J. B. HELLER.

PERMUTATION MECHANISM.

APPLICATION FILED JUNE 2, 1919.

1,427,381.

Patented Aug. 29, 1922.

3 SHEETS—SHEET 1.

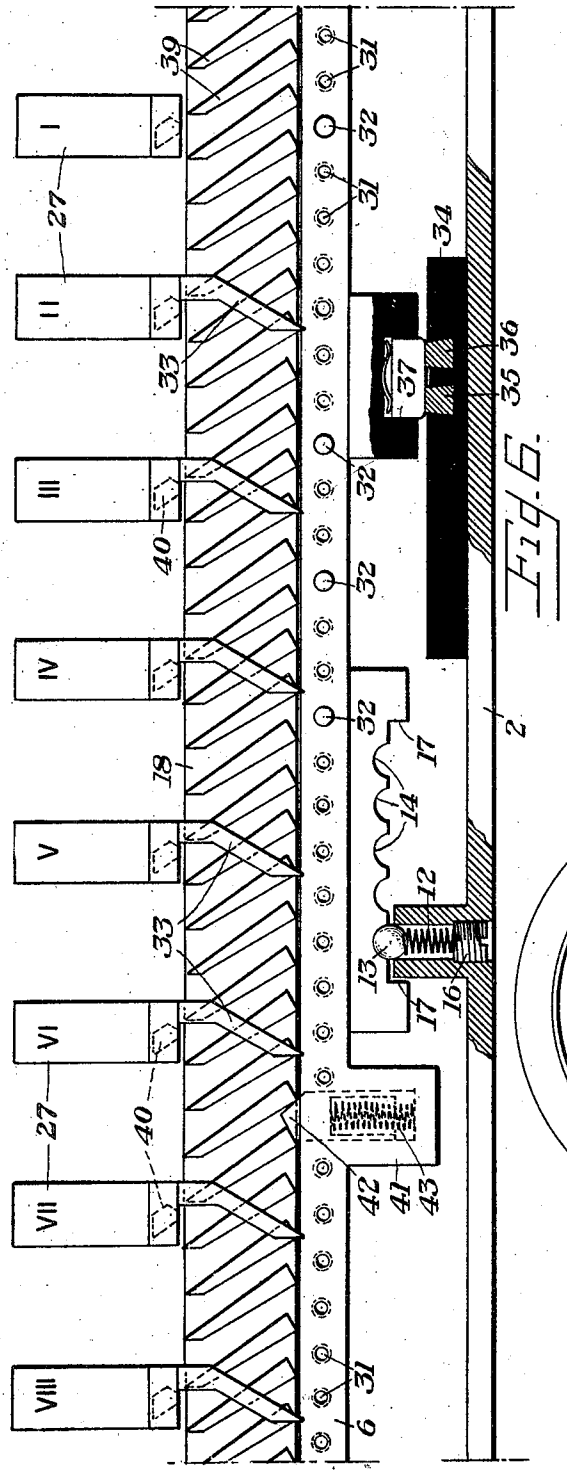


Fig. 2.

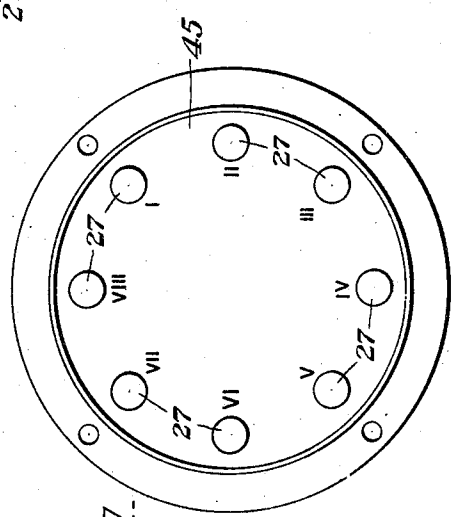


Fig. 1.

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Fig. 2.

