Feb. 15, 1944. D. A. JOHNSTON 2,341,870

AUTOMATIC CUTOFF

Filed Nov. 15, 1941 4 Sheets-Sheet 1

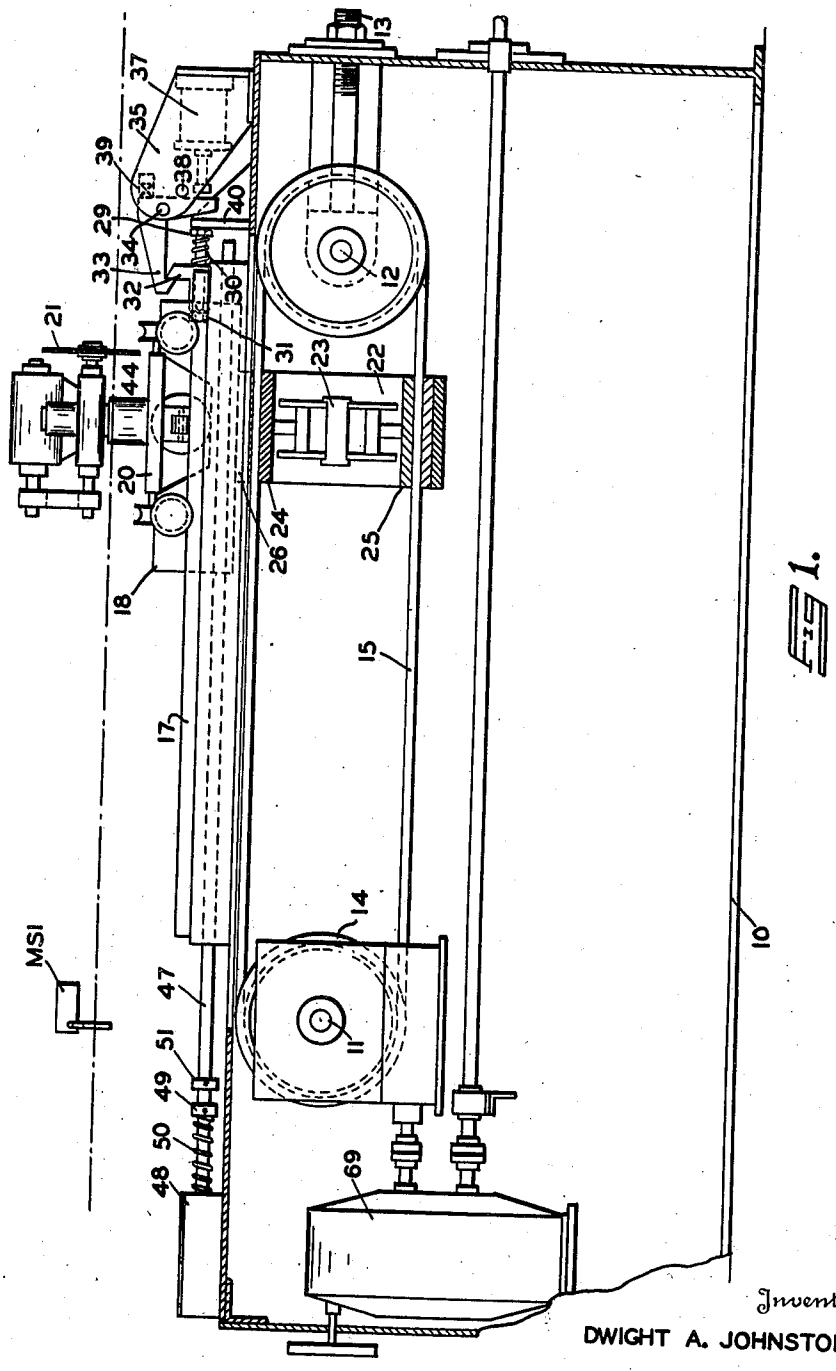


Fig. 1.

