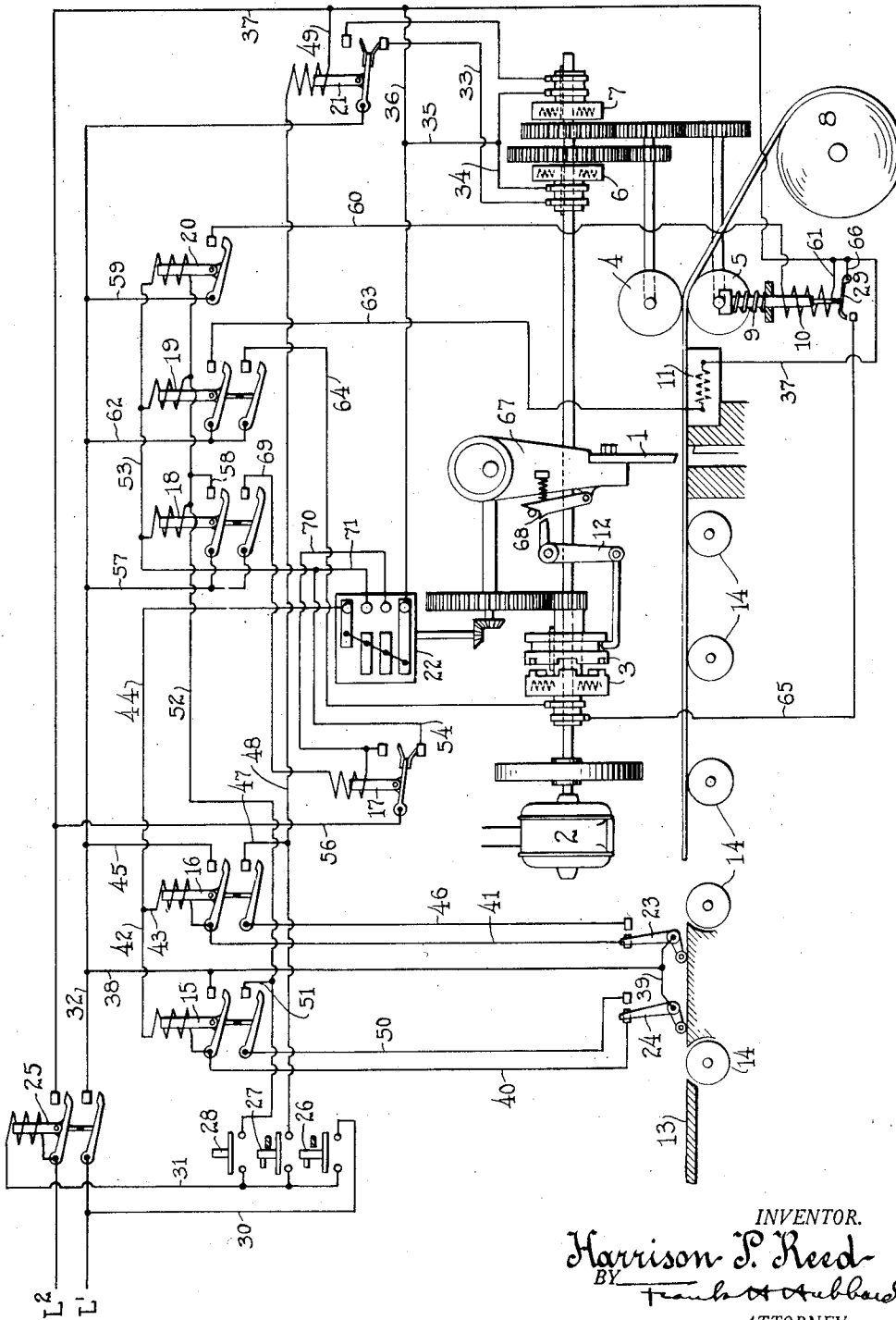


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ELECTRICAL CONTROLLER.
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ELECTRICAL CONTROLLER.

Application filed January 28, 1920. Serial No. 354,558.

To all whom it may concern:

Be it known that I, HARRISON P. REED, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Electrical Controllers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

This invention relates to electrical controllers and more particularly to controllers for mechanisms adapted to cooperate cyclically, of which class of mechanisms power operated shears may be taken as exemplary.

