United States Patent

[11] 3,592,094

[72] Inventor Louis W. Greenblatt
12 Ladue Manor, St. Louis, Mo. 63124

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[54] BANDSAW WORK FEED
11 Claims, 10 Drawing Figs.

[52] U.S. Cl. 83/201, 83/425
[51] Int. Cl. B26d 1/46
[50] Field of Search ..... 83/201, 201.07, 425; 143/26 R, 51 R

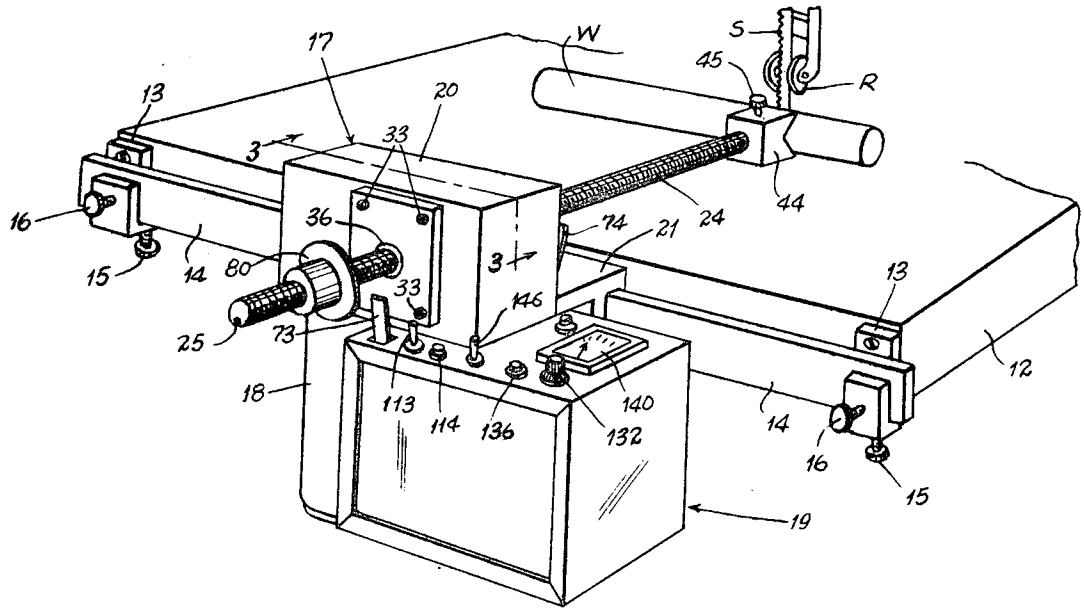
[56] References Cited

UNITED STATES PATENTS

3,063,302	11/1962	Hover	143/26 R X
3,077,132	2/1963	Whitmore	83/201.07
3,182,538	5/1965	Whitmore et al.	83/201

Primary Examiner—William S. Lawson
Attorney—Kingsland, Rogers, Ezell, Eilers & Robbins

ABSTRACT: A variable-speed, constant-thrust, work feed for band and circular saws. It employs a DC motor generator in which motor speed and generator output voltage normally decrease as load increases, but it uses a control which increases motor voltage input as a function of generator voltage reduction to maintain substantially constant speed and power. The feeding speed may be adjusted and may be automatically regulated to limit the load on the saw blade to prevent injury to the blade, and to give warning to the operator. Means to increase the feeding rate temporarily is provided. Withdrawal is at higher speed. Limit switches control feed and withdrawal. Dynamic braking prevents overtravel in either direction when the mechanism is stopped intentionally or by limit switches. A feeding speed indicator is provided.



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SHEET 1 OF 2

Fig. 1.

