Aug. 24, 1948. A. V. ALVINO 2,447,890

ELECTROMAGNETIC MECHANISM

Filed Dec. 3, 1942

Fig. 1.

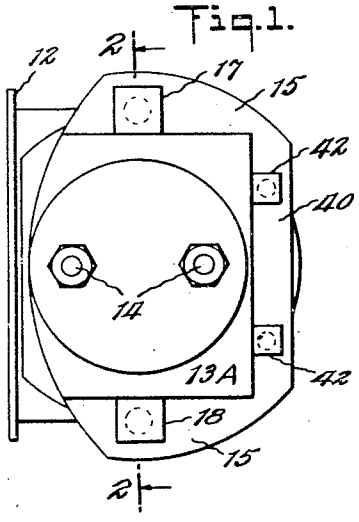


Fig. 2.

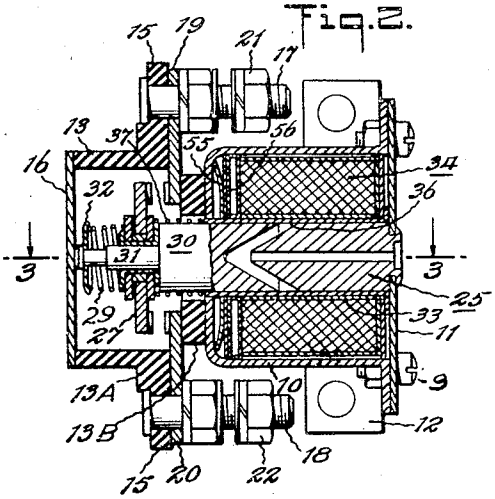


Fig. 3.

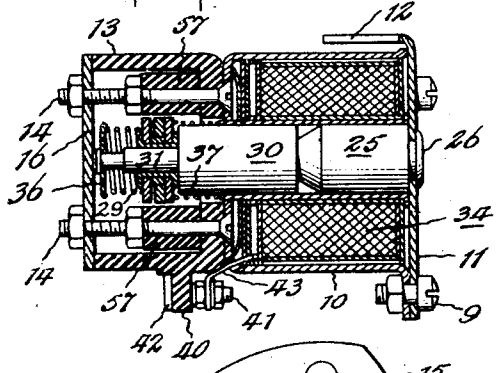
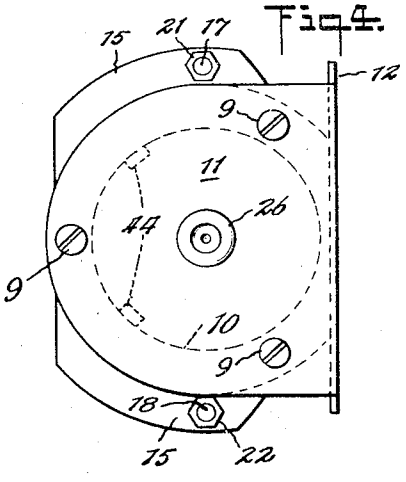


Fig. 4.



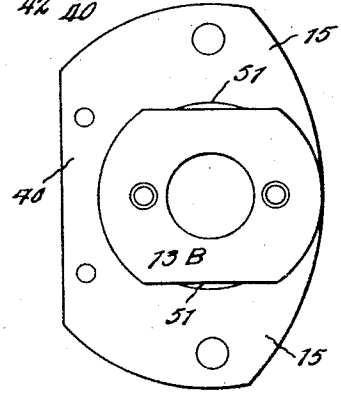


Fig. 5.

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ELECTROMAGNETIC MECHANISM

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6 Claims. (Cl. 200—111)

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This invention relates to electromagnetic mechanism, and more particularly to electromagnetic mechanism of the "solenoid" type, in which the magnetic circuit includes a closeable gap located within a current receiving winding, or coil.

In the accompanying drawing the invention is shown in an embodiment which has been favorably received for use as part of a system of control of the energization of high amperage circuits of the type employed in aircraft electrical systems; but of course the accompanying drawing is illustrative only, and is not intended as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

To a certain extent the illustrated embodiment follows the pattern of the solenoid switch mechanism disclosed in Patent No. 1,803,908 granted to Raymond P. Lansing on May 5, 1931. The departures from the Lansing disclosure will be described in detail, as they embody the novel features of the present invention.

