils. Also, when either of the load lines **270** or **274** is overloaded by excessive current, the heater elements **316** and **318** will open the normally closed switches **312** and **314** associated therewith in order to interrupt the energizing circuits for the directional control relay coils **268** and **276**. The energizing circuit for the forward relay coil **268** is completed through the selector control component upon closing of the forward switch **292** connected to the conductor **308** through conductor **320** and the normally closed stop switch **278**. The forward selector switch **292** is however connected to the relay coil **268** through the limit switch **252** and the normally closed relay switch **276***d* aforementioned. The limit switch **248** is closed until opened by the carriage approaching the end of its return stroke while the limit switch **252** is opened whenever the carriage assembly approaches the end of its forward stroke. The energizing for the forward relay coil **268** may also be established in by-pass relation to the forward selector switch **292** when the jog switch **280** is displaced to its operative position bridging the contacts **286** and **288**. Similarly, an energizing circuit for the reverse relay coil **276** is established when the reverse selector switch **290** is closed connecting the conductor **320** to the relay coil **276** through the normally closed relay switch **268***d*. An energizing circuit for the reverse relay coil **276** may also be established in by-pass relation to the reverse selector switch **290** by closing the limit switch **256** and the automatic return switch **294**.

The secondary winding **304** of transformer **300** also supplies power to the directional control component under control of the timing circuit **260** through which the duration of dynamic braking is predetermined. The timing circuit **260** includes a solenoid element **322** connected across load lines **270** and **272** operative when energized to open a normally closed switch **324** and at the same time close the normally opened switches **328** and **330**. Switch **326** is also closed and upon deenergization of the solenoid **322** opens after a preset time delay controlled by a pneumatic device for example, (not shown). The normally opened switches **328** and **330** are connected to the conductor **320** so as to complete a holding circuit either for the reverse relay coil **276** through relay switch **276***f* after the reverse selector switch **290** is released following energization of the timer solenoid element **322** or for the forward relay coil **268** through the relay switch **268***f* and the jog switch normally bridging the contacts **282** and **284**. Thus when power is supplied to motor **182** load lines **270** and **272**, the relay coils **268** and **276** will remain energized until limit switch **252** or **248** is opened as the carriage approaches the end of the forward or return stroke. Opening of the limit switches deenergizes relay coil **268** or **276** to disconnect the load lines from the source of power to also deenergize the solenoid element **322**. The timer switches **324**, **328** and **330** return to the position shown in FIGURE 17 while switch **326** remains closed for the preset delay period connecting the brake control relay coil **310** across the secondary winding **304** of transformer **300** in series with the switch **324** and the normally closed relay switches **268***e* and **276***e* that prevent energization of the relay **310** as long as the forward or reverse relay coil is energized.

The transformer **300** also supplies electrical energy for energization of the spray control relay coil **334** connected to one terminal of the secondary winding **304**

through the limit switch **250**, the circuit being completed through the relay coil **334** to the other terminal of the secondary winding **304** through either the normally opened relay switch **268***g*, closed by energization of the forward relay coil **268** or the normally opened relay holding switch **334***a*.

The braking action of the dynamic braking control **258** is initiated upon energization of the brake control relay coil **310** during the preset time delay aforementioned in order to close the normally opened relay switches **310***b*, **310***c*, **310***d* and **310***e*. At the same time, the normally closed relay switch **310***f* is opened to deenergize the timer solenoid element **322** associated with the timing circuit in order to prevent energization thereof during the timing cycle terminated by opening of switch **326**. The element **322** is energized simultaneously with motor **182** prior to operation of the dynamic braking control by being connected across the load lines **270** and **272** through the normally closed relay switch **310***f*. Power for operation of the dynamic braking control is supplied on the other hand by transformer **336** including the primary **338** connected across the power lines **262** and **264** and the secondary **340**, having an adjustable power tap **341** connected to relay switch **310***c*. Upon energization of the brake control relay **310**, the relay switches **310***b* and **310***c* are closed in order to connect the secondary winding **340** to the input terminals of a full wave rectifier **342**. The DC output of the rectifier is adjustable by means of the tap **341** to provide sufficient braking torque to overcome inertia forces only during the preset delay period. One output terminal **344** of the rectifier is therefore connected to the load line **272** while the other output terminal **346** is connected to the load lines **270** and **274** through the relay switches **310***d* and **310***e*. It will be apparent therefore, that supply of a DC voltage to the load lines from the rectifier **342** will produce a dynamic braking action on the motor **182** in order to retard either forward or reverse rotation.

