## Feb. 7, 1928.

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### R. B. HUNTER

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CONTROLLER FOR ELECTRIC MOTORS

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Filed July 6, 1926

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BY Frank ATTORNEY

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# Patented Feb. 7, 1928. 1,658,242 UNITED STATES PATENT OFFICE.

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CONTROLLER FOR ELECTRIC MOTORS.

Application filed July 6, 1926. Serial No. 120,694.

This invention relates to controllers for respective motors is controlled by electrore-

electric motors, and more particularly to con-sponsive switches S, S<sup>1</sup> and S<sup>2</sup>. Individual trollers for motor operated woodworking push-button stations P,  $P^1$  and  $P^2$  are promachines and the like. vided for control of the energizing circuits Woodworking machines for tenoning or of the respective electroresponsive switches 60 mortising ordinarily comprise a plurality of S, S<sup>1</sup> and S<sup>2</sup>, said energizing circuits being cutter motors, each cutter being adapted to also subject to control by suitable overload perform an operation upon a piece of wood relays OL, OL<sup>1</sup> and OL<sup>2</sup>, which may be of simultaneously with the other cutters; and a the delayed action type. Relays OL concommon feed motor which pushes the wood trolling the energizing circuit of switch S 65 The energizing circuit of switch S is also subject to control by normally closed auxiliary contacts 10 of an electroresponsive relay R; whereas the energizing circuit of relay  $\tilde{R}$  70 is subject to control by normally open auxiliary contacts 11 of switch S in conjunction with auxiliary contacts 12 or 13 of switches  $S^1$  and  $S^2$ , respectively. Contacts Another object is to provide means for in- 12 and 13 are of the transient closing type; 75 opened or closed positions of switches S<sup>1</sup> and  $S^{\overline{2}}$ , respectively, but are adapted to be tem-Another object is to provide automatic porarily closed during opening or closing of 80 Switches S, S<sup>1</sup> and S<sup>2</sup> are also provided with normally open auxiliary contacts 14, 15 and 16 adapted when closed to provide maintaining circuits for said switches, respectively. Normally closed overload relay 85 contacts 17, 18 are included in the energizing circuit of switch S, as aforedescribed; whereas normally closed overload relay contacts 19, 20 and 21, 22 are included in the energizing circuits of switches S<sup>1</sup> and S<sup>2</sup>, 90 respectively. Push-button station P comprises normally open contacts 23 adapted when closed to effect starting of motor M, and normally closed contacts 24 adapted when opened to effect stopping of said mo- 95 tor. Push-button stations P<sup>1</sup> and P<sup>2</sup> similarly comprise normally open contacts 25

- 5 10 past the several cutters. If a cutter breaks may be omitted if desired. or fails to cut due to a knot or other obstacle in the wood, it is highly desirable that the cutter motor affected and the feed motor be 15 stopped as quickly as possible.
  - An object of the invention is to provide simple and efficient means for accomplishment of the aforementioned desirable result, among others.
- 20suring against operation of the feed motor that is to say, they are normally open in the during starting of one or more of the cutter motors.

25 electrical control means for effecting stop- the latter. ping of the feed motor jointly with one or more of the cutter motors under predetermined conditions. Another object is to provide manual con-30 trol means for effecting starting or stopping of the several motors jointly or individually, but subject to control by suitable electrical interlocks.

Other objects and advantages of the inven-35 tion will hereinafter appear.

The accompanying drawing illustrates an embodiment of the invention which will now be described, it being understood that the embodiment illustrated is susceptible of va-40 rious modifications without departing from the spirit and scope of my invention as defined in the appended claims.

In the drawing, M designates a feed motor and 27 and normally closed contacts 26 and adapted to effect passage of a piece of wood 28 for effecting starting and stopping of through a woodworking machine (not motors  $M^1$  and  $M^2$ , respectively. 45shown), and M<sup>1</sup> and M<sup>2</sup> designate the cutter. The operation of the control system will 100 motors. It is to be understood that the num- now be described. Upon closure of pushber of cutter motors included in the control button switch 27 an energizing circuit is system may be increased or decreased if de- completed for switch S<sup>2</sup>, said circuit extend-50 sired. Said motors are adapted to be sup- ing from line L<sup>3</sup> by conductor 29 through 103 plied with energy from a suitable source, as said switch 27, by conductor 30 through the indicated at lines  $L^1$ ,  $L^2$  and  $L^3$ ; line  $L^2$  be-normally closed contacts of push-button ing directly connected to terminals T<sup>2</sup>, re- switch 28, by conductor 31 through the spectively, whereas connection of lines L<sup>1</sup> winding of switch S<sup>2</sup>, by conductor 32 55 and L<sup>s</sup> with terminals T<sup>1</sup> and T<sup>3</sup> of the through the normally closed contacts 22 and 110