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

It is another object of the invention to provide such a device which embodies a release spring amply strong to insure a positive, quick break under all circumstances.

Another object is to provide a device of the above character which is designed to have a highly efficient magnetic circuit, causing firm effective contact without undue current consumption.

A further object is the provision of such a device which is comparatively small and light so as to provide a quick, clean break of the contacts.

Another object is to provide a novel terminal assembly, featuring a single terminal cup to securely hold both switch and coil terminals.

Another object is the provision of a magnetic switch which is inexpensive to manufacture, and in which the parts may be readily assembled or removed 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 an end view of a device embodying the invention;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1;

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Fig. 3 is a sectional view taken on line 3—3 of Fig. 2;

Fig. 4 is an end view; and

Fig. 5 is a view of the terminal cup.

Referring first to Fig. 2 of the drawing, numeral 10 indicates a cup-shaped shell or casing member, preferably formed as a steel stamping. The member 10 is closed at its open end by a bracket 11 which extends laterally therefrom and is provided with a flange 12 by which the switch may be mounted in any desired location, such as a motor or upon any other part to be associated therewith. Screws 9 hold cup 10 to bracket 11.

The cup 10 is placed back-to-back with respect to a second cup 13 of insulating material, and the two are held together by suitable means such as screws 14 having their heads seated in the base of cup 10 and their threaded ends clamped to cover 16 (see Fig. 3) to hold the parts in assembled relation. Cup 13 is provided with a rectangular ledge portion 13A, also laterally projecting portions 15 having openings in which terminal members 17 and 18 are mounted. These terminal members are in the form of threaded bolts of good conducting material, such as copper or brass, and receive bars 19 and 20 which pass through slots 51 in cup 13 and act as the stationary contacts of the switch. Suitable nuts 21, 22, are threaded onto the outer portions of the bolts for securing the same to the terminal cup 13, and for attaching the conductors (not shown) to said bolts. The heads of the bolts 17 and 18 have their sides in registry with the straight sides of ledge 13A (see Fig. 1) and thus are locked against any turning tendency which might otherwise loosen the circuit connections. The same is true of heads 42 of terminal bolts 41, to which the coils ends 43 connect. These ends 43 pass through small openings 44 in cup 10, to connect with terminals 42.

The closure plate 11 is provided with a central opening, and a pole-piece 25 is mounted with its outer end suitably fixed in said opening, as by means of the lip 26 expanded therein. A plunger 30 of magnetic material, having a slightly smaller diameter than the outside diameter of guide member 36, has suitably fixed thereto a rod 31 and serves as a movable pole-piece to cooperate with the fixed pole-piece 25. Rod 31 carries contact assembly 27, also a disc 32 which retains a coiled spring 29 under compression, thus assuring steady engaging pressure on contact assembly 27 when the coil 34 is energized.

A spool or core 33 of suitable insulating mate-

rial is located within the shell 10, and is adapted to receive the winding 34. Between the core 33 and pole-pieces 25 and 30 is a sleeve 36 of non-magnetic material, which sleeve facilitates free sliding movement of pole-piece 30; the sleeve being flanged at one end and engaged by a spring 37 at the other end.

When the control circuit through the solenoid winding 34 is closed by the operator in any suitable manner (as by means of a remote control switch) the magnetic flux produced in said winding 34 will move the plunger 30 to the right, compressing the spring 37 and moving the plate of the contact assembly 27 into intimate engagement with the terminal bars 19 and 20 of the controlled circuit. This closes said circuit and causes the operation of the motor or other part to be energied. When the control switch is opened by the operator, the magnetic flux of the solenoid drops almost instantly to zero, and spring 37 instantly and forcibly thrusts the contact assembly 27 away from the terminal bars 19 and 20 in spite of any burning together of the surfaces thereof which may have taken place, and so rapidly that any appreciable amount of arcing is prevented.

In order to permit the coil to elongate in one direction in response to absorption of heat, there is provided a flat spring 55 having a normally bowed disposition, as shown in Figs. 2 and 3, and operatively engaging a disc 56 abutting the coil spool 33, the spring being flexed so as to normally bear against the surface of disc 56. The spring thus constitutes a resilient support for the coil and permits an elongation of the coil in response to absorption of heat therein; expansion in the other direction being prevented by the engagement with the flange provided on sleeve 33 adjacent bracket 11.

