The invention hereinafter described and claimed has to do exclusively with new and useful electrical interlock circuits for controlling a plurality of operative devices whereby selective operation of said devices may be effected and in a manner making it impossible to operate more than one at a time.

The primary object of the invention is to provide a circuit having a plurality of operative devices and having interlock means whereby only one of said devices may be operated at a time, and means for automatically resetting for another operation.

The various features and details of the circuit of the present invention are hereinafter more fully set forth with reference to the accompanying schematic drawing illustrating the preferred embodiment thereof.

With reference to the drawing it is seen that the circuit may best be described by dividing it into four component circuits, the first of which comprises a plurality of switches 10, only three of which, 10A, 10B, and 10B, are shown, and profusely of the single pole, double throw variety, connected in series across a power line 11 having lines A and B for supplying suitable voltage, and in series with a switch 12, contact K-3-1 of switch 13, and the coil of a relay K-1. Each of the switches 10 is operatively and respectively associated with a solenoid 14, 14A and 14B, connected in parallel in the second component circuit and to power line 11. The solenoids are operatively connected by their armatures 15, 15A and 15B respectively, to devices 16, 16A and 16B, each to be operated upon energization of its associated solenoid. These devices may be of any number of different types, or if desired, may be electric ject apparatus such as described in the co-appending application entitled "Article Storing and Issuing Apparatus," Serial No. 187,636, filed April 16, 1962, in the name of Richard I. Kester, and assigned to the assignee of the subject invention.

Relay K-1 includes the normally closed switch 13 in the third of the component circuits, identified by the reference character 20 (at the bottom of the drawing), which also has a relay coil 2 and a start switch 22, all connected in series across a suitable source of voltage indicated at 24. It should be understood that switch 22 in the present illustrated embodiment of the invention is disposed in a position which is inaccessible until switch 12 is closed, as more clearly set forth in the Brewer et al. application identified below. The switch 25 of relay K-2 is connected in a D.C. circuit 26, the fourth component circuit, having in series, relay contact K-2-2, relay coil 23 and a capacitor 24. Connected in shunt to contact K-2-2 of switch 25 and the battery 24 between capacitor 25 and the minus side of the circuit, is a resistor 30.

In the operation of the circuit to energize or operate one of the output devices 16, 16A or 16B, one of the single pole, double throw switches 19 is moved from its N0. 1 to its No. 2 contact, either manually, or in the manner set forth in the co-appending application entitled "Inventory Control System and Apparatus," Serial No. 162,630, filed December 12, 1961, in the names of Brewer, White and Colburn, and assigned to the assignee of the present invention. Reference may be had to that application for further details, if desired, although it is not necessary to a complete understanding of the present invention. It is only necessary to know here, that actuation of one of the switches by any means, selects the particular device to be operated.

Normally the circuit is connected to the power source 11 as by closing switch 12, which may be manually operated, or it may be closed by the opening of a door as set forth in the above mentioned Brewer et al. application, or by some other means, not shown. Closing of switch 12 completes a circuit from one side "A" of the line through the switch, and then successively through the series-connected switches 10, 10A and 10B, contact K-3-1 of switch 13, the coil of relay K-1 to the other side "B" thereof, thus energizing relay K-3, to move its switch 18 to open condition against contact K-1-1, as illustrated by the broken line. The circuit is now in its "ready" condition for selective operation of one of the devices 16, 16A or 16B.

Let it be assumed, for purposes of illustration, that it is desired to operate the No. 2 device 16A, in which case the pole of switch 10A is moved from its No. 1 contact, shown in full line, to its No. 2 contact, as shown by the broken line. This opens the circuit through relay K-1, dropping it out and returning its associated switch arm (switch 18) from contact K-1-1 to contact K-1-2, as shown by the full line, thus rendering the circuit for energization by closure of start switch 22. It is understood, of course, that switch 13 is still in its full line condition (on contact K-3-1) and that no power is being fed to the solenoid 14A as yet. Depression of start button 22 will now energize relay K-2 to move switch 25 from its K-2-2 contact to its K-2-1 contact causing the coil of relay K-3 to be momentarily energized by displacement current through capacitor 24. Relay K-3 will move its switch 13 from contact K-3-1 in line "B" to contact K-3-2 in line "A" closing the circuit from line A through contact No. 2 of switch 10A and solenoid coil 14A to line "B," thus to effect operation of the device 16A through armature 15A. The surge of displacement current through D.C. circuit 26 causes the capacitor 25 charges, approximately .25 second with the values set forth below by way of example. During the initial surge, the coil 14A is energized, as described above, but when the capacitor reaches full charge, power to relay K-3 cuts off and it will drop out, moving its switch 13 back to full line condition (K-3-1 contact) opening the circuit to relay 14A.

In particular accordance with the present invention, it will be understood that only one of switches 10, 10A or 10B can be operative at one time, thus interlocking the circuit by locking out operation of more than one of the devices 16. If, for example, more than one switch is moved to its operative condition (on No. 2 contact), as shown in the drawing, it can be seen that electrical energy can flow only through the switch 19 closest to line switch 19. If switch 16B is on its No. 2 contact, current cannot flow through this switch to switch 10A, or any of the others to the left of switch 10B.

Thus, it is obvious that only one of the devices 10 can be operated at a time and that a second article cannot be issued until completion of a cycle of operation and resetting of the circuit, as described below.

