Dec. 4, 1962 J. A. WILSON 3,066,863

SEQUENCE CONTROL MECHANISM

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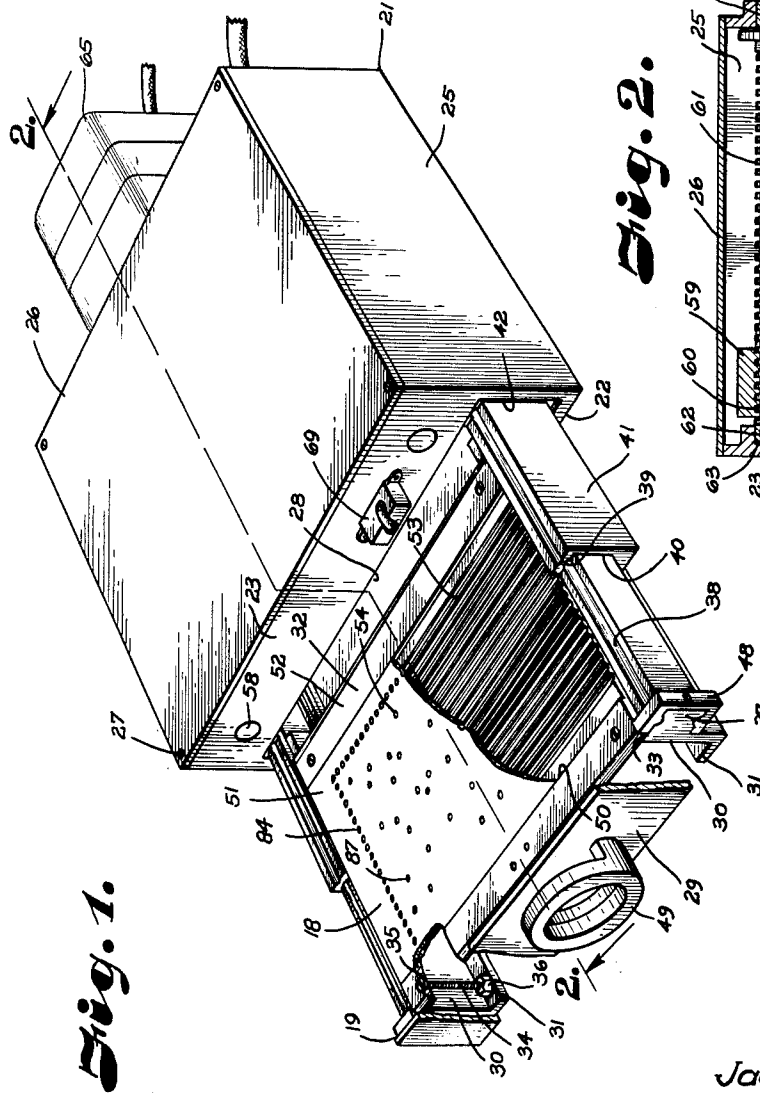


Fig. 1.

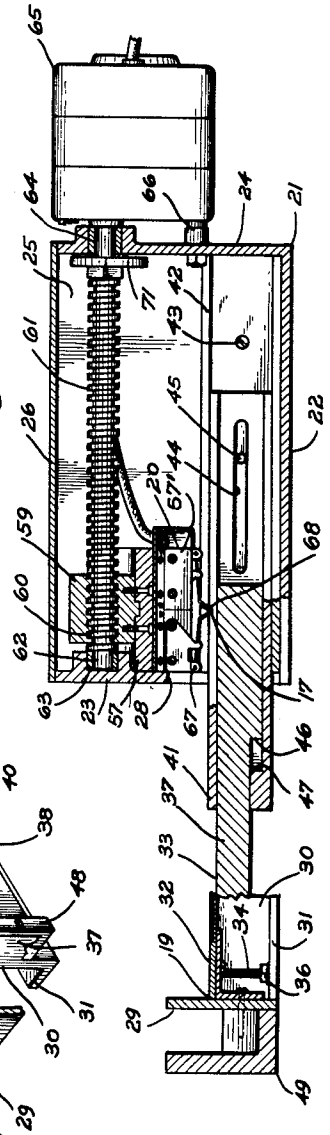


Fig. 2.

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Fig. 4.

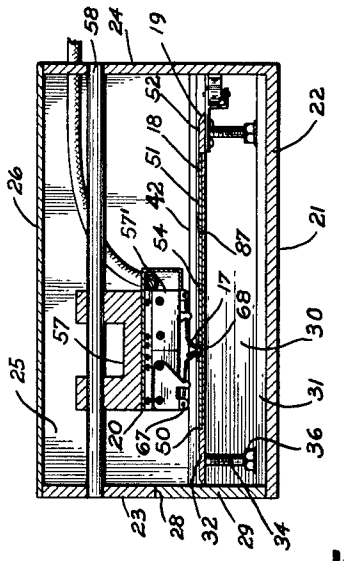


Fig. 5.

