Dec. 18, 1934. P. McSHANE 1,985,049

TOOL LIFTING DEVICE

Filed April 12, 1932

Fig. 1.

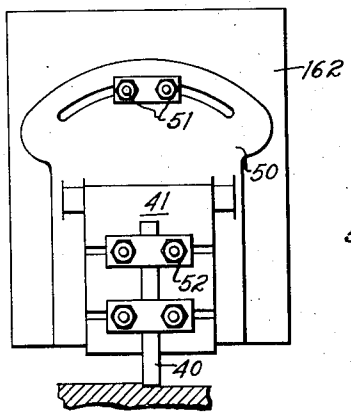


Fig. 2.

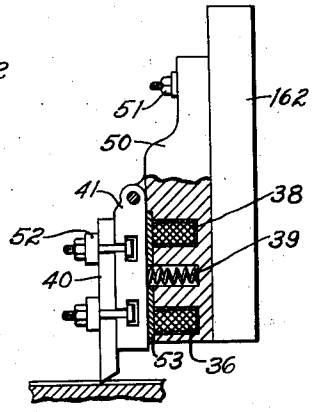


Fig. 3.

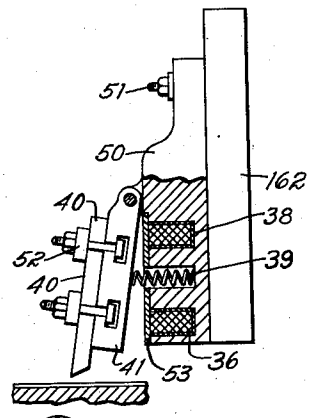


Fig. 4.

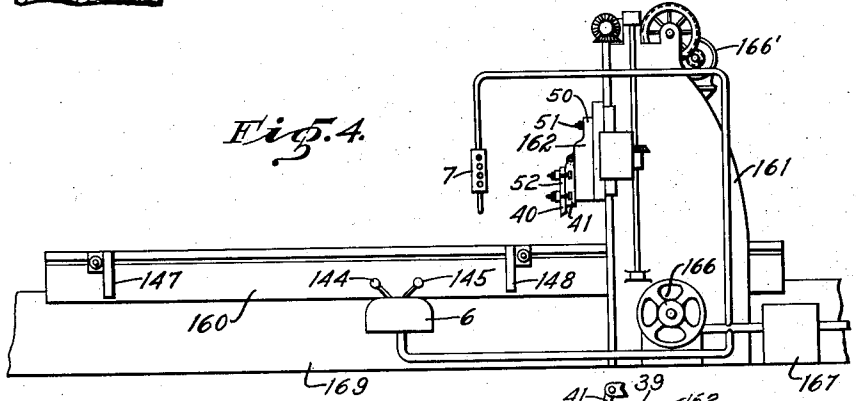
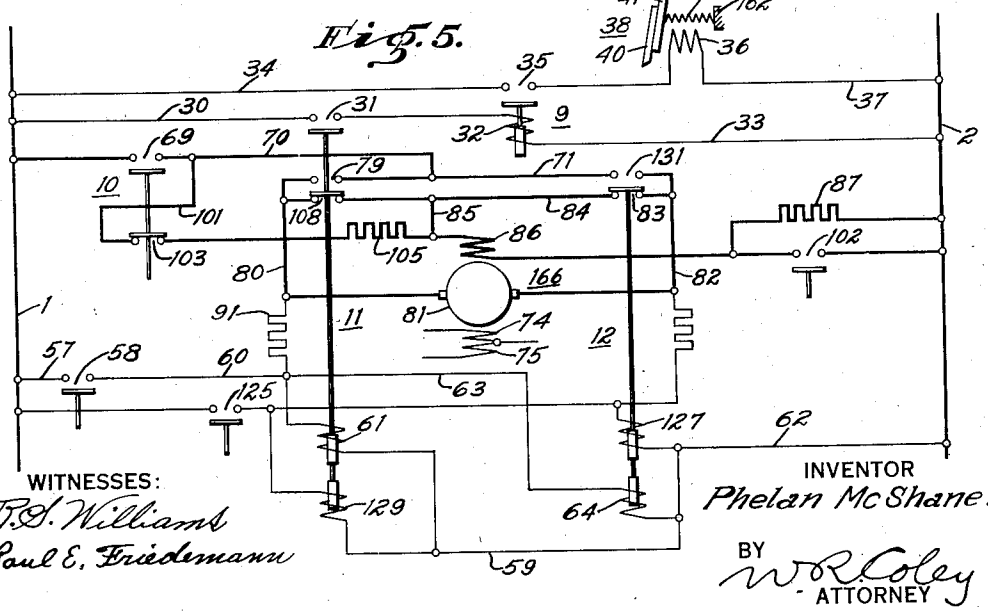


Fig. 5.