In the operation of certain types of shears, it has been customary to employ a continuously operating motor to supply power both for driving the shear and for advancing the work thereto, and to provide electromagnetically operable instrumentalities to effect intermittent power connections for the mechanical elements performing the foregoing functions and also for holding the work during the cutting operation, and the present invention has among its objects that of providing a controller for rendering the action of the aforesaid and other similarly correlated instrumentalities fully automatic.

Another object is that of providing a controller of the character stated which while adapted to provide full automatic cyclic control of the aforesaid and similarly correlated instrumentalities is further amenable to adequate voluntary control for any desired number of cycles or parts of a cycle.

Another object is that of providing a controller of the character aforestated wherein provision is made for varying the control from automatic to voluntary or vice versa, without interruption or derangement of the cycle of operation of the controlled mechanism.

Another object is that of providing a controller of the character stated wherein the action of the various control agencies is so correlated with reference to the degree or extent of operation of certain of the elements to be controlled as to maintain for the cyclic operations of said elements an adequate timing relation for adjusted settings of the mechanism both as effecting

speed of operation and dimension or other physical characteristics of the output.

Other objects and advantages will herein- after appear.

The accompanying drawing illustrates schematically and diagrammatically one of the embodiments which the invention may assume in practice.

Referring to the drawing, the same illustrates a shear 1 to be driven intermittently by a motor 2 through an electromagnetically engageable and mechanically releasable jaw clutch 3 and suitable gearing. Feed rolls 4 and 5 are adapted to be driven continuously in opposite relative directions by said motor 2 at either of two preselected speeds dependent upon selective energization of speed clutches 6 and 7 for drawing the stock from a roll 8 thereof and feeding the same to the shear 1, said rolls being pressed together by means of a spring 9 to engage and grip the stock and being separable through energization of a solenoid magnet 10 to release the stock, while a hold down magnet 11 serves when energized to stop and hold the stock during cutting. The shear at the completion of its return stroke serves by means of a lever 12 to release itself from the driving motor, the winding of clutch 3 having been previously de-energized. The sections of stock after cutting are advanced to a suitable receiving table 13 by means of continuously rotating rolls 14, which in practice may be driven from any suitable source of power.

The foregoing electromagnetic elements are adapted to be energized from supply lines L^1 , L^2 in proper cyclic order through co-operative action of relays 15 to 21 subject to correlation and timing by means of a drum controller limit switch 22 to be driven in synchronism with the shear 1 and work limit switches 23 and 24 actuated by the stock. A main switch 25 controllable by a two position push button 26 serves to connect and disconnect the controller to its supply lines, while push button switches 27 and 28 serve to subject the action of said relays to voluntary control. Suitable interlocks, to be hereinafter described, provide against a cyclic operation of the various elements.

The foregoing control instrumentalities are associated as follows: Relays 15 and 17

in conjunction with work limit switch 24 serve to control jointly the energizing circuits of relays 18, 19 and 20, of which relay 19 serves to control the energizing circuit of hold down magnet 11 and, jointly with a switch 29 operable by the solenoid magnet 10, to control energization of the winding of shear clutch 3. Relay 20 serves to control energization of the solenoid magnet 10, while relay 18 controls energization of the closing winding of relay 17. Relay 16 controls the energizing circuit of relay 21 which in turn effects selection between the fast speed clutch 6 and slow speed clutch 7, being adapted when deenergized to effect energization of the former and when energized to effect energization of the latter.

Assuming the motor 2 and delivery rolls 14 to be in operation and the various parts to be in the relative positions illustrated, the operation of the device may be described as follows: Closure of the starting push button 26 completes the energizing circuit of main switch 25, said circuit extending from line L' by conductor 30 through said push button switch, by conductor 31 through the winding of said main switch and thence to line L². Said main switch thereupon closes connecting the controller to its supply line, whereupon since relay 21 is de-energized, fast speed clutch 6 is at once energized to drive the feed rolls 4 and 5 at high speed for feeding the stock toward the shear. The circuit of said clutch 6 extends from line L' through the lower contacts of main switch 25, thence by conductor 32 through the down contacts of relay 21, thence by conductor 33 through the winding of said clutch, thence by conductors 34, 35, 36 and 37 through the upper contacts of said main switch to line L².