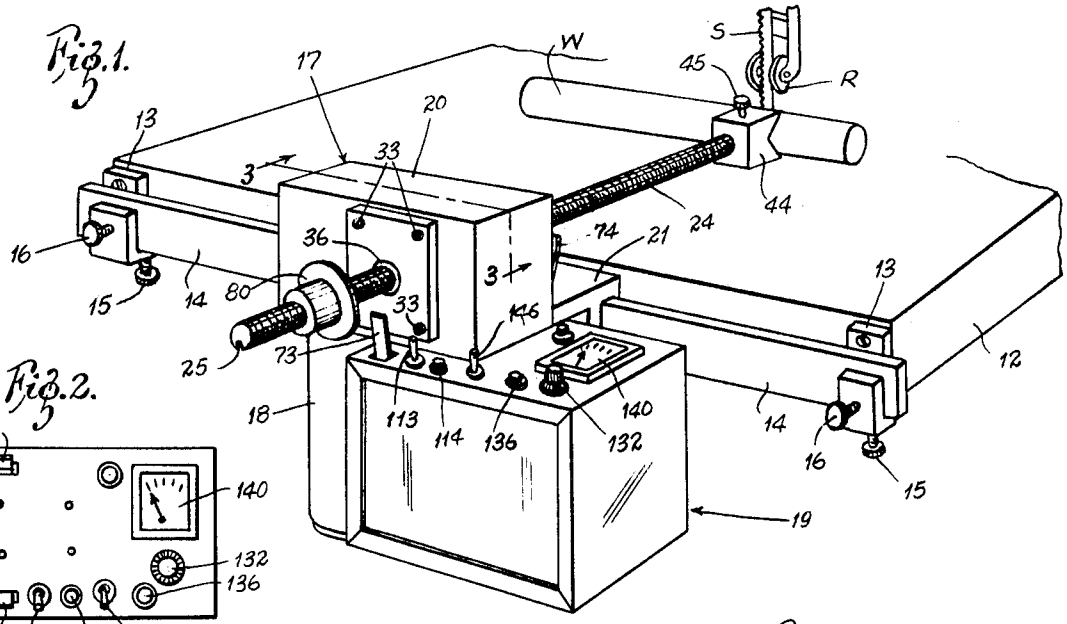


Fig. 2.

Fig. 3.

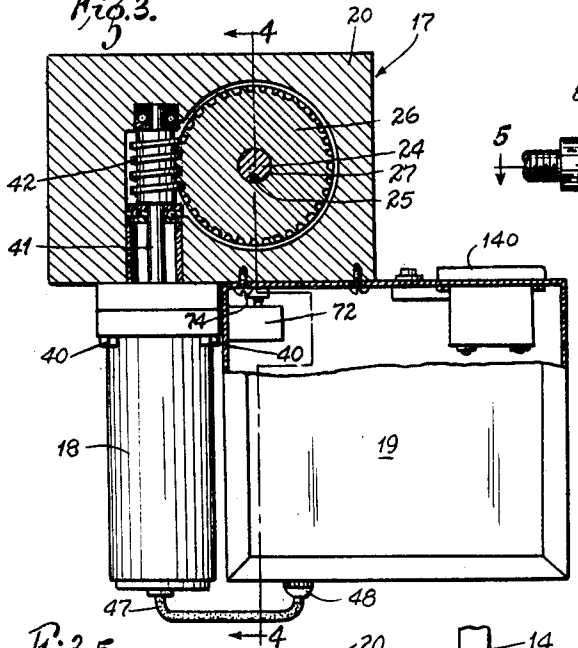


Fig. 4.

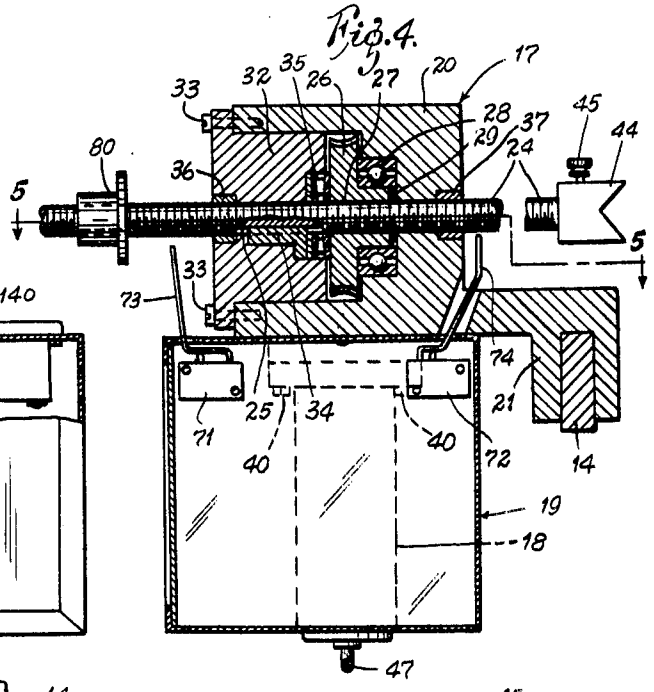


Fig. 5.

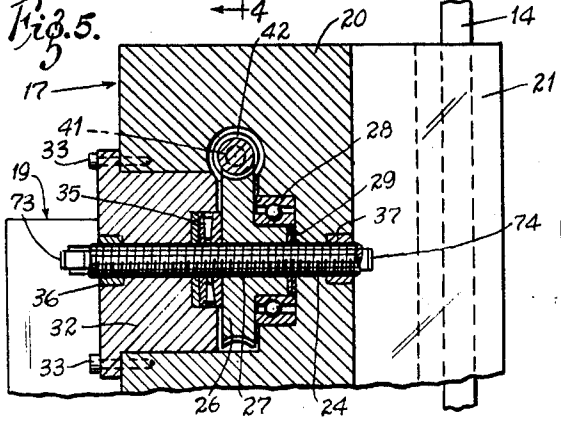


Fig. 6.

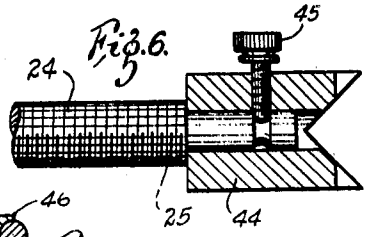
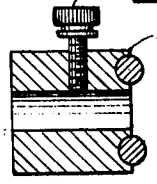


Fig. 7.