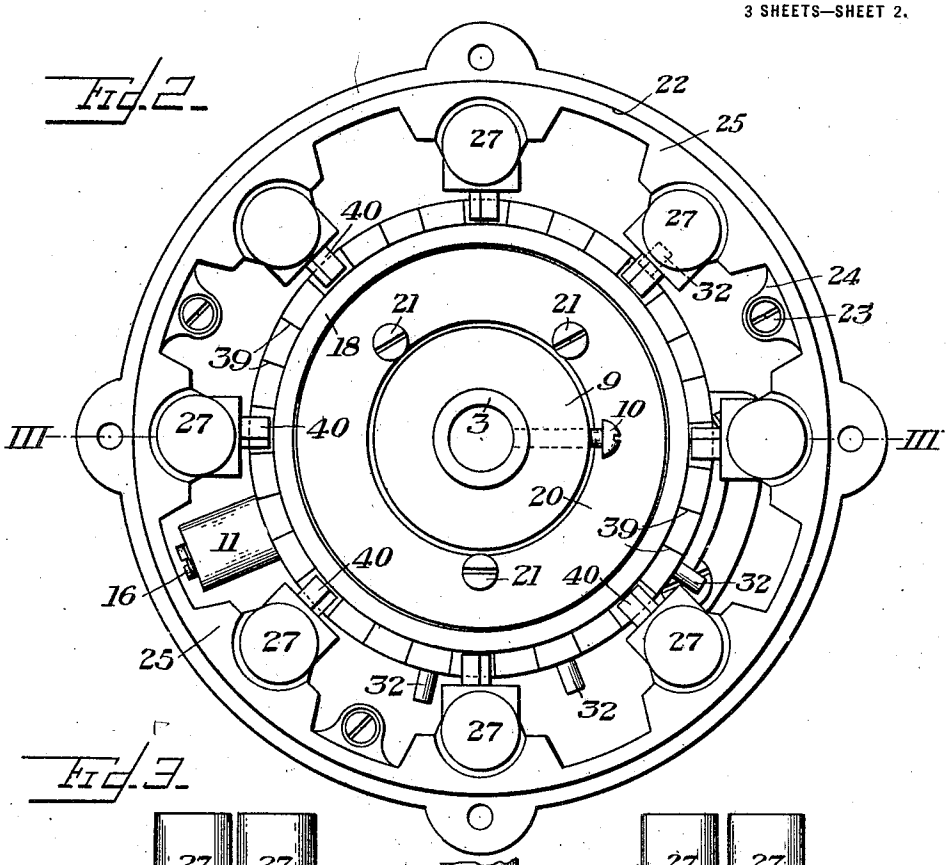
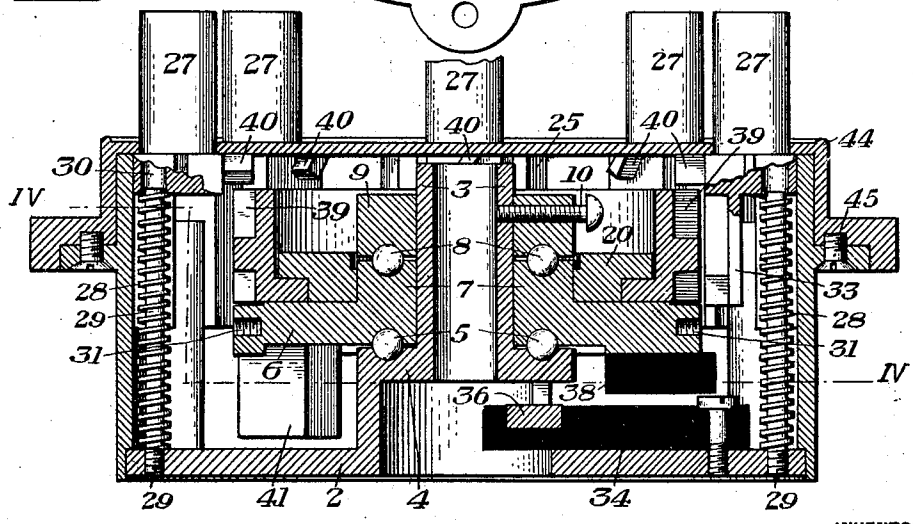


Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 4.