Closure of the main switch during the assumed positioning of the various limit switches also serves to energize the closing windings of relays 15 and 16 through circuit connections extending from line L' through said main switch, thence by conductors 32 and 38 to conductor 39, thence in parallel through the respective left hand contacts of the work limit switches 24 and 23, thence in parallel by conductors 40 and 41 through the respective closing windings of said relays and by conductors 42 and 43 to their junction, thence by conductor 44 to the upper contact of the shear limit switch 22 and through said limit switch to the lower contact thereof, thence by conductors 36 and 37 through the main switch to line L². Said relays 15 and 16 are thereupon adapted to close but owing to the aforescribed position of limit switches 23 and 24 closure of said relays produces no immediate effect. Each of said relays, however, upon closing completes a maintaining circuit for itself, the maintaining circuit

of relay 15 extending to conductor 38 as formerly traced, thence through the upper contacts and through the winding of said relay to line L² as formerly traced, whereas the maintaining circuit of relay 16 extends from conductor 32 by conductor 45 through the up contacts and the winding thereof to conductor 43 and thence as formerly traced.

As the stock is fed forwardly by the rolls 4 and 5 the same passes the shear member 1 and first engages the slow limit switch 23 lifting the same to its upper or right hand position. Such action serves to complete the energizing circuit of relay 21, said circuit extending to and through said slow limit switch as formerly traced, thence by conductor 46 through relay 16, by conductors 47 and 48 through the winding of said relay 21 and thence by conductors 49 and 37 to line L² as formerly traced. Said relay 21 thereupon disengages its down contacts and closes its up contacts thereby de-energizing the fast speed clutch 6 and effecting energization of the slow speed clutch 7 whereupon the speed of delivery of the stock is reduced to a predetermined value preparatory to stopping thereof.

As the stock continues to travel at such reduced speed the same ultimately engages and trips the stop limit switch 24 thus completing the joint energizing circuit of relays 18, 19 and 20, said circuit extending to and through said limit switch as formerly traced, thence by conductor 50 through relay 15, by conductor 51 to conductor 52, thence in parallel through the respective windings of said relays which unite in conductor 53, thence by conductor 54 through the down contacts of relay 17 which is now de-energized and by conductors 56 and 37 to line L² as formerly traced.

Said relays 18, 19 and 20 thereupon close and relay 18 moreover completes a maintaining circuit for all of said relays, said circuit extending to conductor 32 as formerly traced, thence by conductor 57 through the upper contacts of said relay 18, thence by conductor 58 to conductor 52 and thence through the windings of said relays to line L² as formerly traced.

Relay 20 upon closure completes the energizing circuit of the solenoid magnet 10, said circuit extending from line L' to conductor 32 as formerly traced, thence by conductor 59 through said relay, by conductor 60 through the winding of said solenoid magnet and by conductors 61 and 37 to line L² as formerly traced. Said solenoid magnet thereupon responds, drawing down the lower feed roll 5 to release the stock and temporarily arrest feeding thereof by the rolls, and also closing switch 29.

Closure of relay 19 completes the energizing circuit of the holding magnet 11, said circuit extending to conductor 32 as

formerly traced, thence by conductor 62 through the upper contacts of said relay 19, by conductor 63 through the winding of said holding magnet and thence by conductor 37 to line L² as formerly traced. Said holding magnet, as thus energized, serves to attract the stock located thereabove for arresting movement thereof and holding the same rigid during cutting by the shear.

Closure of relay 19 while switch 29 is retained closed also serves to complete the energizing circuit of the shear clutch 3, said circuit extending from line L' to said relay as formerly traced, thence through the lower contacts of said relay, by conductor 64 through the winding of said shear clutch, by conductor 65 through switch 29, thence by conductors 66 and 37 to line L². Said shear clutch thereupon draws in its armature for locking the shear driving mechanism to the motor shaft.

The shear 1 is thereupon driven downwardly to sever the stock and during such downward movement the shear holder 67 moves the latch mechanism 68 to slip by without actuating the clutch releasing lever 12.

Also during such movement the shear limit switch 22 is actuated first to effect engagement of its intermediate contacts, engagement of the upper of said contacts serving to transfer the control of relays 18, 19 and 20 from the down contacts of relay 17 to said shear limit switch. Engagement of the lower of said intermediate contacts, moreover, serves to complete the energizing circuit of said relay 17; said circuit extending from conductor 32 by conductor 57 through the lower contacts of relay 18, which is now closed, thence by conductor 69 through the winding of said relay 17 and by conductor 70 through the shear limit switch to line L² as formerly traced. Relay 17 thereupon closes, de-energizing its down contacts, the energizing circuit of relays 18, 19 and 20 being thereafter maintained through conductor 71 leading from conductor 53 to the shear limit switch. Said relay 17 upon closing furthermore establishes a maintaining circuit for itself, said circuit extending to and through its energizing winding as formerly traced, thence through its upper contacts and by conductor 56 to line L². The down contacts of said relay are thus maintained de-energized pending re-opening thereof thus providing for subsequent de-energization of relays 18, 19 and 20 by the shear limit switch.

