Dec. 8, 1959 D. F. MOYER 2,916,585

SWITCH ASSEMBLY

Filed June 20, 1957 2 Sheets-Sheet 1

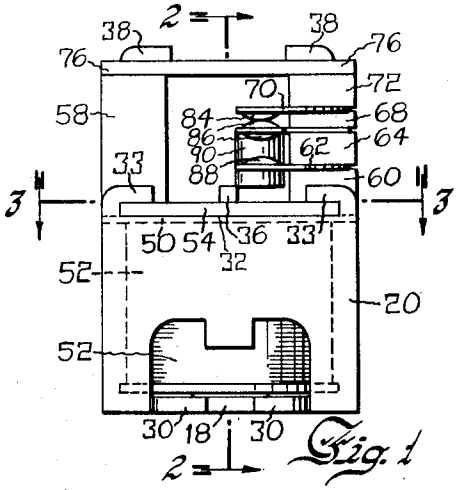


Fig. 1

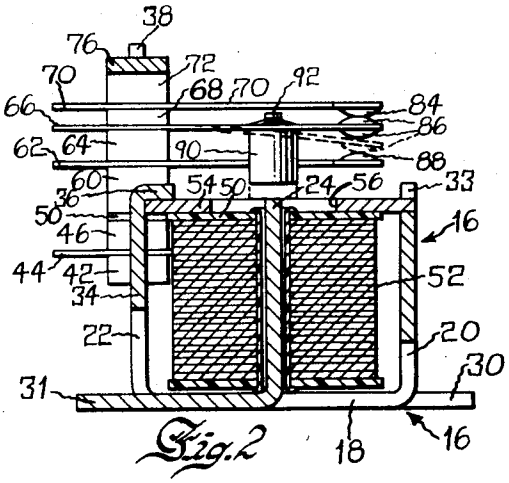


Fig. 2

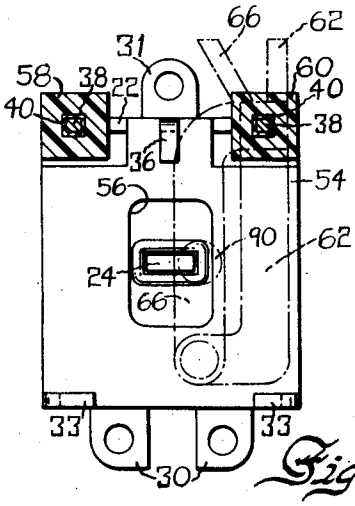


Fig. 3

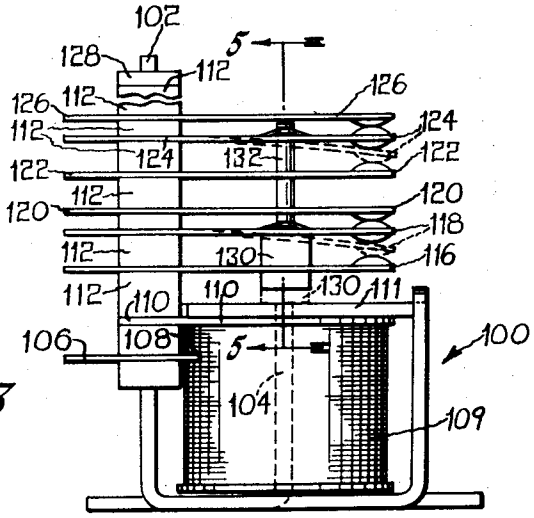


Fig. 4

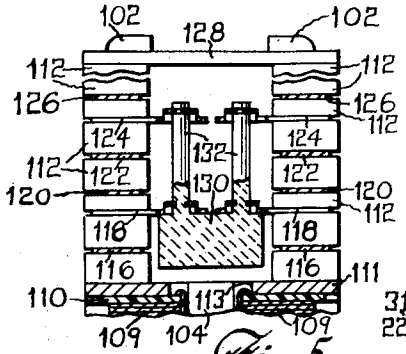


Fig. 5

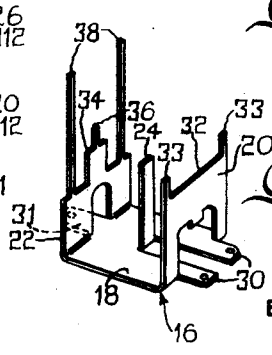


Fig. 6

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SWITCH ASSEMBLY

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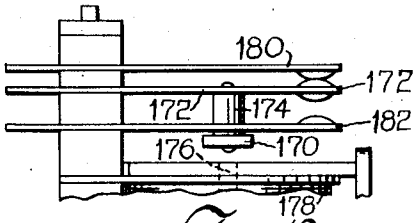