The spray control component **253** includes a solenoid operated valve **348** adapted to be connected across the power lines **264** and **266** upon closing of the normally opened relay switches **334***b* and **334***c* associated with the the spray control relay coil **334**. The relay coil **334** is of course energized upon energization of forward relay coil **268** because of the closing of the normally opened relay switch **268***g* and is then held energized by closing of the relay holding switch **334***a*. The relay coil **334** is then deenergized to terminate the water spray when the limit switch **250** is opened when the carriage reaches a predetermined position.

Also, during movement of the carriage assembly from the start position to a predetermined position spaced therefrom, the contacts **228** and **230** are closed so as to connect the blade lock solenoid **226** across the output terminals of a full wave rectifier **350** which is thereby operative to project the lock pin **222** to a lock position holding the blade retracted. Power is supplied to the input terminals of the rectifier **350** through the transformer **352**, the primary of which is connected to the secondary winding **340** of transformer **336** through the normally opened lock switch **298**. The lock solenoid **226** is therefore selectively energized to hold the blade retracted until the carriage has moved a predetermined distance from the start position causing the contacts **228** and **230** to open and automatically release the blade.

With continued reference to FIGURE 17, operation of the apparatus may be summarized. Assuming that the carriage assembly is in its start position, the operator may close the lock switch **298** energizing the lock solenoid **226** in order to hold the blade **98** in its retracted position until the carriage assembly has moved a desired distance from its start position within limits established by the contacts **228** and **230**. The operator may then actuate the jog switch **280** in order to cause forward movement of the carriage assembly by energizing the forward relay coil **268** closing the normally opened relay switches **268***a*, **268***b* and **268***c* connecting the three-phase power lines to the motor terminals. At the same time, the relay switch **268***e* is opened in order to prevent energization of the brake control relay coil **310** while relay switch **268***f* is closed to energize the water spray control relay **334**. The carriage assembly thus moves forwardly until the jog switch is released. When the jog switch returns to its normal position illustrated in FIGURE 17, the forward relay coil **268** is deenergized interrupting the supply of power to the motor **182** and at the same time closing the relay switch **268***e*. The solenoid element **322** in the timing circuit is then also deenergized so that normally closed switch **324** closes immediately while the normally opened timer switch **326** remains closed for a predetermined delay period during which the brake control relay **310** is energized. Energization of the relay coil **310** initiates operation of the dynamic braking component as aforementioned to supply a DC braking voltage to the load lines from the rectifier **342**. At the same time, the relay switch **310***f* is opened to initiate the timing cycle by deenergizing element **322**. Relay switch **310***a* is also opened in order to prevent energization of the forward relay coil **268** during the braking action. After completion of the timing cycle, the timer switch **326** opens to deenergize the brake control relay **310** and terminate the braking action. When movement of the carriage assembly has stopped, the lock switch **298** may be released so as to release the blade for upward movement.

Operation may then be resumed with the blade spaced from one edge of the web by actuating the jog switch once again so as to project the blade into the moving web producing a predetermined length of leader strip. The jog switch is released to stop operation so that the leader strip may be torn off by the operator at edge **32** as shown in FIGURE 1. The forward selector switch **292** may then be actuated in order to initiate an automatic cycle with the blade in its projected position causing forward movement of the carriage.