Upon continued movement of the shear the upper contact of the shear limit switch is next de-energized thereby dropping out relays 15 and 16. Opening of relay 15 interrupts the closing circuit of relays 18, 19

and 20, said relays however being retained closed by their joint maintaining circuit as described. Opening of relay 16 serves to drop out relay 21 thereby de-energizing the slow speed clutch 7 and effecting energization of the fast clutch 6 for driving the feed rolls at the higher speed, said rolls, however, being at this time disengaged from the stock.

Shortly prior to completion of the up or return stroke of the shear 1, the shear limit switch is restored substantially to the position illustrated, thereby dropping out relays 18, 19, and 20 for de-energizing the winding of shear clutch 3 and also de-energizing hold-down magnet 11 and solenoid magnet 10. The latter action serves to release the stock from its retention and permits the feed rolls to engage and drive the same at high speed. De-energization of the shear clutch winding, however, does not cause immediate release of the clutch, such action being effected mechanically by the shear acting through the lever 12 just as the former completes its return stroke. Thus assuming prior action of the delivery rolls 14 to remove the cut section of stock beyond the limit switches 23 and 24 for permitting resetting of the latter switches, the controller is restored to suitable relation for repeating automatically the as-described cycle of operation.

The arrangement of relays 15 and 16 permits resetting of the work limit switches 23 and 24 respectively without interruption of the circuits which were previously closed due to tripping thereof, whereas co-operation of the upper contacts of the shear limit switch prevents premature reclosure of said relays following early resetting of said stop limit switch. Similarly opening of relay 16 prevents premature energization of relay 21 upon early resetting of the slow-limit switch. Also, the arrangement of relay 17 permits closure of relays 18, 19 and 20 to be effected independently of the shear limit switch while subjecting said latter relays to control by said shear limit switch for opening. The control of the energizing circuit of shear clutch 3 by the solenoid magnet switch 29 provides against operation of the shear until after the stock has been released by the feed rolls 4 and 5. Finally, the combined electrical and mechanical interlock between the shear and its driving clutch provides for operation of the shear only in complete cycles beginning and ending at its extreme upper position.

Obviously, termination of the as-described automatic action may be effected at any time through opening of main switch 25 by the starting push button 26.

From inspection of the drawing it is apparent that push button switches 27 and 28 parallel the relays 15 and 16 respectively

and hence provide for voluntary control of the circuits which during automatic action are controlled by said relays.

Thus for trimming the end of the stock preparatory to automatic cutting, the slow push button switch 27 is first closed and locked, thus completing the circuit of relay 21 whereby upon closure of the starting push button and response of main switch 25 said relay is adapted to respond for de-energizing the fast clutch 6 and energizing the slow clutch 7. The stock is thereafter driven at slow speed and when in proper position for trimming the trim push button switch 28 is momentarily pressed, thus energizing relays 18, 19 and 20 which thereupon close and maintain themselves. The trim button may now be released. Closure of said relays serves to energize the windings of hold down magnet 11, solenoid magnet 10 and shear clutch 3, as aforedescribed, for effecting the trimming cut. Moreover the device will thereafter continue automatically to advance and cut the stock but at slow speed. However, upon release and opening of the slow push button 27 the normal speed for automatic action is assumed.

Obviously the speed of operation of the device may be varied by adjusting the speed of motor 2 or the gear ratio of the feed rolls 4 and 5 thereto, while by varying the distance between the shear 1 and the work limit switches 23 and 24 the length of the cut sections may be preselected, none of which adjustments in any wise affects the cyclic operation of the controller or the relative timing of the various operations.

What I claim as new and desire to secure by Letters Patent is:

1. In a controller for power operated devices having intermittently acting elements including work advancing and work holding elements and elements to act upon the work while so held, the combination with control means for said elements to initiate and terminate action thereof, of means for subjecting said former means to control in accordance with the progress of operation of certain of said elements for effecting automatically a predetermined cycle of operation of all of said elements.

