

Feb. 22, 1966

L. D. BARLEY

3,236,131

HIGH SPEED REVERSE FOR BACKGAGE

Filed April 30, 1965

4 Sheets-Sheet 1

FIG-1

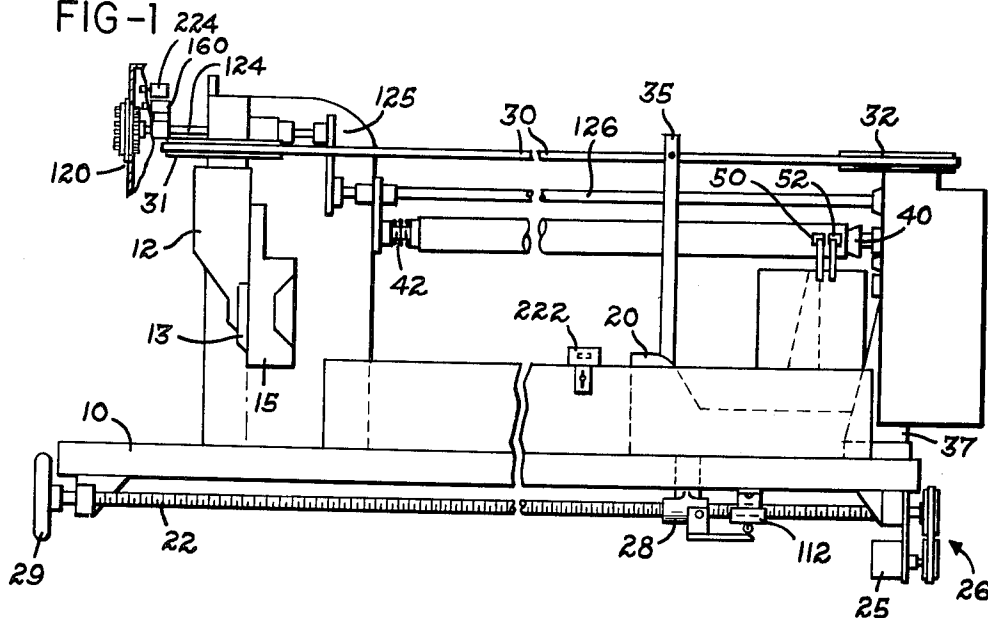


FIG-3

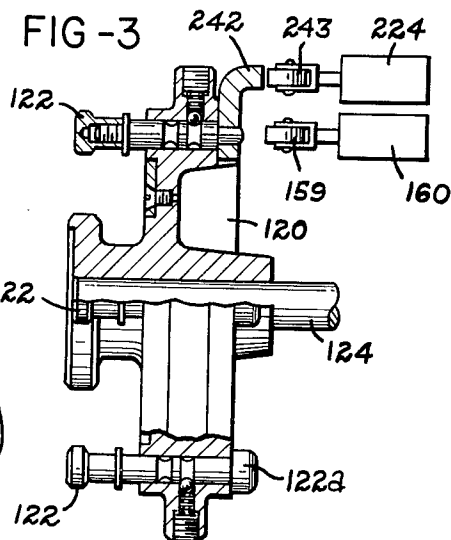
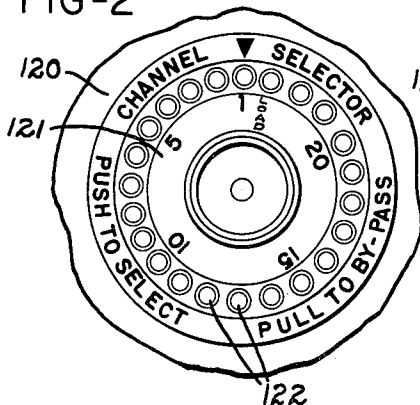


FIG-2



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FIG-5

FWD.

REV.