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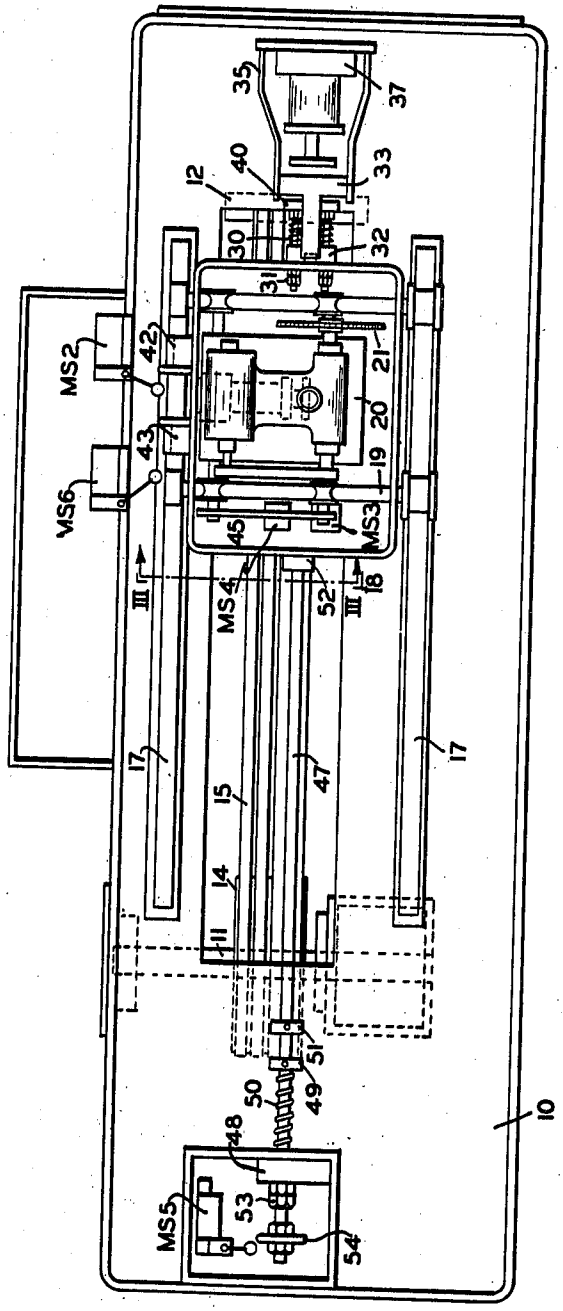


Fig 2.

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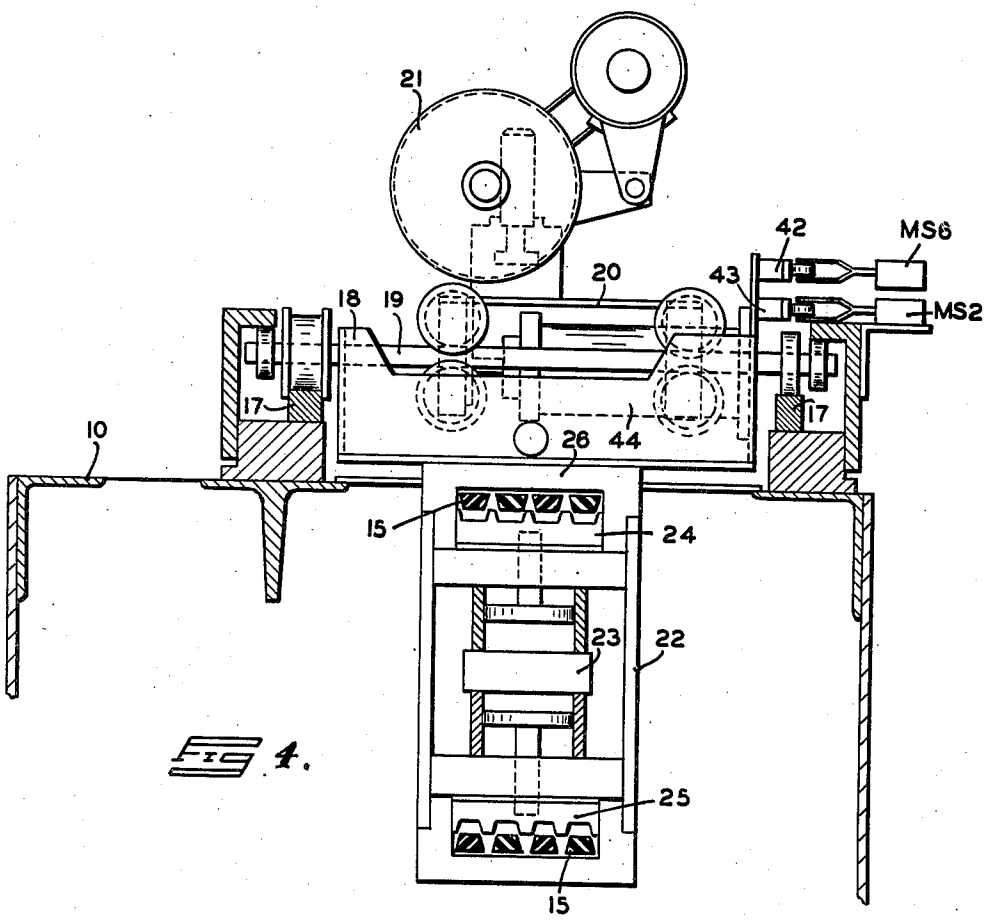


Fig 4.