When the carriage reaches a predetermined position, it opens the limit switch **250** causing deenergization of the water control relay **334** to terminate the water spray. When the carriage assembly approaches its limit position, it opens the limit switch **252** so as to deenergize the forward relay coil **268** initiating the dynamic braking operation and a timing cycle as hereinbefore described. When the carriage assembly has stopped at its limit position and the timing cycle completed, the reverse relay coil is energized if the automatic return switch **294** had been displaced to its operative position. The motor **182** is then connected to the power lines through the normally opened relay switches **276***a*, **276***b*, **276***c* establishing reverse rotation of the motor **182**. Reverse rotation of the motor **182** therefore sequentially retracts the cutter blade through the positioning mechanism and initiates movement of the carriage assembly in the return direction. At the same time, solenoid element **322** of the timing circuit is energized as hereinbefore described in connection with forward operation. Closing of the timer switch **328** as a result thereof, maintains the reverse relay coil **276** energized after opening of the limit switch **246** when the carriage moves away therefrom in the return direction. When the carriage approaches its start position, it opens the limit switch **248** deenergizing the reverse relay coil **276** and initiating operation of the dynamic braking circuit for the preset timing cycle of the timing circuit **260**. An automatic cycle is thereby terminated. It will of course be appreciated that the carriage assembly may be stopped at any position by temporarily opening the stop switch **278** interrupting the energizing circuits for the directional control relay coils. Also, movement in either a forward or a return direction may then be imparted to the carriage assembly by closing of the reverse or forward switches **290** and **292** causing the carriage assembly to move to either of its limit positions.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed to be new is as follows:

1. A cutter apparatus for a traveling web comprising, a carriage, a track mounting said carriage for movement transversely of said web between limit positions, a blade, positioning means mounting the blade on the carriage for displacement between a retracted position and a projected position penetrating the web, drive means operatively connected to the positioning means for simultaneously exerting displacing forces on the carriage and the blade, means for yieldably resisting movement of the carriage from said limit positions to induce displacement of the blade relative to the carriage in response to said displacing forces, and stop means engageable with the positioning means for preventing displacement of the blade relative to the carriage to induce movement of the carriage by said displacing forces.

2. A cutter apparatus for traveling web comprising, a carriage, a track mounting said carriage for movement transversely of said web between limit positions, a blade, positioning means mounting the blade on the carriage for displacement between a retracted position and a projected position penetrating the web, drive means operatively connected to the positioning means for simultaneously exerting displacing forces on the carriage and the blade, means engageable with the carriage for yieldably resisting movement thereof to induce displacement of the blade by the drive means, the stop means engageable with the positioning means for preventing displacement of the blade to induce movement of the carriage, said stop means including means engageable by the positioning means for inducing movement of the carriage with the blade in the projected position, and selectively controlled lock means for preventing displacement of the blade from the retracted piositon during movement of the carriage a predetermined distance from one of the limit positions thereof.

3. The combination of claim 2 wherein said drive means comprises, a driven wheel rotatably mounted on said carriage, a drive wheel rotatably mounted by the track, an endless flexible drive element entrained about said drive and driven wheels, reversible motor means drivingly connected to said drive wheel, and one-way brake means engageable with the driven wheel for preventing retraction of the blade only while the carriage is being moved in a forward direction.

4. The combination of claim 3 wherein said positioning means comprises, a slide member displaceable along a displacement axis intersecting said web, link means connecting the drive wheel to the slide member, and blade holder means rotatably mounted by the slide member about a second axis at an angle to the displacement axis for reorientating the blade in response to movement of the carriage.

5. The combination of claim 4 including dynamic braking means operatively connected to the reversible motor means for retarding movement of the carriage in response to deenergization of the motor means and timing operatively connected to the braking means for limiting the period during which movement of the carriage is retarded.

6. The combination of claim 5 including shock absorbing means engageable by the carriage during approach thereof to the limit positions and limit switch means operatively connected to the dynamic braking means for retarding movement of the carriage during said approach thereof to the limit positions.