174

175

176

177

178

182

170

225

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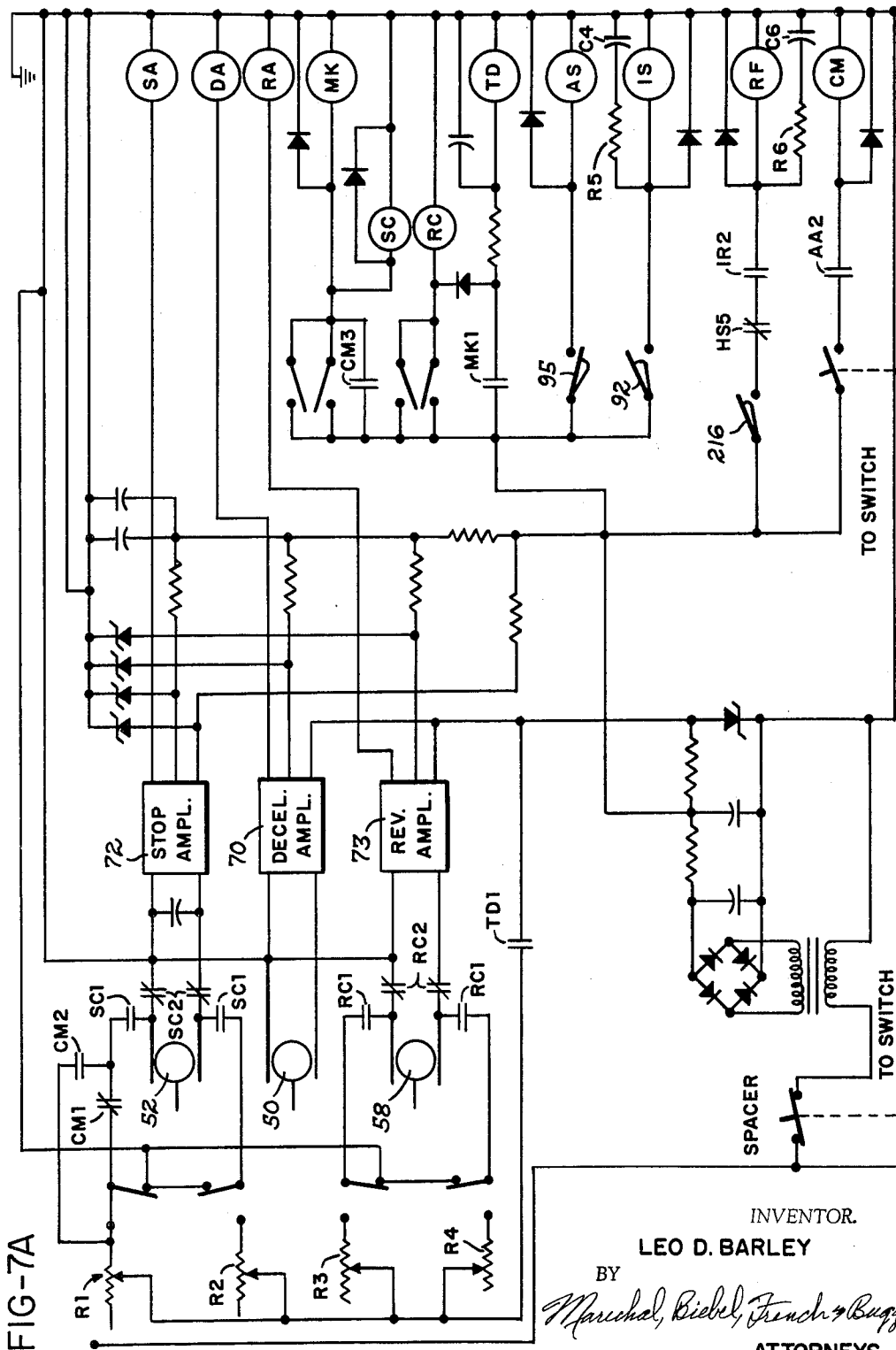
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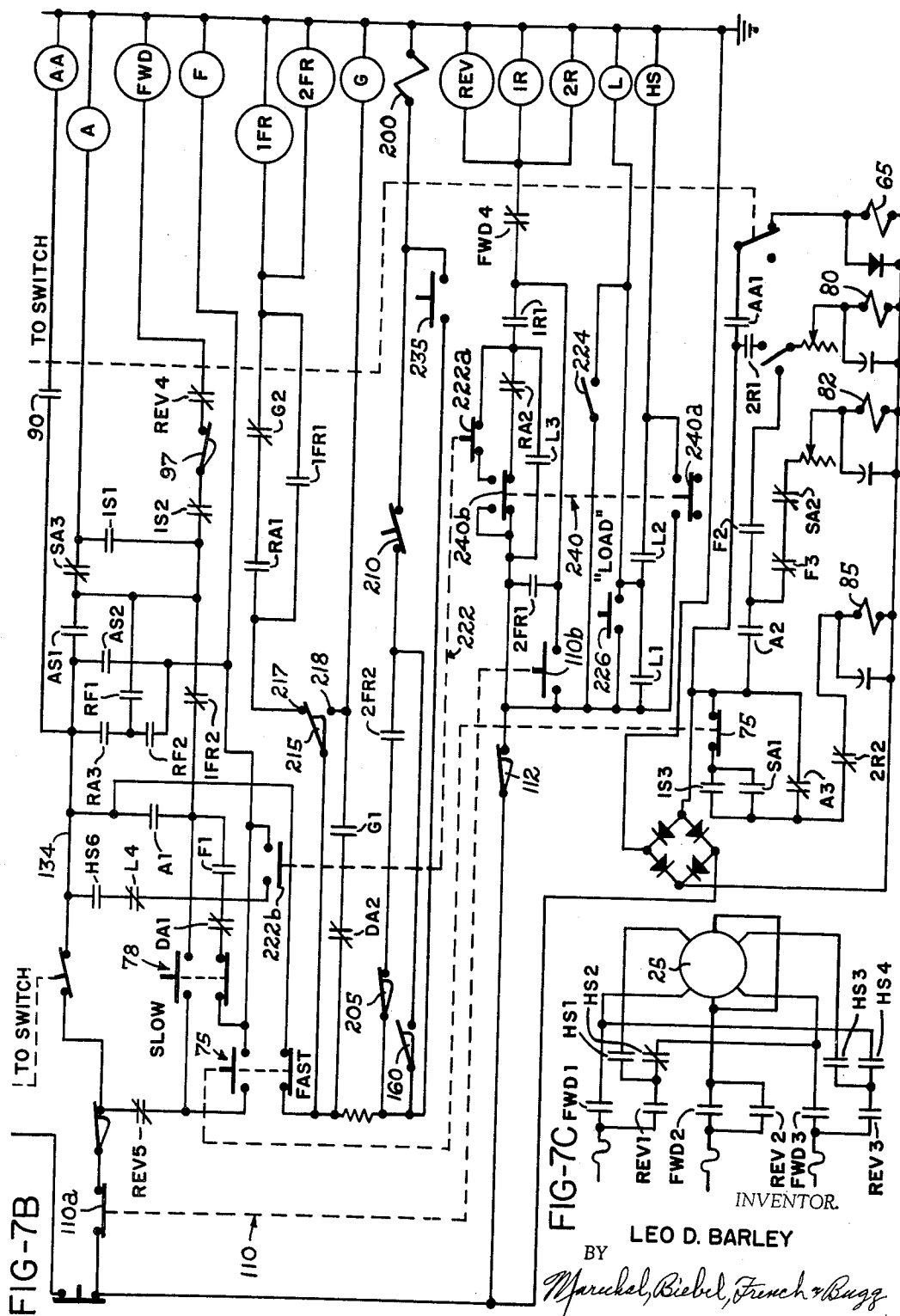


FIG-7C

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1

2

3,236,131

HIGH SPEED REVERSE FOR BACKGAGE

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Filed Apr. 30, 1965, Ser. No. 452,327

6 Claims. (Cl. 83—71)

This application is a continuation-in-part of application Serial No. 250,678, filed January 10, 1963, now Patent No. 3,195,384, and assigned to the same assignee as the present application.

This invention relates to cutting machines, particularly for machines for cutting stacks of sheet material such as paper, paperboard, cardboard, and the like and particularly to an improvement in the backgagage control system for speedily returning the backgagage to its rearmost position to reduce materially the time involved in the loading operation of the machine.

In these machines, the stacks of material to be cut are supported upon a work table, and a guillotine type knife is mounted for movement toward the table in a cutting plane which intersects the table surface. Immediately adjacent the knife, and independently operable, is a clamping member which can be moved under power against the stack to hold it stationary during the cutting stroke of the knife. The backgagage is in the form of a pusher member which is mounted to move on the surface of the work table for pushing and positioning the stack of material into and through the cutting plane, thus determining the position at which the stack comes to rest for making each desired cut.

The backgagage is power operated, preferably by a two-speed reversible motor, and can be actuated automatically to move the stack forward in a predetermined sequence of movements and at a predetermined speed, so that a series of cuts can be made in the stacked material. This predetermined sequence is known in the art and will be hereafter designated as a "program" or "job program."

