Aug. 1, 1967 H. L. CARR 3,333,612

INDUSTRIAL ELECTRIC SET WORKS

Filed March 29, 1965 2 Sheets-Sheet 1

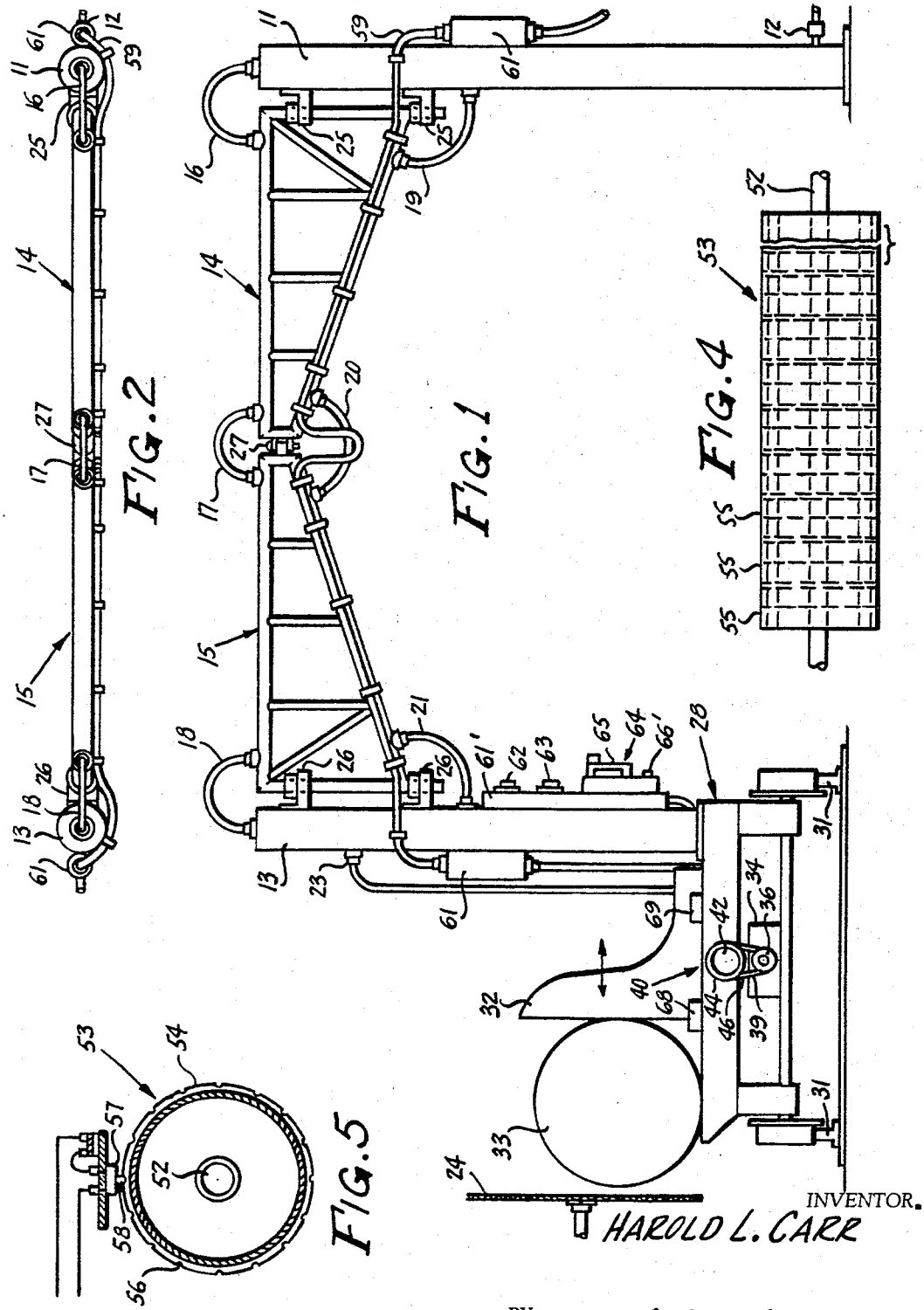

FIG. 1

FIG. 2

FIG. 4

FIG. 5

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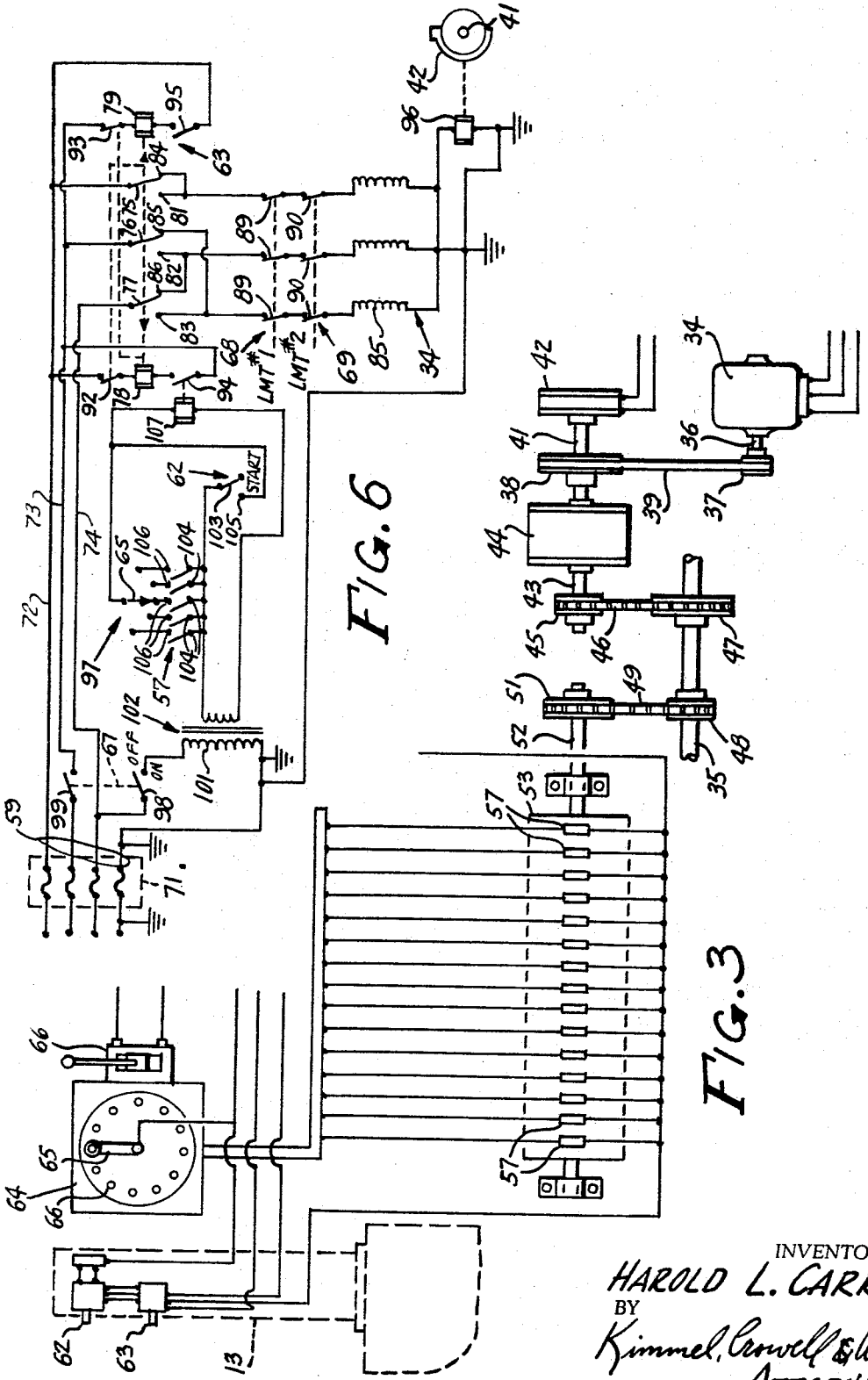

FIG. 6

FIG. 3

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INDUSTRIAL ELECTRIC SET WORKS
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ABSTRACT OF THE DISCLOSURE

A control system for saw mill knees comprising a drum having a plurality of channels and a plurality of switches associated with the respective channels, a selector switch connected in series with the respective channel switches, a holding circuit, and a momentary start switch for initiating a drive motor for repositioning the knees of the saw mill carriage, said holding circuit maintaining the motor in energized condition until the motor has driven the drum to a predetermined position corresponding to the selected channel and switch associated therewith is disclosed. A pantograph type frame for distributing power to a saw mill carriage is also disclosed.

