Sept. 11, 1956 W. W. SMITH 2,762,402

SAW MILL CARRIAGE AND DRIVE THEREFOR

Filed July 9, 1945

2 Sheets-Sheet 1

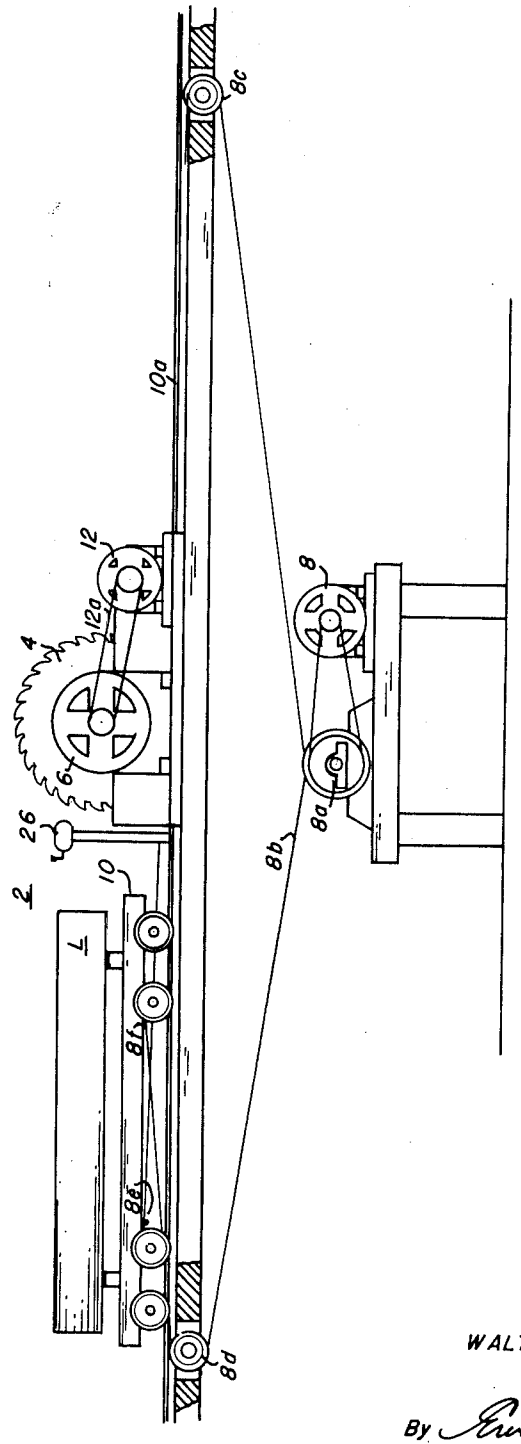


FIG. 1

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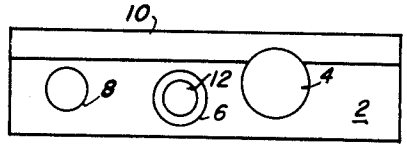
FIG. 3