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TOOL LIFTING DEVICE

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Application April 12, 1932, Serial No. 604,694

4 Claims. (Cl. 90—55)

This invention relates generally to tool-shifting devices for tool operating machines. More specifically, this invention relates to a tool-lifting device for moving the tool of a machine, such as a planer, shaper, power saw, etc., from an operative to an inoperative position for a part of the cycle of operation of the machine, and from an inoperative to an operative position during the remainder of the cycle of operation of the machine.

In the operation of planers, it is frequently necessary to provide for shifting or lifting the cutting tool at the end of every cutting stroke to prevent dragging the cutting edges of the tool over the work in the reverse direction, as the work table makes a return stroke. The tool-shifting operation merely consists of tilting the pivotally mounted tool holder, which is carried by the tool block, to some position other than its normal working position at the end of the cutting stroke of the work table, and permitting the tool holder and tool to return to the normal working position at the end of each return stroke.

In order to perform this operation, the usual practice heretofore adopted has been to provide manually or mechanically operable means by which the operator may shift the cutting tool at the end of the cutting stroke and return it to the working position at the end of the return stroke of the work table. In some cases, a system of complicated mechanical elements,—levers, shafts, gears, etc.—inter-connected with some operating part of the tool machine is utilized to automatically shift the tool block and tool from the normal working position during the cutting stroke to an inoperative position during the return stroke.

In order to eliminate this manual operation or complicated automatic mechanical operation, provision is made, in the present invention, for utilizing a spring actuated tool block and an electromagnet cooperating therewith to perform the tool-shifting operation, when necessary. While, in this disclosure of the invention, the control system is being applied to a planer, it will be readily apparent, as the description proceeds, that it may also be applied to machine tools of various types having similar operating characteristics.

One of the objects of this invention, generally stated, is to provide a tool-shifting system for planers and the like which shall be simple and efficient in operation and economically manufactured and installed.

A more specific object of the invention is to provide for automatically shifting the tool block and tool, by the cooperative action of mechanical and electro-magnetic means interconnected with the electrical control system of the machine being controlled.

A broader object of this invention is to control the tool-shifting operation of a tool by electro-magnetic control means.

A further object of the invention is to provide for operating the tool block carrying a tool by coacting mechanical and electromagnetic means controlled by the operation of the reversing switches of the reversing motor driving a tool machine.

It is also an object of the invention to control electromagnetic tool-shifting devices by the operation of reversing switches.

Another object of the invention is to control tool-shifting devices by the operation of switches controlled by the counter-electromotive force of the motor during the reversing operation of a reciprocating machine.

Other objects and advantages of this invention will become evident from the following description, taken in conjunction with the accompanying drawing, in which:

Figure 1 is a view in front elevation of a tool block and tool carried thereby of a tool operating machine;

Figs. 2 and 3 are views in side elevation, partly in section, of the tool block shown in Fig. 1, showing the operative and inoperative positions, respectively, for the tool block and tool carried thereon;

Fig. 4 is a view in side elevation of a planer showing one general arrangement for the shiftable tool; and

Fig. 5 shows, diagrammatically, just so much of the electric control system of the planer for illustrating the cooperative action of this invention with such control system.

For a more detailed and complete showing of the control system per se, but not forming a part of this invention, reference should be had to the patent application of George E. King et al., filed May 6, 1930, Serial No. 450,102.

Referring more particularly to the figures in the drawing, Fig. 1 shows a front view of a tool block 162, provided with an adjustable tool carrier 50 for adjusting the tool at an angle to the work by means of the adjusting screws 51. A pivotally mounted tool holder 41 is carried by the tool carrier 50 and securely holds the tool

40 by means of the adjustable screw mechanisms 52.

Fig. 2 shows more of the details of the tool holder and tool carrier, showing the tool in normal working position, whereas Fig. 3 is a view similar to Fig. 2, except that the electromagnetic tool-shifting device 38 does not have its coil 36 energized. The spring 39, shown in conjunction with the pivotally mounted tool holder, is, therefore, free to move the tool holder and tool 40 to the position shown in Fig. 3.

The tool carrier 50, consisting of magnetic material, has the coil 36 of the electromagnet 38 mounted in an annular groove. The tool holder 41 is also of magnetic material, and may, therefore, be utilized to effectively and firmly hold the tool holder in the position shown in Fig. 2, if and when the coil 36 is energized. However, when the coil 36 is not energized, the tool holder and tool will be disposed in the position shown in Fig. 3. To prevent the possibility of having the tool holder stick or firmly held in the position shown in Fig. 2 when the coil 36 is not energized, a shim of non-magnetic material 53 is interposed between the tool carrier 50 and the tool holder 41. The non-magnetic shim, therefore, acts like an air gap, thus preventing sticking of the tool holder when the coil is not energized.