INVENTOR:
LOUIS W. GREENBLATT,
BY Kingsland, Rogers, Ezell, Eilers & Robbins
ATTORNEYS

Fig. 8.

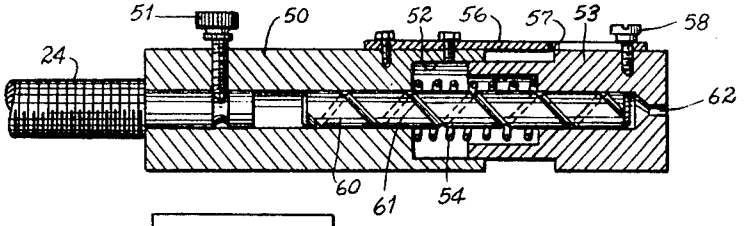


Fig. 9.

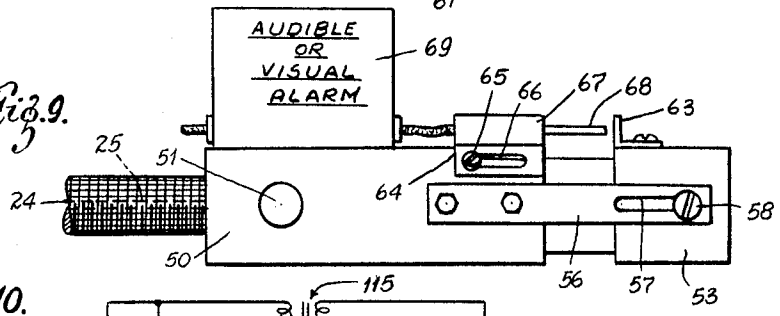
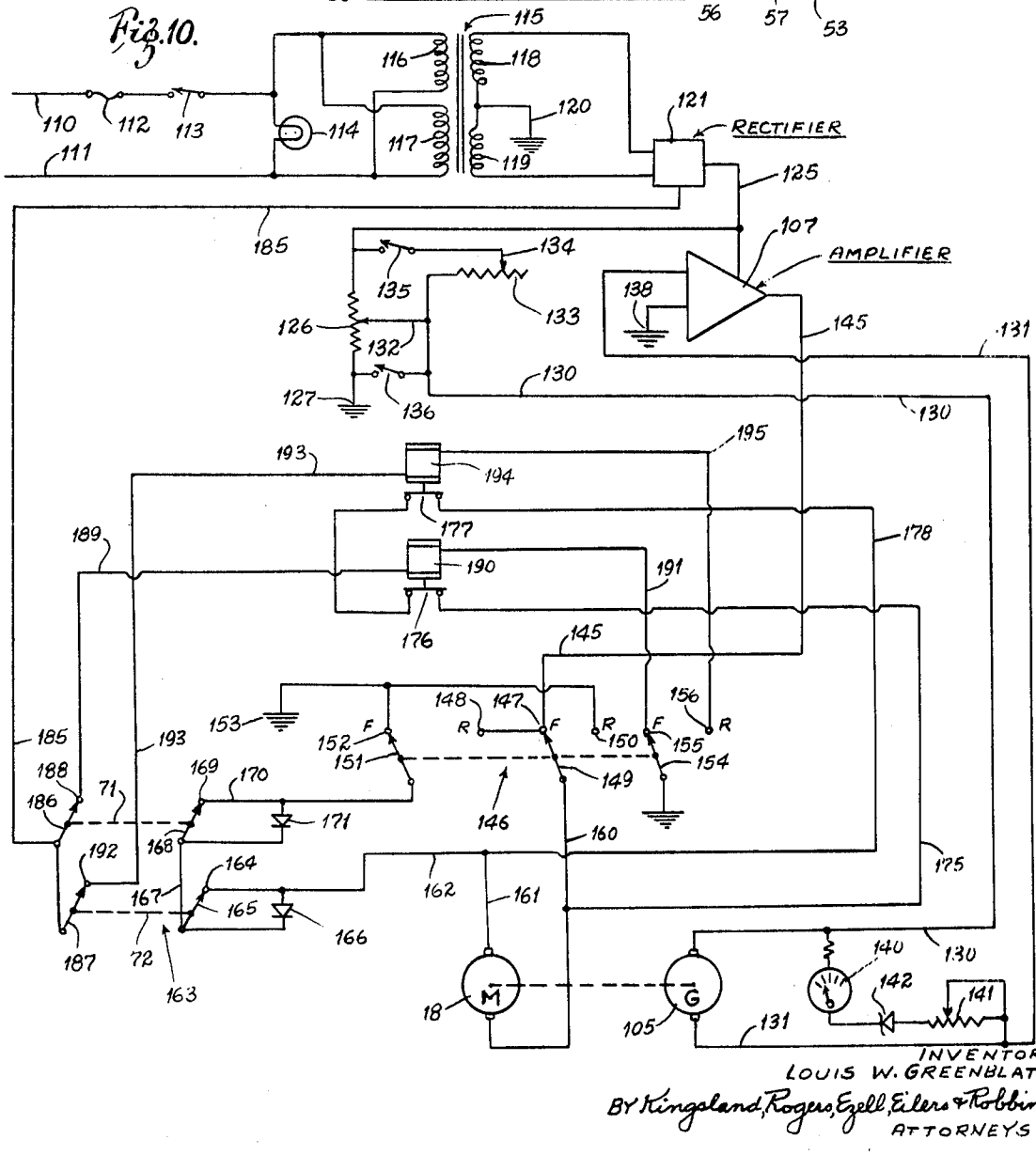


Fig. 10.