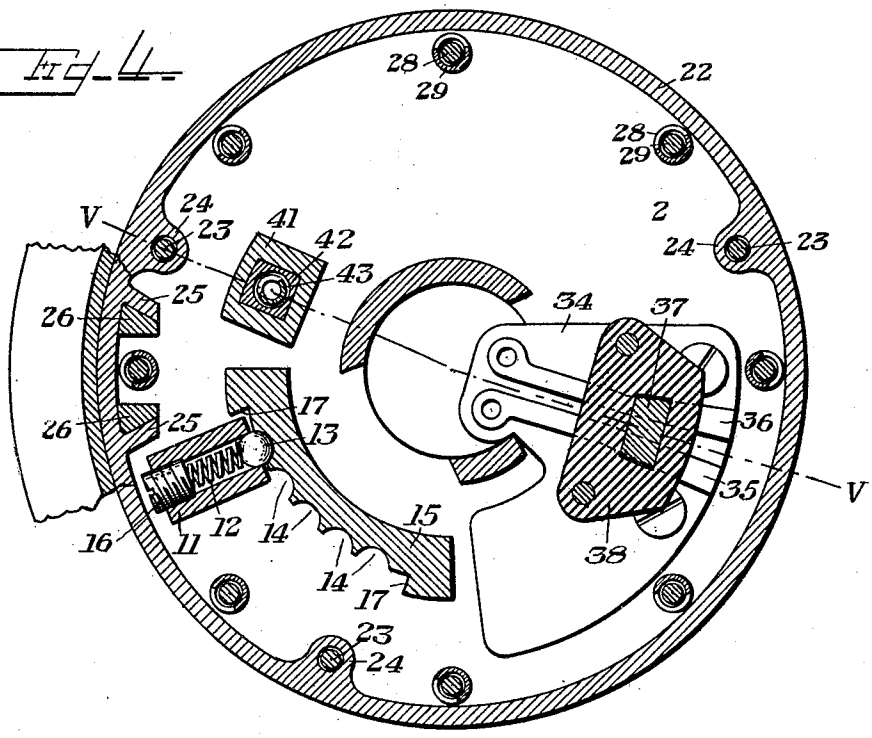
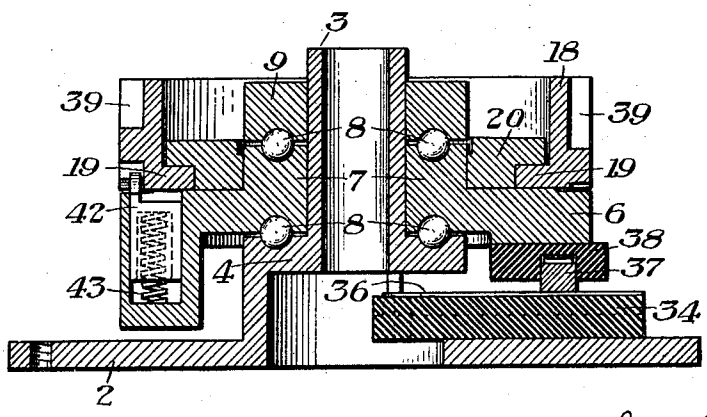


Fig. 5.



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UNITED STATES PATENT OFFICE.

JESSE B. HELLER, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO NATIONAL MOTOR CONTROL CO., A CORPORATION OF DELAWARE.

PERMUTATION MECHANISM.

1,427,381. Specification of Letters Patent. Patented Aug. 29, 1922.

Application filed June 2, 1919. Serial No. 301,319.

To all whom it may concern:

Be it known that I, JESSE B. HELLER, a citizen of the United States, and residing at Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Permutation Mechanism, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a plan view of one form of device constructed in accordance with my invention;

Figure 2 is a plan view of the device on a larger scale, with the cover removed;

Figure 3 is a transverse sectional view on the line III—III of Figure 2, and in which the advanced cam for the plunger at the left-hand side has been removed;

Figure 4 is an irregular sectional plan view on the line IV—IV of Figure 3;

Figure 5 is a sectional view on the line V—V of Figure 4, with the shell and cover removed; and

Figure 6 is a development of the device.

This invention relates to an improvement in permutation mechanism, and is designed to provide an efficient device, in which the driven member is moved step by step to its operative position by means of actuated devices, when said actuated devices are actuated in a predetermined order, together with means for moving the driven member step by step to its inoperative position, when any of the actuating devices are operated out of their order.

The device as shown in the drawings is more particularly designed for actuating a switch for controlling an electric current, although the permutation mechanism may be used in connection with other devices than electric switches.

The precise nature of my invention will be best understood by reference to the accompanying drawings, which will now be described, it being premised, however, that various changes may be made in the details of construction, and the general arrangement of the parts, without departing from the spirit and scope of my invention, as defined in the appended claims.