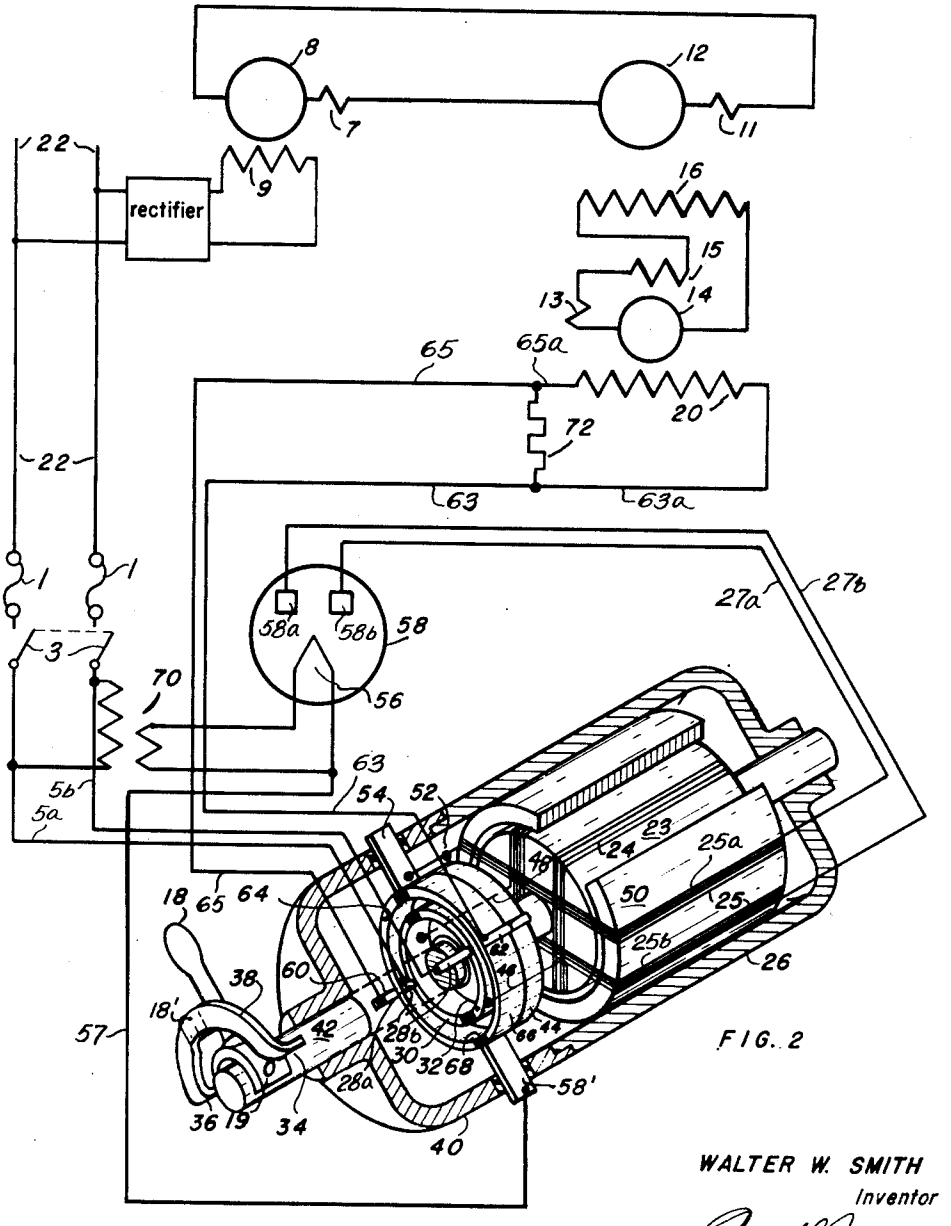




FIG. 2

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# SAW MILL CARRIAGE AND DRIVE THEREFOR

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12 Claims. (Cl. 143—108)

This invention relates to lumber sawing mills, and more particularly to large mills used for sawing logs longitudinally into smaller cross section as well as smaller mills for sawing the sections into boards and machines for milling the boards into special wood manufactures such as battery separators and the like. More specifically the invention relates to a system of control for such mills which is applicable to large and small mills alike and which is adaptable for manual control or for automatic control.

Certain features of this invention described but not claimed in this patent are described and claimed in my copending applications Ser. No. 76,615 filed February 15, 1949, and issued March 9, 1954, as Patent No. 2,671,886, and Ser. No. 193,048 filed October 31, 1950, and abandoned.

In large mills for sawing logs into smaller sections the control of the sawing operations is necessarily manual because a log is a non-uniform object requiring the exercise of judgment by a skilled "sawyer" as to what cut to make, the speed of feed, and so on. In smaller mills where the operations are unvaried and moreover desirably uniform, the control of the sawing operations is preferably automatic. It is one of the objects of this invention to provide a saw mill the control of which is adaptable for both manual and automatic operation so that a uniform type of apparatus may be employed for controlling both types of mills with attendant advantages including that the operators need become familiar with but a minimum of equipment.