## 1,658,242

21 of overload relays OL<sup>2</sup>, and thence conductor 45 through auxiliary contacts 11 through the right-hand overload relay coil of switch S, by conductors 46 and 47 through to line L<sup>1</sup>. Switch S<sup>2</sup> thereupon closes to the right-hand overload relay coil, and complete the line connections for motor M<sup>2</sup>, thence to line L<sup>1</sup>. Relay R immediately 5 said line connections being obvious. Dur- closes and provides a maintaining circuit 70 ing closure of switch S<sup>2</sup> auxiliary contacts for itself, said maintaining circuit extending 13 are temporarily closed for a purpose here- from line L<sup>3</sup> by conductors 48 and 49 inafter described. Also upon closure of through the main contacts 50 of said relay, switch S<sup>2</sup> auxiliary contacts 16 thereof are by conductors 51 and 44 through the wind-10 adapted to provide a maintaining circuit ing of relay R, and thence to line L<sup>1</sup> as pre-75 therefor, said circuit extending from line viously traced. Relay R in closing effects L<sup>3</sup> by conductor 33 through the left-hand opening of its normally closed auxiliary overload relay coil, through the left-hand contacts 10 thereby interrupting the aforemain contacts of switch S<sup>2</sup>, through auxil- described maintaining circuit of switch S, 15 iary contacts 16, by conductor 34 through whereby the latter is opened to effect stop- 80 push-button switch 28, and thence to line  $L^1$  ping of motor M. Moreover, switch S in as previously traced. The power and con- opening effects opening of its auxiliary control circuits for motor M<sup>1</sup> and any other tacts 11 thereby interrupting the aforecutter motor which might be included in described maintaining circuit of relay R 20 the system are exactly like those described which thereupon assumes its normally open 85 with reference to motor M<sup>2</sup>, and hence fur- position. Obviously, if motors M, M<sup>1</sup> and M<sup>2</sup> are ther discussion thereof is deemed unnecesin operation an overload upon motor M<sup>1</sup> With switches S<sup>2</sup> and S<sup>1</sup> closed in the will effect interruption of the maintaining sary. 25 manner aforedescribed, closure of switch S circuits of switches S<sup>1</sup> and S for simultane-90 may be effected by closure of push-button ous stopping of motors M<sup>1</sup> and M, as aforeswitch 23, which completes an energizing described in connection with motors M<sup>2</sup> and circuit extending from line L<sup>3</sup> by conductor M. If either of the cutter motors  $M^2$  or  $M^1$ 35 through said switch 23, by conductor 36 is stopped due to an overload the other 30 through normally closed push-button switch cutter motor will be left running, but no 95 24, by conductor 37 through the winding of harm will result because the feed motor M switch S, by conductor 38 through normally will likewise have been stopped. The lastclosed auxiliary contacts 10 of relay R, by mentioned cutter motor may thereupon be conductor 39 through normally closed con- stopped by depressing the stop push-button 35 tacts 18 and 17 of overload relays OL, and switch 28 or 26, as the case may be, there- 100 thence through the right-hand overload re- by interrupting the maintaining circuit of lay coil to line  $L^1$ . Switch S thereupon switch S<sup>2</sup> or S<sup>1</sup>, respectively. closes to complete the line connections for It is to be understood that any of the motor M. Switch S upon closure of its motors M, M<sup>1</sup> or M<sup>2</sup> may be stopped at will 40 auxiliary contacts 14 provides a maintain- by depressing the respective push-button 105 ing circuit for itself, said circuit extending switches 24, 26 or 28, whereas the means from line L<sup>3</sup> by conductor 40 through the aforedescribed will operate to insure stopleft-hand overload relay coil, through the ping of the feed motor M upon stopping of left-hand main contacts of switch S and one or more of the cutter motors. 45 auxiliary contacts 14, by conductor 41 In the normal operation of the system 110 through push button switch 24, and thence by the manual control means, all of the cutter motors will be started by closing the Switch S is also provided with normally respective push-button switches 27, 25; and to line L<sup>1</sup> as previously traced. open auxiliary contacts 11 which are adapted thereafter the feed motor will be started by 50 upon closure thereof to preset the energiz- closing the push-button switch 23. How-115 ing circuit of relay R for completion upon ever, if the feed motor should be intentiontemporary closure of either or both sets of ally or inadvertently started prior to startauxiliary contacts 12 and 13 of switches ing of any or all of the cutter motors, the  $S^1$  and  $\tilde{S}^2$ , respectively. Thus upon the oc- former will be automatically stopped during 55 currence of an overload upon motor M<sup>2</sup>, one closure of switches S<sup>1</sup> or S<sup>2</sup>, through tem- <sup>120</sup> or both of the overload relay contacts 21 porary closure of auxiliary contacts 12 or and 22 will be opened, thus interrupting the 13, respectively. Such closure of auxiliary aforedescribed maintaining circuit of switch contacts 12 or 13 completes the energizing S<sup>2</sup>; whereas the latter in opening will ef- circuit of relay R, whereas the latter in clos-60 fect transient engagement of its auxiliary ing effects opening of its auxiliary contacts 125 contacts 13 to complete the energizing circuit 10 to interrupt the energizing circuit of of relay R. Said circuit may be traced switch S with consequent stopping of motor from line L<sup>3</sup> by conductors 29 and 42 M as aforedescribed. Moreover, in stopping through said contacts 13, by conductors 43 the system as a whole the motor M is preferably first stopped by depressing the push-130 85 and 44 through the winding of relay R, by