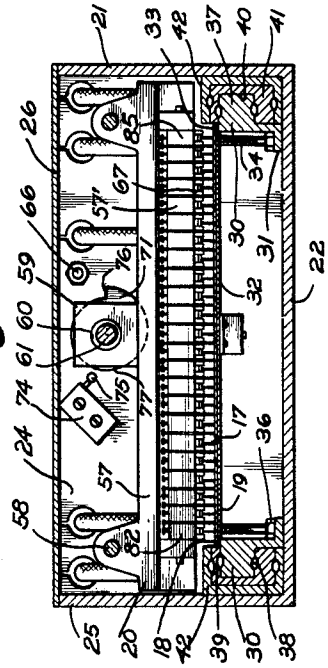
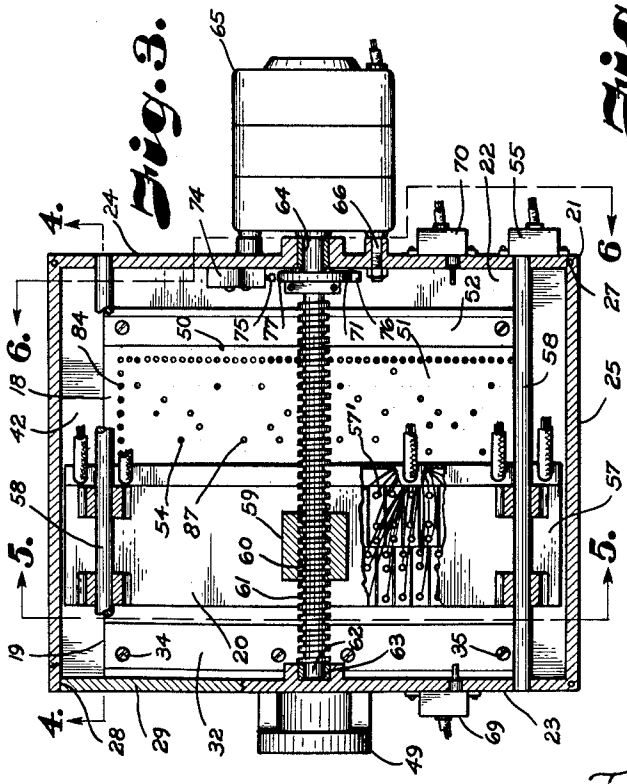


Fig. 3.



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Fig. 7.

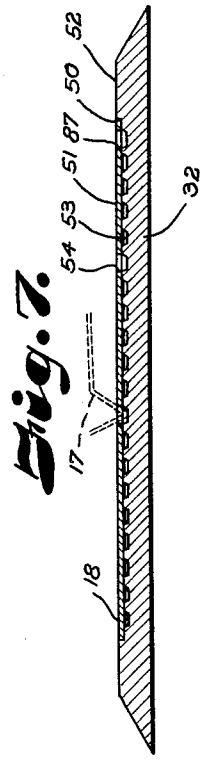


Fig. 6.

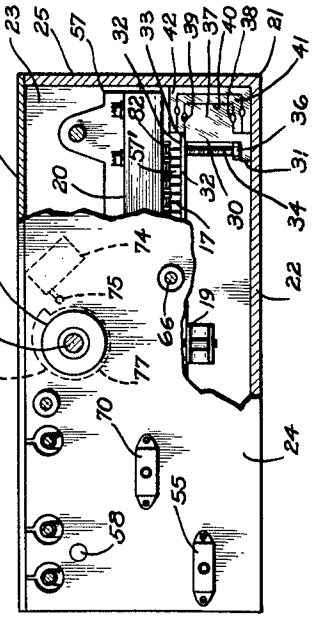
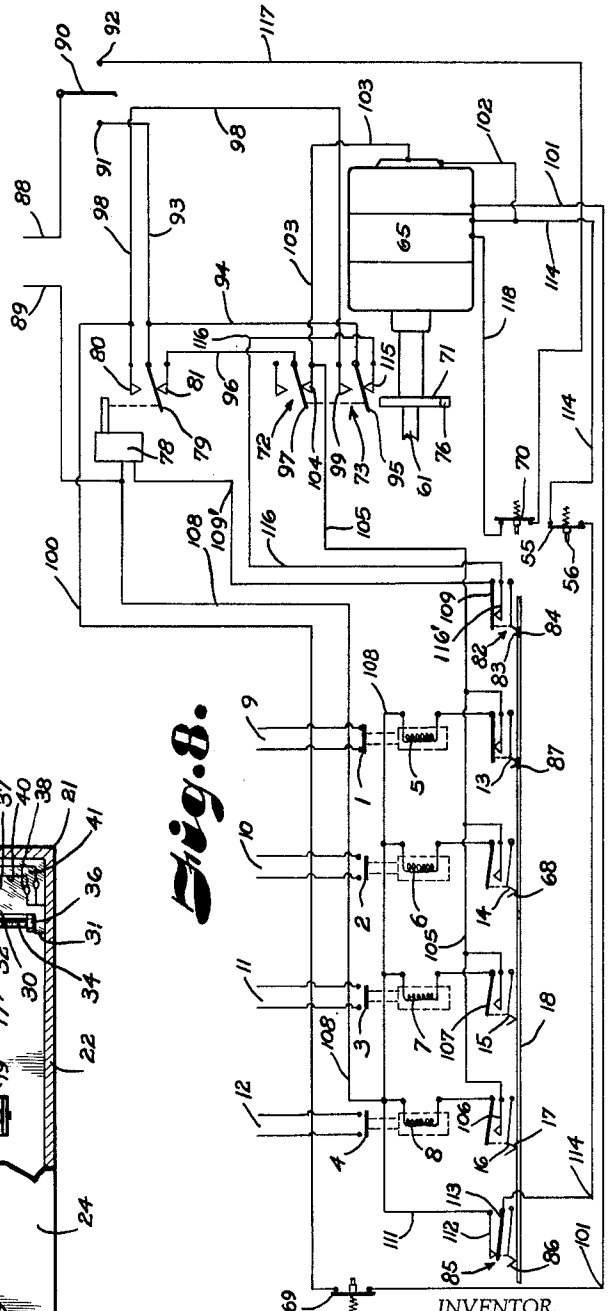