This invention relates more particularly to such mills which are driven by electrical motors and in which the control is electrical in character and has for a further object the provision of a highly sensitive and responsive controlling system which permits the sawyer to maintain a much higher production rate than has heretofore been possible, through the provision of control which permits high speeds of feeds and practically instantaneous response to starting, accelerating, decelerating, and stopping demands by the operator. Thus, where logs vary in length or diameter, the length and speed of approach of the carriage to the saw being a variable, the feed is accurately controlled to approach at a maximum speed and is decelerated at the saw by the sawyer to permit the required speed for initiating the cut.

Other objects and advantages will appear from a consideration of the following specification and the accompanying drawings, in which like characters of reference refer to like parts and in which:

Figure 1 shows a saw mill embodying my invention;

Figure 2 shows the wiring of the electrical system for driving and controlling the mill; and

Figure 3 is a diagrammatic representation of Figure 1 for use in connection with Figure 2.

Referring first to Figure 1, the mill comprises a saw **4** driven by a motor **6**, and a carriage **10** driven by a motor **8** in reciprocation, to and from the saw, of the log L. A manual controller **26** is mounted for manual actuation by the sawyer while observing the operation of the saw and carriage. The drive of the carriage, which travels on rails **10***a*, is by a cable **8***b* trained over pulleys arranged at **8***c* and **8***d* endwise of the limits of travel and rotating drum **8***a*, said cable being fastened to the carriage **10** at **8***e* and **8***f*.



The usual source of available power is alternating current. The most flexible control is effected through employing a direct current separately excited carriage feed motor **8**, having commutating poles series connected. Power for this drive is obtained from the shaft of motor **6** through a belt which drives the direct current generator **12**, the motor **6** being chosen to have sufficient power to drive both the saw **4** and, through generator **12**, the carriage feed motor **8**. The field excitation of motor **8** is derived from a suitable direct current source, such as a rectifier feeding the field winding **9**. The direct current generator **12** delivers a voltage which is manually controlled through separate excitation, and feeds its own commutating field **11** as well as that of motor **8** at **7** and the armature of motor **8**. Through provision of the commutating fields **7** and **11**, the severe commutation duty imposed is, of course, minimized.

The manual excitation control of generator **12** is exercised in the form illustrated through an exciter **14** preferably driven by motor **6** and being mounted on the same shaft as generator **12** as is well known in the electrical generating art, having the separately energized field winding **20** and an opposing series field winding **15** which exciter is very sensitive to changes in its separate excitation to provide a corresponding response in the generated voltage of generator **12**. The field **20** of the exciter **14** is provided with a discharge resistance **72** for the purpose of protecting the manual controller and rectifier tube to be described.

The excitation of field **20** of the exciter is obtained from a source of variable direct current voltage which voltage is derived from a source **22** of constant alternating current voltage through a source of continuously variable alternating current voltage. A source of alternating current voltage of constant value, such as supplied by a utility at **22** is applied to the controller **26** and a rectifier **58**, the controller including a transformer **50** having a continuously variable ratio of transformation under the control of the operator actuated handle **18** provided to rotate shaft **42** and the rotor core **23** of the primary winding **24** to vary the coupling of winding **24** with secondary **25** between zero and a maximum when **24** and **25** are parallel. Current from source **22** is conducted to the rotor winding **24** via fuses **1**, switch **3**, conductors **5***a* and **5***b*, brushes **28***a* and **28***b* contacting slip-ring-like sectors **30** and **32** and connecting leads **48** and **46**. In the position shown, current flows in the winding **24** but none flows in the secondary **25** since none is effectively generated therein.

The field **20** secures its flow of current in either of two directions depending upon the position of handle **18** at the right or left of notch **18'**. One side of the secondary winding **25** is connected to a brush **54** which contacts either one of the half-rings **64** and **66**. The current, flowing only from the plates **58***a* and **58***b* to the filament **56** in rectifier tube **58**, flows only in the direction from brush contact **54** to secondary winding terminal **52** under all conditions of flow, and hence, when contact **54** is in contact with slip ring segment **64** the flow is from filament **56**, through conductor **57**, to and thru brush **58'** to and thru slip ring segment **66** to and thru brush **62** to and thru conductors **63** and **63***a* making the right hand terminal of field winding **20** positive and leftward in field **20** thence to and thru conductors **65***a* and **65** to and thru brush **60** to and thru slip ring segment **64** to and thru brush contact **54** to and thru secondary coils

