

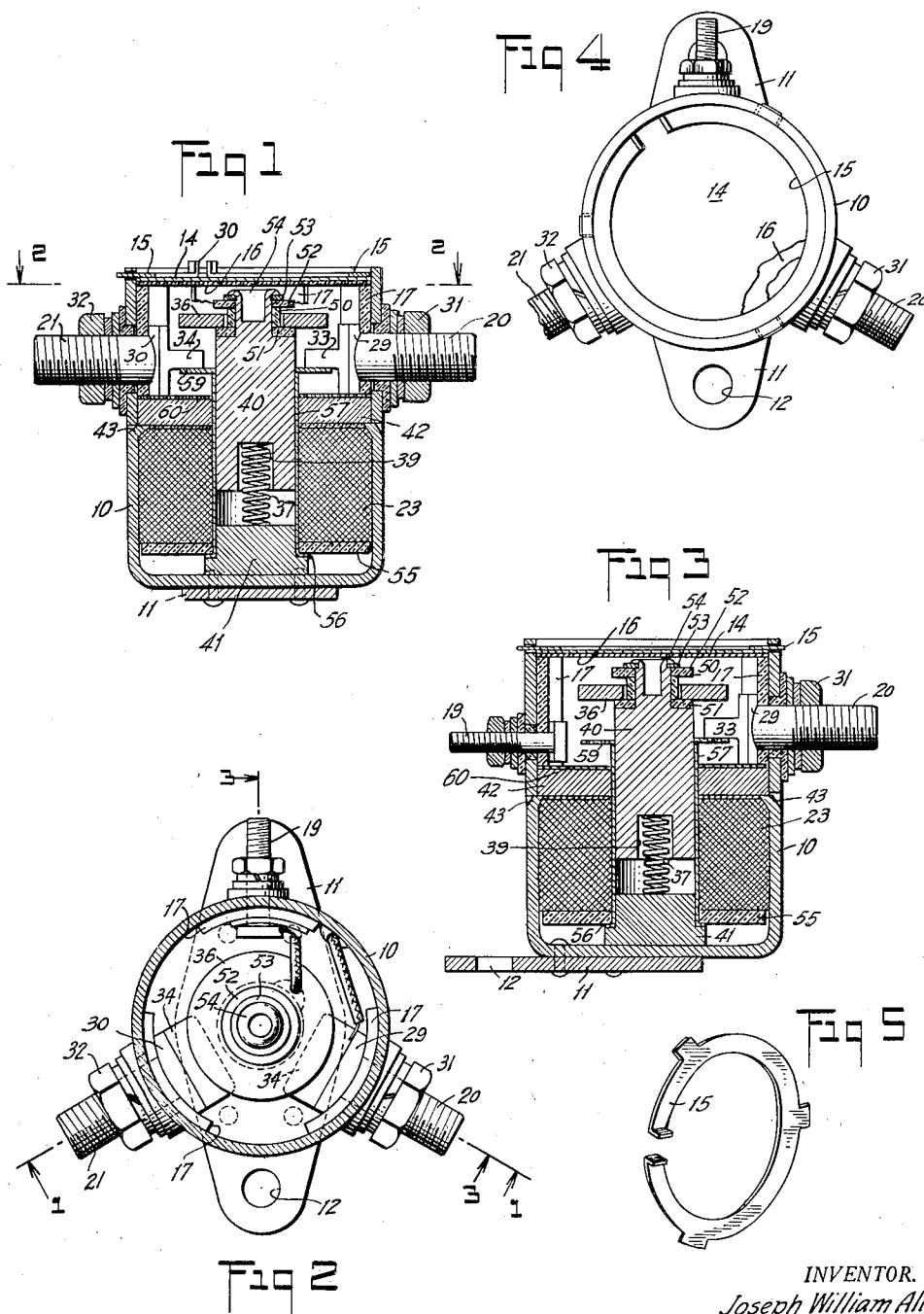
Oct. 3, 1933.

J. W. ALLEN

1,928,846

SWITCH MECHANISM

Filed Oct. 30, 1931



INVENTOR.

Joseph William Allen

BY *Martin J. Linnegar*
ATTORNEY.

UNITED STATES PATENT OFFICE

1,928,846

SWITCH MECHANISM

Joseph William Allen, East Orange, N. J., assignor, by mesne assignments, to Eclipse Aviation Corporation, East Orange, N. J., a corporation of New Jersey

Application October 30, 1931. Serial No. 572,186

7 Claims. (Cl. 200—111)

This invention relates to solenoid switches, and more particularly to a magnetic solenoid switch of the type which is frequently used to control electrical circuits for starting motors for internal combustion engines.

Switches of this type have been used in order to provide a remote control of the motor energizing circuit, so that the starting switch may be located directly between the battery and starting motor, thus allowing the battery leads to be as short as possible, while the remote control switch may be located on the dash of the vehicle or in any other location convenient for the operator.