Fig. 12

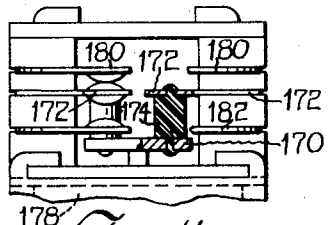


Fig. 11

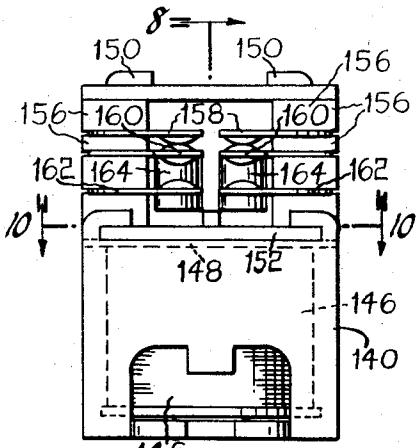


Fig. 7

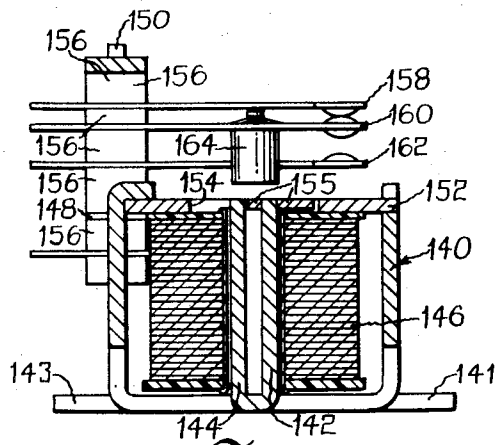


Fig. 8

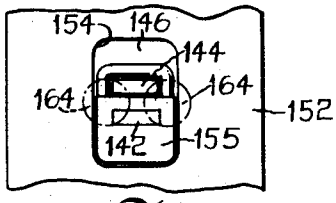


Fig. 10

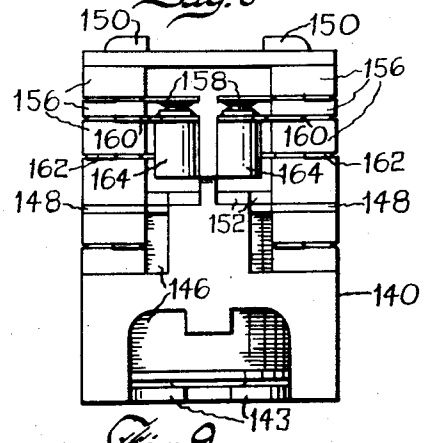


Fig. 9

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2,916,585

SWITCH ASSEMBLY

David F. Moyer, Dayton, Ohio

Application June 20, 1957, Serial No. 666,868

15 Claims. (Cl. 200—104)

This invention relates to a switch assembly. The invention relates more particularly to an electrically operable switch assembly, sometimes referred to as an electric relay.

In the art of electrically operated switch mechanisms it has been customary to provide an armature member pivotally carried by a support structure. The armature member being operable by magnetization of a core which is encompassed by an electric coil. The pivotally attached armature of the conventional electrically operated relay assembly has been directly attached to switch members through insulator means or has been provided with arm members for engaging switch members for the operation thereof with movement of the armature.

Numerous problems have been involved in the conventional switch mechanisms or relays. For example, an armature carried by a support structure has, of necessity, been of such physical size or mass that speed of operation of the armature has been limited. Furthermore, a pivotally mounted armature has often failed to operate properly due to the fact that binding or resistance of some type has frequently occurred between the armature and its support structure. Also, a problem has existed in regard to insulation of the armature from the switch members of an assembly.