Fig. 8.



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United States Patent Office

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Patented Dec. 4, 1962

3,066,863

SEQUENCE CONTROL MECHANISM

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Filed Nov. 20, 1959, Ser. No. 854,313

8 Claims. (Cl. 235—61.11)

This invention relates to sequence control mechanism for use in actuating periodic operations, and more particularly to such mechanism using a perforated record card and sensing apparatus for controlling the sequence of operations in response thereto.

The principal objects of the present invention are to provide a sequence control mechanism using a perforated card and having a plurality of electric switches actuated in response to engagement of fingers in holes of the perforated card and in electric circuits for respective energization of same; to provide such a mechanism with a block or carrier having a plurality of sensing switches and a card positioning holder with means for periodic advancement by relative movement of the switch block and card holder; to provide such a mechanism with related advancing and timing or operation completion responsive apparatus wherein the card and sensing switches remain in one position until an operation is completed and then the card and sensing switches are advanced to the next position; to provide such a mechanism with electric circuits and controls to prevent accidental or improper operations; to provide such a mechanism with enclosed switches which reduce hazards in dusty or other fire hazardous areas; and to provide such a mechanism that is economical to manufacture, positive and efficient in operation for controlled operations and desired periodic sequence.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings wherein are set forth by way of illustration and example certain embodiments of this invention.

FIG. 1 is a perspective view of a perforated card sensing mechanism with a card in a holder and in retracted position, portions being broken away to better illustrate portions of the structure.

FIG. 2 is a vertical sectional view through the card sensing mechanism, taken on the line 2—2, FIG. 1.

FIG. 3 is a horizontal sectional view through the card sensing mechanism with the card and holder in operating position.

FIG. 4 is a vertical sectional view through the card sensing mechanism taken on the line 4—4, FIG. 3.

FIG. 5 is a vertical sectional view through the card sensing mechanism taken on the line 5—5, FIG. 3.

FIG. 6 is a vertical sectional view taken on the line 6—6, FIG. 3, with portions broken away to illustrate the interior of the housing.

FIG. 7 is an enlarged sectional view through the card supporting plate and card to illustrate the finger-engaging recesses under said card.

FIG. 8 is a diagrammatic view of the electrical circuit for the sequence control mechanism.

Referring more in detail to the drawings:

The sequence control mechanism embodying the features of the present invention is adapted to periodically actuate switches at selected intervals in respective circuits for energizing same and effecting actuation of operating mechanisms (not shown) for performing the required step or function. In the electrical wiring diagram illustrated in FIG. 8, there are switches 1, 2, 3 and 4 operated by relays 5, 6, 7 and 8 respectively for controlling circuits through pairs of conductors 9, 10, 11 and 12 respectively, which lead to operating mechanisms (not shown). Any desired number of

switches and circuits may be controlled, depending upon the size of the card and sensing mechanism arranged for same. There is a sensing micro switch and actuating finger for each of the relays 5, 6, 7 and 8, the sensing switches being designated 13, 14, 15 and 16 respectively, with actuating fingers 17 for each of the sensing switches, the fingers being adapated to engage a perforated record card 18, as later described. The sensing switches, together with the respective fingers, and the card holder 19 are a part of a card reading device 20 now to be described.

