

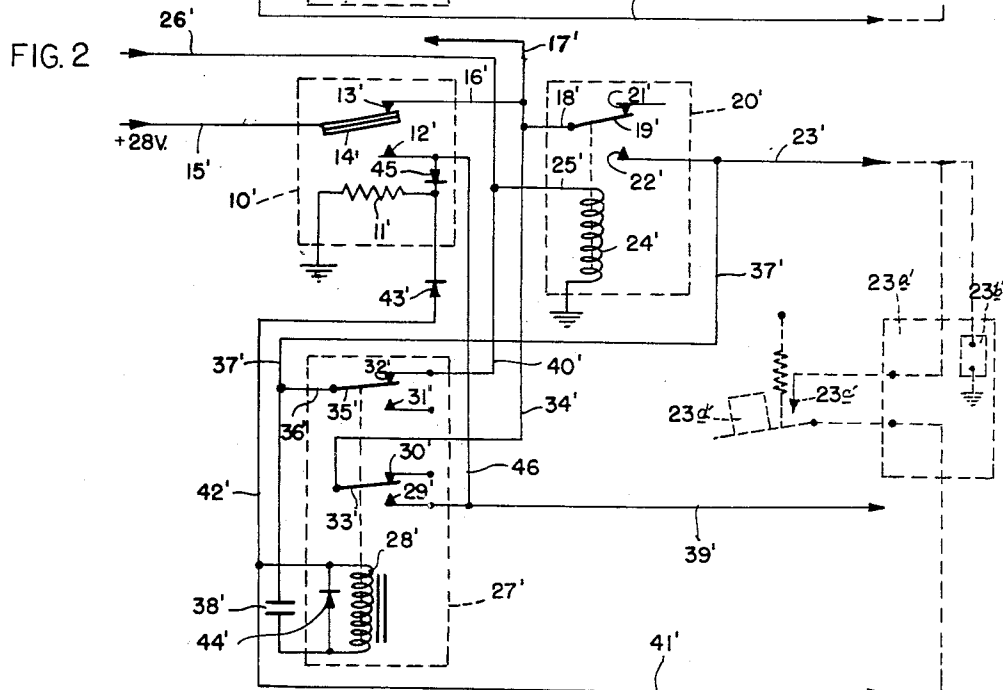
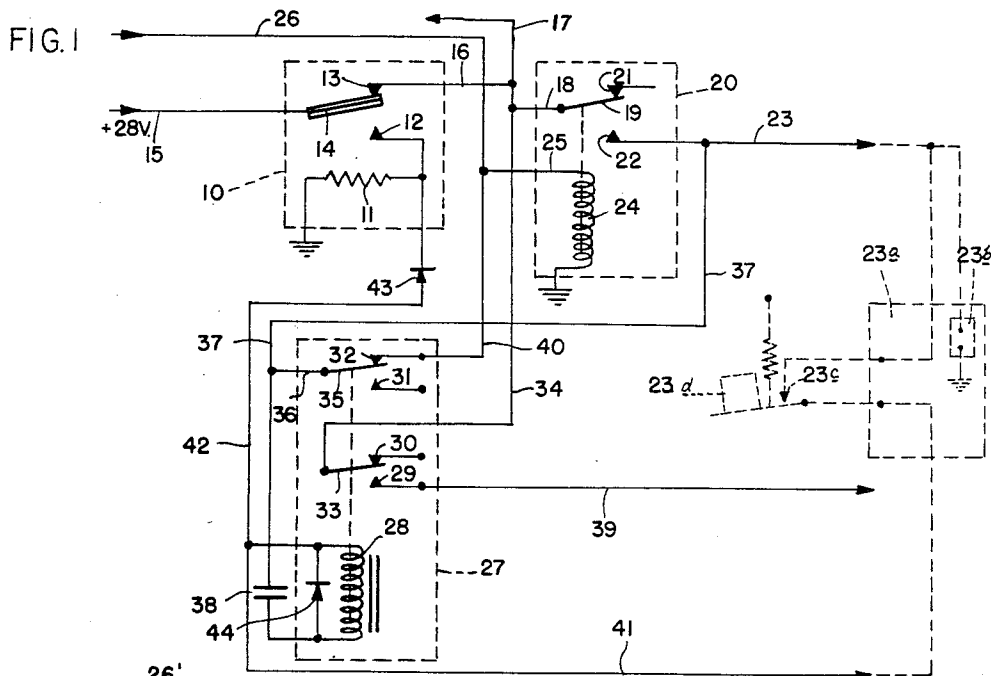
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COUNTER CONTROL CIRCUIT

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COUNTER CONTROL CIRCUIT

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This invention relates to a control circuit, and more especially to a counter control circuit for interconnecting an actuator with a counting device in a manner such that the functions or operations of the actuator are tallied or indicated by the counting or other indicia device.