INVENTOR:
LOUIS W. GREENBLATT,
BY Kingsland, Rogers, Ezell, Eilers & Robbins
ATTORNEYS

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BANDSAW WORK FEED

SUMMARY OF THE INVENTION

The use of the variable-speed constant-thrust drive for a saw feed to relieve the operator of the work to maintain feed against varying resistance. Also the use of limit means to prevent excess feed in either direction, and dynamic braking to prevent overtravel when the apparatus is halted. The feed speed is adjustable and means is provided to have rapid acceleration of the speed when needed, as for example when the work is introduced into the machine. In the preferred form, there is means to reduce the feeding rate in response to excess resistance of the work, which prevents irreparable injury to the saw teeth.

In the drawings:

FIG. 1 is a perspective view of the device showing its relationship to a bandsaw;

FIG. 2 is a plan view of the top of the control box with the drive mechanism gearbox removed;

FIG. 3 is a vertical side-to-side section taken on the line 3–3 of FIG. 1;

FIG. 4 is a vertical section along the axis of the pusher shaft taken on the line 4–4 of FIG. 3;

FIG. 5 is a horizontal section through the axis of the shaft looking downwardly;

FIG. 6 is an enlarged section of one form of feeder head;

FIG. 7 is a diametrical section through a modified form of feeder head;

FIG. 8 is a diametrical horizontal section through a resistingly yieldable type of feeder head;

FIG. 9 is an elevation of the head shown in FIG. 8; and

FIG. 10 is a schematic wiring diagram of the apparatus.

The apparatus is designed to be used with a saw and to be mounted on the forward edge of the table thereof. In FIG. 1 a bandsaw table 12 has two clamping supports 13 attached to its forward edge by screws. Each support 13 has a U-shape, to receive with a sliding fit the opposite ends of a support rail 14, and support it in vertical position. Adjustment screws 15 project upwardly into the U-sections of the supports 13 to engage the bottom edge of the rail 14 and set its elevation. Lock screws 16 can be turned against the front faces of the rail to secure it in set position, and can be loosened to permit removal of the rail with the equipment mounted on it. A bandsaw blade *S* has a backup roller *R*. An illustrative workpiece is shown as a circular metal rod *W*.

The present invention includes a drive mechanism 17, a driving motor 18, and a control 19.

The drive mechanism 17 includes a support housing 20 having a bifurcated rail-engaging section 21 that has a close sliding fit over, and is adjustable laterally along, the rail 14 that is secured to the forward edge of the table 12. This provides smooth and accurate lateral adjustment of the apparatus with a minimum of lost motion.

There is a threaded ram or driving shaft 24 that can reciprocate through the housing support 20. The shaft has a key slot 25 in it.

The housing 20 has a circular recess of sufficient size to receive a worm wheel 26. The wheel 26 is threaded onto the ram shaft 24. It is mounted for rotation in a ball bearing 28 and can engage at its inner end against antifriction rings 29. A block 32 fits into the recess in the housing 20 and is held by screws 33. It holds a key 34 against rotation, which key engages in the axial key slot 25 in the ram shaft 24. It also holds a thrust bearing 35 that applies axial restraining force against the worm wheel 26. The housing 20 and block 32 may have have hardened sleeve bearings 36 and 37 to support the shaft 24.

The motor 18 is mounted on the bottom of the support 20 by screws 40. This motor has a vertical shaft 41 mounted in appropriate antifriction bearings to drive a worm 42 which meshes with the worm gear 26. Thus, when the reversible motor 18 turns, the worm turns and rotates the worm gear 26 clockwise or counterclockwise, and by the threaded engagement 27 with the ram shaft 24, which is held against rotation by the key 34, causes the shaft to advance or to withdraw. The motor is electrically connected to the control 19 by a cable 47 and removable plug 48.

The ram shaft 24 has its end reduced and peripherally grooved to receive any of a number of work-engaging heads. In FIG. 4, a notched head 44 is secured to the shaft end by a releasable screw 45 that engages in the groove in the reduced projecting end of the threaded ram shaft 24. This enables the screw 45 to hold the head 44 against accidental removal, but permits its removal when desired, and also its rotation about the shaft axis to engage the work most suitably. In FIG. 7 a different head 46 is shown having cylindrical abutments that can operate with either flat or rounded workpieces.