The card reading device 20 includes a housing 21 having a bottom wall 22, front wall 23, rear wall 24, side walls 25, and a top wall or cover 26 removably mounted on the upper edges of the front, rear and side walls and secured thereto by suitable fastening devices such as screws 27, the cover 26 being removable to facilitate assembly and maintenance of the various parts enclosed within the housing. The housing is preferably rectilinear, and the front wall 23 preferably has an opening 28 in the lower portion thereof that is substantially normally closed by an end member or plate 29 on the forward end of a card holder 19 which is in the form of a drawer-like member. The drawer-like member has side pieces 30 that have upright portions terminating at their lower ends in inwardly turned flanges 31. A top plate 32 extends between the side members or pieces 30 and rests on the upper faces 33 thereof and is secured by suitable fastening devices 34 that extend through apertures 35 in the plate and are threaded into bosses 36 on the flanges 31. In the illustrated structure, the bosses 36 are in the form of nuts secured as by welding to the flanges 31. The side members 30 have outwardly extending ribs 37 with grooves 38 in the upper and lower faces thereof adapted to engage ribs 39 in ways 40 of slidable guides 41 carried by guides 42 secured in the lower side portions of the housing by suitable fastening devices 43. The slidable guides or members 41 have slots 44 extending longitudinally thereof with stop pins or lugs 45 fixed to the guides 42 extending longitudinally thereof with stop pins or lugs 45 fixed to the guides 42 extending in the slots 44 to limit movement of the guides 41 longitudinally of the guides 42. Also, the portions 37 and the guide members 41 have cooperating shoulders 46 and 47 respectively whereby pulling the drawerlike card holder 19 outwardly of the housing 21 engages the shoulders 46 and 47 to pull the guides 42 outwardly to support the holder when it is fully extended from the housing. Stop members 48 are secured to the members or ribs 37 at the forward ends thereof and adapted to engage the forward ends of the guides 41 whereby movement of the card holder inwardly of the housing effects engagement of the lugs 43 with the guides 41 to push said guides 41 into the housing with said card holder. A suitable handle 49 is secured to the plate member 29 of the card holder to facilitate moving same in and out of the housing.

The upper face of the top plate 32 of the card holder 19 is recessed as at 50, the recess corresponding in size and shape to the periphery of a card 18, and said recess being the same depth as the thickness of the card whereby the upper face 51 of the card when in the recess will be substantially in the plane of the upper face 52 of the plate 32. The top plate 32 is further provided with a plurality of spaced recesses or grooves 53 extending from end to end of the recess 50, said grooves being of substantially the same width as the diameter of holes 54 punched in rows in the card, and also having the same spacing as the closest positioning of the holes 54 in a row. The arrangement of the recesses or grooves

53 permits greater movement of the fingers 17 when engaged in a hole 54, as later described. A switch, such as a micro switch, 55 is supported on the rear wall 24 and has an arm 56 engaged by the card holder to close a circuit only when said card holder is moved into the housing 21 to properly position the card for operation of the sensing apparatus. The switch 55 is designed to complete a circuit when the card holder is positioned in the housing and to interrupt the circuit when the card holder is withdrawn from the housing, as later described.

A switch carrier bar or block 57 is slidably mounted on guide rods 58 spaced laterally in the housing 21 above the card holder 19, said rods preferably being near the side walls 25 to aid in holding the bar 57 in alignment. The bar 57 also has an upwardly extending lug 59 provided with a threaded bore 60 through which extends a threaded shaft 61 having a forward end 62 rotatably mounted in a suitable bearing 63 carried by the front wall 23. The rear end of the shaft 61 is rotatably mounted in a bearing 64 carried by the rear wall 24 and is connected to the drive shaft of a motor 65 supported by suitable fastening devices 66 on the rear wall 24 whereby the motor 65 is exteriorly of said housing. The motor 65 is preferably a reversible type motor and is of a conventional speed reduction type motor wherein the shaft 61 is rotated at low speed, and energization of the motor rotates said threaded shaft 61 to move the bar 57 toward the front wall of the housing. Reversal of the motor moves said bar toward the rear wall of the housing.

A plurality of micro switches including the switches 13 to 16 inclusive and like switches adapted to be connected to other circuits to be controlled are mounted on the bar 57 to extend downwardly therefrom, said switches each being enclosed in individual substantially sealed housings 57' to be dustproof and eliminate danger of fire from arcing on making and breaking the circuits controlled thereby. The housings are relatively thin and arranged side by side, as illustrated in FIG. 5, forty-five such micro switches being shown on the bar 57 in FIG. 5, arranged in two rows and in a staggered relation, the micro switches being identical in structure and differing only in the connection in the various circuits, as later described. Each micro switch has a finger 17 supported on the bottom thereof as, for example, the ends of the fingers are pivotally mounted in ears 67, and the mid-portions of said fingers are bent downwardly in substantially a V-shape to form a lug or detent 68 adapted to engage in the holes 54 of the cards as the switches are moved thereover. The fingers are normally biased or urged downwardly whereby the ends of the lugs 68 will normally extend through the holes 54 and into the grooves 53 when said lugs are registering with the holes, and at other times when the lugs do not register with the holes said lugs ride on the upper face 51 of the record card 18, with the difference in the position of the fingers being that necessary for actuating the switches between open and closed position. A switch 69 is mounted on the front wall 23 and is adapted to be actuated by engagement of a portion of the bar 57 therewith, said switch normally being in circuit-making position and moved to circuit-interrupting position when the bar 57 is being moved toward the front wall and reaches the limit of its desired operating travel over a card in the card holder prior to return of the bar and the micro switches carried thereby to the rear of the housing or to starting position.