The present invention relates generally to motor control systems particularly adapted to drive saw mill set shafts and, more particularly, to a controller having a motor driven record that stops the motor when it has been driven to a predetermined extent.

Briefly describing a preferred embodiment of the present invention, there is provided a motor for driving a set shaft synchronously with a record having a plurality of different tracks or channels thereon. The tracks are formed as a series of parallel indentations on the surface of a drum having a low coefficient of friction. Each track includes a microswitch having normally closed contacts that are opened when an indentation is reached. The number of tracks provided equals the number of expected different extents that the set shaft is to be driven. Selection of the desired extent to which the set shaft is driven is made with a switch that connects only one of the microswitches in a control circuit for the motor.

The motor control circuit is arranged such that power is supplied to the motor whenever the contacts of the microswitch in the selected track are closed. As soon as these contacts engage an indentation on the drum, power for the motor is removed and movement of its output shaft is immediately terminated in response to activation of an electromechanical brake. The motor is not started again until a start button, having its normally open contacts shunting the microswitch contacts, is momentarily activated. Activation of the start switch causes the motor, and hence the drum to be driven so that the microswitch contacts are again closed to enable the set shaft to be driven until the next indentation is reached.

The motor control system of the present invention is designed particularly, but not exclusively, to drive the set shaft of a saw mill works. The control system is ideally suited for this environment because of its low cost, simplicity and virtually maintenance free service. In addition, identical units are capable of controlling heavy or light loads, as well as motors of different ratings.

When the motor control circuit is utilized in its preferred environment, power is supplied thereto from a fixed source via a pair of freely pivotably pantograph arms. The end of one of the arms is carried by a carriage having mounted thereon the control circuit, electric motor and the usual knees that drive the logs relative to the saw blades. For the convenience of the sawyer, and to enable the lob to be set into position in a minimum time period, the start switch is mounted on the arm attached to the carriage. Each time the start switch is activated, the knees

advance the log toward the saw blade by the selected extent. Located at approximately the same location as the start switch is a switch for selecting what extent the knees are to be driven. Also, a reversing switch is provided for enabling the motor drive direction to be reversed whereby the knees can be retracted from the blade after a log has been completely cut.

Another feature of the present invention is that the knees can not be driven too close to the blade or retracted so far that they might be in danger of falling off the carriage. This safety feature is attained by connecting a pair of normally closed limit switches in the circuit that energizes the motor coil. The switches are opened to stop the motor drive shaft promptly if the knees travel too close or far away from the saw blade.

An additional feature of the invention is that once the motor has begun to translate the knees in one direction, it cannot be reversed. This lock-out feature is particularly useful when the knees are being driven toward the saw blade under control of the automatic stopping arrangement associated with each track. It prevents slip between the microswitch and drum surface that might occur when the drum rotation direction is suddenly reversed. Slippage could result in the microswitch being incorrectly translated relative to the drum, so that the knee position is not thereafter correctly correlated with the microswitch position on the drum.

It is, accordingly, an object of the present invention to provide a new and improved motor control system particularly adapted for use with a saw mill set works.

Another object of the invention is to provide new and improved, inexpensive motor control system that is relatively uncomplicated and requires very little maintenance.

A further object of the invention is to provide a new and improved motor control system employing a record having plural tracks, one of which is selectively activated to control the extent that the motor is driven each time a start switch is activated.

An additional object of the invention is to provide a saw mill set works in which the sawyer is able to conveniently and automatically drive the set shaft to one of a plurality of extents through an inexpensive, uncomplicated mechanism that requires little or no maintenance.

