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G. MEYFARTH

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PNEUMATICALLY OPERATED ELECTRIC SWITCH

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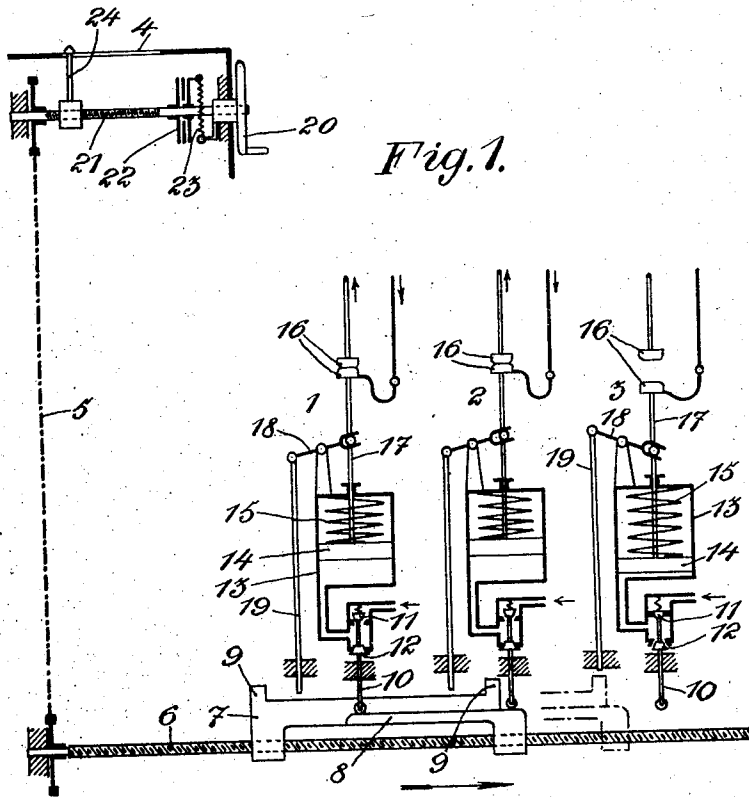


Fig. 1.

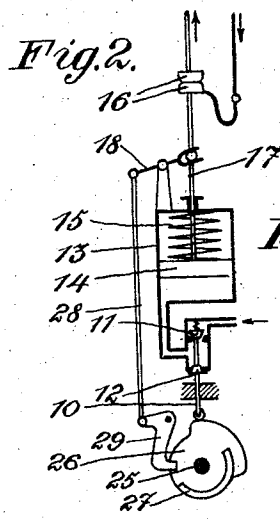


Fig. 2.

Fig. 3.

Fig. 4.

Inventor
Gottlieb Meyfarth
By *James H. McElroy*
his attorney.

UNITED STATES PATENT OFFICE.

GOTTLIEB MEYFARTH, OF GENEVA, SWITZERLAND, ASSIGNOR OF ONE-HALF TO SOCIÉTÉ ANONYME DES ATELIERS DE SECHERON, OF GENEVA, SWITZERLAND, A CORPORATION OF SWITZERLAND.

PNEUMATICALLY-OPERATED ELECTRIC SWITCH.

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The present invention relates to improvements in devices for mechanically controlling a group of pneumatically operated electric switches.

5 It is known to control a set of pneumatically operated electric switches by mechanically actuating the air valves. This control hitherto has not been applicable to motors, more particularly on electrically driven vehicles
10 because faulty or short-circuit-producing switching was liable to occur in the main circuits, since no interlocking means were provided between the switch in its contact positions for the main circuits and the mechanism
15 operating the pneumatic valves.

The present invention remedies this condition of things by providing means whereby the mechanism actuating the valves of the switches is mechanically interlocked in accordance with the contact position of the
20 switches so that the working of the latter cannot be faulty.

Two constructional examples of the device according to the present invention are diagrammatically illustrated in the accompanying drawings in which
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Fig. 1 is a view of one construction and