Therefore, it is an object of this invention to provide a switch assembly of the electrically operable type, the armature of which is directly and rigidly attached to a switch member and supported thereby for operation thereof.

It is another object of this invention to provide an electrically operable switch assembly having an armature which requires no guides or pivotal support members.

Another object of this invention is the provision of an armature having a minimum mass.

It is another object of this invention to provide a switch assembly having a simple magnetic bridging circuit in which a movable bridge of the circuit has minimum dimensions.

It is another object of this invention to provide a switch assembly having a minimum number of parts or elements.

It is another object of this invention to provide a switch assembly in which the core of the magnetic circuit and all the members of the support structure are integral.

It is another object of this invention to provide an electrically operated switch assembly in which only one member or element of the assembly requires a bending operation in the formation thereof.

Another object of this invention is to provide an electrically operated switch assembly in which the armature member thereof consists of a magnetizable insulator material which may be either permanently magnetized or which is instantaneously magnetizable.

Another object of this invention is to provide an electrically operable switch assembly in which a single armature member is firmly attached to a plurality of switch members for the operation thereof so that no intermediate connector members are necessary.

Another object of this invention is to provide an electrically operable switch assembly in which the armature is constructed of a material which, in effect, has a residual air gap within the material so that the necessity of the conventional air gap in the magnetic structure or in the magnetic circuit of the apparatus to prevent "sticking" of the armature is eliminated.

Another object of this invention is to provide a switch assembly which may have two separate magnetic cores, each of which is integral with the support structure of the assembly.

Another object of this invention is to provide a switch assembly having a minimum physical size.

Another object of this invention is to provide a switch assembly which may have unidirectional assembly of the parts thereof, so that the assembly of the parts is readily adaptable to the use of automatically operating machinery.

Another object of this invention is to provide a switch assembly which may be built at low cost, is long lived, and durable.

Other objects and advantages reside in the construction of parts, the combination thereof, the method of manufacture, and the mode of operation, as will become more apparent from the following description.

Referring to the drawings, Figure 1 is a front elevational view of a switch assembly of this invention, the switch assembly being provided with a movable switch member and a plurality of stationary switch members.

Figure 2 is a sectional view taken substantially on line 2—2 of Figure 1.

Figure 3 is a sectional view taken substantially on line 3—3 of Figure 1.

Figure 4 is a side elevational view of a switch assembly of this invention provided with a plurality of movable and stationary switch members.

Figure 5 is a fragmentary sectional view taken substantially on line 5—5 of Figure 4.

Figure 6 is a perspective view on a smaller scale of a support structure and core member of a switch assembly of this invention.

Figure 7 is a front elevational view of a switch assembly of this invention having a plurality of groups of movable and stationary contact members.

Figure 8 is a sectional view taken substantially on line 8—8 of Figure 7.

Figure 9 is a rear elevational view of the switch assembly as shown in Figures 7 and 8.

Figure 10 is a fragmentary sectional view taken substantially on line 10—10 of Figure 7.

Figure 11 is a fragmentary front elevational view with parts broken away showing another modification of a switch assembly of this invention.

Figure 12 is a fragmentary side elevational view of the modification shown in Figure 11.

Referring to the drawings in detail, a switch assembly of this invention comprises support structure **16** shown in Figures 1, 2, and 6 which is preferably originally a single sheet of magnetizable material. The support structure **16** comprises a base **18**. A forward wall **20** and a rearward wall **22** are normal to the base **18** and are integral therewith.

A core **24** extends upwardly from the base **18** at substantially the center thereof and is integral therewith. The core **24** constitutes a strip which is partially severed from the base **18** and from the forward wall **20** and then bent normal to the base **18**, as best shown in Figure 6.

A pair of mounting feet **30** extend forwardly from the forward wall **20**. The mounting feet **30** comprise portions partially severed from the forward wall **20** and extending in alignment with the base **18**, as shown in Figures 1, 2, 3, and 6.

A mounting foot **31** extends from the rear wall **22**.

The foot **31** is severed from a portion of the rear wall **22** and extends rearwardly from the base **18** in alignment therewith and integral therewith.