Referring to Fig. 5, a motor 166 is shown, which is of special design, including shunt field windings 74 and 75 connected in parallel-circuit relation, series stabilizing field winding 86, and series dynamic-braking resistor 105. The control panel 167, shown in Fig. 4, carries the main-line contactor 10, directional switches 11 and 12, the control relay 9 and other control equipment not part of this invention.

In Fig. 4, the motor 166 is shown associated with the control panel 167, the planer, including, among other elements, the table 169, platen 160, crossbar standard 161 and tool holder 162. On the crossbar standard 161, or any other convenient part of the planer, are supported one or more pendant-switch stations 7 from each of which complete control of the motors 166 and 166′ may be had. The pendant-switch stations are mounted in the most accessible places for the attendant.

Below the planer platen 160 and at the side of the table 169 is positioned a limit switch 6 having projecting levers 144 and 145. At the side of the platen are positioned a pair of lugs 147 and 148 which may be adjusted longitudinally of the platen 160 within grooves of T-shape. The levers 144 and 145 cooperate with lugs 147 and 148, respectively, to control the reciprocations of the platen in a manner set forth more in detail in the application of George E. King et al. above mentioned.

For the purpose of this invention, it is sufficient to know that the levers 144 and 145 operate limit switches in the housing 6 which in turn successively effect the operation of a control relay, one or the other of a pair of directional control relays, depending on the direction of travel of the platen, i. e., whether in the cut or return direction, and one or the other of directional contactors 11 and 12, depending upon the reversing operation that is to be effected.

When the directional control relay for the cut direction is caused to operate, as above broadly outlined, contact members 58 are closed. Closure of contact members 58 establishes a circuit from the positive line conductor 1 through conductor 57, contact members 58, conductor 60, actuating coil 61 of the directional contactor 11 and conductors 59 and 62, to the negative line conductor 2. A coil 64 of the directional contactor 12 is connected in parallel circuit relation to the actuating coil 61 by a circuit extending through conductor 63, coil 64 and conductors 59 and 62 to the negative line conductor 2. The effect of coil 64 at this stage is merely to insure that contact members 83 of the directional contactor 12 are held in closed position.

An instant after the closure of contact members 58, the main line contactor 10 is caused to operate, by means not part of this invention, closing the contact members 69 and opening the contact members 103. Closure of the contact members 69 establishes a circuit from the positive line conductor 1 through contact members 69, conductors 70 and 71, contact members 79 of contactor 11, conductor 80, armature 81, conductor 82, contact members 83 of contactor 12, conductors 84 and 85, series stabilizing field winding 86 of motor 166 and the starting resistor 87, to the negative line conductor 2. The accelerating or starting resistor 87 may be shunted in a suitable and well known manner by accelerating switch 102.

It should be noted that the operation of the directional contactor 11, which effects the operation of the platen in the cut direction, causes the interlocked contact members 31 to close, thereby establishing a circuit for the actuating coil 32 of control relay 9 by a circuit from the positive conductor 1 through conductor 30, contact members 31 of contactor 11, actuating coil 32 of relay 9 and conductor 33 to the negative conductor 2.

Operation of the control relay 9 establishes a circuit from the positive conductor 1 through conductor 34, contact members 35 of relay 9, actuating coil 36 of the tool-shifting electromagnet 38, and conductor 37 to the negative supply conductor 2. The electromagnet 38 cooperates with the pivotally mounted tool holder 41 carrying the tool 40. A compression spring 39 disposed between the base or support 162 and the holder 41 biases the tool to the position shown. When the coil 36 is energized as just explained, the tool is firmly held in an operative or vertical position as shown in Figs. 1, 2 and 4.

At the end of the cut stroke, care must be taken that the coil 36 is not deenergized before the cut has been completed and the motor has come substantially to rest, or else the tool will move to the position shown in Figs. 3 and 5, thereby making an improper finishing cut.

When the platen has traveled substantially to the end of the cut stroke, lug 147 actuates lever 144. By a sequence broadly indicated heretofore, contact members 58, and contact members 69 of line contactor 10 are caused to open. Opening of contact members 58, however, does not immediately cause the opening of contact members 31 and 79. Deenergization of the line contactor 10 causes closing of contact members 103.