A switch 70 is mounted on the rear wall 24 and is normally in circuit-closing position and has a portion adapted to be engaged by the bar 57 to interrupt a reversing circuit when the bar 57 has reached the end of its return travel to starting position after completion of the operations.

A cam 71 is fixed on the shaft 61 inside of the housing 21 and adjacent the rear wall 24 and is positioned whereby the cam actuates a pair of coupled micro switches 72 and 73 contained in a housing 74, said switches being actuated by an arm 75 normally urged toward the cam periphery and moved by the lobe 76 of the cam to change the circuits but returned to normal position when the arm 75 moves off the lobe 76 to the dwell 77 of the cam.

The motor 65 preferably has a motor brake in the housing thereof to retard rotation of the shaft 61. The control circuit includes a control such as a motor 78 which, when energized, moves a switch arm 79 from a contact 80 to a contact 81 for a period as, for example, until an operation of the controlled operating mechanism is completed, or if desired the motor may be arranged as a timer to maintain the circuit for a set period or interval desired for the operating mechanism controlled by the circuits 9 to 12 inclusive. The sensing apparatus has one micro switch 82 on the bar 57 with a finger 83 positioned to move into holes 84 in a line adjacent one side of the card for each position of the card in the sequence of movement of the bar 57, and another micro switch 85 having a finger 86 adapted to engage an unperforated marginal portion of the card 18, the switch 85 being arranged to interrupt the circuit and prevent operation of the apparatus when no card is in the card holder. The card 18 has a plurality of other holes 87 positioned to be engaged by the respective fingers of the micro switches controlling circuits to operating mechanism, said holes being in lines longitudinally of the path of movement of the switches on the bar 57 to be engaged by the respective fingers during the period in the sequence that it is desired that the respective operating mechanism be actuated. Also, the holes 87 are in line with the respective period hole in the row 84, the line being transversely of the direction of travel of the bar 57.

The control circuit of the apparatus is connected by leads 88 and 89 to a suitable source of electrical energy, as, for example, a 110-volt alternating current supply with the lead 88 connected to a switch arm 90 adapted to be moved between a start contact 91 and a reset or reverse contact 92. The contact 91 is connected by a conductor 93 with the switch arm 79, which normally is engaged with the contact 80. The conductor 93 is also connected by a conductor 94 to a switch arm 95 of the switch 73. The contact 81 is connected by a conductor 96 to the switch arm 97 of the micro switch 72. The contact 80 is connected by a conductor 98 with a switch contact 99 of the switch 73 and is also connected by a conductor 100 to one contact of the switch 69, the other contact being connected by a conductor 101 to the motor 65. The motor brake of the motor 65 is connected by a conductor 103 to a contact 104 of the switch 72, said contact 104 also being connected by a conductor 105 to each of the contacts 106 of the micro switches 13 to 16 inclusive with the switch arms 107 of the micro switches 13 to 16 inclusive being connected to relay coils 5 to 8 respectively, the other ends of said coils being connected to a conductor 108. The conductor 108 is connected to a conductor 111 which is connected to a contact 112 of switch 85. The arm 113 of the switch 85 is connected by a conductor 114 to the motor 65, the conductors 101 and 114 being connected to the coils of the motor for forward drive of the motor. The conductor 114 is also connected by a conductor 102 with the motor brake. The contact 115 of the switch 73 is connected by a conductor 116 to the contact 116' of switch 82 and the switch arm 109 is connected by a conductor 109' to the winding of the motor 78, the other end of which is connected to the conductor 89. The reset contact 92 is connected by a conductor 117 to one contact of a reset micro switch 70, the other contact of which is connected by a conductor 118 to the reverse winding of the motor 65.

In operating an apparatus constructed and assembled

as described and wired in circuit as illustrated in FIG. 8, the card holder 19 is pulled outwardly from the housing 21 to a position as illustrated in FIG. 1. The perforated record card 18 having the holes therein in the sequence of operations desired is then placed in the recess 50 of the card holder and, in this position, even though the start switch 90 will move to engage the contact 91, no operation could be effected because the circuit to the motor 65 is interrupted by the switch 85. The card holder is then pushed inwardly into the housing with the bar 57 at the rearward end of said housing and, when the card is properly positioned, that is, the card holder completely in the housing, the holder will engage switch 56 moving same to circuit-making position; also, the finger 83 will engage in the first of the row of openings 84, causing the micro switch 82 to be in closed position. Also, with the card in place the micro switch 85 will be engaged with the surface of the card to close said switch and, then, upon movement of the start switch to engage the arm 90 with the contact 91, the switch arm 79 being engaged with the contact 80, the circuit will be completed through the conductor 93, switch arm 79, contact 80, conductor 100, switch 69, conductor 101, to the motor 65, and through the conductor 114, switch 85 and conductor 111 to the conductor or lead 89 to complete the circuit to the motor 65. The motor 65 is then energized to rotate the screw shaft 61 moving the bar 57 forwardly in the housing until the finger 83 engages in the next hole 84 of the row of sequence holes. The switch 82 is then closed and simultaneously therewith the cam dwell aligns with the arm of the micro switches 72 and 73 whereby current flows from the lead 88, switch arm 90, contact 91, conductor 93, conductor 94, switch arm 95 of the switch 73, contact 115, conductor 116, contact 116', switch arm 109 and conductor 109' to the motor 78, and then to the lead 89, energizing the control motor 78 which moves the switch 79 whereby current also flows from the conductor 93 to the contact 81 and conductor 96, switch arm 97, contact 104 and conductor 103 to the motor brake and conductor 102 to the conductor 114 setting the brake to hold the motor 65 against rotation. Current also flows from the switch 72 and contact 104 through the conductor 105 to any of the switches 13 to 16 inclusive wherein the respective finger 17 registers with a hole 87 in the card, and then through the respective relay winding 5, 6, 7 or 8 to energize the respective operating circuit.