1,658,242 button 24, whereupon the motors  $M^1$  and  $M^2$  ously closed to effect operating energization are stopped by depressing the respective of said relay, and normally closed auxiliary 5 buttons 26 and 28 are depressed while motor cuit of one of said switches.

15 failed to operate properly upon stopping of one or both of the cutter motors.

push-button switches 26 and 28. On the contacts on said relay adapted when opened other hand if either or both of the push- to effect interruption of the energizing cir-M is still in operation the means heretofore 5. The combination with a plurality of 70described acts automatically to effect stop- motors, of individually operable electroresponsive control switches therefor, means It will be noted that relays OL in the for rendering one of said switches subject to 16 circuit of motor M provide an additional control by another of the same under given 75 safety feature, inasmuch as the same will conditions, said means comprising an elecact to interrupt the energizing circuit of troresponsive relay and auxiliary contacts switch S in the event of an overload upon on said switches adapted when simultanesaid motor, such as might occur if relay  $\mathbb{R}$  ously closed to effect operating energization of said relay, all of said auxiliary contacts 80 being normally open but certain of the same being adapted for temporary closure during opening of their respective switches, and normally closed auxiliary contacts on said relay adapted when opened to effect inter- 85 ruption of the energizing circuit of one of 25 said energizing circuit, said means compris- electroresponsive control switches therefor, 30 30 temporarily closed during closing or open- ing circuit of one of said switches, and 95 auxiliary contacts on a plurality of said

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The control switches and relays employed may be of simple and standard construction, as will be obvious.

What I claim and desire to secure by  $20^{\circ}$ Letters Patent of the United States is: 1. The combination with an electromag- said switches. netically operable switch, of an energizing 6. The combination with a plurality of circuit therefor, and means for completing electric motors, of individually operable ing a second electromagnetically operable and means for insuring against operation of switch having auxiliary contacts which are one of said motors during starting of other open in the opened and closed position of of the same, said means comprising an elecsaid last-mentioned switch but adapted to be troresponsive relay controlling the energiz-