The "job program" is recorded on a precision drum which extends from a point immediately behind the clamp to the back of the table. The drum is coated with a magnetic material and contains the information necessary to control the operation of the backgagage. A pair of magnetic sensing heads are mounted on the backgagage and positioned adjacent the drum to sense the magnetic marks recorded on the drum and thereby control, through appropriate circuitry, the forward movement and speed of the backgagage. Another magnetic sensing head is mounted on the backgagage and positioned on the opposite side of the magnetic drum and is used to initiate and to control the reversing movement of the backgagage.

The magnetic drum is divided into twenty-three segments, twenty-two of which are used to control the position, speed and reversing movement of the backgagage. The twenty-third channel is used to send the backgagage to its rearmost position at a speed higher than that normally used so that the loading time for the machine is materially reduced. A selector dial mounted on the front of the machine is used to control the position of the magnetic drum.

The time for loading the stacked material on the backgagage can be reduced by increasing the speed at which the backgagage is placed in its rearmost, or loading position. The backgagage of the present invention is automatically returned to the rear limit position at a speed which is greater than that used to forward the backgagage to its cutting position, particularly after the backgagage in its forward travel has completed one job program and is returning to a rearward position preparatory to starting a new program.

The present invention employs a reversible two-speed electric motor to drive the backgagage for increasing the machine efficiency. The lower speed windings are used for the two speeds of forward motion and one speed of reverse motion of the backgagage while the high speed motor windings are used exclusively for the high speed reversing movement of the backgagage. This allows the operator to increase the efficiency of the machine by speeding the backgagage to its loading position while maintaining the two forward speeds of the backgagage at their optimum values.

Accordingly, an important object of this invention is to provide a novel control for the backgagage of paper cutting machines including in such control automatically operating mechanisms for returning the backgagage at high speed to the rear limit position of the job program selector.

An additional object of this invention is to provide a novel control arrangement which will allow the backgagage to proceed to its rearmost position at high speed by a signal from the operator at any time during the last forward run of a job program or after the backgagage has started its regular reverse run.

Another object of this invention is to provide a novel backgagage control which will allow the backgagage to proceed to a point selected by the operator short of the rear limit position of the cutting machine.

It is a further object of this invention to provide a backgagage control which will permit the backgagage to reverse to a preselected position at a high speed without being adversely affected by any magnetic signals on the memory drum.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings:

FIG. 1 is a diagrammatic side elevational view showing the overall arrangement of the cutting machine embodying the present invention;

FIG. 2 is a view showing the control dial for the memory device;

FIG. 3 is a detail view partly in section and partly in elevation showing the construction of the selector pins and the detents therefor;

FIG. 4 is a detail view on an enlarged scale with the cover removed and with certain parts broken away and shown in section, illustrating details of the drive and associated controls for indexing the memory device with respect to different job programs;

FIG. 5 is a sectional view on an enlarged scale taken on line 5—5 of FIG. 4;

FIG. 6 is a further enlarged view showing a detail of the switch control arm in the apparatus shown in FIG. 4; and

FIGS. 7A, 7B and 7C are schematic electrical diagrams illustrating a typical control system according to the present invention.

Referring to the drawings, and particularly to FIG. 1, the cutting machine comprises a work table 10 above which is mounted a knife 12 including a replaceable blade 13 which reciprocates in a generally vertical plane toward and away from the table to make the desired cuts. Adjacent to the knife is the clamp member 15 which also moves toward and away from the table, independently of the knife, to clamp the stack or pile of material for cutting. Various power operated drives and controls for the knife and clamp are known to those skilled in the art, and since they form no specific part of this invention, they are not illustrated.

The backgagage 20 is mounted to move over the surface of table 10, toward and away from the cutting plane of knife 12. Power for movement of the backgagage is derived

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from lead screw 22 which is driven, in a preferred embodiment, by a two-speed electrical motor 25, through a suitable two-speed transmission 26. This lead screw engages a nut 28 on the backage. The lead screw may also be rotated manually by the hand wheel 29 which is fixed thereto and positioned at the forward edge of work table 10.

The position of the face or pushing area of backage 20 is displayed accurately to the operator by means of a tape 30, preferably metallic, which is reeved about a front wheel or pulley 31 and a rear wheel 32. A mast 35 extends from the backage member 20 upwardly adjacent the tape, and is fastened thereto so that movement of the backage will produce corresponding movement of the tape. The tape preferably is marked in convenient graduations of measurement which can be viewed with reference to an index mark at the front of the machine by the operator. The rear wheel 32 is mounted on a vertically extending post 37 at the rear of the work table, and this post provides support for a rear mounting jaw 40 which, together with a spring loaded forward jaw 42 (FIG. 1), forms a rotatable support for the program record or memory device, which is in the form of an elongated drum 44 having a surface coating or covering of material capable of retaining a magnetic pulse, for example by means of minute ferro-magnetic particles in the coating which will become and remain magnetized when exposed to an electrical field, and which can be "erased" by forming a uniformly magnetized path or channel along the material with an opposed field.

Actually, these pulses, in the form of discrete segments of the channels which are oppositely polarized from the rest of the channel, can be aptly described as "magnetic marks" which will produce a pulse of electricity in a reading head when there is relative movement between the magnetized or marked area and the head. It will be understood that magnetic "marks" may therefore be placed upon the memory device in a number of longitudinal paths, each path forming a program record.

In one embodiment of the invention, the memory drum 44 is divided into twenty-three channels, twenty-two of which are used to record magnetic marks used in positioning the backage. There are also intermediate channels for a separate recording and/or reading head, to be used in controlling the forward or reverse operation of the backage motor 25. Because there are an odd number of channels, as in the illustrated example, the reverse channels can be diametrically opposed to the corresponding forward control channel, and cooperate therewith to form a job program.

In a preferred embodiment of the invention, the backage motor 25 has two sets of field windings, one set being used for driving the backage at the two forward speeds and the standard reverse speed, and the other set being used exclusively for the high speed reversing of the backage. The motor 25 drives the two speed transmission 26 which selects the forward speed of the backage. The two-speed motor along with the two-speed transmission therefore constitute a multiple speed reversible drive means for the backage.

A circuit is provided for changing the drive ratio of transmission 26 from fast to slow when the backage is determined to be approaching a magnetic mark on drum 44 indicating a desired cutting position. This circuit, which will be explained further on in detail, responds to a magnetic pulse on memory drum 44 by receiving head 50 to slow the backage, while a separate receiving head 52, spaced a predetermined distance behind the head 50, produces stop pulses to halt the backage in the desired position.