Referring to D.C. circuit 26, it will be understood when capacitor 25 is fully charged that current to relay K-3 is cut off causing it to drop out, and if at this time the start button has been released (opened) the circuit will reset to its normal condition ready for selection of another, or even the same switch 19.

In the drawing it will be noted that the operative devices 16 are numbered No. 1, No. 2 and No. X to indicate that any number of devices may be connected in the series, 1020.
the circuit lines being indicated as broken between switches 19 and 10A for this purpose.

The resistor 30, in shunt around relay coil K3 and capacitor 28, from switch 25 to the negative side of the line in circuit 26, is effective when the switch is in the full line condition shown, to discharge the capacitor 28 to ready the circuit for a subsequent operation. From the above, it is seen that start button 22 must be released before a second selection can be made, thus effecting a built-in reset feature in the circuit.

By way of example, the relay K3 may have a value of 10,000 ohms, the resistor a similar value, the capacitor a value of 12 μf., and all of the circuits may be supplied with 115 volts.

From the above, it is now clear that the invention provides an electric circuit having all of the characteristics and advantages set forth above.

What is claimed is:

1. Electrical circuit means for selectively effecting operation of only one of a plurality of devices, comprising:
   (A) first and second component circuits each connectible to a source of voltage;
   (B) said second circuit having a plurality of electrically responsive means, each for actuating only one of said devices when energized;
   (C) said first and second circuits having series connected first and second switch means in common and in normally closed condition in said first circuit and normally open condition in said second circuit;
   (D) said first switch means comprising a plurality of switches each operable to connect only one of said electrically responsive means in said second circuit;
   (E) electrically operative means for actuating said second switch means from its normally closed condition in said first circuit to close its normally open condition in said second circuit thus cooperating with said first switch means to connect said second circuit to its voltage source to energize the selected one of said electrically responsive means thus to effect operation of the device selected by said first switch means;
   (F) the means in said first circuit rendering said electrically operative means inoperative while said first and second switch means are connected in series circuit in said first circuit but to render it operative upon the closure of one of said plurality of switches in said second circuit.

2. Electrical circuit means for selectively effecting operation of only one of a plurality of devices, comprising:
   (A) first and second component circuits each connectible to a source of voltage;
   (B) said second circuit having a plurality of electrically responsive means, each for actuating only one of said devices when energized;
   (C) said first and second circuits having series connected first and second switch means in common and in normally closed condition in said first circuit and normally open condition in said second circuit;
   (D) said first switch means comprising a plurality of switches each operable to connect only one of said electrically responsive means in said second circuit;
   (E) additionally normal open circuit means for actuating said second switch means from its normally closed condition in said first circuit to close its normally open condition in said second circuit thus cooperating with said first switch means to connect said second circuit means to its voltage source to energize the selected one of said electrically responsive means thus to effect operation of the device selected by said first switch means;
   (F) means in said first circuit in response to movement of the said one of said plurality of switches of said first switch means to connect one of said electrically responsive means in said second circuit to render said additional circuit means in condition for actuation of said second switch means and
An electrical circuit for operating selected ones of a plurality of operative devices, comprising:
(A) individual solenoid means operatively connected by armature to each of said devices;
(B) a plurality of first switches each operatively associated with only one of said solenoids,
(1) each of said first switches being of the single pole, double throw type with their normally closed contacts connected in series and the normally open contact of each connected to a different one of said solenoids,
(2) said solenoids being connected in parallel to one side of a source of voltage;
(C) means to connect said series connected contacts of the switches to first and second lines of a source of voltage, said connecting means comprising,
(1) the normally closed side of a second single pole, double throw switch, and
(2) a first relay coil connected to said second line,
(3) the normally open side of said second single pole, double throw switch being connected to a source of voltage having the same polarity as said first line;
(D) a start circuit comprising in series,
(1) first and second single pole, single throw switches, and
(2) a second relay coil; and
(E) a D.C. circuit having connected in series,
(1) a third single pole, double throw switch,
(2) a third relay coil,
(3) a capacitor; and
(4) a resistor connected in shunt across said circuit around said relay coil and said capacitor;
(F) said first relay coil being operatively connected to said second switch in said start circuit;
(G) said second relay coil being operatively connected to said third single pole, double throw switch in said D.C. circuit; and
(H) said third relay coil being operatively connected to said second single pole, double throw switch;
whereby
I) the movement of one of said first switches to connect one of said solenoids for operation of a selected device being effective to de-energize the said first relay coil which is effective to close the said second switch in said start circuit;
(J) closure of said first switch in said start circuit after the closure of said second switch being effective to energize said second relay coil to move the single pole, double throw switch in said D.C. circuit in position to connect the circuit to its source of voltage thereby energizing said third relay coil;
(K) said third relay coil being effective to move said second single pole, double throw switch to close its normally open side with said first line, thus to connect said electrically responsive means to its source of voltage to actuate the selected device;
(L) said capacitor providing means for cutting off voltage to said third relay coil after only momentary energization of the coil; and
(M) said resistor providing means to de-energize said capacitor after re-opening of said start circuit.

References Cited by the Examiner

UNITED STATES PATENTS
2,867,736 1/59 Wiswell 307—141
2,971,135 2/61 Ebert 317—137

SAMUEL BERNSTEIN, Primary Examiner.
LLOYD McCOLLUM, Examiner.