An exemplification of a type of mechanism or actuator with which the counter control circuit may be used is a dispenser that may be in the form of a conveyor adapted to move packages or other articles past a counting station. In this type of mechanism, it is frequently essential to maintain an accurate count of the packages advanced through the counting station, and accuracy in this respect has posed a serious problem in the prior art. This is especially true where the conveyor has a cyclic or intermittent operation, which often results in a package being located in the counting station at termination of the conveyor movement. As a consequence of this, false counts are made—that is, such a package is counted twice, once when the conveyor movement is terminated, and again upon its subsequent initiation.

An object of this invention is to provide a control circuit useful in conjunction with counter networks, and which is effective to obviate this problem of false counts. Still another object of the invention is in the provision of a counter control circuit adapted to be interconnected with an actuator and counting device, and which functions to energize the counting device only in response to predetermined actuator conditions.

Still another object of the invention is that of providing a counter control circuit of the character described, which is responsively operative to an actuator only when an article has completely traversed the same, and thus ignores any other conditions which might simulate a true count. Yet a further object is to provide a circuit of the type described, having response and control relays as parts thereof interconnected through an actuator in a manner such that the condition of either relay is selectively dependent upon the other—with the result that condition changes of the actuator which are independent of true counting changes therein, are ineffective to cause false responses of the relays. Additional objects and advantages of the invention will become apparent as the specification develops.

Embodiments of the invention are illustrated in the accompanying drawings, in which—

Figure 1 is a schematic circuit diagram showing one form of the invention; and Figure 2 is a schematic circuit diagram showing a modified form thereof.

The control circuit shown in Figure 1 includes as an ancillary part thereof an idle-time cut-off device, indicated in general by the numeral 10 and illustrated in the form of a thermal relay. The relay has a resistance element 11 that is heat-responsive to the flow of current therethrough, connected to ground at one end thereof. The other end of the heater 11 is connected to a contact 12 which is a part of the cut-off device 10, and is located in spaced relation with a contact 13. A bimetallic blade 14 is positioned between the contacts for selective engage-

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ment therewith, and is connected by a lead 15 to a voltage source, which may be positive 28 volts for the circuit illustrated.

The contact 13 is connected by lead 16 to a conductor 17 that supplies voltage for actuating the drive motor of a mechanism with which the control circuit is used, when the blade 14 is in its normal position of engagement with the contact 13. The lead 16 is also seen to be connected through line 18 to the movable switch blade or armature 19 of a magnetic control relay, designated in general by the numeral 20. The blade 19 is selectively engageable with spaced contacts 21 and 22, the latter of which is adapted to be connected by a lead 23 to the actuating or counter switch of such a mechanism when in use with the circuit of Figure 1.

A typical mechanism is a dispenser, illustrated diagrammatically in Figure 1 with broken lines, that may take the form of a package conveyor. For identification, the dispenser generally is denoted by the numeral 23a, the drive motor thereof with the numeral 23b, the normally closed counter switch with 23c, and the package which is positioned on the switch to open the same by the number 23d.

The relay 20 has an energizing coil 24 grounded at one end, and connected at its other end through a lead 25 to a conductor 26 that, in turn, is adapted to be connected to a pulsing network or device (not shown) that supplies voltage pulses of short duration to the control relay 20 for energizing the same. Such pulses may have a value of positive 28 volts in the specific circuit illustrated.

The circuit is also seen to include a magnetic response relay 27 having an energizing coil and two sets of spaced contacts designated, respectively, with the numerals 29—30 and 31—32. Movable between contacts 29 and 30 for selective engagement therewith is a switch blade or armature 33, connected by a line 34 to both the stationary contact 13 of the cut-off device 10 and the movable contact 19 of the control relay 20. A switch element or armature 35 is positioned for movement between the spaced contacts 31 and 32 for selective engagement therewith, and is connected by a lead 36 to a line 37 that terminates at one end in connection with the contact 22 of relay 20, and at its other end, through a capacitance 38, with one side of the energizing coil 28 of the response relay 27. The line 37 and its connections with the contacts of relays 20 and 27 forms a holding circuit for control relay 20.