Because of the nature and function of the heads 50 and 52, they must be spaced apart a certain physical distance, and the machine may be called upon to perform certain trim cut operations which require a forward movement of the backage member by a distance less than

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this spacing between these heads. Such slight movement should be accomplished at the slower drive speed. Therefore, in the event a so-called trim cut mark is located between the heads 50 and 52 when the backage has halted with the head 52 opposite a mark, it is necessary to perform a scanning operation of the heads prior to resumption of backage movement.

This scanning movement is provided by moving the heads 50 and 52 in a direction causing reverse relative movement between the heads and the program memory device with respect to their normal relative movement during forward motion of backage member 20. If the head 50 senses a mark during its scanning motion, as will be described, the backage is caused to start at the slower speed. The heads are returned to their forward or at-rest position before the backage member begins to move.

The circuit diagram, FIG. 7A, shows the heads 50, 52 and 58 schematically. The head 50 functions only as a reading head, and it will transmit an impulse, upon approaching a mark on the memory device through the decelerating amplifier 70 which will in turn energize the relay DA. Similarly, the head 52 will cause the stop amplifier 72 to transmit an operating pulse to the relay SA, and the head 58 will cause the reverse amplifier 73 to operate the direction control relay RA.

READ AND STOP

For purposes of explanation, it will be assumed that the backage member 20 is at its farthest or full rear position from the knife, and that it is at rest. The operator initiates movement of the backage by momentarily pressing the fast switch 75 to complete a circuit through relay F. Contact F1 closes, energizing relay FWD, and energizing relay A through the normally closed contacts SA3. Relay A in turn completes a holding circuit for the relay F through the back contacts of the slow switch 78, via contacts A1. Thus, once the fast switch 75 is momentarily depressed, the relay F locks in.

Relay F also has a contact F2 (FIG. 7B) in the motor control circuit which will then complete a circuit through the fast or higher speed clutch 80, causing the backage member to move forward at its higher speed. When the first mark, on that control channel aligned with the heads, is reached by the head 50, this will transmit a pulse through the amplifier 70 to cause the relay DA to be momentarily energized. This relay then opens its normally closed contacts DA1 in the holding circuit for relay F, and that relay drops out. At the same time, this will open the contacts F2 of relay F in the circuit of the fast clutch 80 (incorporated in transmission 26), and close the normally closed contacts F3 of this same relay in the circuit of the slow clutch 82 in the transmission. The backage proceeds forward at its slower speed.

The head 52 is then approaching the same mark which caused the "slow down" pulse from head 50. When head 52 reaches this mark it transmits a pulse through amplifier 72 to momentarily energize relay SA. This relay opens its contact SA2 in the slow clutch circuit and closes its contact SA1 in the circuit of the brake coil 85, and a brake (not shown) is engaged to hold lead screw 22, stopping the backage immediately. The normally closed contacts SA3 in the circuit of relay A are opened concurrently at this time, and that relay is deenergized to interrupt the power supply to the fast and slow clutches (only the latter was operative) and to seal in the brake circuit through the normally closed contacts A3 which are in parallel with the normally open contacts SA1.

SCAN AND CONTINUE

In normal operation, once the backage is stopped the operator will actuate the usual controls to cause the clamp 15 to descend, followed by the knife 12 which will sever the pile at the designated place. Suitable interlock arrangements are provided, which per se form no part of

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the present invention, to assure that the backage remains stationary during the clamping and cutting operation. A convenient such interlock may be provided by a solenoid (not shown) which has normally open contacts 90 in the energizing circuit of the coil of relay AA. Thus, with such an arrangement this solenoid can be energized as the knife passes through its up stroke, the contacts 90 will be closed, and relay AA energized. This relay has a first set of normally open contacts AA1 in the energizing circuit of the pre-scanning solenoids 65 (see FIG. 7B). This solenoid is connected to the heads 50 and 52 and when energized causes the heads to move across the magnetic memory drum 44. When this solenoid begins to move its armature, it closes a switch 92 which in turn energizes the coil of the IS relay. This relay has normally open contacts IS1 which then close and normally closed contacts IS2 which open, in the circuit of the relay FWD. Also, contacts IS3 in the circuit of brake coil 85 are also closed to hold the brake on during the scanning operation.

When the armature of the pre-scan solenoid 65 is moved to its full extent, this causes closing of switch 95 which in turn energizes the coil of the AS relay. Thus, the contacts AS1 are closed and complete a circuit through the normally closed contacts SA3 to the coil of relay A. This relay is locked in through its contacts A1 and the normally closed SA3 contacts. The contacts AS2 of the AS relay also are closed when it is energized, and complete a circuit through the coil of the F relay which also locks in through the contacts F1 and A1 and the back contacts of the slow switch 78. In the lower portion of FIG. 7B, contacts A2 and F2 close, completing the circuit through the fast or higher speed clutch coil 80.

When the relay contacts 90 are opened, as the knife comes to a stop at its raised position, relay AA is de-energized, and its contacts AA1 open to deenergize the pre-scanning solenoid 65. As this solenoid releases its armature, the switch 95 is opened, to deenergize the AS relay, and as the armature reaches its terminal deenergized position switch 92 opens to deenergize the IS relay. This in turn causes the contacts IS2 to return to their normal closed condition and, so long as the clamp is raised permitting the clamp interlock switch 97 to close, then the relay FWD will be energized, closing its contacts FWD1, 2 and 3 in the directional control circuit of the backage motor 25 (FIG. 7c). The backage will thus proceed forward at its higher speed.

SLOW START FORWARD

If during the scanning movement the pickup head 50 crosses a mark on the program channel which rests between the heads 50 and 52 as they stopped, it will send a pulse through the decelerating amplifier 70 to energize the DA relay. It should be recalled that when the head 50 first sensed a stop mark it caused the transmission to shift to the slower speed, and also transferred control from itself to the stop head 52. If there is a mark denoting a trim cut which immediately follows the first mark, at a spacing closer than the physical spacing between the heads 50 and 52, then the head 50 has passed over this second or trim cut mark without effect on the circuit, by the time the backage is stopped. Thus, the purpose of the scanning operation is to determine whether such a trim cut mark is then located between the heads.