25*a* and 25*b*, to and thru the anodes 58*a* and 58*b* of rectifier tube 58 to the filament 56; and when brush 54 is in contact with slip ring segment 66, the flow is from filament 56 via conductor 57, brush 58', slip ring segment 64, brush 60, conductors 65 and 65*a* to make the left end of field winding 20 positive, rightward thru winding 20 and via conductors 63*a*, 63, brush 62, slip ring segment 66, brush 54, secondary coils 25*a* and 25*b* and conductors 27*a* and 27*b*, anodes 58*a* and 58*b* and back to filament 56. Thus, by shifting the handle 18 clockwise slightly the direction of current flow in 20 is selected for one direction of drive. In making such shift, however, no current flow is interrupted because there is no voltage being induced in the secondary sufficient to cause the tube 58 to conduct. Only after contact has been made between 54 and 66, as well as 58' and 64, does sufficient voltage result in winding 25 to cause current to flow in tube 58. Therefore no current flow is broken in the circuit changer involving brushes 54 and 58' and slip-ring-like contacts 64 and 66.

The rotation of shaft 42 is limited by stops 34, so that brushes 28*a* and 28*b* are always in contact with the respective rotating contacts 30 and 32, and so that one brush never leaves contact with its assigned rotating contact 30 or 32. Thus the direction of flow of current in field 20 is always in one direction corresponding to a direction of rotation of handle 18.

The slip-ring-like contacts 30, 32, 64, and 66 are mounted securely to shaft 42 so as to rotate therewith, being carried on an annular insulating plate 44.

The handle 18 is preferably provided with a centering feature including the notch 18' and a pivot for the handle at 19 to permit the handle to drop into the notch when in center position.

The filament 56 of tube 58 is excited from source 22 through a transformer 70.

I claim:

1. In combination in a saw mill, a saw, means for driving the saw, a carriage for carrying the work to and from the saw, means for driving the carriage comprising a reversible direct current electric motor, a direct current generator for supplying energy to said direct current carriage driving motor, means for driving said direct current generator, and exciting means for said generator comprising a rectifier, a source of alternating current, a controller embodying therein a continuously variable ratio transformer and a reversing switch, the output of said transformer being connected to the rectifier and the excitation system of the generator and the reversing switch so that direct current of either of two polarities may be supplied to the excitation system, and the transformer being of continuously variable ratio so that any desired value of current may be applied to the field of the generator, said controller embodying a single manual controller for concurrently controlling the direction of carriage drive and its speed.

2. Timber sawing apparatus comprising, in combination: a carriage for carrying timber to be sawed, means for driving said carriage in reciprocation comprising a reversible electric motor and means for connecting the motor to the carriage for driving thereof; a variable voltage electric generator and connections therebetween and the reversible motor to apply the voltage of the generator to the reversible motor, said variable voltage electric generator comprising a field winding; and means for applying current to said field winding in selectively variable amounts to cause said generator to vary its generated voltage comprising an excitation generator having a field winding, a source of alternating current of substantially constant voltage, and means for translating a unidirectionally variable current to the field winding of the excitation generator from the alternating current source including a manual controller mounted in view of the carriage so that the speed of the carriage may be varied at will.



3. Timber sawing apparatus comprising, in combination: a carriage for carrying timber to be sawed, a source of alternating current, a motor mechanically connected for driving the carriage, a second motor and generator for generating a variable voltage to power the first motor, the second motor being connected to the alternating current source; the generator having a field winding; and a source of reversible variable field current for application to the generator field winding for varying the voltage generated by the generator, said source comprising a rectifier and a manually operable controller mounted adjacent the carriage, said controller having stationary and rotary coils and having stationary and rotary switch parts and having brushes and slip rings cooperating therewith, the slip rings being connected in circuit with the movable coil and with the brushes and source of alternating current, and the switch parts and stationary coil being connected in circuit with the rectifier to form a part of the source of reversible variable field current so that when the controller is moved a current is induced in the stationary coil proportional to the rotation of the rotatable coil and so that at certain positions of the parts little or no induction occurs between the coils and reversal of the circuit connections by the switch parts occurs.