The preferred form of head, however, is that illustrated in FIGS. 8 and 9, which is designed to react to the force applied by the ramhead against the work and so make it possible to respond to excessive resistance of the saw and prevent injury to the bandsaw teeth, or to the machine. This preferred head includes a sleeve 50 attached to the ram shaft 24 by a screw 51 corresponding to the screw 45 and having the same advantages. The sleeve 50 is recessed at 52 to receive a telescoping abutment member 53 with a space to receive a compression spring 54 between the abutment 53 and the sleeve 50. This spring 54 tends to move the abutment 53 out of the sleeve 50. Such movement may be limited by appropriate means such as strap 56 secured to the sleeve 50 and having a slot 57 engageable over the shoulder screw 58.

Greater strength in the operation is attained by having a pin 60 secured in the abutment 53 and slidable within an axial opening through the sleeve 50. Spiral or like grooves 61 can be provided in the periphery of the pin to permit any trapped air to escape out through a bleed hole 62 in the forward end of the abutment.

It will be seen that if the ram shaft 24 is moved inwardly, forcing the work *W* against the bandsaw blade *S* by having the abutment head 53 press against the work, the stiff spring 54 will prevent significant inward telescoping of the abutment 53 into the sleeve 50 when there is only normal resistance to the feeding of the work against the blade. If the resistance increases beyond such point, the spring will be compressed, permitting the abutment 53 to telescope into the sleeve 50 in amount that is a function of the resistance of the work to the saw.

An actuating leaf 63 is attached onto the head or abutment 53 by screws, and projects radially outwardly as indicated. A mounting bracket 64 is secured to the sleeve 50 by a screw 65 that engages in a slot 66 in the bracket. The screw 65 holds the bracket 64 in an appropriately adjusted position. The bracket holds a control device (potentiometer) 67 having its movable actuating element 68 disposed in the path of the outstanding leaf 63. The adjustment afforded by the slot 66 permits the control device to be adjusted toward the leaf 63 so that when a predetermined amount of compression of the spring 54 has occurred, the leaf 63 will engage and actuate the control 67.

The control device 67 may in addition include a switch to operate an audible or visual alarm 69. Also, as will appear, it preferably comprises a control such as a potentiometer to modify the circuitry of the driving motor 18 so as to reduce its speed and hence reduce the thrust applied through the rod 24 to the work.

The other end of the ram shaft 24 receives a limit collar 80. The collar 80 is either threaded onto the end of the shaft 24, as illustrated, or may have other appropriate quick-acting or slow-acting adjusting means so that it can be moved axially along the shaft and held in its position of adjustment. As appears in FIG. 4, the control 19 includes two limit switches 71 and 72 having actuating blades 73 and 74, respectively, projecting upwardly. The collar 80 engages the limit switch 73 upon maximum forward movement of the shaft 24 and the head 38 or other head on the shaft 24 engages the limit switch pole 74 when the shaft moves backward toward the operator its maximum distance.

The control 19 employs a constant velocity DC servomotor generator set with an amplifier circuit, wherein the decline in motor generator speed causes an increase in voltage applied to the motor and hence an increase in motor torque. The basic DC constant velocity servomotor generator can be, for example, an E500 series made by Electrocraft Corporation of Hopkins, Minn., the principles of which are illustrated in combination with other structure in FIG. 10. The motor generator is of the permanent magnet DC motor generator type having a common shaft. There is a high-gain feedback amplifier 107, which, as will appear, has an input voltage derived by subtracting the inverse feedback voltage derived from the generator, from a reference voltage from a rectified source which may be adjusted to suit the requirements. The inverse feedback voltage from the generator is proportional to motor generator speed and increases as the speed thereof increases. The differential voltage is changed with any change in motor speed and its sign depends upon whether the motor is running too fast or too slow. Its magnitude is a function of the differential between the set speed desired and the actual operating speed. Hence the amplifier always delivers an output voltage to the motor which increases if the speed drops or decreases if the speed rises, so that the motor speed remains substantially constant regardless of load changes and become dependent only upon the setting of the speed reference potentiometer.

In the particular commercial system referred to, the motor generator actually has two windings on the same armature: one for driving the motor and the other for generating the voltage that is proportional to speed. That voltage from the generator is fed to the controller where it is compared with the reference voltage. The controller, which is a servoamplifier, then provides more or less voltage to the motor windings, increasing or decreasing speed to maintain a balance between the reference voltage and the generator voltage. Thus, as the load increases, it tends to reduce the speed of the motor but this causes more voltage to be applied to the motor so that the speed returns substantially to the set value.

In the schematic wiring diagram in FIG. 10, a power supply is indicated by the two wires 110 and 111. Power passes through a fuse 112, the master on-and-off switch 113, and a pilot light 114 energized to show that the master switch is closed. A transformer 115 has two primaries 116 and 117 connected in parallel across the power lines. The transformer 115 has two reduced-voltage secondaries 118 and 119 energized respectively by the two primaries 116 and 117. A common ground 120 is provided for the secondaries. The two secondaries feed a rectifier 121 to give full-wave rectification.

A wire 125 leads from the rectifier to the high-gain amplifier 107 and also to a resistor 126 grounded at 127. This arrangement provides the application of the reference voltage to the amplifier 107.

