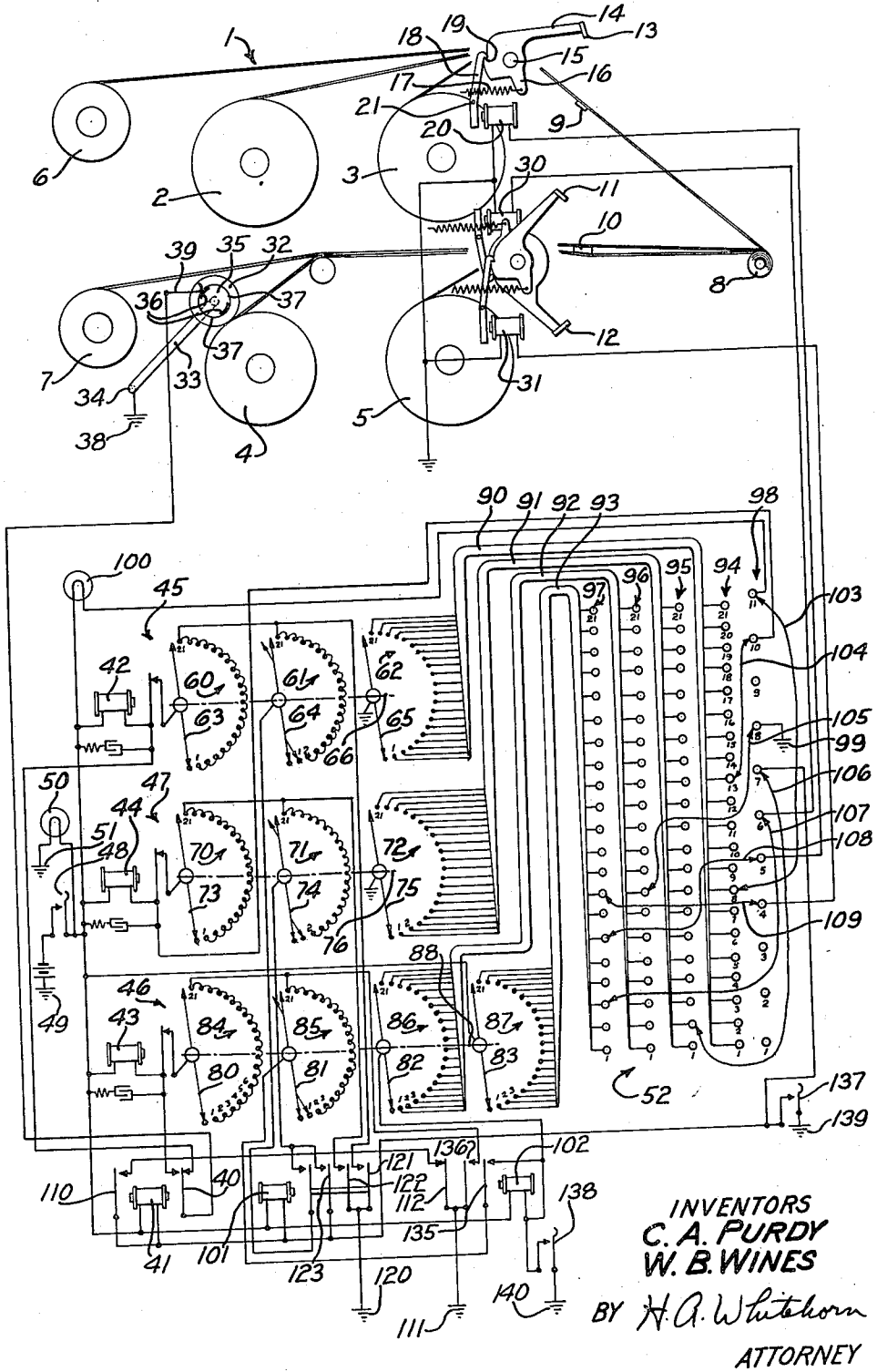
Feb. 14, 1939. C. A. PURDY ET AL 2,146,848

CONTROL MECHANISM

Filed June 25, 1936



INVENTORS
C. A. PURDY
W. B. WINES
BY H. A. Whitehorn
ATTORNEY

Patented Feb. 14, 1939

2,146,848

UNITED STATES PATENT OFFICE

2,146,848

CONTROL MECHANISM

Chester A. Purdy, Hinsdale, and William B. Wines, Elmhurst, Ill., assignors to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application June 25, 1936, Serial No. 87,234

11 Claims. (Cl. 164—43)

This invention relates to control mechanism for material handling or working apparatus, and more particularly to an adjustable control for selectively timing the operation of various devices in a material handling or working apparatus under control of the material worked or handled.