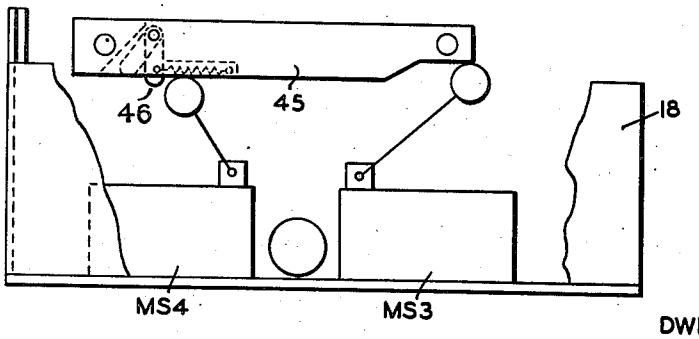


Fig 3.

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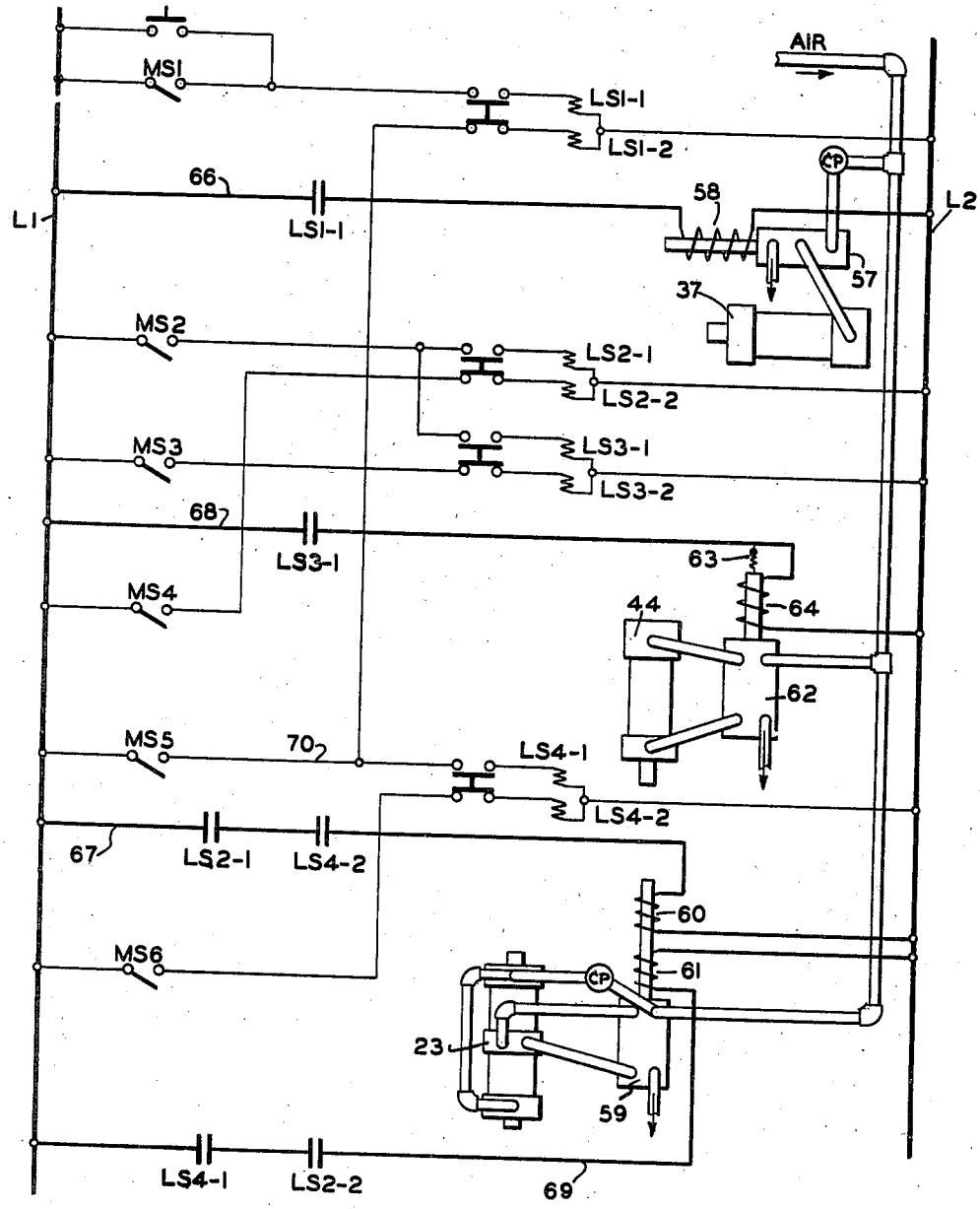


FIG 5.