The above and still further objects, features and advantages of the present invention will become apparent upon consideration of the following detailed description of one specific embodiment thereof, especially when taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a plan view of a pantograph arm in combination with a carriage in accordance with a preferred embodiment of the present invention;

FIGURE 2 is a top view of the pantograph arm of FIGURE 1;

FIGURE 3 is a partially schematic drawing of the electromechanical control apparatus of the present invention;

FIGURE 4 is a plan view of the program drum employed in FIGURE 3;

FIGURE 5 is a side view of the drum of FIGURE 4; and

FIGURE 6 is a schematic diagram of the control circuit according to the present invention.

Reference is now made to FIGURES 1–5 of the drawings, wherein stationary stand pipe **11** forms a reservoir for storing air supplied thereto by an external supply (not shown) via fitting **12**. Air fed from stand pipe **11** is coupled to a further stand pipe **13** via the pipes in pantograph arms **14** and **15** via air hoses **16–21**. From stand pipe **13**, fitting **23** supplies the stored air to operate a cylinder to "dog" and "hand" the log in position.

Pantograph arms **14** and **15** are pivotably connected to stand pipes **11** and **13** via hinges **25** and **26**, respectively.

Arms 14 and 15 are also free to rotate relative to each other by virtue of hinge 27 that joins the arms. The stand pipe 13 is translated along rails 31 in response to movement of carriage 28.

On the upper horizontal surface of carriage 28 is mounted knee 32 for bringing log 33 into cutting relationship with blade 24. Log 33 is fastened in situ relative to knee 32 by teeth on the knee operated by an air cylinder which is controlled by the sawyer. Knee 32 is translated relative to the position of blade 24 in response to activation of three phase electric motor 34, mounted on carriage 28, which motor drives set shaft 35, FIGURE 3.

Set shaft 35 is coupled to motor shaft 36 through a mechanical linkage comprising pulley wheels 37 and 38 that are connected together by V belt 39. Wheel 38 drives shaft 41 that is held immovable by electromechanical brake 42 except when power is supplied to motor 34. Shaft 41 is geared to shaft 43 through 100:1 reduction gear box 44 so that the latter shaft drives sprocket 45 at low speed and high torque. The teeth on sprocket 45 drive chain 46, that in turn rotates sprocket 47 that is fixedly secured to set shaft 35. Set shaft 35 is connected in driving relationship with knee 32 by any well known means, such as a rack and pinion.

A further sprocket wheel 48 is fixedly secured on set shaft 35 to drive chain 49, attached by way of sprocket 51 to shaft 52. Shaft 52 rotates record, which is preferably in the form of a drum 53; the angular position of the record is thereby directly correlated with the position of the vertical edge of knee 32 relative to saw blade 24.

Secured to the outer surface of record (drum) 53 that is positioned on the underneath side of carriage 28 and has its longitudinal axis aligned with shaft 41, is sleeve 54. Sleeve 54 is fabricated from an electrically insulating material having a low coefficient of friction and is not subject to wear, such as Teflon. Plural parallel tracks or channels 55 extend about the periphery of sleeve 54, which may be considered as a multi-channel record. Each track includes a plurality of equally spaced indentations 56 in the surface of sleeve 54 with the indentation spacings on each track being different. The distance between adjacent indentations on each track is correlated exactly with translation of knee 32 in response to rotation of set shaft 35. The number of tracks 55 corresponds with the expected number of log cutting settings normally desired in a mill operation.

Each track 55 is provided with a microswitch 57, having finger 58 that selectively engages indentations 56. When finger 58 engages an indentation, the contacts of microswitch 57 are opened. The opposite condition of the microswitch contacts occurs when finger 58 rides on the surface of sleeve 54 between adjacent ones of indentations 56.