Contact 29 of the relay 27 connects with a conductor 39 adapted to lead to a signal lamp and counter or other indicia device (not shown) that indicates each energization of the relay 27. In a manner to be described hereinafter, such energizing of the relay 27 and, consequently, of such signal lamp and counter arrangement is in direct relation to the number of package units 23d being tallied or counted—that is, passing over the counter switch 23c. It is apparent that the contact 30 terminates in an open connection, and normally the switch contact 33 is in engagement therewith as illustrated. Contact 31 also terminates in an open connection, and the associated contact 32 thereof, which is normally engaged by the switch blade 35, is connected by a line 40 to the line 26 carrying the 28-volt initiating pulses.

The energizing coil 28 of the relay 27 at one end thereof connects with a line 41 that, in use of the circuit, is connected to the counter switch 23c, as shown. Extending from the juncture of the coil 28 and line 41 is a lead 42 having a uni-directional current flow device 43 such as a germanium rectifier interposed therein. Such lead terminates at its other end in connection with the heater 11 of the thermal cut-off device 10. The rectifier 43 serves as a blocking element to prevent the

flow of current from the heater 11 to the coil 28. A similar uni-directional current flow device 44, which may also be a germanium rectifier, is connected in shunt with the coil 28 and forms a part of the charge path for the capacitor 38 through the line 42, rectifier 43 and heater 11.

The modified circuit illustrated in Figure 2 is for the most part identical with the embodiment of the invention heretofore described in detail, and for this reason the same numbers have been adopted to designate the various components; but in order to provide a clear line of demarkation between the two embodiments, each of the numerals of Figure 2 has been primed, with the exception of those which identify additional components.

It will be noted in Figure 2 that a rectifier 45 is interposed between the contact 12' and heater 11' of the thermal relay 10'. Another change in the circuit of Figure 2 is the inclusion of a conductor 46 which at one end thereof is connected to the contact 12', and at its other end to the conductor 39'. Apart from these differences, as has been stated, the circuits are identical.

Before describing the specific functioning of the counter control circuit, it is believed that it will be helpful to set forth briefly the manner in which the conveyor mechanism operates, at least with respect to the actuator or counter switch 23c thereof. In this regard, the switch is normally maintained in closed position by a suitable biasing means, such as the helical spring shown. The switch is opened whenever a package 23d is located thereon. For example, the switch may be interposed in the path of travel of a conveyor so that each package or other article advanced thereby must traverse the switch. It is apparent that the switch will be closed only when the package leaves the same. In a specific functional embodiment of the invention used with a conveyor of the type described, a package will be advanced over the switch in a minimum time of about $\frac{2}{10}$ of a second.

The timing or initiating pulses for setting the circuit in operation come in through the line 26 which is connected to a suitable pulsing network. These pulses may be of short duration; and once received, the circuit functions independently thereof. In the specific operational embodiment referred to above, the pulses impressed on the circuit through the line 26 are of several milliseconds duration. Also, a voltage for energizing the drive motor of the conveyor apparatus originates at the line 15, and is fed to the motor or control therefor through the line 17. Thus, in considering the circuit operation, it may first be assumed that the conveyor motor is energized through the lines 15 and 17 and bimetallic switch 14.

When an initiating pulse is impressed on the line 26, the coil 24 of the relay 20 is energized since a circuit is completed thereto through ground. Immediately upon energization of the control relay, the initiating pulse or pulses lose control, for the relay 20 is self-holding in that it has a holding or feed-back circuit from line 16 through armature 19, contact 22 (which is engaged by the armature when the relay is initially energized), line 37, armature 35, contact 32, lines 40 and 25, and to ground through coil 24. The control relay 20 will remain in this energized condition until the holding circuit thereof is interrupted, which will only occur when the armature 35 of response relay 27 disengages contact 32.

When the control relay 20 is energized, the 28-volt potential from line 15 is also fed through armature 19 and contact 22 to the counter or actuating switch 23c of the conveyor apparatus; and if that switch is closed, which will be the case unless a package is at rest thereon, the potential will be fed through line 41 to line 42 and to ground through rectifier 43 and heater 11. At the same time, both sides of the capacitor 38 will be at the same potential in that 28 volts will be applied to the bottom side thereof from line 42 through coil 28 of the

response relay 27, and to the upper side thereof by line 37, which, as heretofore noted, is also connected to the 28-volt source.