Assuming that there is a trim cut signal mark, when relay DA is energized this will open the normally closed contacts DA1 in the holding circuit of relay F, causing it to be deenergized and thereby opening the contact F2 in the circuit of fast clutch 80. At the same time, normally closed contact F3 will close to complete a circuit through the slow clutch coil 82, and the backage will move forward at its slower speed.

It should be noted that when the head 52 passes over a pulse during the scanning operation, the resultant pulse through amplifier 72 will energize relay SA, causing the normally closed contacts SA3 to open momentarily.

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Therefore, to insure that relay A is kept energized, relay IS must be held energized, to keep contacts IS1 closed, until relay SA returns to normal, and contacts SA3 are again closed. This is accomplished by the condenser C4 which is charged through resistor R5 while the switch 92 is closed. When this switch opens, C4 discharges through the coil of relay IS for the overlap interval required.

JOB PROGRAM SELECTOR

In normal operation, the backage will start and continue to move forward after the last cut has been made until a reversing signal is sensed by head 58 actuating relay RA in response to a magnetic mark on the reverse channel on magnetic memory drum 44.

During the rearward movement of the backage, the invention provides for an automatic selection of any predetermined sequence of job programs stored on the memory drum 44. As already explained, dial 120 carries movable pins 122 in 22 of the 23 available positions, each corresponding to a channel on the memory drum 44 where a job program may be recorded. Each of the pins can be displaced manually to occupy one of two positions as shown in FIG. 3. Any pin that is displaced inwardly of dial 120 will be able to operate the actuator roller 159 of switch 160 which is mounted directly behind the head. Therefore, the operator can select a desired sequence of one or more of the channels 1 through 22 by depressing the appropriate pins 122, and as will be explained, the memory dial and the dial 120 connected thereto will be rotated automatically to the next program during the time when the backage travels toward its rearmost position at the completion of a previous job.

The pin 122 in channel 23 has connected to its end an actuator 225 which when depressed will operate the actuator roller 243 of switch 242. During the movement of the dial 120 through the channel 23 position switch 224 may be momentarily actuated. This normally occurs at the completion of a preset job sequence. The momentary closure of normally open switch 224 will initiate the high speed reversing operation of the backage which will be described in detail hereafter.

The mechanical power for this operation is derived from the tape 30 which rotates the rear pulley 32 as the backage moves. As shown in FIG. 4, this pulley is fixed to a stub shaft 162 which is mounted in the top of the post 37. Transfer gears 163 derive power from the shaft 162 and rotate a bevel pinion 164 which in turn drives a bevel gear 165, also mounted on the post 37. Gear 165 is in turn connected to rotate a drive sprocket 167 and this sprocket is connected through chain 168 to a lower driven sprocket 170, carried on a sleeve 172 which is free to rotate on the shaft 128.

The sprocket 170 carries a plurality of pins 174, on each of which there is a pivotally mounted pawl 175, as shown in FIG. 5. Each pawl is provided with a corresponding spring 176 which tends to engage the pawl with a ratchet member 178, such member being free to rotate about the shaft 128. Accordingly, power is transferred from sprocket 170 to the ratchet member 178 only in one direction, namely when the sprocket 170 is rotated during backward travel of the backage. When the backage moves forward, the pawls ride over the ratchet member.

The sprocket 170 has a friction drive connection through a friction ring 180, to a control cam 182 which is free to rotate on the sleeve member 172. Similarly, the ratchet member 178 has a friction drive connection through a ring of suitable friction material 184 to the lowermost of the gears 127, i.e., that gear which is connected to rotate the shaft 128. In effect, the sprocket 170 therefore has slip clutch drive connections to both the cam 182 and to the shaft 128, but these connections are separate and distinct. In order to maintain the parts in alignment, the outboard ends of the shafts 126 and 128 are provided with contacting bearing wheels 187 which function merely to keep the parts aligned. A spring 188

preferably is mounted around shaft 128 between the sleeve 172 and the ratchet member 178, providing pressure for drive contact in each of the slip clutches.

The shaft 128 also carries a pair of ratchet wheels 190 and 192, which are shown partly in FIG. 4. These ratchet wheels are suitably fastened to shaft 128 immediately behind the jaw 40. A pawl 193 is rotatably mounted on the post 37, and urged by spring 194 into engagement with the ratchet wheel 192. The direction of teeth on this wheel, and the mounting of pawl 193, are such that any rotation of shaft 128 during forward movement of the backage is prevented. This is merely to assure that the memory drum 44 is held stationary at this time, in case there should be a momentary transmission of driving force through the ratchet member 178. During rearward movement of the backage, when shaft 128 may be rotated to provide indexing movement, pawl 193 rides over the teeth of ratchet wheel 192.

The teeth of ratchet wheel 190 are arranged opposite to the ratchet wheel 192. A pawl 195 is pulled into engagement with ratchet wheel 190 by a spring 196, and this pawl includes an outwardly extending lever arm 198 which engages the output pin 199 of a solenoid 200. During an indexing operation, if it is desired to change to the next job program, solenoid 200 is energized to release pawl 195 from ratchet wheel 190.

The cam 182 controls the operation of a number of switches, as will be explained, which in turn control the circuits for advancing or indexing the magnetic record tube to the next selected position, as represented by the next depressed button or pin 122 in the direction of rotation of the channel selector head 120. One of these switches is a normally closed switch 205 (FIG. 4) which is provided with an operating roller follower 206 normally resting in a depression or cavity 208 in the cam 182. When the cam is moved during an indexing or job selecting operation, as soon as the cam rotates by an amount equivalent to the angular distance between the pins 122, the roller 206 will be moved as the cavity 208 turns away from it, and switch 205 will be opened. Referring to the wiring diagram, FIG. 7B, switch 205 is shown in its normally closed position. It is in a series circuit with contacts 2FR2 of relay 2FR, and this circuit in turn is connected through a manually operable index switch 210 (shown closed) to control the supply of power to the index solenoid 200.

PROGRAM SELECTOR CONTROLS

In connection with the controls for operating the program selector mechanism, it should be noted first that there are circuits provided for automatically reversing the direction of movement of the backage, as follows.

REVERSE—STANDARD SPEED

Upon receipt of a reversing signal by the head 58 amplifier 73 will cause relay RA to pulse. Voltage will be passed from line 134 through the back contacts of the fast switch 75 through contact 217 of switch 215, through the now closed contacts RA1 and normally closed contacts 62 to relays 1FR and 2FR. Holding current for these relays is supplied through now closed contact 1FR1. Relays A, FWD and F will open since the holding current through contacts 1FR2 is now removed. Contact 2FR1 will close supplying a current from the reverse limit switch 112 to the REV, 1R and 2R relays thus causing them to close, and contacts 2FR2 will close in the control circuit of solenoid 200.