Three phase power for motor 34 is supplied from a suitable source located adjacent to stand pipe 11. The power is fed to the motor and circuit controlling it via cables 59 and power boxes 61 attached to pantograph arms 14, 15 and stand pipes 11, 13 respectively. The box on stand pipe 13 includes start switch 62 and reverse switch 63, both of which are manually activated by the saw mill operator. Positioned on box 61, below reversing switch 63, is switch box 64 having a rotatable contact arm 65 that is adapted to engage one of contacts 66 that are circularly located about the arm pivot point. Mounted to one side of switch box 64 is lever type "on-off" switch 66'.

To prevent knee 32 from being translated too far or close to saw blade 24, a finger indicated at 40 is fixedly mounted on the knee. Finger 40 is adapted to engage the contacts of microswitches 68 and 69, fixedly mounted on the upper surface of carriage 28. When the contacts of either microswitch 68 or 69 are engaged by fingers 40, power to motor 34 is interrupted to prevent possible damage to knee 32.

Reference is now made to the circuit diagram of FIGURE 6 wherein power from a three phase, four-wire, 60-cycle source is applied through fuse box 71 to cable 59.

Each of the three phases on leads 72–74, respectively, is connected to a separate one of switch armatures 75–77, respectively.

Armatures 75–77 are controlled from their central, unconnected position by relay coils 78 and 79; the former activating the armatures to the left into engagement with contacts 81–83 and the latter activating the armatures to the right into engagement with contacts 84–86. Power is supplied to coils 78 and 79 by the phase voltage between leads 72 and 73. In series with each of coils 78 and 79 are separate relay contacts 92 and 93 activated by the other coil so that only one coil can be activated at a time. Additional contacts 94 and 95 are connected respecively in series with coils 78 and 79 and the power source activating them. Contacts 95 are closed directly by activating reverse switch 63 while contacts 94 are closed in response to activation of start switch 62, in a manner seen infra. With coil 78 activated, power is supplied to field coils 85–87 of motor 34 via contacts 89 and 90 of limit or microswitches 68 and 69, causing rotation of shafts 35 and 36 in a first direction. Simultaneously, contact 93 is opened so power cannot be fed to coil 79. Thereby, depression of reverse switch 63 to closed contacts 95 now has no effect on motor 34. Activation of coil 79, with coil 78 deactivated, connects windings 85 of motor 34 to leads 72–74 in a manner such that motor shaft 36 rotates in a direction opposite to that from which it rotates when coil 78 is activated. With power supplied to coil 79, contacts 92 open to prevent energization of coil 78.

To stop set shaft 35 and knee 32 exactly at the points they occupy when motor 34 is de-energized, coil 96 is connected across one of the windings 85 of motor 34. Coil 96 is electromechanically coupled with brake 42 for shaft 41 so that the brake is normally energized and is released to permit shaft rotation only when power is supplied to the motor winding.

The circuit 97 for controlling contact 94 is connected between one phase 74 and ground through contact 98 of "on-off" switch 67. The other contact 99 of switch 67 is connected to phase 73 so that motor 34 cannot be activated in response to accidental closing of reverse contact 95. The input of circuit 97 is the primary winding 101 of step down transformer 102, the 24 volt secondary of which is connected in parallel to armature 103 of start switch 62 and to one contact 104 on each of the microswitches 57 for the various tracks 55. The other side of start switch 62, contact 105, is selectively connected to contact 106 of one of the microswitches 57 via rotary arm 65. The junction between arm 65 and contact 105 is connected to one side of relay coil 107 that activates armature 94, with the other side of the coil connected to the secondary winding of transformer 102.

To provide a fuller understanding of the manner by which the present invention functions, an operating cycle will now be described. It is assumed that the log is secured in place on carriage 28 in abutting relationship with knee 32 and a few cuts have been taken.

The next cut is initiated by depressing start switch 62, momentarily, connecting armature 103 to contact 105 so coil 107 is energized. Energization of coil 107 causes contacts 94 to close so that coil 78 is activated, closing armatures 75–77 on contacts 81–83, respectively, and opening contact 93 so coil 79 cannot be seized. Motor shaft 36 now begins to turn, translating knee 32 toward blade 24, because of the polarity of the three phase voltages supplied to windings 85 of motor 34. As shaft 36 rotates, drum 53 so that finger 58 is pushed out of the indentation it formerly occupied and rides on the outer Teflon surface 54. As finger 58 rides on the outer drum surface 54, contacts 104 and 106 of the microswitch associated with the selected track 55 are connected together, whereby current flows through these contacts and contact arm 65 to relay coil 107. Thus, a locking circuit is provided for relay coil

107 so that motor shaft 36 continues to rotate after switch 62 has been released.