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UNITED STATES PATENT OFFICE

2,341,870

AUTOMATIC CUTOFF

Dwight A. Johnston, Youngstown, Ohio, assignor to McKay Machine Company, Youngstown, Ohio, a corporation of Ohio

Application November 15, 1941, Serial No. 419,253

14 Claims. (Cl. 29—69)

This invention relates to a cut-off machine, and more particularly, to a machine for automatically severing predetermined lengths from continuously moving metal sections as the latter move along a production line. Machines of this nature are particularly useful to cut pre-formed metal sections into predetermined lengths as the metal sections issue from a continuous forming or forming and welding mill. Since the metal section is of continuous or indefinite length and advances continuously in the forming process, the cut-off machine is normally provided with a reciprocating carriage for supporting the severing tool or die and means is provided to move the carriage in synchronism with the stock or section while the cut is being effected.

Heretofore, considerable difficulty has been encountered in providing in a practical assembly an operable arrangement for accelerating the carriage to the speed of the stock travel and for returning the carriage to its initial starting position upon completion of the cutting operation while cushioning the impact of the carriage at either end of its stroke. This difficulty is increased by the higher productive speeds of the modern forming processes and the desirability of cutting the stock into short lengths of reasonable tolerances. The present invention is concerned primarily with the provision of an improved arrangement for accelerating and moving the severing tool or die carrier along with the stock and back to its original starting position. The present invention is an improvement in design and construction of the cut-off machine disclosed and claimed in the co-pending application of Dwight A. Johnston, Serial No. 282,885, filed July 5, 1939, now U. S. Patent No. 2,293,260.

A primary object of the invention is the provision in a cut-off machine having a reciprocating tool or die carriage of an improved arrangement for accelerating the carriage to the speed of the stock, moving the carriage along with the stock, and for returning the carriage back to its starting position and this object is accomplished primarily by employing a collapsible member, as a spring, to absorb the impact of the carriage as it approaches its starting position and latching the collapsible member so that upon release of the latch, the energy stored in the member may be utilized to accelerate the carriage at the start of its operating stroke. Further, the machine is generally simplified in design by employing a common resiliently acting power means to move the carriage out along its operating stroke and to return the carriage to its starting position. The accomplishing of this object results in a quick but smooth acting machine which is of rugged and durable construction. Moreover, the carriage moving arrangement enables the lengths cut off to be gauged with substantial accuracy.

The above and other objects and advantages of the invention will become apparent from a consideration of the following detailed specification and the accompanying drawings wherein there is disclosed a preferred embodiment of the invention.

In the drawings:

Figure 1 is a side view, partly in section, of an automatic cut-off machine constructed in accordance with the principles of the invention;

Figure 2 is a plan view of the machine of Figure 1;

Figure 3 is a fragmentary end view of the tool carriage of the machine of Figure 1;

Figure 4 is a partial end view, partly in section, of the machine of Figure 1; and

Figure 5 is a schematic view of the controlling system for the machine of Figure 1.

Referring to the drawings, reference numeral 10 indicates a base in which is journaled a pair of transversely extending, but longitudinally spaced, shafts 11 and 12, the former of which is adapted to rotate about a fixed axis, while the latter is journaled in a block slidably mounted in the base and held in position by the screw 13. Keyed to shafts 11 and 12 are multi-grooved pulleys 14 over which are entrained a plurality of endless V belts 15.

Shaft 11 is arranged to be driven by any suitable variable delivery power device, not shown, operated either by an independent motor or by means mechanically coupled with the rotating parts of a forming or other mill with which the cut-off may be used. Extending longitudinally along the top of the base 10 is a pair of spaced parallel tracks 17 on which is adapted to travel a carriage 18. Carriage 18 supports a pair of spaced transversely extending rails 19 on which moves a frame 20 supporting a motor driven saw 21. It should be understood, however, that any type of stock severing means may be substituted for the transversely moving saw 21 and supported on carriage 18. Carriage 18 is arranged to be moved both forwardly and rearwardly by the belts 15 and for this purpose a windowed frame 22 is secured to the bottom part of the carriage and extends downwardly a sufficient distance to encompass both the upper and lower reaches of the belts. Positioned within the frame 22 and intermediate the upper and lower reaches of the