Thus it is apparent that the expansion of the coil cannot interfere with the calibration of the switch, since such expansion does not cause any variation in the width of air gap between the fixed and movable pole-pieces 25 and 30, respectively.

Sleeves 57, of insulating material, have flat external surfaces which, like flat-sided bolt-heads 17, 18 and 42, serve to resist any turning tendency of screws 14.

What is claimed is:

1. In a magnetic switch, a pair of cup-shaped members, one of the cup-shaped members being formed of an insulating material and the other of said members being formed of a magnetic material, means for holding said cup-shaped members in back-to-back abutment, said means including screws extending through said one cup-shaped member, a current receiving coil in the other of said cup-shaped members, and a switch element operated by said coil, the terminals for both said coil and said switch element being carried by said one cup-shaped member and cooperating therewith in such manner as to resist loosening of the terminal connections.

2. In a solenoid switch, a cup-shaped shell of magnetic material, a solenoid coil therein, a cup-shaped shell of non-conducting material, said latter shell having straight-edged plane surfaces on several sides thereof, a pair of terminal screws carried by the second-named shell and having heads engageable with one of said plane surfaces, and means for attaching the coil ends to said terminal screws, said coil ends being led through spaced-apart apertures in said first-named shell.

3. In a solenoid switch, a cup-shaped shell of magnetic material, a solenoid coil therein, a cup-shaped shell of non-conducting material, means for securing said cup-shaped shells in back-to-back abutment, said second-named shell having straight-edged exterior plane surfaces on several sides thereof, a pair of terminal screws having heads engageable with one of said plane surfaces, means for attaching the coil ends to said terminal screws, said coil ends being led through spaced-apart apertures in said first-named shell, and means housed in said second-named shell for closing a circuit in response to flow of current through said coil, said last-named means including a circuit bridging element, a pair of conducting bars engageable by said bridging element, and terminal screws passing through said bars for securing said bars to said second-named shell, each of said terminal screws having a head engageable with one of the straight-edged exterior plane surfaces of said second-named shell.

4. In a solenoid switch, a cup-shaped shell of magnetic material, a solenoid coil therein, a cup-shaped shell of non-conducting material, means for securing said cup-shaped shells in back-to-back abutment, said second-named shell having straight-edged exterior plane surfaces on several sides thereof, a pair of terminal screws having heads engageable with one of said plane surfaces, means for attaching the coil ends to said terminal screws, said coil ends being led through spaced-apart apertures in said first-named shell, and means housed in said second-named shell for closing a circuit in response to flow of current through said coil, said last-named means including a circuit bridging element, a pair of conducting bars engageable by said bridging element, and terminal screws passing through said bars for fastening said bars to said second-named shell at the exterior thereof, each of said terminal screws having a head engageable with one of the straight-edged exterior plane surfaces of said second-named shell, said second-named shell having slotted openings at diametrically opposed areas through which said bars project to the exterior.

5. In a solenoid switch, a cup-shaped shell of magnetic material, a solenoid coil therein, a cup-shaped shell of non-conducting material, said second named shell having straight-edged plane surfaces on several sides thereof, and means housed in said second-named shell for closing a circuit in response to flow of current through said coil, said means including a circuit bridging element, a pair of conducting bars engageable by said bridging element, and terminal screws having heads engageable with one of the straight-edged plane surfaces, said terminal screws passing through said bars and securing said bars to said second-named shell.

6. In a solenoid switch mechanism, a cup-shaped shell of magnetic material, a solenoid coil therein, a cup-shaped shell of non-conducting material, switch means housed in said second-named shell for closing a circuit in response to flow of current through said coil, means for holding said cup-shaped shells in back to back abutment, said second-named shell having an exterior edged surface, terminal screws for the solenoid switch mechanism, said terminal screws carried by said second-named shell, electrical connections for said solenoid switch mechanism leading to said terminal screws from the interior of at least one of said cup-shaped shells, said terminal screws having heads engageable with said exterior edged surface of the second-named shell and

cooperating therewith in such a manner as to resist loosening of the terminal connections.

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