In the drawings the reference character 2 designates the base of the device, which is provided with an upwardly extending hollow spindle 3, and a flange portion 4. This flange portion 4 is provided with a ball recess for the reception of balls 5, which are interposed between what I have termed the driven member 6 and the flange on the base. This driven member also has a bearing on the hollow spindle 3, and is provided with a ball recess in the upper portion of its boss 7 for the reception of balls 8, which balls also are seated in a recess in the under face of a collar 9, which surrounds the spindle 3. This collar 9 is secured to the spindle by means of a screw 10, or may be secured thereto in any other desired manner. By this arrangement the driven member is free to rotate about the spindle 3. Formed integrally with the base 2 is a boss 11, which is bored out for the reception of a spring 12, which engages a centering member 13, which in this case is a ball and which is arranged to engage notches 14 on a sector member 15 extending downwardly from the driven member 6. The spring 12 is held in position by means of a screw 16, which engages the threaded outer end of the opening in the boss. Extending radially from the sector member 15 are projections 17 which are arranged to form positive stops to prevent the driven member from being jarred or moved beyond a predetermined point in either direction, and which are arranged to engage opposite sides of the boss 11. 18 is a trip or return wheel rotatably mounted on the driven member 6, and which is provided with an annular flange 19. This flange 19 is seated in an annular recess formed between the upper face of the driven member, and a flanged collar 20, which flanged collar is secured to the driven member by screws 21, which are clearly shown in Figure 2, the arrangement being such that the trip or return wheel is free to rotate or oscillate on the driven member.

Surrounding the base 2 is a shell 22, which is connected to the base by means of three screws 23, which pass through bosses 24 on the shell and which screws engage threaded openings in the base 2. This shell is provided with 8 sets of guiding projections 25 for the reception of guide members 26 which extend downwardly from actuating plungers 27.

In the construction shown there are eight of such actuating plungers, which are normally held in their elevated positions by

means of springs 28, each of which surrounds a pin 29 secured to the base 2. The upper ends of these pins 29 are seated in openings 30 in their respective plungers, and which openings are of sufficient depth to permit the plungers to be depressed a sufficient distance to actuate the trip and driven member as hereinafter described.

The driven member 6 in the form shown is provided with thirty-two threaded openings as indicated at 31 in Figure 6, and which are also shown in Figure 3. These threaded openings are arranged to receive pins 32, as clearly shown in Figures 2 and 6. In the construction shown there are four pins mounted in the openings 31. Connected to each of the actuating plungers, with the exception of one plunger, is a driven member actuating cam 33, and which are arranged to advance the driven member when operated in proper sequence. Connected to the base 2 is a pad 34 of insulating material, and on which are fixedly mounted contact members 35 and 36, which are adapted to be connected in a line through which the electrical current is to be closed. 37 is a contact shoe or switch member mounted in an insulating pad 38 which is connected to the driven member 6, and when the driven member is moved to its operative position, as shown in Figure 6, the circuit will be closed through the device.

The trip or return wheel 18 is provided with thirty-two angular cam members, as indicated at 39 in Figure 6, which are arranged to be engaged by cam projections 40 on the plungers 27, and are arranged to move the trip wheel to the left as viewed in Figure 6. Mounted in a guide projection 41 on the driven member 6 is a friction pawl 42, which is held in its elevated position in engagement with the angular cam members on the trip wheel 18 by means of a spring 43, to frictionally hold the driven member 6 and the trip wheel 18 in predetermined positions with relation to each other.

In the drawings I have designated the different plungers I to VIII and the combination of this particular device is II, V, IV, III, and when the driven member is in its inoperative position, or the pawl 13 is in the last notch 14 to the right as viewed in Figure 6, the driven member will be moved to its full inoperative position. When it is desired to move it to its operative position, the operator first presses plunger II, which will advance the driven member 6 to the right and advance the pin 32, which was formerly directly under plunger II to the next position at the right, and bring a pin 32 directly under plunger V. When plunger V is operated the driven member will be moved another step and bring a pin 32 under plunger IV. Plunger IV is then operated to move the driven member 6 another step, which will bring a pin under plunger III, and at which time the contact shoe or switch member will be resting on contact 35 but will not be in contact with contact 36. Plunger III is then actuated to move the driven member to the position shown in Figure 6, which will close the circuit through contacts 35 and 36, and at which time there will be a pin 32 directly under plunger I, and if the actuating cam 33 were left on this plunger I, and it should be actuated, the mechanism would be jammed, and therefore I prefer to remove a cam member 33 from the plunger at the right or counter clockwise to the first plunger of the combination.