belts is a double piston and cylinder assembly 23, the upper piston of which is mechanically coupled with a friction plate 24 having a series of parallel grooves in its upper wall to accommodate the respective belts as the plate 24 is moved upwardly by the upper piston. The lower piston of assembly 23 is coupled with a second friction plate 25 also having parallel grooves to accommodate the belts 15 along their lower reach. The upper piston of assembly 23 is operative to securely clamp the belts 15 between the plate 24 and the top wall 26 of the frame 22, while the lower piston of assembly 23 is operative to clamp the belts between plate 25 and the bottom wall 27 of the frame 22. In operation the belts 15 are normally continuously driven and it should be apparent that upon actuation of the upper piston in assembly 23, the upper reach of the belts will be clamped to the carriage and the carriage will be moved in one direction while upon actuation of the lower piston, the lower reach of the belts will be clamped to the carriage and the carriage will be moved in the opposite direction.

Received in apertures in the frame of carriage 18 and extending rearwardly therefrom are the headed bolts 29 and a coil spring 30 encircles each of the bolts between the head thereof and the frame. As indicated in Figure 1, the bolts 29 are free to move to the left against the compression of the springs 30. Outward movement of the bolts is limited by the adjustment of the nuts 31. Also secured to the frame of the carriage 18 is an upwardly extending cammed dog 32 which is adapted to be engaged by a latch 33 pivoted at 34 to a pair of spaced plates 35 suitably secured to the base of the machine. Latch 33 is provided with an integral downwardly extending operating arm which is arranged to be engaged by the piston rod of an air cylinder 37 to rotate the latch clockwise, as viewed in Figure 1. The cross pin 38 limits the counter-clockwise rotation of the latch 33 and a biasing spring 39 normally maintains the latch in position against the pin 38. The outer ends of bolts 29 engage stops 40 when the carriage returns to its initial starting position and the various parts are so designed that the springs 30 take up the shock of deceleration of the carriage 18 and compress a substantial amount before the latch 33 overrides dog 32 and locks the carriage against reverse or outer movement.

Referring to Figures 2 and 4, a switch MS2, having an operating lever, is mounted on the base along the side of the machine and is arranged to be momentarily closed by a gate type of operator 42 mounted on the carriage and which, as shown in Figure 2, is operative to actuate the switch upon outer movement of the carriage but which overrides the switch operating arm upon movement of the carriage in the opposite direction. Also mounted along the side of the frame is a second switch MS6 which is adapted to be momentarily closed by a gate type of operator 43 as the carriage reaches the end of its return stroke. Frame 20, providing the immediate support for the motor driven saw, is moved transversely of the machine by an air cylinder 44 mounted on the carriage 18. Also mounted on the carriage 18 is a pair of transversely spaced switches MS3 and MS4, the former of which is adapted to be closed by a cammed surface on switch operator 45 mounted on frame 20, all as indicated in Figures 2 and 3. As shown, switch MS3 is closed as the frame 20 reaches the end of its transverse cutting stroke. Incorporated in switch operating member 45 is a gate type of switch actuator 46 (Figure 3) which is operative to momentarily close switch MS4 as the frame 20 approaches the end of its retracting stroke.

Extending longitudinally to the lower part of carriage 18 is a rod 47 which is slidably anchored at one end in a block 48 extending upwardly from one end of the base 10. A collar 49 is keyed to rod 47 intermediate block 48 and carriage 18 and intermediate collar 49 and block 48 is positioned a coil spring 50. A second collar 51 is keyed onto rod 47 intermediate collar 50 and carriage 18 and a bumper block 52 is secured to carriage 18 to engage collar 51 as the carriage reaches the end of its operating stroke. Lock nuts 53 are screwed onto the rod 47 on the opposite side of block 48 from the spring 50 to prevent movement of the rod to the right, as viewed in Figures 1 and 2, and secured to the extreme end of rod 47 is a switch operating ring 54 which is operative to close switch MS5 upon the carriage 18 reaching the end of its operating stroke and the compressing of spring 50. To initiate the operation of the machine in a manner to be hereinafter more fully described, another switch MS1 is provided, which switch may, in accordance with well-known principles, be arranged to be actuated by the leading end of the stock or by the extent of rotation of a measuring roll which may be positioned on the forming mill or on the cut-off machine.