It is an object of the present invention to provide a simple control mechanism selectively operable to control the sequence of operation of various devices in a material handling or working apparatus.

In accordance with one embodiment of the invention as applied to a semi-automatic condenser winding apparatus, a roller driven by the paper being wound into a condenser drives a commutator which, through the making and breaking of an electrical circuit thereby, operates selector switches of the type commonly used in automatic telephone exchange equipment. The contacts of the selector switches are connected to plugs which may be inserted in selected jacks in a switchboard, thereby to selectively control the operation of the various devices in the winding machine in accordance with the amount of paper which has been fed.

Other objects and advantages of the invention will more fully appear from the following detailed description taken in connection with the accompanying drawing, wherein the single figure shows diagrammatically a condenser winding machine with an electrical control circuit embodying the invention.

Referring now to the drawing wherein the numeral 1 designates generally a condenser winding machine in which four servings of paper and two servings of metallic foil are drawn from paper rolls 2, 3, 4 and 5 and foil rolls 6 and 7 by an arbor 8. The structural details of a suitable winding machine are disclosed in Reissue Patent 19,320 to Chester A. Purdy, issued September 18, 1934, and are therefore not shown in detail herein.

The arbor 8 draws the serving of foil from roll 6 and the servings of paper from the rolls 2 and 3 over a shearing platen 9, suitable guide rollers being provided for directing the foil and paper to the platen 9. The serving of foil from the roll 7 passes over suitable guides and a shearing platen 10, and thence to the arbor 8, whereas the servings of paper from the rolls 4 and 5 pass under the platen 10. The separation of the foil and paper servings at the platen 10 permits the two different materials to be separately sheared by knives 11 and 12 which are provided for that purpose. A knife 13 is provided for shearing the paper from rolls 2 and 3 and the foil from roll 6.

The knife 13 is carried by a bell crank lever 14 pivoted at 15 and having its short arm 16 connected to one end of a tension spring 17. Tension in the spring 17 tends to move the bell crank lever 14 in a clockwise direction, but the knife is normally held in a raised position by a latch 18 engaging a catch 19 integral with the bell crank lever 14.

A portion of the latch 18 serves as an armature for an electromagnet 20 so that when the electromagnet 20 is energized the latch will be rocked on its pivot 21 to release it from engagement with its catch 19 and thus permit the energy stored in the spring 17 to force the knife 13 into shearing relation with the platen 9 to sever the paper and foil as they pass over the platen toward the arbor 8. The knives 11 and 12 are operated in the same manner as the knife 13, being operable under control of a pair of electromagnets 30 and 31, respectively, similar to the electromagnet 20.

Mechanism is provided for automatically controlling the operation of the knives 11, 12 and 13 in any desired sequence and after a predetermined selected amount of material has been wound on the arbor 8. This mechanism includes a roller 32 rotatable on the free end of a lever 33 pivoted at 34. The roller 32 which rests on the roll of paper 4 and will be driven thereby has a commutator 35 fixed thereto, comprised of insulating portions 36 and conducting portions 37 connected to ground at 38 through the lever 33. The roller 32 and lever 33 are sufficiently heavy to hold the roller in engagement with the roll of paper 4 by the force of gravity. Thus the roller with its commutator provides the initial element of a measuring system's determinations of the length of material being wound.

Mounted in engagement with the commutator 35 is a brush 39 which wipes over the surface of the commutator to periodically continue the circuit from ground at 38 to an armature 40 of a relay 41 as the commutator rotates.