2. The combination with an electromag- switches adapted to control the energizing netically operable switch, of an energizing circuit of said relay. circuit therefor, means for completing said 7. The combination with a plurality of 35 energizing circuit, said means comprising electric motors adapted to be operated 100 a second electromagnetically operable switch jointly, of means for insuring against operhaving auxiliary contacts which are open in ation of one of said motors during starting the opened and closed position of said last- of other of the same and for effecting stopmentioned switch but adapted to be tem- ping of said one of said motors upon stopporarily closed during closing or opening ping of other of the same, said means com- 105 of the latter, and means adapted upon clo-prising a plurality of electroresponsive sure of said first-mentioned switch to pro- switches for individually controlling said vide a maintaining circuit therefor. \_\_\_\_\_ motors, an electroresponsive relay having 3. The combination with a plurality of normally closed contacts controlling the 45 separately operable driving motors, of elec- energizing circuit of one of said switches, 110 troresponsive switches for respectively con- and normally open auxiliary contacts on trolling the energizing circuits of said other of said switches adapted to be temmotors, means for interrupting the energiz- porarily closed during opening or closing ing circuit of one of said motors upon inter- of the latter to thereby control the energiz-<sup>50</sup> ruption of the energizing circuit of another ing circuit of said relay. of the same, said means comprising an elec- 8. The combination with a plurality of troresponsive relay adapted upon operation electric motors, of control means therefor thereof to interrupt the energizing circuit comprising individually operable electroof one of said switches, and auxiliary con- responsive control switches for the respec-<sup>55</sup> tacts carried by another of said switches and tive motors and overload relays having nor- <sup>120</sup> adapted upon opening of the latter to effect mally closed contacts included in the ener-operating energization of said relay. gizing circuits of the respective switches, 4. The combination with a plurality of manually operable means for completing the motors, of individually operable electrore- energizing circuits of said switches respecsponsive control switches therefor, means tively, and means for insuring against ener- 125 for rendering one of said switches subject to gization of one of said switches during inicontrol by another of the same under given tial energization of other of the same, said conditions, said means comprising an elec- means comprising an electroresponsive relay troresponsive relay and auxiliary contacts having normally closed contacts included in

115 on said switches adapted when simultane- the energizing circuit of one of said switches, 130

and normally open contacts carried by a opening of the auxiliary contacts of the plurality of said switches and adapted when latter. jointly closed to complete the energizing 11. In a controller for woodworking macircuit of said relay.

1,658,242

comprising individually operable electro- said motors respectively, manually operable responsive control switches for the respec- means for effecting energization and detive motors and overload relays having nor- energization of said switches individually 60 10 mally closed contacts included in the ener- at will, means for insuring against energizagizing circuits of the respective switches, tion of one of said switches during initial manually operable means for completing the energization of other of the same and for energizing circuits of said switches respec- effecting de-energization of said one of said 15 gization of one of said switches during ini- the same, said means comprising an electrotial energization of other of the same, said responsive relay having normally closed conmeans comprising an electroresponsive relay tacks included in the energizing circuit of having normally closed contacts included in 20 and normally open contacts carried by a switch and on other of said switches and plurality of said switches and adapted when adapted when jointly closed to complete the jointly closed to complete the energizing energizing circuit of said relay. circuit of said relay, certain of said auxil- 12. In a controller for woodworking ma-25 opened or closed position of their respective plurality of electric motors, electroresponsive switch but adapted for temporary closure switches for controlling the circuits of during closing or opening of the latter. said motors respectively, manually operable comprising individually operable electro- at will, means for insuring against energiresponsive switches for the respective motors zation of one of said switches during iniand overload relays having normally closed tial energization of other of the same and

chines and the like, the combination with a 55 9. The combination with a plurality of plurality of electric motors, electroresponelectric motors, of control means therefor sive switches for controlling the circuits of tively, and means for insuring against ener- switches upon de-energization of other of 65 one of said switches, and normally open the energizing circuit of one of said switches, auxiliary contacts on said last-mentioned 70 iary contacts being normally open in the chines and the like, the combination with a 70 10. The combination with a plurality of means for effecting energization and deelectric motors, of control means therefor energization of said switches individually 80 contacts included in the energizing circuits for effecting de-energization of said one of of the respective switches, manually operable said switches upon de-energization of other 85 35 means for controlling the energizing cir- of the same, said means comprising an eleccuits of said switches respectively, and troresponsive relay having normally closed interruption of the energizing circuit of auxiliary contacts on said last-mentioned 90 an electroresponsive relay having normally adapted when jointly closed to complete the closed auxiliary contacts adapted to be in- energizing circuit of said relay, and overcluded in the energizing circuit of one of load relays having normally closed contacts said switches, normally open auxiliary con- included in the energizing circuits of certain 95

means for effecting interruption of the ener- contacts included in the energizing circuit gizing circuit of one of said switches upon of one of said switches, normally open 40 other of the same, said means comprising switch and on other of said switches and 45 tacts carried by said last-mentioned switch, of said switches and adapted under given and auxiliary contacts carried by other of conditions to automatically interrupt said said switches and adapted for temporary circuits. closure during opening of the latter, said In witness whereof, I have hereunto subauxiliary contacts of said switches when scribed my name. 50 jointly closed being adapted to complete the energizing circuit of said relay to effect

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