The current supplied to a starting motor for starting an internal combustion engine must be relatively heavy, sometimes amounting to hundreds of amperes when the engine is stiff; and in case of a failure of the engine to start on the first trial, this current must be broken by the starting switch. The arcing caused by breaking this heavy current, increased by the self inductance of the motor windings, causes the contacts in the starting switch to burn and stick. Furthermore, the magnetic reluctance of the device retards the breaking of the contacts and tends to increase the arcing and burning hazard. It is accordingly an object of the present invention to provide means for minimizing the possibility of such arcing and burning.

It is another object of the present invention to provide a solenoid switch which is positive in its action, but which operates with small current consumption.

It is another object of the invention to provide a novel switch mechanism in which the stationary contacts are disposed in such a relation to the movable contact (or contacts) and to each other, that a combined rectilinear and oscillatory, or tilting, movement results as the parts move to circuit closing position, and a similar, though oppositely directed action results as the circuit opens; the advantage of such arrangement being the creation of a force couple producing a lever action which multiplies the effectiveness of the applied force and insures a quick, clean break, preventing prolonged arcing and burning of the contacts.

Another object is the provision of a device which is inexpensive to manufacture, and in which the parts may be readily assembled or taken out for inspection or replacement.

Other objects and advantages will be apparent from the following description taken in connection with the disclosure in the accompanying drawing.

In the drawing,

Fig. 1 is a sectional view of an assembled device constituting one embodiment of the present invention;

Fig. 2 is a horizontal view thereof;

Fig. 3 is a sectional view along the line 3—3 of Fig. 2;

Fig. 4 is a top plan view; and

Fig. 5 is a perspective view of a detail.

The embodiment of the invention shown in the drawing comprises a cup-shaped shell constituting a casing member 10 adapted to be supported by attachment to a bracket 11 having suitable openings 12 through which may be inserted screws or other fastening means for attachment to a motor casing or the frame-work of a vehicle or other unit upon which the device is installed. The open end of the casing 10 is closable by a plate 14 resting upon members hereinafter described, and retained in position by a resilient split ring 15 (Fig. 5) having radial lugs engageable with corresponding slots in the casing 10, and terminating in upturned ends which may be grasped and pressed together to insert or withdraw the ring. Beneath plate 14 is a thin sheet 16 of insulating material superposed upon cylindrical segments 17, also of insulating material, the latter having openings for entry of terminal members 19, 20, and 21, the former serving as a connection between a low voltage source of current and the winding 23 of the solenoid, and the latter two serving for attachment at their outer ends of the comparatively heavy motor and battery cables which form a part of the circuit to the motor or other device to which the invention is applied.

The inner ends of the terminal members 20 and 21 are formed with enlarged rectangular portions, as indicated at 29 and 30, forming shoulders which, in conjunction with the nuts 31 and 32, serve to hold the terminals in proper position and also serve to clamp the insulating segments 17, and thereby providing support for the members 14 and 16 relative to casing 10. The inner ends of the terminals 20 and 21 are flattened to provide plane surfaces which are parallel with surfaces of a member to be contacted therewith, as indicated at 33 and 34, respectively, such surfaces being engageable by the metallic disc 36 constituting the bridging member of the switch mechanism, and normally maintained in the position indicated in Figures 1 and 3 by the action of a compression spring 37, one end of which enters the central recess 39 in the plunger 40, and the opposite end of which bears against the upper surface of a member 41. The member 41, in con-

junction with a metallic disc 42 supported by shoulders 43 cut in shell 10, constitute stationary core pieces responsive to the energization of the coil 23 of the solenoid to form a path for the magnetic lines of force which are thus made effective to exert a downwardly directed pressure on the movable core 40 to move the disc 36 into engagement with the fixed contacts 33 and 34 against the pressure of the spring 37.

It will be noted that the terminals 20 and 21, instead of being placed in diametrically opposed positions, are arranged in closer angular relation, and therefore as the disc 36 engages the upper surfaces of the contacts 33 and 34, the continued pull of the magnetic circuit tends to draw the unresisted section of the disc further downward, thus tilting the disc slightly and insuring a firm contact with the members 33 and 34. Likewise, upon de-energization of the coil 23, the force exerted by the spring 37 will create a force couple producing a lever action operating to pry the disc 36 from the members 33 and 34 with a combined rectilinear and angular movement which multiplies the force which the spring 37 alone would exert, and thus insures a quick, clean separation of the disc from the contacts and eliminates the danger of prolonged arcing or sticking.

The disc 36 may be insulated from the core 40 by any suitable means, but as shown, such means includes an insulating sleeve 50 engaging at its lower end with an insulating disc 51 and with a similar insulating disc 52 at its upper end, the disc 52 being in turn held in place by the collar 53 and the peened upper end 54 of the core 40. The sleeve 50 is preferably longer than the thickness of disc 36, in order to provide a clearance permitting the tilting action above described.

The coil 23 is supported on an insulating disc 55 which in turn rests on the lower flanged end 56 of the sleeve 57, the latter serving as a spool for reception of the winding 23 and also as a guide for the rectilinear movement of the core 40. At its upper end, the sleeve 57 holds in position an insulating washer 59 which engages the under-surface of the contacts 33 and 34 and thus opposes any displacement thereof in a downward direction. Washer 59, in conjunction with plate 60 resting on the upper surface of the core 42, forms an annular pocket in which any particles of metal burned off or broken away from the contacts 33, 34, and 36, will fall and be held, in which position they are not liable to produce any short-circuiting action or otherwise interfere with the proper operation of the device.