In the diagram shown in FIG. 8, the switch 13 has the finger 17 thereof engaged with a hole 87 whereby the current flows through the winding 5 energizing the relay to move the switch 1 to closed position energizing the circuit 9 to effect operation of the respective operating mechanism controlled thereby. The motor 65 remains stationary until the motor 78 has operated for its set period of time, or in response to completion of the operation called for by the card the motor 78 causes the switch arm 79 to break the circuit to the contact 81, moving the switch arm back to engagement with the contact 80, thereby interrupting current to the solenoid winding 5 whereby the switch 1 interrupts the circuit to the operating circuit 9. Upon moving the switch arm 79 into engagement with the contact 80, the circuit is re-established to the motor 65 which starts its rotation rotating the cam 71 to move the switches 72 and 73 to break the circuit to the motor brake and also interrupt the circuit to the motor 78. The motor 65 rotates the threaded shaft 61 to again move the switch carrying bar 57 to the next step of the sequence wherein the motor 65 is stopped and the motor 78 started for operation of the operating circuits wherein the fingers of the switches 13 to 16 inclusive are engaged with an opening 87 in the card, if any. If there is no opening 87 in the card in that sequence, the control motor 78 will still operate for its period of time, and the circuit again energized through the respective switches to start the motor 65 at the end of the operation of the control motor for the next movement of the switch carrying bar 57. These sequences of operation are repeated until the switch bar has moved over the entire card. Then the switch carrying bar 57 engages the micro switch 69, stopping operation of the mechanism until the switch arm 90 is moved into engagement with the reset contact 92 whereby the motor 65 is reversed to move the switch carrying bar 57 back to its original position adjacent the rear end of the housing. Then the card holder may be pulled from the housing and the card removed and another inserted, or the same card may be used for repeating the cycle of operations until the switch arm 90 is moved into engagement with the start switch contact 91.

It is to be understood that while I have illustrated and described one form of my invention, it is not to be limited to the specific form or arrangement of parts herein described and shown except insofar as such limitations are included in the claims.

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

1. A sensing apparatus for a perforated record card wherein perforations are arranged in spaced rows for indicating a sequence of operations of operating mechanism comprising, a plurality of electric circuits which when energized effects actuation of operating mechanism controlled thereby, a card holder, means locating a record card with rows of perforations therein on said card holder, a carriage, means supporting said carriage and card holder for relative movement in planes parallel to a record card in said card holder, a driving motor, a timing motor means responsive to operations being performed and being energized during such performance and de-energizing at the completion thereof, an electric control circuit connected to the driving motor and timing motor means, a switch in said electric control circuit for completing the circuit to the driving motor while the timing motor means is de-energized and interrupting the circuit to the driving motor when the timing motor means is energized, means driven by said driving motor and operatively connected to said carriage to move same relative to said card holder in a direction parallel to the rows of perforations on the record card, switch means in the electric control circuit for controlling energization of the timing motor means, means operated by the driving motor to actuate said switch means for said timing motor means after a predetermined movement of the carriage to energize said timing motor means and interrupt the circuit to the driving motor whereby said carriage remains stationary during the time of operation of the timing motor means and then the driving motor is re-energized for further movement of the carriage, and means on the carriage adapted to engage in respective perforations in the record card when in registry therewith to effect completion of the respective electric operating circuit.