4. Timber sawing apparatus comprising, in combination: a carriage for carrying timber to be sawed, a source of alternating current, a carriage motor mechanically connected for driving said carriage in reciprocation; a second motor and generator for generating a variable and reversible voltage to power the carriage motor and effect any required speed thereof in either direction of reciprocative movement of said carriage, the second motor being powered directly by the source of alternating current to drive the generator, and the generator having a field winding; a rectifier having a cathode and two anodes; means for controlling the speed and the direction of rotation of the carriage motor through controlled energization of the field winding including a manual controller positioned to permit viewing the carriage in operation having a pair of stationary coils each connected at one end to one of the anodes and a stationary switch contact connected to both stationary coils at their other ends and a pair of stationary contacts connected to the ends of the field winding and a fourth stationary contact connected to the cathode of the rectifier, the controller having a rotor providing a coil rotatable to either of two positions to provide a maximum inductive coupling with the stationary coils and rotatable to one position to provide inductive coupling of minimum value, slip rings connected to the rotatable coil and brushes with circuit connections from the source of alternating current for applying alternating current at the circuit voltage to the rotary coil and the rotor further having a pair of rotary arcuate contacts disposed with respect to the first four mentioned contacts so that at minimum induction the stationary coil circuits are open and whereby slight rotation of the rotor in one direction permits current to flow in one direction to one terminal of the field winding, and so that by a slight rotation from such position in the other direction current is permitted to flow in one direction to the other terminal of the field winding.

5. In timber sawing apparatus having a carriage, an electric motor for driving said carriage at variable speed and in either one of two directions, having an electrical generator connected to variably power said electric motor to cause the same to rotate in either direction of rotation at any speed in proportion to the voltage generated by said generator, and having a source of power for driving said generator, means for altering the polarity and value of the voltage generated by said generator comprising, in combination: a field winding for said generator; a source of alternating current; means for converting energy from said alternating current source to energy in unidirectional current form and for reversing

and varying such current including a rectifier having two anodes and a cathode; a controller having a pair of stationary coils on one end of each of which is connected a respectively one of the anodes and the other ends of these coils being connected together at a common junction, the controller further having a rotary coil connected to the source of alternating current and a manual means for rotating the rotary coil to vary the induction of voltage in the stationary coils, and the controller further including switching means connected to the field winding, the rectifier, and the stationary coils to change the direction of current flow through the field winding as the controller rotates the rotatable coil in varying the voltage induced in the stationary coils.

6. Apparatus for applying unidirectional currents of variable amounts and reversible in direction to a load circuit such as the field winding of an electric generator to reverse its voltage polarity comprising a first pair of brush type switch contacts for connection with the load circuits, a shaft journalled for rotation on an axis between the said first pair of contacts, a second pair of brush type contacts disposed at opposite sides of said shaft axis each of which is peripherally positioned arcuately midway between the contacts of the first pair of contacts, two arcuate contacts mounted on the shaft respectively of arcuate extent and arrangement to, in one position of the shaft, contact one of the first pair of contacts and lie adjacent to but out of contact with the contacts of the second pair of brush contacts, an alternating current transformer having a primary winding and a secondary winding, means for rotating one of said windings in synchronism with said shaft, the other of said windings being so arranged that upon rotation of the first winding the magnetic axes of the windings shift relatively to vary their mutual inductance between a minimum and a maximum value, a source of alternating current connected to one of said windings and a rectifier connected in circuit with the other winding and the second pair of contacts, the arrangement being such that minimum mutual induction between the windings occurs while the shaft is in the said one position.

7. An apparatus for translating alternating current to unidirectional current and for varying the average value of the unidirectional current continuously from a maximum value of one polarity toward zero value and toward a maximum value of the opposite polarity comprising in combination: a transformer having primary and secondary windings, the secondary windings being in two sections joined together at a common tap; an electronic valve having two anodes and a cathode; switch means, the two sections of the secondary winding being connected to the valve anodes and the cathode of the valve being connected to the switch means, the switch means including a pair of load circuit terminals and means for connecting the common tap to either one of the load circuit terminals and the cathode to the other one of the load circuit terminals; and means for changing the relation of the primary and secondary windings while changing the switch position so as to vary the value of the current in the secondary winding.