If I use three steps for advancing the driven member to its operative position from its full inoperative position, it will not be necessary to remove one of the actuating cams 33 from a plunger, or if I use forty teeth or angular cam members on the trip wheel and forty tapped openings in the driven member, the device can be moved four steps without placing any of the pins in a position to jam the device when using a four-step combination.

It will therefore readily be understood that if the actuating plungers are moved in their proper sequence, the driven member will be moved from its inoperative position to its operative position in four steps, and when the plungers are moved in their proper sequence the driven member is moved to the right by the actuating cams 33 engaging the pins 32, while the trip wheel 18 is moved to the left by the cam projections 40, which engage the angular cam members 39 on the trip wheel, and during such movement the friction pawl 42 will pass under the angular cam members 39. If any of the plungers are operated out of their order, the cam projections 40 will rotate the trip or return wheel 18 to the left, and as the frictional engagement between pawl 42 and the trip wheel is greater than the frictional engagement of the centering member 13 with the notches 14, the driven member will be moved to the left one space for the movement of each plunger which is moved out of sequence.

In the drawings the trip wheel 18 is provided with thirty-two teeth, the number being equal to the number of tapped openings in the driven member 6. The arrangement is such that when the plungers 27 are in their elevated positions, the trip wheel 18 can be rotated on the driven member 6, in either direction. By this arrangement the trip wheel may be set in any position with relation to the driven member, as the friction pawl 42 will position the trip wheel with relation to the driven member.

If desired, I may, however, form a trip wheel which is only provided with eight annular cams, which are arranged to engage one side of the cam projections 40 when the

plungers are in their elevated positions. The other sides of the cam projections must, however, be cut away a sufficient distance to permit the trip wheel 18 to be advanced the distance between the two tapped openings in the driven member, or at least a distance equal to 11° and 15′. When the trip wheel is made in this form, it is provided with five teeth arranged to be engaged by the pawl 42, which are spaced 11° and 15′ from each other.

In the drawings I have merely shown a structure in which the contact shoe is arranged to close one circuit, but it will readily be understood by those familiar with the art that a circuit may be closed at the second, third and fourth positions.

By such an arrangement the switch when in its first position would be in an open position, when moved to its third position the switch contact might close the circuit through an electric lock for unlocking the starting motor, and when moved to the fourth position the circuit through the ignition system might be closed. When the device is moved in the reverse direction, the circuit to the ignition system would be broken when passing from the fourth to the third position, when passing to the second position a circuit might be closed through a magnet for locking the starting motor or breaking the circuit thereto, and when moved to its first or off position the circuit to all of the devices would be broken. By this arrangement the starting motor can be operated when the switch member is moved to the third position and which would be held in this position until after the switch contact is moved back to its second position, which would break the circuit or lock the mechanism to prevent the rotation of the motor.

It will be readily understood by those familiar with the art that other circuits may be controlled by this device than those mentioned, and that I may use a greater or less number of positions to which the switch is moved than described and shown.

The advantages of my invention result from the provision of permutation mechanism which is arranged to move the driven member step by step to its operative position when the actuating plungers are moved in proper sequence, and which is also so arranged that the driven member will be moved backward one step at each time that any of the actuating plungers are moved out of sequence excepting when the driven member has been moved to its full off position.

Another advantage results from the provision of mechanism which is so arranged that the driven member will be moved step by step from its full off position to its full operative position if the plungers are moved in their prearranged order, and which will be moved one step from its full operative position toward its full off position when any of its plungers are operated, to break the circuit.

I claim:

1. Permutation mechanism, comprising a driven member, actuating members, cooperative devices between the actuating members and the driven member for moving the driven member step by step to its operative position when actuated in proper order, and means for moving the driven member backward step by step when any one of said actuating devices is moved out of order, substantially as described.

2. Permutation mechanism, comprising a driven member, actuating members, cooperating devices between the actuating members and the driven member for moving the driven member step by step to its operative position when actuated in proper order, means for moving the driven member backward step by step when any of the actuating devices are moved out of order, and means for centering the driven member in any of its shifted positions, substantially as described.