Now, if a package 23d moves onto the switch 23c causing it to open, the capacitor 38 is immediately charged by connection of the lower side thereof to ground through rectifier 44, line 42, rectifier 43 and heater 11. The time required to charge the capacitor 38, again with reference to the specific functional embodiment of the invention referred to above, is about $\frac{1}{10}$ of a second. Since it requires about $\frac{1}{10}$ of a second for the package to completely pass over the switch 23c, it is apparent that the capacitor will be charged in such time.

The moment that the package moves beyond the switch 23c, permitting it to close, the response relay 27 will be energized due to discharge of the capacitor 38 through the energizing coil 28. When the response relay is energized, armature 35 thereof will disengage contact 32, thereby breaking the holding circuit for control relay 20 which then returns to the condition shown in Figure 1. At the same time, armature 33 of relay 27 will engage contact 29, thereby connecting line 16 and the 28 volts thereon with line 37 which leads to the counting devices employed in conjunction with the circuit, such as an indicator lamp and electrical counter. The relay 27 will be energized for approximately 25 milliseconds, which is more than sufficient to break the holding circuit for control relay 20 (its requirement being about five milliseconds), and also to actuate the counter or indicia devices that require only about fifteen milliseconds. The response relay 27 will be deenergized as soon as the charge on the capacitor 38 falls below the requisite energizing current for the coil 28. The circuit is now returned to the initial condition, and will perform a similar operational cycle upon the receipt of another initiating pulse through the line 26.

If the conveyor movement is terminated with a package positioned on the switch 23c, no count is taken thereof because the response relay 27 cannot be energized.

However, as soon as the conveyor is again actuated and 28 volts applied to the line 37 through relay contact 22 and armature 19, the capacitor 38 charges in the same manner heretofore described, and such charging occurs immediately. Consequently, when the package moves off of the switch, the capacitor discharges through the relay coil 28 to energize the same in the manner above set forth, with the result that counter pulses are fed to the line 39. Thus, it is seen that counts are taken only when a package moves off of the switch, irrespective of whether such package movement is continuous or interrupted. Consequently, the circuit enables only true counts to be made, and simulated counting conditions (that is, shutting down of the conveyor apparatus) are totally ignored.

The idle-time cut-off device 10 is a useful adjunct to the circuit in that it shuts down the conveyor after a period of operation thereof when no packages are being discharged therefrom. For example, if the conveyor is in operation, and an initiating pulse has been applied to the line 26 to energize the control relay 20 but no packages are being advanced by the conveyor, a continuous current flow through lines 15, 16, 23, 41 and 42 and through heater 11 to ground for a predetermined period will cause the bimetallic switch 14 to terminate its engagement with contact 13, thereby isolating line 17 from a voltage source necessary to energize the conveyor drive motor. The idle-time cut-off device 10 can be omitted, and the line 42 connected directly to ground through an ordinary resistance that, for example, may have a value of about 470 ohms. In such event, the blocking diode or rectifier 43 can also be eliminated since its function is to prevent the flow of current from line 15 to line 42 when the switch 14 is in engagement with the contact 12. The diode 44 functions to provide a charge path for the ca-

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capacitance 38 that excludes the energizing coil 28 of relay 27. It also causes the capacitance 38 to discharge through the coil 28, thereby energizing the relay 27. It is apparent that alternative arrangements may be used in place of the diode 44.

The circuit of Figure 2 functions in precisely the same manner as the Figure 1 embodiment, but connects the line 39' to the voltage source afforded by the line 15' whenever the bimetallic switch 14' is in engagement with the contact 12'. This situation results because of the interconnection of the line 39' with the contact 12' through lead 46. The diode 45 is a blocking device between the heater 11' and contact 12'.

While in the foregoing specification embodiments of the invention have been set forth in considerable detail for purposes of adequate disclosure thereof, it will be apparent to those skilled in the art that numerous changes may be made in those details without departing from the spirit and principles of the invention.