The moving masses of the machine in the cut direction drive the motor 166 as a generator to supply energy to the energy-dissipating dynamic-braking resistor 105. The dynamic-braking circuit may be traced from the left hand or positive terminal of the motor through conductor 80, contact members 79 of contactor 11, conductors 71, 70 and 101, contact members 103 of

contactor 10, dynamic-braking resistor 105, conductors 85 and 84, contact members 83 of contactor 12 and conductor 82 to the right hand or negative terminal of the motor.

A minor dynamic-braking circuit is also established which circuit may be traced from the left side of the armature 81, through conductor 80, resistor 91, the parallel circuit of actuating coil 61 and conductor 59, and conductor 63 and back contact coil 64 of the directional contactors 11 and 12, respectively, conductor 62, negative line conductor 2, contact members 102 of the shunt for the accelerating resistor 87, series stabilizing field winding 86, conductors 85 and 84, contact members 83 and conductor 82 to the right hand terminal or negative terminal of the armature. From the circuit just traced, it is apparent that coils 61 and 64 are subjected to a voltage of the same sign as the line voltage, and that the cut directional contactor 11 is thus held up with contact members 79 closed, whereas the return directional contactor 12 is held down with the back contact members 83 closed despite the fact that line voltage has been removed.

The cut directional contactor 11, during the dynamic-braking period, therefore, remains in the up position holding the contact members 31 closed. The electro-magnetic tool-shifting device, therefor, remains energized until the counter-electromotive of the motor is quite low, i. e., when the motor has come substantially to rest. The tool thus moves to the end of the cutting stroke, and beyond, and immediately thereafter when the return directional contactor 12 operates and the cut directional contactor 11 has been moved to the inoperative position, the spring 39 moves the holder 41 and tool 40 to the non-work engaging position shown in Figs. 3 and 5.

When return directional contactor 12 has operated, contact members 131 are closed and contact members 108 are closed, thereby connecting the motor to the supply conductors 1 and 2 for reverse operation.

The sequence of operation for the control units controlling the reverse operation is very similar to the sequence of operation for the cut direction, i. e., contact members 125 are closed and the actuating coil 127 of the return directional contactor 12 and the back coil 129 of the cut directional contactor 11 are energized. At the end of the return stroke, the motor is stopped by a dynamic braking effect, and after the motor has come to rest, the cut directional contactor 11 is operated, and in consequence, the tool is firmly and positively held in the work-engaging position against the action of the spring 39 by the electro-magnetic means 38.

The invention is not to be restricted to the specific structural details, arrangement of parts or circuit connections herein set forth, as various modifications thereof may be effected without departing from the spirit and scope of this invention, and it is desired that only such limitations shall be imposed as are indicated in the appended claims.

I claim as my invention:

1. In a system of control for a tool, a machine having a reciprocating member for holding a work piece, a motor for moving said member, a tool-holder means for biasing said tool-holder to an inoperative position, electromagnetic means including a coil for moving said tool-holder from said inoperative position to an operative position, a control relay adapted to energize said coil when caused to operate, and a cut-directional contactor for causing the motor to operate said reciprocating member in such a direction that the tool may cut the work piece on the reciprocating member and also adapted to operate the control relay to energize said coil for the electromagnetic means.

2. In a system of control for a tool, a machine having a reciprocating member, a motor for operating said member, a tool-holder, means for biasing said tool-holder to an inoperative position, electromagnetic means including a coil for moving said tool-holder from the inoperative position to an operative position, a control relay adapted to energize said coil, and a directional contactor for the motor adapted to energize said control relay.

3. A tool-shifting device, comprising a pivotally mounted tool-block carrying an operating tool, electromagnetic means including an operating coil for shifting the tool from an inoperative to an operative position when said coil is energized, in combination with a tool operating machine including a reciprocating table, a motor for reciprocating the table, a line contactor, a pair of directional contactors, means for controlling the actuation of said directional contactors by the movements of said table, means for dynamically braking and stopping the movement of the table at each end of its movement, a control relay adapted to be energized by the operation of one of said directional contactors, means for effecting the energization of said control relay only during movement of said table, and a circuit adapted to be closed by the operation of said control relay to energize said operating coil for said electromagnetic means.

4. A tool-shifting device, comprising a pivotally mounted tool-block carrying an operating tool, electromagnetic means including an operating coil for shifting the tool from an inoperative to an operative position when said coil is energized, in combination with a tool operating machine including a reciprocating table for reciprocating relative to said tool-block and with a system of control for the tool operating machine and said electromagnetic means, said system of control including, an electric motor, a pair of directional contactors adapted to be responsive to the reciprocating movements of said table for controlling the direction of operation of said motor, and a control relay adapted to be energized by one of said directional contactors, and control the energization of said operating coil.

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