The ground path over the armature 40 of relay 41 will be continued to one side of the winding of an electromagnet 42 or to one side of the winding of an electromagnet 43, depending upon the position of the armature 40 under control of the relay 41. The electromagnets 42 and 43 and a similar electromagnet 44 constitute the operating mechanism for three selector

switches designated generally by the numerals 45, 46 and 47, respectively.

A manually operable key 48 is provided for connecting grounded battery at 49 to one side of the winding of the electromagnets 42, 43 and 44 when the apparatus is being used, and a signal light 50 is connected to one side of the key 48 so that when the key is operated a circuit will be completed through the lamp 50 to ground at 51 to light the lamp indicating that the control apparatus is in operation. The selector switches 45 and 47 count the number of rotations of the commutator 35 due to circuit connections which will be described more in detail hereinafter, and the selector switch 46 controls the operation of the electromagnets 20, 30 and 31 in the condenser winding machine in a predetermined selected sequence, as determined by the interconnection of circuits at a switchboard indicated generally by the numeral 52.

The selector switches 45, 46 and 47 are of the type used in automatic telephone equipment and comprise a plurality of banks of contacts and a brush associated with each bank, there being twenty-two contacts in each bank. The switches may be of the type disclosed in Patent No. 1,472,465, issued October 30, 1923 to O. F. Forsberg et al. The selector switch 45 includes three banks of contacts 60, 61 and 62, and the banks of contacts have brushes 63, 64 and 65, respectively, associated therewith. All of the brushes of the selector switch 45 are mounted upon a common shaft 66 rotatable by a pawl and ratchet mechanism (not shown) which operate under spring pressure upon release of the electromagnet 42 as is usual in such switches. The brush 64 is a bridging brush which engages two adjacent contacts at a time, whereas the brushes 63 and 65 are not of the bridging type for a purpose which will become apparent as the description progresses.

The selector switch 47 includes three banks of contacts 70, 71, and 72, and three brushes 73, 74 and 75 mounted on a shaft 76 operable under control of electromagnet 44. The brush 74 is a bridging brush and brushes 73 and 75 are non-bridging as were the corresponding brushes in selector switch 45. Selector switch 46 is of the same construction as the other two switches, except that it has four brushes 80, 81, 82 and 83 associated with four banks of contacts 84, 85, 86 and 87. Brush 81 is a bridging brush and brushes 80, 82 and 83 are non-bridging and all of them are mounted upon a shaft 88 operable under control of electromagnet 43.

The selector switches as pointed out hereinbefore have twenty-two contacts in each of their banks. In the normal position of the switches, (as shown), the brushes on all of the banks are engaging contacts not connected to any other parts of the apparatus. In the banks 62, 72, 86 and 87 the remaining 21 contacts are connected in multiple through cables 90, 91, 92 and 93 to rows of jacks 94, 95, 96 and 97, respectively, in the switchboard 52. Each of the rows of jacks 94, 95, 96 and 97 have twenty-one jacks numbered 1 to 21, consecutively, from bottom to top, and these jacks are, as hereinbefore mentioned, connected to the contacts numbered 1 to 21 in the banks of contacts, respectively. A fifth row 98 of jacks is also provided in the switchboard 52, which jacks are connected to various pieces of apparatus, in the manner to be described, extra jacks being provided in the row 98 for connection to apparatus other than that shown if it is desired to provide a control for more parts than are necessary in the present disclosed embodiment of the invention.

The fourth jack from the bottom in the row 98 is connected to one side of the winding of the electromagnet 31; the fifth jack in row 98 is connected to the winding of electromagnet 20; the sixth jack in row 98 is connected to the winding of electromagnet 30; the seventh jack in row 98 is connected to an armature and one side of the winding of a relay 101 and to the winding and an armature of relay 41; the eighth jack in row 98 is connected to ground at 99; the tenth jack in row 98 is connected to the winding of electromagnet 44, and the eleventh jack is connected to one side of the filament of a lamp 100, the other side of the filament of which may be connected through the key 48 to grounded battery at 49. A relay 102 having one side of its winding connected to the common lead for relays 41 and 101 is also provided for a purpose which will become apparent as the description progresses.