I claim:

1. In a control circuit adapted for use with a count actuator and counter therefor, circuit means adapted to include such count actuator so as to be sequentially interrupted thereby when articles being counted are successively sensed by the count actuator, a control relay having normally open contacts in said circuit means for completing the same when the relay is energized and having also a self-holding circuit for maintaining such energized condition thereof, means for feeding energizing signals to said control relay, a response relay having an energizing coil in said circuit means and having also both normally closed contacts in said self-holding circuit for breaking the same when the response relay is energized and normally open contacts adapted to be connected to such a counter for feeding a count signal thereto each time said response relay is energized, a capacitor connected with said energizing coil in said circuit means so as to be charged when the circuit means are interrupted by such count actuator and to discharge through said coil to energize the same when the circuit is subsequently completed by the count actuator, and means for applying an operating potential to said circuit means through said control relay contacts and to said last mentioned normally open contacts.

2. In combination with a count actuating switch adapted to be opened when articles are moved therepast, circuit means connected to said actuating switch and controlled thereby so as to be repetitively interrupted as successive articles are sensed thereby, said circuit means including a response relay having an energizing coil in said circuit means and having also both normally closed and normally open contacts, a control relay in said circuit means for completing the same when the control relay is energized and having a self-holding circuit for maintaining such energized condition thereof and including said normally closed contacts, means for feeding energizing signals to said control relay, a capacitor connected with said energizing coil in said circuit means so as to be charged when the circuit means are interrupted by said actuating switch and to discharge through said coil to energize the same when the circuit is subsequently completed by the actuating switch, and means for applying an operating potential to said circuit means through said control relay when it is in an energized state, said response relay being adapted to be connected to a counter device to feed a counting signal thereto each time the response relay is energized.

3. The control circuit of claim 2 in which said control relay is equipped with normally open contacts connected in said circuit means, and in which said means for applying an operating potential to said circuit means is connected thereto through said normally open contacts.

4. The control circuit of claim 3 in which said self-holding circuit comprises said normally open contacts.

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5. In a control circuit adapted for use with a count actuator and counter therefor, a control relay equipped with normally open contacts, a response relay having an energizing coil adapted to be connected to said contacts through said count actuator so as to interrupt such connection each time the count actuator is disturbed by an article moving therepast, means for successively energizing said control relay, means for maintaining each such energization of the control relay, means comprising said response relay for deenergizing the control relay each time said response relay is energized, means including said response relay adapted to be connected with such counter for feeding counting signals thereto, means for applying operating potentials to said control circuit through the control relay contacts, and means for energizing said response relay for a period of predetermined duration only after the connection thereof to the contacts of said control relay has been interrupted by said count actuator.

6. The control circuit of claim 5 in which said last mentioned means comprises a capacitor connected at one side to the energizing coil of said response relay and at its other side to the contacts of said control relay so that no charge appears across the capacitor until said count actuator interrupts the connection between the response relay and the contacts of said control relay, and after the return of such count actuator to its normal position, said capacitor discharges through the energizing coil of said response relay to actuate the same.

7. In a circuit of the character described, a control relay equipped with an energizing coil and with a pair of normally open contacts, means for feeding successive energizing pulses to said coil to actuate said control relay, means for applying an operating potential to said contacts, a counting switch connected at one side to said contacts, a response relay having an energizing coil connected at one end to the other side of said counting switch, a capacitor connecting the other side of said last mentioned energizing coil to said contacts, a pair of normally closed contacts provided by said response relay, a self-holding circuit for said control relay including said normally closed contacts, and contact means provided by said response relay for connection to a counter device so as to feed counting signals thereto when the response relay is energized, said capacitor in its association in said circuit being characterized by acquiring a charge when said actuating switch is opened and thereafter discharging through the energizing coil of said response relay to actuate the same when said actuating switch is subsequently closed.

8. The circuit of claim 7 in which a unidirectional current flow device is connected in parallel with the energizing coil of said response relay to permit said capacitor to charge without energizing the response relay.

9. In a counter, a response relay having a coil with one side thereof connected to one side of a capacitor, a circuit interconnecting the other side of said capacitor and the other side of the coil, means for connecting one of said other sides to an electrical potential, means for connecting the other one of said other sides to a different electrical potential, said circuit including a switch between said connecting means for opening the circuit to charge the capacitor and closing said circuit to discharge the capacitor through said coil.

10. The combination called for in claim 9 including a rectifier shunting the coil to confine the energization of the coil to one position of said switch.

11. The combination called for in claim 9 including a rectifier shunting the coil and oriented to confine the energization of the coil to the discharge of the capacitor.

12. The combination called for in claim 9 in which one of said connecting means includes a control relay

having a coil in series with a switch of said response relay.

13. The combination called for in claim 9 including a counter circuit and in which said response relay includes a switch in said counter circuit controlled by said coil. 5

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