Referring now to Figure 5 which is a schematic representation of the control system utilized in the machine described above, latch cylinder 37 is provided with a control valve 57 which is arranged to be operated by the solenoid 58 and the operation is such that when solenoid 58 is energized, air is admitted to behind the piston in cylinder 37 and the piston rod is moved outwardly to rotate latch 33 clockwise, as viewed in Figure 1. Cylinder assembly 23 is provided with a balanced four-way valve 59 which is operated in one direction by a solenoid 60 and in the opposite direction by solenoid 61. When neither of the solenoids is energized, both the pistons in assembly 23 are in retracted position; when solenoid 60 is energized, the upper piston is moved upwardly to clamp the upper reach of the belts to the carriage 18, and when solenoid 61 is energized, the lower piston is forced downwardly to clamp the lower reach of the belts to the carriage. Cylinder 44, which moves the frame 20 transversely and, consequently, the saw into the path of travel of the stock, is provided with a control valve 62 which is of the self-reversing type, i. e. its operating element is normally biased to one position as by the spring 63, for example, in which position the piston in cylinder 44 is maintained in retracted position. To move the valve operating element to its other position which will supply fluid under pressure to behind the piston to move the piston rod outwardly, a solenoid 64 is provided.

Solenoids 58, 60, 61 and 64 are energized under the control of a suitable electrical circuit, now to be described, and this circuit is in turn controlled by the switches MS1 thru 6 positioned about the machine, as explained above. The circuit in its preferred and illustrated embodiment utilizes four latching double throw relays LS1 thru 4 which, as is well understood in the art, operate in such manner that when the armature is moved to one position by one of the coils, the contacts thus established remain until the armature is moved to its other position by the

other of the coils. In the drawings, associated coils and contacts bear the same reference designation, the contacts being indicated by two small spaced parallel lines, for the purpose of simplifying the disclosure.

Control and operating current is supplied to the system through conductors L1 and L2, hereafter termed the line. The control circuit will be described in connection with the operation of the machine. In operation, stock is supplied to the machine along a path which is capable of being crossed by the saw 21 and shaft 11 is driven at such speed by its variable speed powering device that the horizontal reaches of the drive belts 15 travel at exactly the same speed as the stock, the paths of the stock and the belt reaches being parallel. This identity in speed may be accomplished either by driving the shaft 11 from the forming mill supplying stock to the cut-off or by an independent adjustable speed power system. To begin the cycle of operation, springs 39 are compressed and latch 33 is hooked over dog 32, thus restraining outward movement of the carriage. Switch MS1 is properly positioned or adjusted to be actuated by the end of the stock when a predetermined length has moved past the line of cut or by desired extent of rotation of a roll which measures the length of the stock and when the proper length is reached, the switch energizes relay coil LS1—1 since it is in series with this coil across the line and this in turn closes contacts LS1—1 in conductor 66 thereby energizing solenoid 58 and admitting air to the latch cylinder 37. Actuation of the latter raises latch 33 thereby allowing compressed springs to rapidly accelerate the carriage. As the carriage advances a small distance and approaches the speed of movement of the stock and belts, switch MS2 is momentarily closed by gate operator 42 thereby energizing relay coil LS2—1, this switch and coil being in series across the line. This results in the closing of contacts LS2—1 which are in conductor 67 in series with the normally closed contacts LS4—2 and the solenoid 60 across the line. Thus solenoid 60 is energized and, as explained above, this results in the upward movement of the upper piston in assembly 23 and securely clamping the saw carriage 18 to the drive belts 15. Closing of switch MS2 simultaneously energizes relay coil LS3—1 which, through contacts LS3—1 in conductor 68, energizes solenoid 64 and moves the saw transversely along its cutting stroke.

Referring to Figure 3, after the saw has completed its cut, the switch operating member 45 mounted on saw frame 20 operates to close switch MS3 and by referring to Figure 5, it will be noted that the closing of MS3 energizes relay coil LS3—2 thereby opening contacts LS3—1, de-energizing solenoid 64 and allowing the piston in cylinder 44 and the saw frame 20 to be retracted in the manner described above.

When the saw approaches the end of its retracting stroke, gate operator 46 on member 45 (Figure 3) momentarily closes switch MS4 which energizes relay coil LS2—2 thereby opening contacts LS2—1 in conductor 67 and establishing contacts LS2—2 in conductor 69. The breaking of the circuit through conductor 67 de-energizes solenoid 60 allowing the upper piston in assembly 23 to retract and releasing the clamp between the carriage and the drive belts. The carriage is then free to drift and it does so against the compression of spring 59 (Figure 2). As the spring is compressed, rod 47 moves along with the carriage and operator 54 on the end of the rod closes switch MS5.