Assuming that the generator 105 is operating, it will deliver a voltage, that varies with its speed, to the two wires 130 and 131. The wire 130 leads to an adjustable contact 132 of the potentiometer 126 and to the resistor of a potentiometer 133. The variable contact 134 of this potentiometer 133 is moved by the actuator 68 of the control device 67, across the resistor 133. The contact 134 is connected to a switch 135 that is connected to the wire 125. There is also a quick-acting switch 136 connected from the wire 130 to the ground connection 127. The amplifier has a ground 138.

Also across the wires 130 and 131 is connected a speed-reading meter 140 with appropriate isolating resistances and a calibrating potentiometer 141, as well as a Zener diode 142. This is a voltmeter, but since the voltage generated by the generator varies with its speed and that of the motor, the meter dial 140 can be calibrated in terms of motor speed, or in per-minute travel or ram 24.

The output of the amplifier is between an output wire 145 and the ground 138. The wire 145 leads into a forward and reverse switch 146 of the multiple-pole type. Specifically, the wire 145 leads to the contact 147 and to the contact 148. The contact 147 is controlled by a pole 149 that can shift, coordinately with the other poles, in which event the pole 149 closes with the contact 150. The contact 148 is operated by a pole 151 that also cooperates with the contact 152. The contacts 150 and 152 are connected to ground at 153. Another coordinately operated switch pole 154 in the switch 146 cooperates with a contact 155, or alternately with a contact 156. The switch 154 can also assume a neutral position out of contact with both of the two contacts 155 and 156.

The switch 146 is shown in its forward position in which the circuit for the motor 18 operates in what can be considered the forward direction to feed the work toward the saw blade. As appears, the switch pole 149 is connected with a wire 160 leading to one side of the motor 18. The other side of the motor is connected by a wire 161 to a wire 162 that leads to a limit switch mechanism 163. This limit switch has a contact 164 that can be engaged by a pole 165. As appears, a diode rectifier 166 is connected around this switch. The pole 165 is connected by a wire 167 to a pole 168 that is part of the limit switch for the opposite direction of movement of the motor. The pole 168 can close with the contact 169 leading to the wire 170 that is connected to the pole 151. A diode rectifier 171 is connected around the switch 168.

The foregoing provides the circuit from the output 145 of the amplifier through the forward-reverse switch 146, the motor in its forward direction, the two limit switches, again through the forward-reverse switch, to ground and back to the amplifier. If the forward-reverse switch 146 is shifted to its other position, moving the three poles 149, 151 and 154 all the way to the right in the illustration, the motor connections will be in the opposite direction. The pole 149 will be connected to ground 153 and the amplifier output 145 will be connected at the contact 148 through the pole 151, backward through the limit switches 168 and 165, and thence through the motor in the opposite direction, back through the pole 149 now connected at 150 to ground.

Dynamic braking is provided for the motor 18 by short circuiting its two wires 160 and 161 under certain circumstances. As illustrated, there is a wire 175 connected to the wire 160 and leading through a relay switch 176 and thence through a second relay switch 177 and by a wire 178 back to connect with the wire 161. When the two relay switches are closed, which is the condition when both relay coils are deenergized, the motor is short circuited, and the back e.m.f. generated thereby will cause the motor to stop abruptly.

However, normally when the circuit is rendered operative, one or the other of the relay switches 176 and 177 is opened. There is a wire 185 that leads from the output side of the rectifier 121 to two limit switch poles 186 and 187. The pole 186 is connected to the pole 169 and the pole 187 to the pole 165. The pole 186 can cooperate with the contact 188 connected by a wire 189 that leads through the coil 190 of the relay switch 176 and thence by wire 191 to the terminal 155, which in the drawing is illustrated as closed with the pole 154 of the forward-reverse switch which in turn is grounded. Consequently, at the position illustrated, the coil 190 would be energized and switch 176 is open, breaking the short circuit of the motor 18.

The other limit switch pole 187 is closed with the contact 192 that is connected by a wire 193 through the coil 194 of the relay switch 177 and that in turn is connected by a wire 195 to the other terminal 156 that can be closed with the pole 154. Thus when the pole 154 of the forward-reverse switch is in either of its extreme positions, one or the other of the two coils 190 and 194 will be energized to break the short circuit. However, when that switch is in its middle position, the short circuit is complete.

Operation

At a normal start, an appropriate feeding head is disposed on the forward end of the shaft 24, here assumed to be the head 50. The combined drive mechanism 17, motor 18, and control 19 are fitted over the rail 14 and may be secured thereto by thumbscrews if desired. However, the portion 21 of the housing 20 fits over the rail 14 with a smooth sliding fit and screws may be unnecessary.

The rail **14**, which as noted may have the apparatus mounted on it, is then fitted into the brackets **13** and the screws **15** are adjusted to bring the shaft **24** to the height suitable to the work. Thereupon the lock screws **16** are tightened and the position of adjustment is thereafter maintained. The operating assembly of drive mechanism motor and control is slid laterally on the rail **14** to bring the pressure point of the ramhead to the proper location with respect to the saw blade edge, taking into consideration the shape of the work to be sawed.