The forward wall **20** has an upper edge **32** and a pair of projections **33** extending upwardly therefrom at opposite sides thereof.

The rear wall **22** is shorter than the forward wall **20**. However, the rear wall **22** has a central portion **34** extending upwardly therefrom to the level of the upper edge **32** of the forward wall **20**. The central portion **34** has an upwardly extending projection **36** which is discussed below.

Extending upwardly from the rear wall **22** and integral therewith at opposite sides of the central portion **34** are post members **38**, as best shown in Figure 6.

Encompassing each of the posts **38** and extending from the wall **22** along most of the length of each post **38** is an insulator sleeve **40**, as shown in Figure 3. Encircling each of the posts **38** and the sleeve **40** thereof and resting upon the rearward wall **22** is an insulator spacer **42**, as shown in Figure 2. Resting upon each of the insulator spacer members **42** and having a portion encompassing its respective post **38** is a connector lug **44** which extends rearwardly and forwardly from its respective post **38**. The purpose of the connector lug **44** is discussed below.

Resting upon each connector lug **44**, encircling each of the posts **38**, and its insulator sleeve **40** is an insulator spacer **46**. Resting upon the insulator spacer members **46** and having portions thereof encompassing each of the posts **38** is a support plate **50**. The support plate **50** has rigidly attached thereto a coil **52** which encircles the core **24**, as shown in Figure 2. Thus, the coil **52** is carried by the support plate **50** which is supported by the insulator spacer members **46** and the posts **38**. Terminal leads of the coil **52** are connected to the connector lugs **44**.

Disposed above the support plate **50** parallel thereto is a magnetizable cover plate **54**. The cover plate **54** lies upon the upper edge **32** of the forward wall **20** and upon the upper edge of the central portion **34** of the rear wall **22** of the support structure **16**. The cover plate **54** is held firmly in engagement with the walls **20** and **22** by the projections **33** and **36** which are bent over into engagement therewith.

The cover plate **54** is provided with an aperture **56** through which the core **24** extends, as shown in Figures 2 and 3. Thus, there is a magnetic air gap between the core **24** and the cover plate **54**.

As shown in Figures 1 and 2, encircling one of the posts **38** is an elongate tubular spacer member **58** which rests upon the support plate **50** and extends upwardly therefrom to a position adjacent the upper end of the post **38**. The other post **38** is provided with a short encircling spacer member **60** which engages the support plate **50**. The spacer member **60** supports a resilient contact stem or switch member **62** which has a portion thereof encircling the post **38** and the insulator sleeve **40** thereof. The contact stem **62** extends rearwardly and forwardly from the post **38**, as shown in Figure 2. Encircling the post **38** and in engagement with the contact stem **62** is a spacer **64** which separates the contact stem **62** from a resilient contact stem or switch member **66**. A spacer **68** engages the contact stem **66** and separates the contact stem **66** from a resilient contact stem or switch member **70**, as shown in Figures 1 and 2. The rear portion of the contact stem **66** is shown in Figure 3 extending angularly with respect to the other contact stems. Such an angular relationship provides greater clearances for connection purposes when deemed desirable.

Supported by the contact stem **70** and encircling the post **38** is a spacer **72**. Thus, the spacers **60**, **64**, **68**, and **72** and switch members **62**, **66**, and **70** of one post **38** comprise a stack equal to the length of the tubular spacer member **58** of the other post **38**.

Lying upon the tubular spacer **58** of one post **38** and the spacer member **72** of the other post **38** is a cover strip **76**.

The upper ends of the posts **38** are bent over into engagement with the cover strip **76** firmly retaining the position of all of the elements which encompass the posts **38**, as shown in Figures 1 and 2. Attached to the forward end of the contact stem **70** is a contact tip **84**. The contact stem **66** has at the upper and lower surfaces of the forward end thereof contact tips **86**. The upper contact tip **86** is normally in engagement with the contact tip **84** of the stem **70**, as shown in Figures 1 and 2. The contact stem **62** has at the forward end thereof a contact tip **88**.