3. Permutation mechanism, comprising a driven member arranged to be moved step by step from its fully inoperative position to its operative position, actuating members, cooperating devices between the actuating members and the driven member for moving the driven member step by step to its operative position when actuated in proper order, and means cooperating with the actuating members and the driven member to move the driven member backward one step from its fully operative position when any one of said actuating members is operated out of order, substantially as described.

4. Permutation mechanism, comprising a driven member arranged to be moved to its operative position by a step by step movement, actuating members, cooperative devices on the driven member and the actuating members for advancing the driven member step by step from its inoperative position to its operative position when the actuating members are operated in a predetermined order, and means actuated by any of said actuating devices for moving the driven member backward one step away from its operative position when the actuating members are operated out of order, substantially as described.

5. Permutation mechanism, comprising a driven member, actuating members, cooperative devices between the actuating members and the driven member for moving the driven member step by step to its operative position when actuated in proper order, and cooperative devices between the actuating members and the driven member for moving

the driven member step by step from its operative position to its fully off position when any of the actuating devices are moved out of order, substantially as described.

6. Permutation mechanism, comprising a driven member, arranged to be moved to its operative position by a step by step movement, interchangeable pins on said driven member, a plurality of plungers having cams thereon arranged to engage said pins when moved into alignment with the cams to advance the driven member one step toward its operative position, a trip member having cams thereon, a cam projection on each plunger in alignment with a cam on the trip wheel and arranged to move the trip wheel backward when any of said plungers are operated, means for holding the driven member in its shifted position, and a friction device between the trip wheel and the driven member arranged to move the driven member backward when the trip wheel is moved by one of the plungers which is moved out of order, substantially as described.

7. Permutation mechanism, comprising a driven member having actuating members thereon, a trip wheel having a plurality of actuating members thereon, a friction device between the trip wheel and the driven member, a plurality of actuating plungers, said actuating plungers having means for simultaneously moving the trip wheel in one direction and the driven wheel in the opposite direction when the driven member is advanced, substantially as described.

8. Permutation mechanism, comprising a driven member arranged to be moved step by step in either direction within a predetermined limit, means for centering said driven member at each of its shifted positions, a plurality of shiftable pins connected to the driven member, a trip wheel mounted on the driven member, a plurality of cams on said trip wheel, actuating plungers, cams on said actuating plungers for engaging the pins on the driven member when the plungers are actuated in a predetermined order, cam projections on said plungers, said cam projections being arranged to move the trip wheel backward and then forward during each reciprocation of any of the plungers, and a friction pawl member connecting the trip wheel to the driven member arranged to move the driven member backward one step when any of the plungers are actuated out of their order, substantially as described.

9. Permutation mechanism, comprising a driven member arranged to be moved step by step to its operative or inoperative position, a plurality of actuating pins thereon, actuating plungers, cams on said plungers arranged to engage the pins on the driven member when actuated in a prearranged order to move the driven member step by step from its inoperative to its operative position, a trip wheel, actuating connections between the trip wheel and each of the plungers for oscillating the trip wheel when any of said plungers are actuated, and a spring actuated friction pawl connecting the trip wheel to the driven member which is arranged to move the driven member backward one step when the plungers are actuated out of order, substantially as described.

10. In a permutation mechanism, a series of actuating members, a circuit closing member, a trip wheel, cooperating devices on the actuating members and the circuit member to advance said circuit closing member step by step to close the circuit when said actuating members are operated in proper sequence, cooperative devices on said actuating members and the trip wheel for oscillating the trip wheel when any of said actuating members are operated, and a connection between the circuit closing member and the trip wheel tending to return said circuit closing member one step when the trip wheel is moved in one direction, substantially as described.

11. In a permutation mechanism, a series of actuating members, a circuit closing member, cooperating devices arranged to move the circuit closing member step by step to close the circuit when operated in proper sequence, a trip wheel arranged to be oscillated, connections between all of said actuating members and the trip wheel for oscillating the trip wheel when any one of said members are actuated and a yielding connection between the trip wheel and the circuit closing member arranged to move the circuit closing member toward its off position when the actuating members are moved out of order, substantially as described.

In testimony whereof, I have hereunto set my hand.

JESSE B. HELLER.