The switchboard 52 permits the jacks in row 98 to be selectively connected through double ended cords 103, 104, 105, 106, 107, 108 and 109 to any desired jacks in the rows 94, 95, 96 and 97. By connecting the jacks in the switchboard 52 the desired sequence of operations may be obtained. In the embodiment shown the lamp 100 will be lighted at a predetermined time as determined by the connections in the switchboard to indicate to the operator that metallic condenser terminals should be inserted between windings of foil and paper wound on the arbor 8, and at a later time in the cycle the cut off knives 11, 12 and 13 may be operated in any desired sequence automatically after a predetermined selected amount of paper has been drawn from the roll 4.

Each time the commutator 35 makes one revolution it will make and break its circuit from ground to the armature 40 of relay 41 twice. Each time ground is applied to the armature 40, an electrical circuit will be completed from ground at 38 through the lever 33 and commutator 35, armature 40 to one side of the winding of the electromagnet 42 if relay 41 is not energized. It being assumed at this time that the key 48 has been closed, the circuit prepared by the commutator 35 will be completed through battery to ground at 49, thereby energizing electromagnet 42 and holding it energized until the circuit is again broken at the commutator.

As pointed out hereinbefore, each time an electromagnet such as the electromagnet 42 is energized, it will prepare its shaft 66 for rotation, and upon deenergization of the electromagnet the rotation of the shaft will take place. Therefore, each time the circuit to the electromagnet 42 under control of the commutator 35 is made and broken, the brushes 63, 64 and 65 will be stepped from one contact to another on their associated banks of contacts.

With the switchboard 52 connected in the manner shown, the brushes 63, 64 and 65 will be moved over the contacts of their associated banks until they engage the eighth contact in their banks, at which time ground connected to brush 65 will be connected through double ended cord 103 and the eleventh jack in the row 98 to the filament of the lamp 100, which will immediately light since the key 48 has been closed and the circuit path through the lamp will be continued to ground at 49. The lamp 100 will remain lighted for a short time while brush 65

engages its eighth contact indicating, for example, that the operator is to insert a terminal into the condenser being wound on the arbor 8. The operation of the brushes 63, 64 and 65 will continue until brush 65 engages its thirteenth contact, at which time ground from the brush 65 will be connected through the thirteenth jack in row 94, double-ended cord 104, tenth jack in row 98 to the winding of the electromagnet 44. Electromagnet 44 will thereby be energized over a path from grounded battery at 49 through winding of electromagnet 44 and tenth jack in row 98 to ground over the circuit just traced, causing the brushes 73, 74, and 75 to move onto contact numbered 1. Continued rotation of the commutator 35 will cause the brushes 63, 64 and 65 to be stepped successively into engagement with all of their contacts until brush 65 again engages its eighth contact, whereupon the lamp 100 will again be lighted and the brushes will continue to move over their contacts until brush 65 again engages its thirteenth contact to transmit another pulse through the electromagnet 44, thereby causing the brushes 73, 74 and 75 to engage the second contacts in their associated banks 70, 71 and 72, respectively. As the brush 75 engages the second contact in its bank 72, ground at the brush 75 will be connected to the second jack from the bottom in row 95, and through double ended cord 106 to the seventh jack in row 98 and thence through the winding of relay 41 and operated key 48 to grounded battery 49 energizing relay 41.

Upon energization of relay 41, armature 40 will be shifted from its break to its make contact, and will be held in that position so long as brush 75 remains on its second contact. The relay 41 will also attract another armature 110 to connect ground at 111 over an armature 112, and a break contact of relay 102 now deenergized to lock the relay 41 in its operated position until relay 102 is energized.

The next time the commutator 35 is connected to ground at 38, this ground connection will be connected over armature 40 of relay 41 to one side of the winding of electromagnet 43 the other side of the winding of which has been connected to grounded battery at 49 through the operation of key 48. As soon as the circuit from ground is broken at the commutator 35, electromagnet 43 will be deenergized to move its brushes 80, 81, 82 and 83 into engagement with the first contacts on their associated banks.