If the reverse speed selector switch 240 is placed in the standard speed position (as shown) holding current to relays REV, 1R and 2R will be supplied through the lower contacts of switch 240b, the normally closed contact RA2 (this relay is only momentarily actuated) and the now closed contacts 1R1.

The operation of relay REV will reverse the phase of the voltage applied to motor 25 through the operation of

contacts REV1, REV2 and REV3 illustrated in FIG. 7C.

As previously mentioned, contacts 2FR2 close as the circuits are set up which reverse the movement of the backage. At this time, switch 205 is also closed and as a result solenoid 200 will be energized if the index switch 210 has been closed by the operator, when he wishes the apparatus to index automatically. When solenoid 200 is energized, it withdraws the pawl 195, the ratchet wheel 190 is released and a drive connection is completed from the sprocket 170 through the ratchet member 178 (since the sprocket is now rotating in a reverse direction) and through the friction drive connection to the gear 127 and the shaft 128. Immediately upon initiation of the reverse direction movement of sprocket 170, it tends to rotate cam 182 through its friction drive connection directly to this sprocket, and as a result switch 205 opens. This breaks the circuit to solenoid 200 through the contacts 2FR2 if the mechanism rotates any farther than the angular spacing between successive pins 122. However, in the meantime the index dial 120 has been rotated such that the depressed pin 122a which was holding open switch 160 no longer engages the roller 159. Consequently, a shunting circuit is completed through normally closed switch 160 to the index switch 210, and solenoid 200 will remain energized if the next selected channel is more than one past the channel where the indexing motion began, until switch 160 is opened by the next depressed pin 122.

As mentioned above, switch 205 is opened after a relatively slight rotary movement of the indexing mechanism equal to the spacing between successive selector pins 122. Therefore, the ultimate deenergizing of solenoid 200 when a channel is to be skipped, and the resultant re-engagement of pawl 195 with ratchet wheel 190, depends upon the opening of switch 160 when the next selected channel is presented to the reading and recording heads.

Switches 215 (FIGS. 4 and 7B) and 216 (FIGS. 4 and 7A) are also operated in response to movement of cam 182. Switch 215 is a double throw switch which in its normal condition completes a circuit through its contact 217 to the control circuits for the relay coils 1FR and 2FR. When switch 215 is operated it shifts to its contacts 218 which supplies power to a coil of a relay G. Switch 216 is in the D.C. control circuit, and controls power to the coil of relay RF. This switch is normally open, and closes when the switch 215 shifts.

In order to operate both these switches from cam 182, a follower arm 220 (FIG. 6) is pivotally mounted on a stud 221, and provided with a roller 223 which follows the edge of cam 182. When the cam rotates during operation of the indexing mechanism, it completes approximately 348° of movement before a notch 225 in the edge of cam receives roller 223. At this time, due to the urging of the internal springs (not shown) in the switches, the roller 223 will drop into notch 225. Both switches 215 and 216 have their operating rollers 227 and 228 pressing against a cross arm 229 which is an integral part of the operating arm 220. Thus, both switches are operated simultaneously when roller 223 drops into the notch 225.

After the backage has moved rearwardly approximately twenty inches, cam 182 will have made slightly less than a complete revolution, enough to move all channels in the magnetic memory drum 44 past the pickup heads. Switch 215 will move from contact 217 to contact 218 to energize relay G and deenergize relays 1FR and 2FR. Simultaneously, switch 216 will close and actuate relay RF through the closed contacts 1R2. The relay RF will remain closed for a short period of time due to the action of capacitor C6 even after contacts 1R2 open. The backage will continue to reverse until it either reaches the limit switch 112 or until a reverse-to-forward pulse, recorded on magnetic memory drum 44 is sensed by pickup head 58.

The backage can be made to automatically begin a for-

ward movement if a reverse to forward pulse is recorded on the magnetic memory drum 44 on the channel now selected during the rearward motion of the backage. If a reverse to forward signal is placed on the magnetic memory drum 44, this signal will be sensed by the head 58 and caused relay RA to momentarily pulse. This will open the normally closed contacts RA2 and remove the holding current to relays REV, 1R and 2R. Contact RA3 will close momentarily and actuate the FWD and the A relay through now closed contact RF1. Current from RA3 will also pass through the closed contacts of RF2 and actuate the F relay. Holding current to relays A, FWD and F is again supplied through the now closed contacts 1FR2. When relay 1R is deenergized it opens its contacts 1R2 in the circuit of the RF relay, but condenser C6 discharges through resistor R6 and through the coil of the RF relay, holding it until relay A is energized to seal in the FWD circuits.

Of course the backage can be moved rearwardly at any time when the operator actuated reverse switch 110a and 110b. Switch 110a will release the holding current on relays A, FWD and F while switch 110b will actuate relays REV, 1R and 2R. The sequence of operation is otherwise the same as described above.

After a slight overrun the backage will start forward at fast speed, the cam 182 will move in the opposite direction to open switch 216 and shift switch 215 to its contacts 217, and he head 58 will pass the same mark going forward. This causes another pulse to the RA relay, but its contacts cause no change in the circuits since relay G is still held energized to prevent a false action of 1FR and 2FR. However, the first time the backage stops at a mark in the new control program which has been presented to the heads 50 and 52, the circuit to relay G is broken because relay DA is energized, and its normally closed contacts DA2 open. It should be noted that the cam 182 will continue to rotate until the slot or cavity 230 (FIG. 7) in its surface is engaged by a leaf spring arm 232 which is mounted on the bracket supporting switches 215 and 216. This arm will stop the rotation of the cam 182, with the notch 225 having moved around to the other side of the roller follower 223. From then on, the friction drive connection between cam 182 and sprocket 170 will slip until a further indexing operation is initiated.

There is a further manually operated switch 235 (FIG. 7B) which is normally open, and which is connected in a bypass circuit around the switch 210 such that when switch 235 is closed the index solenoid 200 will be energized. The operator can close switch 235 manually, when he desires to move the program selector dial 120 manually, and this will cause the pawl 195 to be released from ratchet wheel 190, permitting the operator to change program channels manually.