2. In a controller for power operated devices having intermittently acting elements including work advancing and work holding elements and elements to act upon the work while so held, the combination with control means for said elements to initiate and terminate action thereof, of means for subjecting said former means to control in accordance with the progress of operation of certain of said elements for effecting automatically a predetermined cycle of operation of all of said elements, said latter means including a mechanism to be driven in synchronism with certain of said ele-

ments for effecting a predetermined control of other of said elements.

3. In a controller for power operated devices having intermittently acting elements including work advancing and work holding elements and elements to act upon the work while so held, the combination with control means for said elements to initiate and terminate action thereof, of means for subjecting said former means to control in accordance with the progress of operation of certain of said elements for effecting automatically a predetermined cycle of operation of all of said elements, said latter means including a mechanism to be driven in synchronism with certain of said elements for effecting a predetermined control of other of said elements and also providing for a different character of control of said latter elements.

4. In a controller for power operated devices having intermittently acting elements including work advancing and work holding elements and elements to act upon the work while so held, the combination with electromagnetic means for controlling the action of said elements, of means coacting with said electromagnetic means to provide for full automatic cyclic operation of the device as a whole, said latter means including means for subjecting said latter mentioned elements to control in accordance with the progress of operation of certain of said former elements.

5. In a controller for power operated devices having intermittently acting elements including work advancing and work holding elements and elements to act upon the work while so held, the combination with electromagnetic means for controlling the action of said elements, of means coacting with said electromagnetic means to provide for full automatic cyclic operation of the device as a whole, said latter means including means for subjecting said latter mentioned elements to control in accordance with the progress of operation of certain of said former elements and means for subjecting said former elements to control in accordance with the progress of operation of said latter elements.

6. In a controller for power operated devices having intermittently acting elements including work advancing and work holding elements and elements to act upon the work while so held, the combination with electromagnetic means for controlling the action of said elements, of means to act upon said electromagnetic means to provide for full automatic cyclic control of said elements, said last mentioned means including a switch subject to actuation upon a predetermined operation of said work advancing elements to provide for arrest of operation of said elements and initiation of action of said other elements.

7. In a controller for power operated devices having intermittently acting elements including work advancing and work holding elements and elements to act upon the work while so held, the combination with electromagnetic means for controlling the action of said elements, of means to act upon said electromagnetic means to provide for full automatic cyclic control of said elements, said last mentioned means including circuit control means for rendering action of either of said sets of elements dependent upon a predetermined prior operation of the other set of elements.

8. In an electrical controller for power operated shears and the like, the combination with a source of power, of shear actuating means and work advancing means to be driven by power from said source, means for effecting power connections for the aforesaid sets of means alternately, work holding means, and means subject to control in accordance with the progress of operation of both of said power operated means for automatically effecting adequately timed cyclic operation of all of said means.

9. In a controller for power operated shears and the like, the combination with a driving motor, and a shear and feed rolls to be driven thereby, of electromagnetically operable devices adapted to act intermittently for effecting operating connections between said shear and said motor and between said rolls and the stock and also for stopping and holding the stock during cutting by said shear, relays for controlling energization of said electromagnetic devices, and control means for said relays subjected to control in accordance with the progress of

operation of said shear and said feed rolls for effecting adequately timed cyclic operation of said devices.

10. In a controller for power operated shears and the like, the combination with a driving motor and a shear and feed rolls to be driven thereby, of electromagnetically operable clutches for effecting intermittent driving connection of said shear and for selecting the speed of operation of said rolls, electromagnetically operable means for effecting release of the stock by said feed rolls and for positioning and holding the stock during cutting, and automatic control means for said electromagnetically operable means providing for adequately timed cyclic operation of the instrumentalities controlled thereby.

11. In a controller for power operated shears and the like, the combination with a driving motor and a shear and feed rolls to be driven thereby, of electromagnetically operable clutches for effecting intermittent driving connection of said shear and for selecting the speed of operation of said rolls, electromagnetically operable means for effecting release of the stock by said feed rolls and for positioning and holding the stock during cutting, and automatic control means for said electromagnetically operable means providing for adequately timed cyclic operation of the instrumentalities controlled thereby, said control means including a switch providing against operation of said shear prior to operation of said work releasing means.

In witness whereof, I have hereunto subscribed my name.

HARRISON P. REED.