When relay 41 is energized, ground at 111 will be connected through armature 112 of relay 102, armature of relay 41 to the winding of relay 101 which will thus be energized since the other side of its winding is connected to grounded battery at 49. Energization of relay 101 connects ground at 120 over its armature 121 to contacts 1 to 21 in bank 60 and contacts 2 to 21 in bank 61, and over its armature 122 to contacts 1 to 21 in bank 70 and contacts 2 to 21 in bank 71. Relay 101 will remain locked operated until relay 102 is energized, since ground is connected to the winding of relay 101 over the armature 112 of relay 102, and armature 110 of relay 41.

The ground on contacts 1 to 21 in banks 60 and 70 will cause selector switches 45 and 47 to operate rapidly until the brushes 63 and 73 reach their associated zero or normal positions. As soon as brushes 63 and 73 reach their zero position, ground at 120 will no longer be connected through the brushes to the armatures of electromagnets 42 and 44 and the brushes will stop in their zero position. If one of the brushes 63 or 73 reaches normal before the other, it will stop in that position and relay 101 will remain energized until the other brush reaches normal. It is in this manner that selector switches 45 and 47 are restored to normal.

During the period when switches 45 and 47 were being restored to zero, the commutator 35 continued to send impulses over armature 40 of relay 41 to the electromagnet 43 causing its operation to step its associated brushes 80, 81, 82 and 83 into engagement with succeeding contacts on the banks of contacts 84, 85, 86 and 87, respectively. As brush 83 engaged its third contact, it connected grounded battery at 49 through operated key 48, brush 83, third contact in bank 87, third jack from bottom row 97, cord 107, sixth jack in row 98 and winding of electromagnet 30 to ground, thereby energizing electromagnet 30 and operating shear knife 11. As brush 83 continued moving over its contacts in bank 87, it in time engaged contacts 6 and 8 connected by cords 108 and 109 to the jacks in row 98 connected to the electromagnets 20 and 31, respectively, to operate knives 13 and 12, respectively, in the same manner that knife 11 was operated.

Simultaneously with the completion of the operating circuit for electromagnet 31 by brush 83, brush 82 will connect ground at 99 through cord 105, eighth jack in row 96, eighth contact in bank 86, brush 82, winding of relay 102 through operated key 48 to grounded battery at 49. Relay 102 will thereby be energized and will lock over a circuit from grounded battery at 49 through operated key 48 winding of relay 102, a locking armature 135, brush 81 strapped contacts of bank 85 and make contact 136 of relay 102 to ground at 111. This locking ground to relay 102 will be held until brush 81 reaches normal position due to the fact that brush 81 bridges two contacts at all times.

Upon the energization of relay 102, ground at 111 will also be connected through brush 80 and strapped contacts 1 to 21 of bank 84, thereby to cause selector switch 46 to step rapidly to its normal position in a manner similar to that described in connection with switches 45 and 47.

When relay 102 was energized, it broke the circuit from ground at 111 over its break contact 112, thereby releasing relays 41 and 101. The release of relay 41 will again connect the ground at 38 through the commutator 35 to the winding of electromagnet 42 and the selector switch 45 will, therefore, immediately restart its counting cycle as soon as paper is again drawn from roll 4, thereby to measure the amount of paper fed past the commutator. In this manner an accurate measurement of the amount of paper drawn past the commutator will be made, and the amount of "coasting" or overrunning of the paper, which varies with the size of the paper roll, will not change the accuracy of the measurements made. The method of removing a wound condenser from the arbor 8 and starting a new winding operation will be apparent from a consideration of the Purdy reissue patent mentioned hereinbefore.

For the convenience of the operator under unusual conditions, a pair of switches 137 and 138 have been provided. Switch 137, upon operation, will connect ground at 139 to the windings of relays 41 and 101 to restore selector switches 45 and 47 to normal and, if the commutator 35 is rotating, to start switch 46 through its cycle to operate the knives 11, 12 and 13. Operation of

switch 138 at any time will restore selector switch 46 to normal by connecting ground at 140 to the brushes 80 and 81 and to the winding of relay 102.