7. A cutter apparatus for a traveling web comprising, a carriage, a track mounting said carriage for movement transversely of said web between limit positions, a blade, positioning means mounting the blade on the carriage for displacement between a retracted position and a projected position penetrating the web, drive means operatively connected to the positioning means for simultaneously exerting displacing forces on the carriage and the blade, means engageable with the carriage for yieldably resisting movement thereof to induce displacement of the blade by the drive means, and stop means engageable with the positioning means for preventing displacement of the blade to induce movement of the carriage, said drive means comprising, a driven wheel rotatably mounted on said carriage, a drive wheel rotatably mounted by the track, an endless flexible drive element entrained about said drive and driven wheels, reversible motor means drivingly connected to said drive wheel, and one-way brake means engageable with the drive wheel for preventing retraction of the blade only during forward movement of the carriage.

8. The combination of claim 7 wherein said positioning means comprises, a slide member displaceable along a displacement axis intersecting said web, link means connecting the drive wheel to the slide member, and blade holder means rotatably mounted by the slide member about a second axis at an angle to the displacement axis for reorientating the blade in response to movement of the carriage.

9. A cutter apparatus for a traveling web comprising, a carriage, a track mounting said carriage for movement transversely of said web between limit positions, a blade, positioning means mounting the blade on the carriage for displacement between a retracted position and a projected position penetrating the web, drive means operatively connected to the positioning means for simultaneously exerting displacing forces on the carriage and the blade, means engageable with the carriage for yieldably resisting movement thereof to induce displacement of the blade by the drive means, and stop means engageable with the positioning means for preventing displacement of the blade to induce movement of the carriage, said positioning means comprising a slide member displaceable along a displacement axis intersecting said web, link means connecting the drive means to the slide member, and blade holder means rotatably mounted by the slide member about a second axis at an angle to the displacement axis for reorientating the blade in response to movement of the carriage.

10. The combination of claim 9 including dynamic braking means operatively connected to the drive means for retarding movement of the carriage in response to deenergization of the motor means and timing means operatively connected to the braking means for limiting the duration during which the movement of the carriage is retarded.

11. The combination of claim 10 including shock absorbing means engageable by the carriage during approach thereof to the limit positions and limit switch means operatively connected to the dynamic braking means for retarding movement of the carriage during said approach thereof to the limit positions.

12. A cutter apparatus for a traveling web comprising, a carriage, a track mounting said carriage for movement transversely of said web between limit positions, a blade, positioning means mounting the blade on the carriage for displacement between a retracted position and a projected position penetrating the web, drive means operatively connected to the positioning means for simultaneously exerting displacing forces on the carriage and the blade, means engageable with the carriage for yieldably resisting movement thereof to induce displacement of the blade by the drive means, stop means engageable with the positioning means for preventing displacement of the blade to induce movement of the carriage, and dynamic braking means operatively connected to the drive means for retarding movement of the carriage in response to deenergization of the motor means and timing means

operatively connected to the braking means for limiting the duration during which the movement of the carriage is retarded.

13. The combination of claim 12 including shock absorbing means engageable by the carriage during approach thereof to the limit positions and limit switch means operatively connected to the dynamic braking means for retarding movement of the carriage during said approach thereof to the limit positions.

14. In combination with a track, a carriage mounted thereon for movement between limit positions and a slide member slidably mounted on the carriage, a drive mechanism comprising a driven wheel rotatably mounted on said carriage, a drive wheel rotatably mounted by the track, an endless flexible drive element entrained about said drive and driven wheels, reversible motor means drivingly connected to said drive wheel, one-way brake means engageable with the driven wheel for preventing rotation thereof in one direction only during movement of the carriage toward one of the limit positions, and stop means for preventing displacement of the slide member from one position on the carriage to induce movement of the carriage toward said one of the limit positions.

15. The combination of claim 14 wherein said one-way brake means includes a holding pawl pivotally mounted

by the carriage and engageable with the drive wheel, a spring connected to the pawl urging the same to permit overrun of the drive wheel in the other direction, said stop means including selectively controlled power means operatively connected to the pawl for overcoming the urge of the spring.

16. The combination of claim 1 wherein said means for yieldably resisting movement of the carriage comprises motion retarding brakes mounted by the track and engageable with the carriage at said limit positions.

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