Coil 107 remains energized until shaft 52 rotates drum 54 to a position where finger 58 for the selected track falls into the indentation adjacent to the indentation it previously occupied. When this occurs, contacts 104 and 106 of the microswitch now connected to switch 65 are open circuited, breaking the energizing circuit for relay coil 107. In consequence, contacts 94 open, relay 78 is deactivated and power is no longer supplied to windings 85. Motor and set shafts 36 and 35 and are immediately stopped due to the force appplied by brake 42 to shaft 41.

After a log has been completely cut and knee 32 must be returned to a position where another log can be secured in situ on carriage 32, reverse switch 63 is depressed. As long as switch 63 remains depressed, coil 79 is activated so shafts 35 and 36 rotate oppositely from the direction that they turned when coil 78 was activated. If the sawyer neglects to release switch 63 when knee 32 reaches the edge of carriage 28 remote from blade 24, finger 67 engages microswitch 69 to open contacts 90. Opening contacts 90 de-activates motor 34 and energizes brake 42, thereby preventing further travel of knee 32. To prevent the sawyer from damaging knee 32 or blade 24 when the knee is being translated toward the blade, contacts 89 are opened when finger 67 engages microswitch 68, at the edge of carriage 28 proximate the saw blade.

To provide an indication of the manner by which the present invention is utillized for cutting a pair of logs into boards of two different sizes, the following two examples are given.

In the first example, it is assumed that the sawyer desires to cut the log into 1" x 12" boards. Two sides of the log are to be sawed, thus 1" boards are taken off two sides. The last cut side is turned down, and selector dial 65 is set on a 12" program. One inch boards are taken until a timber 12" in width is left on knees 33. The last cut side is then turned down and selector dial 65 is set on a 1" program. The log is then cut into 1" x 12" boards (as predetermined by the indentions on drum 54) leaving a 2" backing board on the knees.

Assume that the sawyer desires to cut a second log into 2" x 6" boards. Two sides of the log are sawed by taking 1" boards off of the two sides. The last cut side is turned down, and selector dial 65 is set on a 6" program. One inch boards are taken until a timber 6" in width is left on knees 33. The last cut side is then turned down and selector dial 35 is set on a 2" program. The log is then cut into 2" x 6" boards (as predetermined by the indentations on drum 54) leaving a 2" backing board on knees 33.

Since the two specific cutting sequences given are merely exemplary, it is to be understood that indentations on drum 54 may be arranged to provide any predetermined number of different width cuts.

While I have described and illustrated one specific embodiment of my invention, it will be clear that variation of the details of construction which are specifically illustrated and described may be resorted to without departing from the true spirit and scope of the invention as defined in the appended claims.

I claim:

1. A system for selectively controlling the degree of travel of a motor shaft comprising normally open switch means connected in series between a power supply and a coil of said motor, current responsive means for selectively opening and closing said switch means, said last named means comprising: a normally open switch for selectively supplying current from a current source to said current responsive means, and a record driven by said shaft, said record including a plurality of channels, each of said channels including normally closed switch means selectively opened in response to said record being driven to predetermined positions, and means for selectively connecting only one of said normally closed switch means in shunt with said normally open switch means.

2. The system of claim 1 wherein said record comprises a drum having a surface with a multiplicity of indentations, each of said channels including several of said indentations aligned longitudinally on said drum along the same circumference of said drum, each channel including a microswitch selectively engaging the indentations of its respective channel, said microswitches being open circuited only when they engage said indentations.

3. The system of claim 2 wherein said surface is "Teflon."

4. The system of claim 1 further including an electromagnetically activated brake having an activating coil in series with said normally open switch means and said power supply, said brake being deactivated only when said switch means is closed.