It will in general be desirable to have the commutator 35 operating at a fairly rapid rate, so as to provide for fine adjustment of the time of operation of the various devices controlled thereby. It is within the contemplation of the invention, however, to operate the commutator during a complete cycle of the machine a sufficiently small number of makes and breaks that only one counting selector switch will be needed, rather than two in tandem as disclosed herein.

Although a specific embodiment of the invention has been described, wherein the invention is applied to condenser winding machines, it will be apparent that the invention is subject to many alterations and may be adapted to control many types of machines. For example, the impulse transmitter 35 may be driven by any desired means. Accordingly, the invention is to be limited only by the scope of the appended claims.

What is claimed is:

1. In a control device for machines having a plurality of separately operable parts, a commutator driven by material being worked, a selector switch operable under control of the commutator, and a selector switch operable under control of the first selector switch and connectable to the separately operable parts to control their operation.

2. In machines for winding a plurality of layers of material about an arbor, means for cutting the layers of material separately, means driven by one layer of the material for making and breaking an electical circuit, and selector switches operable by said circuit for operating said cutting means in any selected sequence, said selector switches being of the type operable step by step by electrical impulses transmitted theerto.

3. In machines for winding a plurality of layers of material about an arbor, means for cutting the layers of material separately, means driven by one layer of the material for making and breaking an electrical circuit, and selector switches operable by said circuit for operating said cutting means in any selected sequence after a predetermined selected number of operations of said circuit making and breaking means.

4. In a machine having material feeding means, and a plurality of separately operable machine parts for performing operations on said material, a control device including a plurality of selector switches operable under control of material being fed, a switchboard, and electrical circuits selectively connectable to said switchboard for operating the said separately operable machine parts in any desired sequence.

5. In a machine having material feeding means, and a plurality of separately operable machine parts for performing operations on said material, a control device including a plurality of selector switches operable under control of material being fed, a switchboard, and electrical circuits selectively connectable to said switchboard for operating the said separately operable machine parts in any desired sequence after any predetermined selected amount of material has been fed.

6. In a machine having material feeding means, and a plurality of separately operable machine parts for performing operations on said material, a control device including a switchboard, a plurality of selector switches, a commutator driven by material being fed to control the operation of the selector switches, a switchboard connected to said selector switches, and means selectively operable to connect said selector switches to said separately operable machine parts to control the operation thereof.

7. In a control apparatus for material handling machines, a circuit making and breaking device operated by material being handled, a pair of electromagnetically operated selector switches controlled by said device for indicating the amount of material handled, a second selector switch controlled by said pair of switches for preparing a plurality of circuit paths in automatic succession, and selectively operable means for completing selected ones of said circuits.

8. In a control apparatus for material handling machines, a circuit making and breaking device operated by material being handled, a pair of electromagnetically operated selector switches controlled by said device for indicating the amount of material handled, a second selector switch controlled by said pair of switches for preparing a plurality of circuit paths in automatic succession, and selectively operable means for connecting electrical circuits to selected ones of said prepared paths in any desired sequence.

9. In a control apparatus for material handling machines, a circuit making and breaking device operated by material being handled, a pair of electromagnetically operated selector switches controlled by said device for indicating the amount of material handled, a second selector switch controlled by said pair of switches for preparing a plurality of circuit paths in automatic succession, electrical circuits for controlling various parts of the material handling machine, and means for selectively connecting said circuits to the prepared paths in any desired order to control the time and sequence of operations of said circuits.

10. In a control device for machines having a plurality of separately operable parts, a commutator being driven by material being worked, a selector switch operable under control of the commutator, a second selector switch operable under the control of the first selector switch and connectible to the separately operable parts to control their operation, and a means operable under control of said switches for resetting the switches to normal.

11. In a control device for machines having a plurality of separately operable parts, a commutator being driven by material being worked, a selector switch operable under control of the commutator, a second selector switch operable under the control of the first selector switch and connectible to the separately operable parts to control their operation, means operable under control of said switches for resetting the switches to normal, and an auxiliary means operable to control the resetting of the switches to normal.

CHESTER A. PURDY.
WILLIAM B. WINES.