Switch MS5, being in series with conductor 70 and relay coil LS4—1 energizes the latter when closed and contacts LS4—1 in conductor 69 thereupon energize solenoid 61, the contacts LS2—2 in conductor 69 having been previously closed by closing of MS4 and energizing of relay coil LS2—2. As explained above, energization of solenoid 61 actuates the lower cylinder in assembly 23 and clamps the carriage to the lower reach of the drive belts to move the carriage back to its initial starting position. As the carriage approaches its initial starting position, switch MS6 is closed momentarily by gate operator 43 and thereupon relay coil LS4—2 is energized which opens contacts LS4—1 in conductor 69 thereby de-energizing solenoid 61 and releasing the drive belts from the clamp 25. Simultaneously, contacts LS4—2 in conductor 67 are closed to condition the current supply circuit for solenoid 60 so that the latter will again be energized upon the start of the next cycle of operation and the closing of switch MS2. Upon closing of switch MS6 both clamping pistons are de-energized and the carriage drifts freely into contact with stops 40 and springs 38 are compressed in absorbing the inertia of the carriage. The cammed dog 32 underrides the latch 33 and the bight of the latch is moving to in back of the vertical surface of dog 32 by the biasing spring 39. The latch then prevents outward return movement of the carriage until the latch is sprung by the subsequent actuation of cylinder 37. By referring to the control circuit, it is noted that the closing of switch MS5 also energizes relay coil LS1—2 thereby opening contacts LS1—1 in conductor 66 which de-energizes solenoid 53 thereby allowing the air in back of the piston in cylinder 37 to be exhausted. This enables spring 39 to rotate latch 33 against stop pin 38 in which position it is operative to receive and hold dog 32.

It should now be apparent that I have provided an improved arrangement for moving the reciprocating carriage in an automatic cut-off in either direction of its path of travel and of cushioning the carriage at either end of its cycle of movement. Moreover, the cushioning means are utilized to give an impetus to the initial movement of the carriage thereby further relieving the heavy stresses imposed in the principal carriage moving device, which in the embodiment specifically illustrated, are the V belts 15. These objects are accomplished while, nevertheless, maintaining an accurate control over the essential movement of the carriage relative to the length of the pieces to be cut off and the speed of travel of the stock. Since many changes may be made in the apparatus specifically disclosed within the contemplation of the invention, reference should be had to the appended claims in determining the scope of the invention.

What I claim is:

1. Apparatus for cutting a continuously moving length of stock into predetermined lengths comprising in combination a base, a carriage reciprocably mounted on said base, stock severing means on said carriage, a pair of grooved pulleys mounted on spaced parallel axes in said base, means to rotate one of said pulleys, a V belt entrained over said pulleys and having two reaches extending substantially parallel with the direction of travel of said carriage, a frame secured to said carriage and encompassing both of said reaches, and a fluid pressure operated

grooved clamp carried by said frame and adapted to alternately clamp said reaches to said carriage whereby said carriage may be moved in alternate directions on said base by said belt.

2. Apparatus for cutting a continuously moving length of stock into predetermined lengths comprising in combination a base, a carriage reciprocably mounted on said base, stock severing means on said carriage, a pair of grooved pulleys mounted on spaced parallel axes in said base, means to rotate at least one of said pulleys, an endless V belt entrained over said pulleys and having its two reaches intermediate said pulleys extending substantially parallel with the direction of travel of said carriage, a frame secured to said carriage and encompassing said reaches, a cylinder mounted in said frame intermediate said reaches, a pair of pistons in said cylinder, a grooved clamp block in said frame for each of said reaches, and means connecting one of said pistons with one of said blocks and the other said piston with the other said block whereby alternate reaches of said belt may be clamped to said carriage in alternate directions.

3. Apparatus for cutting a continuously moving length of stock into predetermined lengths comprising in combination a base, a carriage reciprocably mounted on said base, stock severing means on said carriage, a pair of grooved pulleys mounted on spaced parallel axes in said base, means to rotate at least one of said pulleys, an endless V belt entrained over said pulleys and having two spaced reaches extending substantially parallel with the direction of travel of the carriage, a frame secured to said carriage and encompassing said reaches, a grooved clamp block carried in said frame for each of said reaches, and means carried with said frame to actuate said clamp blocks alternatively whereby said carriage may be moved in alternate directions.

4. Apparatus for cutting a continuously moving length of stock into predetermined lengths comprising in combination a base, a carriage reciprocably mounted on said base, stock severing means on said carriage to cut said stock while the carriage moves along with said stock, means to move said carriage along with the stock and to move said carriage in a reverse direction back to its original starting point, a spring to absorb the kinetic energy of the carriage as it comes to a stop at said original position, a latch to retain said carriage in said original position against the action of said spring, means responsive to the length of stock beyond said severing means to release said latch, and means independent of said stock to interconnect said first mentioned moving means with said carriage after release of said latch.