5. The system of claim 1 further including a normally closed limit switch in series circuit between said current source and said normally open switch, said limit switch being operated in response to said shaft being driven to a predetermined extent.

6. A system for controlling the extent of travel of a sawmill knee relative to a carriage carrying the knee, the knee being driven toward and away from a saw blade in response to rotation of a set shaft, comprising a pair of hinged arms rotatable relative to each other in the vertical plane, the unhinged end of one of said arms being fixed and the unhinged end of the other arm being secured to said carriage, an electric motor mounted on said carriage having a shaft coupled to said set shaft, said arms carrying a cable for supplying electric power from said fixed end to said motor, a circuit for controlling the travel of said motor shaft to one of a plurality of different predetermined extents, means for selecting one of said different extents at a time, a start switch mounted on the unhinged end of said other arm, means coupled to said start switch and said controlling circuit for driving said motor shaft so that said knee is translated toward said blade by only said selected predetermined extent in response to momentary activation of said start switch.

7. The system of claim 6 further including a reversing switch mounted on the unhinged end of said other arm, and means coupled to said reversing switch and said controlling circuit for rotating said motor shaft so that said knee is translated away from said blade only when said reverse switch is activated.

8. The system of claim 6 wherein said controlling circuit comprises normally open switch means connected in series between a power supply and a coil of said motor, current responsive means for selectively opening and closing said switch means, said last named means comprising: a normally open switch for selectively supplying current from a current source to said current responsive means, a record driven by said shaft, said record including a plurality of channels, each of said channels including normally closed switch means selectively opened in response to said record being driven to predetermined positions; said means for selecting including means connecting only one of said normally closed switch means in shunt with said normally open switch means.

9. The system of claim 8 wherein said record comprises a drum having a surface with a multiplicity of indentations, each of said channels including several of said indentations aligned longitudinally on said drum along the same circumference of said drum, each channel including a microswitch selectively engaging the indentations of its respective channel, said microswitches being open circuited only when they engage said indentations.

10. The system of claim 8 further including an electromagnetically activated brake having an activating coil in series with said normally open switch means and said power supply, said brake being deactivated only when said switch means is closed.

11. The system of claim 8 further including a pair of normally closed limit switches in series circuit between said power supply and said coil, one of said limit switches being activated in response to said knee being driven to a predetermined extent toward said blade, the other of said limit switches being activated in response to said knee being driven to a predetermined extent away from said blade.

12. The system of claim 8 further including a reversing switch mounted on the operator's lever, and means coupled to said reversing switch and said controlling circuit for rotating said motor shaft so that said knee is translated away from said blade only when said reverse switch is activated.

13. The system of claim 12 further including means coupled with said controlling circuit for preventing said motor shaft driving said knee away from said blade once said knee has begun to be driven toward said blade.

14. The system of claim 13 further including means coupled with said controlling circuit for preventing said motor shaft driving said knee toward said blade once said knee has begun to be driven away from said blade.

15. In a system for controlling the travel of a sawmill knee relative to a carriage carrying the knee, said knee being selectively driven by a motor, the improvement wherein the control system comprises:

a record which includes a plurality of control channels;

means interconnecting the record and the motor for driving the record to positions corresponding to the knee positions;

a plurality of switches positioned to be opened and closed according to the position of the record, each of said switches being individually associated with the respective channels for control thereby;

a selector switch; and

circuit means interconnecting the selector switch with the respective switches associated with the channels for controllably driving the motor in accordance with the position of the record and with the selected switch and channel associated therewith.

16. The system of claim 15 further comprising:

a momentary operating start switch;

circuit means interconnecting the start switch, the selector switch and the individual switches associated with the channels for selectively energizing said motor; and

circuit means for maintaining said motor in energized condition until said record has moved to a predetermined position dependent upon which channel was selected by said selector switch.

References Cited

UNITED STATES PATENTS

2,661,036	12/1953	Balch et al.	143—120
2,985,282	2/1961	Elworthy	143—120 X
3,128,803	4/1964	Thrasher	143—115

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