With the workpiece not in place, the shaft **24** is advanced in a manner to be described to its maximum forward position and the collar **80** advanced until it has just actuated the limit switch **71** by engagement against the switch actuator **73**. This action opens the two limit switch poles **168** and **186** as will appear.

It will be assumed that the several meters are appropriately calibrated, it being evident from the wiring diagram how this is done.

The apparatus is electrically energized by closing the master switch **113**. Energization is indicated by the fact that the pilot light **114** on the control panel glows. The switch **146** is at the outset in a neutral position where all of its poles are out of contact with active terminals. The limit switches are closed and, the head **53** being advanced by the spring **54**, the potentiometer **133** is in its normal position in which the motor can operate at its normal speed. The switch **135**, however, which enables the circuit controlled by the head **53** to be effective, is closed. The switch **136**, which is the fast advance switch, is normally open. The potentiometer knob **132** has been turned to place the potentiometer arm in its position to give the desired speed. This can be calibrated at the factory.

To operate the apparatus in a forward direction, the work is placed on the table ahead of the driving head and the forward-reverse switch button **146** is moved into its forward position. The switch pole **154**, being in engagement with the contact **155** and the limit switches **186** and **187** both being closed, the power is delivered from the rectifier **121** through the line **185**, the switch pole **186**, the wire **189**, the relay coil **190**, the wire **191**, the contact **155**, and the pole **154** to ground. The circuit can be completed through the ground wire **120** of the transformer. This causes the switch **176** to open, thereby breaking a short circuit between the terminal wires **160** and **161** of the motor **18**. The short circuit could otherwise be made from the terminal wire **160** by the wire **175**, the switch **176**, the switch **177** and the wire **178** to the terminal wire **161**.

Also when the forward-reverse switch **146** is moved to its forward position, the pole **149** closes with the contact **147** and the pole **151** closes with the contact **152**. The output from the amplifier **107** then passes through the wire **145** to contact **147**, the pole **149**, the line **160**, the motor **18**, the line **161**, the line **162**, the contact **164** of the closed limit switch **72**, the pole **165**, the connection **167**, the pole **168** of the limit switch **71**, contact **169**, the line **170**, the pole **151** of the forward-reverse switch **146**, to the terminal **152** and ground **153**. It will be seen that this causes current to flow in a direction illustrated as from bottom to top of the motor **18**, which thereupon turns in a forward direction, rotating the shaft **41**, the worm **42**, the worm gear **26** and advances the shaft **24** which is held against rotation by the key **34**. This causes the work *W* to be fed into the saw band *S* at a predetermined speed.

As the motor operates, the generator **105** is operated, since they are on the same shaft, the combination being an integrally constructed permanent magnet DC motor generator. The output of the generator **105** is then fed into the potentiometer, contact **132** and to the amplifier **107** in opposition to the applied voltage from the rectifier **121**. The net voltage of the amplifier is therefore the difference between the applied voltage and the generator voltage and varies with the speed of the generator. This causes the motor **18** to maintain a substantially constant speed, since, if it is slowed by increase in load, the opposing voltage from the generator is reduced and the net voltage in the output of the amplifier is increased, giving more voltage applied to the motor and an increase in torque to maintain speed.

The meter **140** can be calibrated in terms of voltage generated by the generator **105** which is a function of the speed of the motor.

To stop the feed, the switch **146** is drawn to its neutral position. This breaks the motor circuit from the amplifier, and breaks the circuit to the coil **190** so that the relay switch **176** closes, thereby short circuiting the motor terminals and producing dynamic braking to stop the motor abruptly.

To reverse the direction of the drive, the switch **146** is moved to its extreme right-hand position in FIG. **10**, whereupon the amplifier feeds from the wire **145** to the contact **148**, the switch pole **151**, the terminal **169**, limit switches **168** and **165**, terminal **164**, the line **162**, the line **161** through the motor now from top to bottom in the illustration, thence by the line **160** now closed through switch pole **149** to the terminal **150** and to ground at **153**. This is a current flow through the motor in the opposite direction, causing it to move in a reverse direction to withdraw the head and the work from the saw blade. The generator circuit is as before, but the polarity of the generator is reversed, casing the generator voltage to add to the applied voltage, so that the withdrawal speed is high. This is desirable, although under some circumstances, the generator connection should be reversed with reversal of the motor connections.

If the forward feed of the shaft **24** continues to such a point that the collar **80** shifts the limit switch **71**, the switch poles **168** and **186** of that switch open their respective contacts. This breaks the circuit of the coil **190** even though the switch **154** remains in its forward position, and it closes the short circuit to the motor terminals through the switches **176** and **177**. Opening of the switch pole **168** opens the forward motor circuit at that point. Dynamic braking follows.

In order to restart the motor **18**, with the shaft in its maximum forward position and the limit switch **71** open, the forward-reverse switch **146** is pulled to its reverse position. The output of the amplifier **107** the continues through the line **145** to the terminal **148**, the switch pole **151** and the line **170**. The limit switch **168** is open but current can flow in this direction only, through the diode **171** to the line **167**, the closed limit switch **165**, the line **162**, the line **161**, the motor **18**, the line **160**, the pole **149**, the terminal **150** and the ground **153**. At the same time, the movement of the pole **154** of the forward-reverse switch to the terminal **156** energizes the coil **194** because the other limit switch **187** is closed, which then opens the short circuit of the motor terminals. Thereupon the motor **18** operates in its reverse direction, withdrawing the shaft **24**. The early part of this movement recloses the limit switch **71**.