When the control circuit through the solenoid winding 23 is closed by the operator in any suitable manner, as by means of a switch in the circuit leading to the terminal 19, and located on the control panel of the vehicle, the magnetic flux produced in the winding 23 will move the core 40 downwardly, as viewed in Figs. 1 and 3, compressing the spring 37 and drawing the contact plate 36 into firm engagement with the contact surfaces 33 and 34 with a combined rectilinear and rotary action, as above explained. This action closes the main circuit from the battery to the engine starting motor or other device to be energized, causing proper operation thereof. When the control switch is opened by the operator, or by some automatic means with which the present invention is not concerned, the magnetic flux created by the solenoid drops almost instantly to zero, and spring 37 is promptly effective to cause a separation of the disc 36 from the contacts 33 and 34 with an oppositely directed

combined rectilinear and rotary action as above explained. There is thus provided a novel switch mechanism in which the stationary contacts are so disposed in relation to the movable contacts and with respect to each other, that a maximum circuit opening force is made available in response to a de-energization of the solenoid. It will be further evident that the invention involves a meritorious arrangement and inter-relation of parts in such a manner that assembling the entire structure is an extremely simple operation, the parts fitting with one another in such a manner as to make it unnecessary to employ screws or rivets or other fastening means on the interior of the device, which would render assembly or removal of the parts difficult. Thus, for example, in order to remove the contacts 36 or the core 40 or the spring 37, it is merely necessary to contract ring 15 to lift off the cover plate 14 and the insulating sheet 16, whereupon the entire core assembly may be withdrawn without disturbing any of the terminals, conductors, or the solenoid proper.

While the construction herein illustrated and described is of considerable practical merit, as is evident from the foregoing description, it is to be understood that the illustrated embodiment is not exclusive of various other embodiments which will now suggest themselves to persons skilled in the art. Accordingly, it is contemplated that changes may be made in the construction, arrangement, number, and proportions of the parts without departing from the spirit of the invention as described herein or from the scope of the appended claims.

What is claimed is:

1. Switch mechanism comprising a solenoid having a movable core and a contact element mounted thereon, said core being concentric with said solenoid, a pair of contacts mounted in the path of travel of said contact element, both said contacts being disposed on the same side of a plane containing the axis of said core, and said contact element being tiltable about an axis perpendicular to said core in response to engagement with said contacts.

2. Switch mechanism comprising a solenoid having a movable core and a contact element mounted thereon, said core being concentric with said solenoid, a cylindrical shell enclosing said solenoid, core, and contact element, and a pair of contacts supported on and extending through said shell at angularly spaced intervals of less than 180 degrees, said contacts having conducting surfaces projecting into the path of travel of said contact element.

3. Switch mechanism comprising a solenoid having a movable core and a contact element mounted thereon, said core being concentric with said solenoid, a cylindrical shell enclosing said solenoid, core, and contact element, a pair of contacts supported on and extending through said shell at angularly spaced intervals of less than 180 degrees, said contacts having conducting surfaces projecting into the path of travel of said contact element, and means for tilting said contact element slightly about an axis perpendicular to said core as it engages said conducting surfaces.

4. Switch mechanism comprising a solenoid having a movable core and a contact element mounted thereon, said core being concentric with said solenoid, a cylindrical shell enclosing said solenoid, core, and contact element, a pair of contacts supported on and extending through

said shell at angularly spaced intervals of less than 180 degrees, said contacts having conducting surfaces projecting into the path of travel of said contact element, means for tilting said contact element slightly relatively to said core as it engages said conducting surfaces, and means for maintaining said core in a rectilinear path of movement notwithstanding said tilting action.

5. Switch mechanism comprising a solenoid having a movable core and a contact element mounted thereon, said core being concentric with said solenoid, a cylindrical shell enclosing said solenoid, core, and contact element, a pair of contacts supported on and extending through said shell at angularly spaced intervals of less than 180 degrees, said contacts having conducting surfaces projecting into the path of travel of said contact element, and means for insulating said contact element from said core.
6. Switch mechanism comprising a solenoid having a movable core and a contact element mounted thereon, said core being concentric with said solenoid, a cylindrical shell enclosing said

solenoid, core, and contact element, a pair of contacts supported on and extending through said shell at angularly spaced intervals of less than 180 degrees, said contacts having conducting surfaces projecting into the path of travel of said contact element, and means for insulating said contact element from said core, said contact element being loosely mounted on said insulating means for movement about an axis parallel to the plane of said conducting surfaces.

7. Switch mechanism comprising a solenoid having a movable core and a contact element mounted thereon, said core being concentric with said solenoid, a pair of contacts mounted in the path of travel of said contact element, both said contacts being disposed on the same side of a plane coinciding with the axis of said core, said contact element being tiltable about an axis perpendicular to said core in response to engagement with said contacts, and means for insulating said contact element with respect to said core.

JOSEPH WILLIAM ALLEN.

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30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140
70	145
75	150