8. Apparatus for converting alternating current to unidirectional current and for manually changing the value of the unidirectional current and, while the unidirectional current is a minimum or zero, changing its direction of flow comprising, in combination: a frame, a shaft journalled in said frame, means on said shaft and said frame for positioning the shaft in a neutral position, a transformer winding on said shaft having its turns disposed to induce a magnetic field at right angles to the shaft axis, a secondary transformer winding on the frame disposed to have its magnetic axis at right angles to the shaft axis, a source of alternating current connected to the first winding, a rectifier, and switch means including load circuit contacts associated with the shaft, the rectifier and the secondary windings to control the voltage and current flowing in the rectifier and load circuit as the primary winding is rotated about the shaft axis.



9. In combination in a saw mill, a saw, means for driving the saw, a carriage for carrying work to and from the saw, means for driving the carriage comprising a reversible direct current electric motor, a direct current generator for supplying energy to said direct current carriage driving motor, said direct current generator being driven by the means for driving the saw, and exciting means for said generator comprising a rectifier, a source of alternating current, a controller embodying therein a continuously variable ratio transformer and a reversing switch, the output of said transformer being connected to the rectifier and the excitation system of the generator and the reversing switch so that direct current of either of two polarities may be supplied to the excitation system, and the transformer being of the continuously variable ratio type so that any desired value of current may be applied to the field of the generator, said controller embodying a single manual controller for concurrently controlling the direction of carriage drive and its speed.

10. In combination in a saw mill, a saw, means for carrying work to and from the saw including an electric motor and an electric generator for supplying energy to said motor, another motor for driving said saw and said generator, and means for controlling the energy delivered to said first motor to cause speed and directional changes in operation thereof comprising an apparatus for translating alternating current to unidirectional current and for varying the average value of the unidirectional current from a maximum value of one polarity toward and through zero value and toward a maximum value of the opposite polarity including: a transformer having primary and secondary windings, the secondary winding being in two sections joined together at a common tap; an electronic valve having two anodes and a cathode; switch means, the two sections of the secondary winding being connected to the valve anodes and the cathode of the valve being connected to the switch means, the switch means including a pair of load circuit terminals and means for connecting the common tap to either one of the load circuit terminals and the cathode to the other one of the load circuit terminals; and means for changing the relation of the primary and secondary windings while changing the switch position so as to vary the value of the current in the secondary winding.

11. In combination in a saw mill, a saw, means for carrying work to and from the saw including an electric motor and an electric generator for supplying energy to said motor, another motor for driving said saw and said generator, and means for controlling the energy delivered to said first motor to cause speed and directional changes in operation thereof comprising an apparatus for translating alternating current to unidirectional current and for varying the average value of the unidirectional current continuously from a maximum value of one polarity toward and through zero value and toward a maximum value of the opposite polarity including: a transformer having primary and secondary windings, an electronic valve having an anode and a cathode; switch means; the secondary winding having one end thereof connected to the valve anode and the cathode of the valve being connected to the switch means, the switch means including a pair of load circuit terminals and means for connecting the other end of the secondary winding to either one of the load circuit terminals and the cathode to the other one of the load circuit terminals; and means for changing the relation of the primary winding to the secondary winding while changing the switch position so as to vary the value of the current in the secondary winding.

12. In combination in a saw mill, a saw, means for carrying work to and from the saw including an electric motor and an electric generator for supplying energy to said motor, another motor for driving said saw and said

generator, and means for controlling the energy delivered to said first motor to cause speed and directional changes in operation thereof comprising an apparatus for translating alternating current to unidirectional current and for varying the average value of the unidirectional current continuously from a maximum value of one polarity toward zero value and toward a maximum value of the opposite polarity including: a variable ratio transformer, an electronic valve, switch means, the transformer being connected to the valve and to the switch means, the switch means including a pair of load circuit terminals and means for connecting one terminal of the transformer to either one of the load circuit terminals and the other transformer terminal to the other one of the load circuit terminals.

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