Therefore, when the backage completes one program, if the index switch 210 is closed by the operator to provide for automatic job program indexing, the backage will move forward far enough clear the pile for removal or manual repositioning at the end of a program, and then the indexing mechanisms and controls will be actuated immediately after the backage reverses and will advance the memory device to the next selected channel. By the time the backage has moved through any significant rearward motion, the direction control channel for the next or succeeding program control will be aligned with the reading head 58, and the magnetic mark therein will determine the position at which the rearward motion of the backage ceases, and it is caused to move forward and begin the new program. In this manner, the operator can predetermine the amount of motion required of the backage in excess of the actual stop positions in a job program, and he can arrange the direction control marks to minimize the amount of and time required for such excess motion.

Of course, the operator can at the same time select any one of the multiple job programs by depressing appro-

prate pins 122, and thus the indexing mechanism can be caused to skip certain channels if desired, or operate in any desired sequence so long as it continues to index from the number 1 channel upward toward the highest channel.

- 5 The indexing mechanism can revolve continuously, and thus it is possible to index, for example, from channel number 4 around to channel number 2, passing over all higher channels between number 4 and the highest numbered channel before returning to pass over the number 1 and stop in the number 2 channel.

REVERSE—HIGH SPEED

- Increasing the speed at which the backage moves in the reverse direction will increase the efficiency of the cutting machine by reducing the time required to position the backage either in its rear limit position for receiving a new stack of material or in an intermediate position so that a stack of material can be turned and positioned against the backage preparatory to receiving a subsequent cut. While it is not practical to merely increase the speed of the backage drive mechanism as a whole, since the distortion of the stack of material might occur when the backage is stopped during forward operation, resulting in inaccurate cuts being made, it is possible to provide selective control over the speed of the backage thereby insuring both accuracy and efficiency in the operation of the cutting machine.

High speed operation of the backage can be accomplished by moving the reverse speed selector switch 240 from the standard to the high speed position.

- 15 The backage may be reversed upon receipt of a reversing signal sensed by head 58 which actuates relay RA, and through contacts RA1 actuate the 1FR and 2FR relays. Holding current to these relays is supplied by the contact 1FR1. Contacts 1FR2 will open and remove the holding current to A, FWD and F. Contacts 2FR1 will close and actuate relays REV, 1R and 2R causing the backage to reverse by reversing the phase on the motor 25 (FIG. 7) as described before. However, with the switch 240 in the high speed position 240a relay HS will close and the motor 25 will have its high speed windings energized through now closed contacts HS2 and HS4.

Since the HS5 contacts are now open, relay RF will not actuate upon the closure of switch 216 which occurs after the backage has traveled approximately twenty inches and consequently the closure of relay contacts RA3 cannot actuate relays A, FWD and F. Likewise, since switch 240b is in the high speed position, the momentary operation of relay RA cannot remove the holding current to relays REV, 1R and 2R. Therefore, a reverse to forward signal placed on the magnetic memory drum 44 will not cause the backage to reverse its direction even though relay RA will actuate.

- It has been found that due to the significantly higher speed of travel of the backage, the reverse-to-forward mode, magnetic sensing head 58 will operate relay RA due to noise signals on the magnetic memory drum 44, causing erratic operation of the backage. This is due in part to the higher noise level which is created by the high speed motion of the backage. To insure reliable reverse-to-forward signals a portable limit switch 222 is mounted on the work table 10 and placed adjacent the backage so that the switch will momentarily open as the backage 20 moves past the switch actuator. This switch is adjustably positioned by the operator at the rearmost position at which he desires the backage to travel.

When the backage operates switch 222 the holding current to relays REV, 1R and 2R through normally closed contacts 222a will be removed. Power is supplied from line 134 through now closed contacts HS6 and through the switch 222b to relay F, FWD and A. The backage thus moves forward at the slower motor speed since the high speed windings of motor 25 are only used for the reversal of the backage.

The backage can also be reversed at the higher speed

by manually depressing switch 110 to cause relays REV, 1R and 2R to close in the same manner as previously described.

LOADING

It is occasionally desired that the backage be placed in the rear limit position so that a new stack of material can be loaded on the machine preparatory to the cutting operation. This normally occurs at the end of a particular job sequence recorded on the magnetic memory drum 44. As explained above, when the backage proceeds in a reverse direction, the indexing dial will revolve and if pin 122 in channel 23 has been depressed, switch 224 will be momentarily operated by actuator 242 when the indexing dial 120 passes over channel 23 on its way to a new job sequence.

After the last cut has been made, the backage normally moves forward slightly to assist in removing the stack of material and then receive a reversing pulse to start the rearward movement of the backage. A reverse pulse received by head 58 will actuate relay RA, and through relay contacts RA1, the relays 1FR and 2FR. As stated before, relays A, FWD and F will lose holding current by the opening of contacts 1FR2 and relays REV, 1R and 2R through now closed contacts 2FR1.

As the backage proceeds to the rear, the indexing dial 120 will rotate and switch 224 will momentarily actuate causing relay L to close, and through contacts L2, actuate relay HS. Holding current to relays REV, 1R and 2R will be supplied through contact L3.

The opening of contact L4 in the circuit to switch 222b and the bypassing of switch 222a by contacts L3 will prevent the actuation of the portable limit switch from having any noticeable effect on the circuit. Since the REV and HS relays are actuated the backage will proceed to the rear limit switch at the highest speed.

Closure of the relays L and HS can also be accomplished by actuating manually the load switch 226. The manual load switch 226 is mounted on the front panel of the machine and is electrically connected in parallel with the switch 224 which is actuated by pin 122 of the indexing dial.

The manual load switch 226 may be actuated by the machine operator whenever he desires the backage to move at high speed to the rear limit position. The operator, for example, may want the backage to proceed to the rear limit position at a high rate of speed before the pin 122 in the indexing dial rotates sufficiently far enough to engage and operate the switch 224. In the event that the magnetic memory drum is not being used and consequently the indexing head is not rotated during the rearward movement of the backage, or in the event that the selector button 122 on the indexing dial has not been depressed, the operator may also actuate the manual load switch 226 at any time either during the last forward run of the backage or during its rearward movement and cause the backage to move rearwardly at high speed. The manual load switch 226 therefore gives the operator increased flexibility in the control of the machine.

Since the manual load switch 226 is electrically connected in parallel with the switch 224, the operation of the associated circuitry and the backage movement is the same as described above in relation to the automatic high speed reversal of the backage.

It should be noted that neither the portable limit switch nor a reverse to forward signal placed on the magnetic memory device will cause the backage to begin a forward movement once the backage starts its high speed rearward movement since the operation of the contacts L3 will prevent the opening of relays REV, 1R and 2R either by the operation of the portable limit switch 222 or the reverse-to-forward relay contacts RA2. Thus, whenever relay L is actuated, the backage will proceed to its rear limit position.