5. Apparatus for cutting a continuously moving length of stock into predetermined lengths comprising in combination a base, a carriage reciprocably mounted on said base, stock severing means on said carriage to cut said stock while the carriage moves along with said stock, means to reciprocate said carriage comprising a pair of grooved pulleys mounted on spaced parallel axes in said base, an endless V belt entrained over said pulleys and having two spaced reaches extending substantially parallel with the direction of travel of the carriage, a frame secured in said carriage and encompassing said reaches, a grooved clamp block carried in said frame for each of said reaches, means carried with the frame to actuate said clamp blocks alternatively, a collapsible device to absorb and store the kinetic energy of the carriage as it comes to a stop at its original starting position, a latch to retain said carriage in said position, means responsive to the length of stock beyond said severing means to release said latch, and means operative upon initial movement of said carriage after release of said latch to actuate one of said clamp blocks.

6. Apparatus for cutting a continuously moving length of stock into predetermined lengths comprising in combination a base, a carriage reciprocably mounted on said base, stock severing means on said carriage to cut said stock while the carriage moves along with said stock, means to move said carriage with the stock and to return the same back to its initial starting position, a collapsible device to absorb and store the kinetic energy of the carriage as it comes to a stop at said position, a latch to retain said carriage in said position, means responsive to the length of stock beyond said severing means to release said latch, and means independent of said stock and responsive to initial movement of said carriage after release of said latch to interconnect said first mentioned moving means with said carriage.

7. Apparatus according to claim 3 further including a collapsible member at either end of said carriage to absorb the kinetic energy of said carriage at the end of either of its strokes, and means responsible to the collapsing of one of said members to actuate one of said clamp blocks.

8. Apparatus according to claim 3 further including a collapsible member at either end of said carriage to absorb and store the kinetic energy of said carriage at the end of either of its strokes, means to latch said carriage against outward movement upon the collapsing of the first of said members, means responsive to the length of stock beyond said severing means to release said latch, means responsive to the initial movement of said carriage after release of said latch to actuate one of said clamp blocks, means responsive to the collapse of the other of said members to actuate the other of said clamp blocks.

9. Apparatus for cutting a continuously moving length of stock into predetermined lengths comprising in combination a base, a carriage reciprocably mounted on said base, stock severing means on said carriage, a normally continuously driven resilient belt mounted in said base and having two reaches moving in opposite directions substantially parallel with the path of travel of said carriage, a frame encompassing said reaches, a clamp block in said frame for each of said reaches, means within said frame to actuate said clamp blocks alternatively whereby said carriage may be moved in alternate directions, a collapsible member to absorb and store the kinetic energy of the carriage as the same returns to its initial starting position, a latch to retain said carriage in said position, means responsive to the length of stock beyond said severing means to release said latch, and means responsive to the initial movement of said carriage after release of said latch to actuate one of said clamp blocks.

10. Apparatus for cutting a continuously moving length of stock into predetermined lengths comprising in combination a base, a carriage reciprocably mounted on said base, stock severing means on said carriage, a normally continuously driven resilient belt mounted in said base and having two reaches moving in opposite directions substantially parallel with the path of

travel of said carriage, a frame encompassing said reaches, a clamp block in said frame for each of said reaches, means within said frame to actuate said clamp blocks alternatively whereby said carriage may be moved in alternate directions, a collapsible member at either end of the path of travel of said carriage to absorb and store the kinetic energy of the carriage as it decelerates at either end of its path of travel, and means responsive to the collapsing of one of said members to actuate one of said clamp blocks.

11. Apparatus according to claim 10 further including means operable upon the moving of said carriage by the other of said members to actuate the other of said clamp blocks.

12. Apparatus for severing predetermined lengths from continuously moving stock comprising in combination a carriage mounted for movement from an initial starting position outwardly along with said stock and thence back to its initial starting position, a stock severing device on said carriage, a continuously moving carriage moving means, means to initiate outward movement of said carriage, means responsive to the initiation of outward movement of said carriage to establish a driving interconnection between said first mentioned means and said carriage, means operable upon said carriage attaining a predetermined advanced position to interrupt said interconnection and to bring said carriage to a stop, and means to establish a driving interconnection between said first mentioned means and said carriage to return said carriage back to its initial starting position.

13. Apparatus according to claim 12 further including means to absorb and store the kinetic energy derived from the deceleration of the carriage at the end of its outward stroke, and means including said absorbing and storing means to aid in the initiation of return movement of said carriage.

14. Apparatus according to claim 12 further characterized in that said means to initiate outward movement of said carriage comprises means to absorb and store kinetic energy imparted to said carriage by said first mentioned moving means.

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