In like fashion, if the shaft **24** is withdrawn to such point that the limit switch **72** is opened, the coil **194** is deenergized, the motor windings are short circuited, and the circuit from the amplifier through the motor is open at the pole **165** of the limit switch **72**. This condition may be reversed by moving the forward-reverse switch to the forward position, because the motor circuit then can in that direction of current flow, bypass the open switch contact **165** through the diode **166**. A short amount of this forward movement will cause the limit switch **72** to be closed.

Thus it can be seen that there is dynamic braking in all cases where the motor circuits are opened. This characteristic prevents overtravel which will be a great disadvantage in a bandsaw.

If the force applied to the work is excessive, it can damage the saw teeth. This is particularly true where the teeth have become somewhat dulled, and unless precautions are taken, the band becomes damaged beyond the ability to be resharpened and repaired. This can be avoided by the use of the head shown in FIGS. **8** and **9**, with its electrical parts illustrated in FIG. **10**.

If the resistance of the work to the saw increases, it will cause the head **53** to telescope into the sleeve **50**, compressing the spring **54** in accordance with Hooke's law.

Usually after a predetermined amount of telescoping movement, the member 63 engages and begins to displace the actuator 68, which will do two things. After a predetermined movement, it will close a switch and sound an audible or visual alarm, warning the operator that the thrust is too great for the condition of the saw. Also the actuator 68 can displace the contact 133 in a direction to reduce the voltage drop across the resistor 133 and reduce thereby the net voltage on the output 145 to ground of the amplifier 107. This will cause the motor to slow down. When the resistance to feed has become alleviated, the spring 54 will return the head 53 to its expended position and the potentiometer 133 will be restored to its initial position. The switch 135, of course, is closed during this operation.

The change in voltage on the motor, caused by increased load, causes the feed to maintain a fixed speed regardless of the condition of the saw teeth. The effect of the telescopic ramhead 50 is to modify the motor speed when the resistance of the work to being cut exceeds a desired limit represented by the initial position of the head 53 under the influence of the spring 54.

The operating speed of the motor may be initially set by adjusting the knob 132 which resets the potentiometer 126, altering the amount of feedback voltage and hence altering the net voltage applied to the motor.

In order to increase the speed of operation temporarily, which may be desirable, for example, when the work is being initially brought up to the saw blade, the switch 136 is closed. This corresponds to movement of the potentiometer 133, and substantially increases the voltage applied to the motor and causes it to increase its speed.

What I claim is:

1. In a work feed for feeding work and a cutting tool together; a driving ram for moving the work and tool together for cutting of the work, driving means including a motor for operating the ram and for withdrawing it; and means in the driving means for adjusting the torque of the motor as the load changes to compensate for change of load and to maintain substantially constant speed of movement of the ram.

2. The work feed of claim 1, including means mounting the same on a worktable and means for adjusting it laterally and vertically.

3. The work feed of claim 1, including a rail upon which the work feed is mounted for sliding movement therealong; clamp means to receive the rail and secure it upon a worktable, interengaging means between the clamp means and the rail for displacing one relative to the other and adjust the height of the rail, and means to secure the rail tightly to the clamp means.

4. The work feed of claim 1 wherein the ram is a threaded shaft, and the driving means includes a housing and a motor, with a motor shaft, a wheel threaded onto the shaft and gearing between the motor and the wheel to rotate the wheel upon operation of the motor, and means in the housing to prevent rotation of the wheel threaded onto the shaft.

5. The work feed of claim 1, with means responsive to excess resistance of the work to being cut, to reduce the speed of the motor.

6. The work feed of claim 5, wherein the means responsive to excess resistance includes a resistingly yieldable device interposed between the motor and the work, yieldable with resistance of the work increases beyond a predetermined value, and means to reduce the speed and torque of the motor, operated by the yieldable device in its yielded position.

7. The work feed of claim 1, with means displaced in response to excess resistance of the work to being cut, and a sensible alarm operated by such displacement.

8. The work feed of claim 1 including means to short circuit the motor windings when the motor circuit is deenergized, to cause the motor to be retarded by dynamic braking.

9. The work feed of claim 1, including limit switch means to deenergize the motor circuit upon operation of the ram to an extreme, and means to short circuit the motor windings when the limit switch means is actuated, to achieve dynamic braking of the motor.

10. The work feed of claim 1, wherein the driving means includes a generator connected to be driven by the motor to produce a potential that varies with generator speed, and means applying the generator voltage in opposition to the energizing voltage applied to the motor, to reduce the net voltage applied to the motor as a function of increasing generator speed, and to maintain the speed of the motor substantially constant.

11. The work feed of claim 1 wherein the motor has means selectively operable at will for adjusting its speed to produce fast operation.