Thus, by providing a two-speed reversible motor to

drive the backage, along with appropriate circuitry to control the speed of the backage motor, more efficient and speedier operation of the cutting machine can be achieved.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appealed claims.

What is claimed is:

1. In a paper cutter having a power operated knife, a backage movable toward and away from said knife to position a pile for cutting, and a two-speed reversible drive motor for said backage having a high speed winding and a low speed winding and including a backage drive control for effecting controlled movement thereof; the combination of a memory device having a plurality of channels each capable of storing a plurality of reference marks indicating desired positions of said backage, reading means for reading the reference marks, control circuitry governed by said reading means and connected to actuate said backage control, means causing relative movement between said memory device and said reading means in correlation to backage movement for reading said memory device with reference to the position of said backage, means arranged to present said reading means to selected ones of said channels, indexing means operative in response to reverse movement of said backage away from said knife to shift the relation of said reading means and said memory device during motion of said backage away from said knife to present different channels to said reading means, and means associated with said indexing means for causing the high speed winding of said two-speed motor to become energized when said indexing means passes a selected predetermined one of said channels thereby causing said backage to proceed rearwardly at the highest available speed.

2. In a paper cutter having a power operated knife, a backage movable toward and away from said knife to position a pile for cutting, and a multiple speed reversible drive means for said backage including a backage drive control for effecting controlled movement thereof; the combination of a memory device having a plurality of channels each capable of storing a plurality of reference marks indicating desired positions of said backage, reading means for reading the reference marks, control circuitry governed by said reading means and connected to actuate said backage control, means causing relative movement between said memory device and said reading means in correlation to backage movement for reading said memory device with reference to the position of said backage, means arranged to present said reading means to selected ones of said channels, indexing means operative in response to reverse movement of said backage away from said knife to shift the relation of said reading means and said memory device during motion of said backage away from said knife to present different channels to said reading means, means on said indexing means controlled by said adjustable program selector to actuate the highest speed of the drive means such that the backage may proceed to a rear limit position in the least possible time, and control circuitry to disengage said reading means during the high speed rearward movement of the backage.

3. In a paper cutter having a power operated knife, a backage movable toward and away from said knife to position a pile of material for cutting, and a multiple speed reversible drive means having slow and fast speed outputs for forward movement of said backage and fast and high-speed outputs for the rearward movement of said backage including a backage drive control for effecting controlled movement thereof; the combination of a memory device having a plurality of channels each capable of storing a plurality of reference marks indicating desired positions of said backage, reading means for reading the

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reference marks, control circuitry governed by said reading means and connected to actuate said backgage control, means causing relative movement between said memory device and said reading means in correlation to backgage movement for reading said memory device with reference to the position of said backgage means arranged to present said reading means to selected ones of said channel, indexing means operative in response to reverse movement of said backgage away from said knife to shift the relation of said reading means and said memory device during motion of said backgage away from said knife to present different channels to said reading means, and means associated with said indexing means and connected to said backgage drive control causing the high speed output of said reversible drive means to become operative when said indexing means passes a selected predetermined one of said channels thereby causing said backgage to proceed rearwardly at the highest available speed.

4. In a paper cutter having a power operated knife, a backgage movable toward and away from said knife to position a pile of material for cutting, and a multiple speed reversible drive means having slow and fast speed outputs for forward movement of said backgage and fast and high speed outputs for the rearward movement of said backgage including a backgage drive control for effecting controlled movement thereof; the combination of a memory device having a plurality of channels each capable of storing a plurality of reference marks indicating desired positions of said backgage, reading means for reading the reference marks, control circuitry governed by said reading means and connected to actuate said backgage control, means causing relative movement between said memory device and said reading means in correlation to backgage movement for reading said memory device with reference to the position of said backgage, means arranged to present said reading means to selected ones of said channels, indexing means operative in response to reverse movement of said backgage away from said knife to shift the relation of said reading means and said memory device during motion of said backgage away from said knife to present different channels to said reading means, means to energize the high speed output during each rearward movement of the backgage, means to disconnect said reading heads while the high speed winding of the drive means is engaged, and means adjustably positioned on said work table and actuated by the backgage to limit the rearward movement of said backgage.

5. In a paper cutter having a power operated knife, a backgage movable toward and away from said knife to position a pile for cutting, and a multiple speed reversible drive means for said backgage including a backgage drive control for effecting controlled movement thereof; the combination of a memory device having a plurality of channels each capable of storing a plurality of reference marks indicating desired positions of said backgage, reading means for reading the reference marks, control cir-

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cuitry governed by said reading means and connected to actuate said backgage control, means causing relative movement between said memory device and said reading means in correlation to backgage movement for reading said memory device with reference to the position of said backgage, means arranged to present said reading means to selected ones of said channels, indexing means operative in response to reverse movement of said backgage away from said knife to shift the relation of said reading means and said memory device during motion of said backgage away from said knife to present different channels to said reading means, manual switch means to energize the highest speed output of said multiple speed reversible drive means so that the backgage may proceed to a rear limit position in the least possible time, and control circuitry actuated in response to the operation of said manual switch means to disengage said reading means during the high speed rearward movement of the backgage.

6. In a paper cutter having a power operated knife, a backgage movable toward and away from said knife to position a pile of material for cutting, and a multiple speed reversible drive means having slow and fast speed outputs for forward movement of said backgage and fast and high speed outputs for the rearward movement of said backgage including a backgage drive control for effecting controlled movement thereof; the combination of a memory device having a plurality of channels each capable of storing a plurality of reference marks indicating desired positions of said backgage, reading means for reading the reference marks, control circuitry governed by said reading means and connected to actuate said backgage control, means causing relative movement between said memory device and said reading means in correlation to backgage movement for reading said memory device with reference to the position of said backgage, means arranged to present said reading means to selected ones of said channels, indexing means operative in response to reverse movement of said backgage away from said knife to shift the relation of said reading means and said memory device during motion of said backgage away from said knife to present different channels to said reading means, first and second means connected to said backgage control for causing the high speed output of said reversible drive means to become operative, said first means being actuated when said indexing means passes a selected predetermined one of said channels, said second means being manually operable, the operation of either said first or said second means causing said backgage to proceed rearwardly at the highest available speed to a rear limit position, and means in said backgage control to disengage said reading means during the high speed rearward movement of said backgage.

No references cited.

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