2. A sensing apparatus for a perforated record card wherein perforations are arranged in spaced rows for indicating a sequence of operations of operating mechanism comprising, a plurality of electric circuits which when energized effects actuation of operating mechanism controlled thereby, a housing having an opening, a card holder movable into said opening to a fixed operative position in said housing, means locating a record card with rows of perforations therein on said card holder, a carriage, means movably supporting said carriage for movement in said housing in a plane parallel to and spaced from said record card in the record holder, a driving motor, a control motor, an electric control circuit connected to the driving motor and control motor, a switch in said electric control circuit for completing the circuit to the driving motor while the control motor is de-energized and interrupting the circuit to the driving motor when the control motor is energized, means driven by said driving motor and operatively connected to said carriage to move same in said housing in a direction parallel to the rows of perforations on the record card, switch means in the electric control circuit for controlling

energization of the control motor, means operated by the driving motor to actuate said control motor switch means after a predetermined movement of the carriage to energize said control motor and interrupt the circuit to the driving motor whereby said carriage remains stationary during the operation of the control motor and then the driving motor is re-energized for further movement of the carriage, and means on the carriage adapted to engage in respective perforations in the record card when in registry therewith to effect completion of the respective electric operating circuits for operation during the period of operation of the control motor.

3. A sensing apparatus for a perforated record card wherein perforations are arranged in spaced rows for indicating a sequence of operations of operating mechanism comprising, a housing, a card holder movable to a fixed operative position in said housing, means locating a record card with rows of perforations therein on said card holder, a carriage, means movably supporting said carriage for movement in said housing in a plane parallel to and spaced from said record card in the record holder, a driving motor, a control means, an electric control circuit connected to the driving motor and control means, a switch in said electric control circuit for completing the circuit to the driving motor while the control means is de-energized and interrupting the circuit to the driving motor when the control means is energized, means driven by said driving motor and operatively connected to said carriage to move same in said housing in a direction parallel to the rows of perforations on the record card, switch means in the electric control circuit for controlling energization of the control means, means operated by the driving motor to actuate said control means switch means after a predetermined movement of the carriage to energize said control means and interrupt the circuit to the driving motor whereby said carriage remains stationary during the energization of the control means and then the driving motor is re-energized for further movement of the carriage, a plurality of switches on the carriage, said switches being spaced on said carriage to align with respective rows of perforations in the record card, a finger on each of said switches on the carriage and extending toward the record card, and means biasing said fingers toward the record card whereby the fingers contact said record card and engage in respective perforations when in registry therewith and actuate the respective switches during the period of energization of the control means wherein the carriage is stationary.

4. A sensing apparatus for a perforated record card wherein perforations are arranged in spaced rows for indicating a sequence of operations of operating mechanism comprising, a housing, a card holder movable to a fixed operative position in said housing, means locating a record card with rows of perforations therein on said card holder, a carriage, means movably supporting said carriage for movement in said housing in a plane parallel to and spaced from said record card in the record holder, a driving motor, a control means, an electric control circuit connected to the driving motor and control means, a switch in said electric control circuit for completing the circuit to the driving motor while the control means is de-energized and interrupting the circuit to the driving motor when the control means is energized, means driven by said driving motor and operatively connected to said carriage to move same in said housing in a direction parallel to the rows of perforations on the record card, switch means in the electric control circuit for controlling energization of the control means, means operated by the driving motor to actuate said control means switch means after a predetermined movement of the carriage to energize said control means and interrupt the circuit to the driving motor whereby said carriage remains stationary during the energization of the control means and then the driving motor is re-energized for further movement of the carriage, a plurality of switches on the carriage, said switches being spaced on said carriage to align with respective rows of perforations in the record card, a finger on each of said switches on the carriage and extending toward the record card, detents on each of said fingers, means biasing said fingers toward the record card whereby the detents contact said record card and engage in respective perforations when in registry therewith and actuate the respective switches during the period of energization of the control means wherein the carriage is stationary, and switches in the control circuit and actuated by the carriage to interrupt said control circuit when the carriage completes its periodic movement across the record card.

5. A sensing apparatus for a perforated record card wherein perforations are arranged in spaced rows for indicating a sequence of operations of operating mechanism comprising, a plurality of electric circuits which when energized effects actuation of operating mechanism controlled thereby, a housing having an opening, a card holder movable into said opening to a fixed operative position in said housing, means locating a record card with rows of perforations therein on said card holder, a carriage, means movably supporting said carriage for movement in said housing in a plane parallel to and spaced from said record card in the record holder, a driving motor, an electric control circuit connected to the driving motor, an operation responsive switch in said electric control circuit for completing and interrupting the circuit to the driving motor, means driven by said driving motor and operatively connected to said carriage to move same in said housing in a direction parallel to the rows of perforations on the record card, switch means in the electric control circuit for controlling the operation responsive switch, means operated by the driving motor to actuate said operation responsive switch means after a predetermined movement of the carriage to interrupt the circuit to the driving motor whereby said carriage remains stationary until the operation responsive switch means effects re-energization of the driving motor for further movement of the carriage, a plurality of switches on the carriage including a switch connected in each of the operating electric circuits, said switches being spaced on said carriage to align with respective rows of perforations in the record card, a finger on each of said switches on the carriage and extending toward the record card, detents on each of said fingers, means biasing said fingers toward the record card whereby the detents contact said record card and engage in respective switches to complete the respective electric operating circuits during the period when the carriage is stationary, and switches in the control circuit and actuated by the carriage to interrupt said control circuit when the carriage completes its periodic movement across the record card.