30 Figs. 2, 3 and 4 illustrate some of the elements of a second construction in various positions.

Fig. 1 shows a set of three single switches 1, 2, 3 belonging to a vehicle control for single phase current. The contacts 16 thereof are on various points of the secondary winding of a step transformer (not shown), the motors being fed through the said contacts and through a choke coil (not shown). It is assumed that the switches 1 and 3 are connected to the same end of the choke coil, the switch 2 being connected to the other and thereof so that the switch 3 must first be closed when the switch 1 is open and conversely the switch 1 must first be closed when 3 is open, for the purpose of preventing short-circuits.
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45 The contacts 16 are operated by a rod 17 displaced in the circuit-closing direction by a piston 14 moving in a compressed air cylinder 13 and in the circuit-opening direction by a spring 15. The ingress and egress of air into and out of the cylinder 13 is controlled by two valves 11 and 12 mounted on a common stem fitted with a roller. The rollers of all the stems 10 co-operate with the travelling
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nut member or runner 7 surrounding a suitably threaded spindle 6 rotated by hand with the aid of two sprockets and a chain 5. The shaft 21 of the driving sprocket is rotated by means of the hand wheel 20 of the controller 4 through a friction clutch 22 and a spring clutch 23.
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60 The travelling nut member 7 has an operating member 8 adapted to contact with the rollers of the stems 10, and two interlocking members 9 co-operating with interlocking rods 19 one of which is fitted to each switch 1, 2, 3. The rods 19 are actuated by the piston rods 17 through the medium of suitably pivoted levers 18. The accurate position of the travelling nut 7 and therefore of the switches 1, 2, 3 may be read off an indicator device
65 comprising the hand 24 moved by means of the threaded portion of the shaft 21.
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The construction just described works as follows: In Fig. 1 the stems 10 of the valves 11, 12 of the switches 1 and 2 are on the operating member 8 so that the said switches are closed while the switch 3 is open. If now the travelling nut member is moved in the direction of the arrow, the rod 10 of the switch 1 comes out of contact with the operating member so that the said switch is opened.
80 The interlocking rod 19 is raised owing to the contacts 16 moving apart from each other so that unobstructed passage is afforded to the left interlocking member 9. Should the contact 16 not be opened by the switch 1 for any cause, the interlocking rod 19 is not raised and the left interlocking member 9 touches the said rod when the nut member 7 is operated in the direction of the arrow so that the said nut member cannot move further, this taking place before the stem 10 of the switch 3 is engaged by the operating member 8. Undue stresses on the drive due to the interlocking and rigid connection between 9 and
85 19 are avoided by the clutch devices or couplings 22 and 23.
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The action of the interlocking means is the same when the operation is reversed, that is to say when the switches 2 and 3 are closed and when the switch 1 is to be closed after 3 is safely open. Thus in this construction a hand drive may be used on the vehicle, the said hand drive being entirely safe as regards faulty switching and combines the known
105 advantages of simplicity and facility of in-

spection of hand controls with those of high switching power and rapidity afforded by pneumatically-operated switches.

Cams may be used when, in contradistinction to the construction described, the sequence of switching operations is not uniform. Referring to the construction of Figs. 2, 3 and 4, the air valves 11 and 12 and their stem 10 are actuated by a cam 26 keyed to a shaft 25. An interlocking sector 27 is provided for interlocking the shaft 25 in case the contacts 16 or the switch are in the incorrect position. To this end, an interlocking pawl 29 operated by means of the piston rod 17, the lever 18 and the link 28, comes in contact with the said sector.

This construction works as follows: Fig. 2 shows the roller of the stem 10 on the boss of the cam 26, the valve 11 being thus open for the inflow of compressed air into the cylinder 13 and the contacts 16 being closed. In Fig. 3 the cam has angularly moved in the direction of the arrow from the position of Fig. 2 so that the roller of the stem 10 is out of contact with the boss, and the outlet valve 12 is open. Assuming now that the contact 16 has remained closed, the interlocking sector is in engagement with the interlocking pawl 29 so that the shaft 25 cannot be further rotated. Referring to Fig. 4, it is now assumed that the contacts 16 are open; the interlocking pawl 29 affords unobstructed movement to the sector 27 in the direction of the arrow so that the shaft can be further rotated. It will be clearly seen from the above description that the switches cannot be incorrectly worked owing to the interlocking means provided therefor.

The hand drive may of course be replaced by a servo-motor, for example an electric motor or by a pressure-operated driving apparatus.

I claim:

1. In an apparatus of the class described, a plurality of switches each having a fixed and a movable contact, means for mechanically operating the movable contact of each individual switch to open the same and for pneumatically operating the movable contact of each switch individually to close the same, a carriage having a surface fixed relatively thereto for controlling the means for the pneumatic operation of the said movable contacts of the said switches, whereby any one of the said switches may be automatically actuated and maintained in a closed position only after another switch has been opened, and means for operating the said carriage.

2. In an apparatus of the class described, a plurality of electric switches each having a fixed and a movable contact, means for mechanically operating the movable contact of each switch individually to open the same

and for pneumatically operating the movable contact of each switch individually to close the same, a carriage provided with a surface fixed relatively thereto for actuating the pneumatic means for operating the movable contact of each switch, a stop device associated with the movable contact of each switch, the said single movable mechanical member also being provided with a surface adapted to contact with the said stop device of the movable contact of each switch when the switch is closed whereby no one of the said switches can be closed until after another switch has been opened, and means for operating the said carriage.

3. In an apparatus of the class described, a plurality of switches each having a fixed and a movable contact, devices for individually operating the said switches each comprising a cylinder, a piston, a piston rod to which the movable contact of the corresponding switch is connected, a spring for moving the piston in one direction to open the switch, and pneumatic devices for actuating the piston in the opposite direction to close the switch, a carriage having a surface fixed relatively thereto and adapted to engage the said pneumatic devices for operating a predetermined number thereof to maintain a predetermined and corresponding number of switches in a closed position only after another switch has been opened, and means for operating the said carriage.

4. In an apparatus of the class described, a plurality of switches each having a fixed and a movable contact, devices for individually operating the said switches each comprising a cylinder, a piston, a piston rod to which the movable contact of the corresponding switch is connected, a spring for moving the piston in one direction to open the switch, and pneumatic devices for actuating the piston in the opposite direction to close the switch, a single movable mechanical member having a surface fixed relatively thereto and adapted to engage the said pneumatic devices for operating a predetermined number thereof to maintain a predetermined and corresponding number of switches in a closed position, a stop device associated with the movable contact of each switch adapted to be engaged when the switch is closed by another surface on the said single movable mechanical member whereby the said switch must be opened to permit the stop device to be clear of the said second surface on the single movable mechanical member before the said member can be moved to close another switch, and means for operating the said single movable mechanical member.

In testimony whereof I have affixed my signature.

GOTTLIEB MEYFARTH.