6. A sensing apparatus for a perforated record card wherein perforations are arranged in spaced rows for indicating a sequence of operations of operating mechanism comprising, a plurality of electric circuits which when energized effect actuation of operating mechanism, a housing, a card holder movable to a fixed operative position in said housing, a plate member in said card holder and having a flat upper surface, means locating a record card having a sequence of perforations therein on said plate member in contact with said upper surface thereof, a carriage, means movably supporting said carriage for movement in said housing in a plane parallel to and spaced from the plate member surface, a driving motor, a control motor, means driven by said driving motor and operatively connected to said carriage to move same in said housing across said record card in the direction of the rows of perforations therein, an electric control circuit connected to the driving motor and to the control motor and including a switch actuated by said control motor for completing the circuit to the driving motor when the control motor is stopped and interrupting the circuit to the driving motor when the control motor is

energized, a cam actuated by the driving motor, control motor control switches in the electric control circuit actuated by the cam upon completion of operation of the driving motor to move the carriage a distance equal to each sequence spacing of perforations on the record card to energize said timing motor, a plurality of switches on the carriage including a switch connected in each of the operating circuits and spaced on said carriage to align with respective rows of perforations in the record card, a finger depending from each of said switches, means biasing said fingers toward the record card whereby said fingers contact said record card and engage in respective perforations when in registry therewith and actuate the respective switches to complete the respective electric operating circuits, and a switch in the housing and connected in the electric control circuit to interrupt same and actuated by the card holder when in position in the housing for completing said electric control circuit.

7. A sensing apparatus for a perforated record card wherein perforations are arranged in spaced rows for indicating a sequence of operations of operating mechanism comprising, a plurality of electric circuits which when energized effect actuation of operating mechanism, a housing, a card holder movable to a fixed operative position in said housing, a plate member in said card holder and having a flat upper surface, means locating a record card having a sequence of perforations therein on said plate member in contact with said upper surface thereof, a carriage, means movably supporting said carriage for movement in said housing in a plane parallel to and spaced from the plate member surface, a driving motor, means driven by said driving motor and operatively connected to said carriage to move same in said housing across said record card in the direction of the rows of perforations therein, an electric control circuit connected to the driving motor and including a switch for completing and interrupting the circuit to the driving motor, a cam actuated by the driving motor, control switches in the electric control circuit actuated by the cam upon completion of operation of the driving motor to move the carriage a distance equal to each sequence spacing of perforations on the record card, a plurality of switches on the carriage including a switch connected in each of the operating circuits and spaced on said carriage to align with respective rows of perforations in the record card, a finger depending from each of said switches, detents on each finger, means biasing said fingers toward the record card whereby the detents contact said record card and engage in respective perforations when in registry therewith and actuate the respective switches to complete the respective electric operating circuits, a switch in the housing and connected in the electric control circuit to interrupt same and actuated by the card holder when in position in the housing for completing said electric control circuit, and switches in the control circuit and actuated by the carriage to interrupt said control circuit when the carriage completes its periodic movement across the record card.

8. A sensing apparatus for a perforated record card wherein perforations are arranged in spaced rows for indicating a sequence of operations of operating mechanism comprising, a plurality of electric circuits which when energized effect actuation of operating mechanism, a housing having an opening, a card holder movable into said opening to a fixed operative position in said housing, a plate member in said card holder and having a flat upper surface, means locating a record card having a sequence of perforations therein on said plate member in contact with said upper surface thereof, said plate member having a plurality of recesses in said upper surface registering with perforations in said record card, a carriage, means movably supporting said carriage for movement in said housing in a plane parallel to and spaced from the plate member surface, a driving motor, a control motor for operation during a predetermined period, means driven by said driving motor and operatively connected to said carriage to move same in said housing across said record card in the direction of the rows of perforations therein, an electric control circuit connected to the driving motor and to the control motor and including a switch actuated by said control motor for completing the circuit to the driving motor when the control motor is stopped and interrupting the circuit to the driving motor when the control motor is energized, a cam actuated by the driving motor, control motor control switches in the electric control circuit actuated by the cam upon completion of operation of the driving motor to move the carriage a distance equal to each sequence spacing of perforations on the record card to energize said control motor, a plurality of switches on the carriage including a switch connected in each of the operating circuits and spaced on said carriage to align with respective rows of perforations in the record card, a finger depending from each of said switches, detents on each finger, means biasing said fingers toward the record card whereby the detents contact said record card and engage in respective perforations when in registry therewith and actuate the respective switches to complete the respective electric operating circuits, one of said switches on said carriage having a finger detent engaging said record card, said last-named switch being in the electric control circuit and adapted to interrupt same when no record card is in the card holder, a switch in the housing and connected in the electric control circuit to interrupt same and actuated by the card holder when in position in the housing for completing said electric control circuit, switches in the control circuit and actuated by the carriage to interrupt said control circuit when the carriage completes its periodic movement across the record card, and brake means on the driving motor energized to hold said driving motor inoperative during operation of the timing motor.

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