Attached to the contact stem **66** intermediate the ends thereof and disposed adjacent the core **24** is an armature or actuator block **90**. The actuator block **90** is attached to the contact stem **66** by any suitable means. Preferably, as shown in Figure 2, the contact block **90** is provided with a small head **92**. The head **92** extends through an aperture in a split protuberant portion of the contact stem **66** and thus firmly secures the actuator block **90** to the stem **66**. The actuator block or armature **90** consists of magnetizable material which is also an electrical insulator material.

Materials having the characteristics of magnitite or lodestone may be used. A suitable material is a ceramic magnetic ferrite. This ferrite material has the general formula of $(M)OFe_2O_3$ where M is a divalent metallic atom.

In this formula atoms of manganese, magnesium, barium, copper or cobalt, provide satisfactory magnetic materials.

The connector lugs **44** electrically connected to the coil **52** may be connected to a source of electrical energy for energization of the coil **52**. It is further understood that the contact stems or switch members **62**, **66**, and **70** may be connected to any suitable control circuit or circuits.

When the coil **52** is properly energized, the core **24** is magnetized. Furthermore, the base **18** and the forward and rearward walls **20** and **22** and the cover plate **54** become magnetized as a magnetic circuit. Thus, the armature or actuator block **90** becomes magnetized. The actuator block **90** is thus caused to move toward the core **24** and toward the cover plate **54**. The actuator block **90** is thus drawn into engagement with an edge portion of the cover plate **54** and an edge portion of the core **24**, as shown in Figure 3. Thus, the actuator block **90** bridges the air gap between the core **24** and the cover plate **54**.

When the actuator block **90** is drawn into engagement with the core **24** and with the cover plate **54**, as shown in Figures 2 and 3, the contact stem **66** is bent so that the contact tip **86** leaves engagement with the contact tip **84** and the contact tip **86** engages the contact tip **88** of the stem **62**. Thus, it is understood that upon actuation of the coil **52** the normally closed circuit between the contact stems **66** and **70** is open and the normally open circuit between contact stems **66** and **62** is closed.

In Figures 4 and 5 a switch assembly of this invention is shown which has a support structure **100**. The support structure **100** is similar to the support structure **16** shown in Figures 1, 2, 3, and 6 except that the support structure **100** is provided with post members **102** which are considerably longer than the post members **38** of the support structure **16**. The support structure **100** has a core member **104** formed in a manner similar to the formation of the core member **24**. The switch assembly shown in Figures 4 and 5 is provided with a plurality of connector lugs **106** which are similar to the connector lugs **44**, shown in Figure 2. The connector lugs **106** are electrically attached to connection leads **108** extending from a coil **109** which encircles the core **104**. The coil **109**

is carried by a support plate **110**. A magnetizable cover plate **111** has an aperture **113** through which the core **104** extends.

Each of the posts **102** carries a plurality of spacer members **112** which are of various thicknesses and which are interposed among contact stems **116, 118, 120, 122, 124,** and **126**. A cover strip **128** engages the uppermost spacer member **112** and is firmly retained by bent-over portions of the upper ends of the posts **102**.

A magnetizable actuator block or armature **130** has a pair of stems **132**. The stems **132** extend between switch members **124** and **118** and are firmly attached thereto. The armature or actuator **130** and the stems **132** thereof are integral and are made of the same material.

The actuator block or armature **130** has sufficient length to extend across the aperture **113** of the cover plate **111**. Upon energization of the coil **109** by means of a suitable source of electrical energy attached to the connector lugs **106**, the core **104** and the support structure **100** with the cover plate **111** are magnetized. Thus, the actuator block **130** with the stems **132** thereof is magnetized and drawn into engagement with the cover plate **111** and into engagement with the core **104**. The actuator block **130** bridges between the core **104** and opposite edges of the aperture **113** of the cover plate **111**. Upon movement of the actuator block **130** toward the core **104**, the contact stems **118** and **124** are resiliently moved from engagement with the contact stems **120** and **126** respectively and are moved into engagement with the contact stems **116** and **122**, respectively.

Due to the fact that there are a plurality of contact stems attached to each of the posts **102** and to the armature **130** and the stems **132** thereof, a plurality of switch operations occur as the actuator block **130** moves. As shown in Figures 4 and 5, the posts **102** may be of any suitable or desired length and any desired number or arrangement of contact stems may be attached to each of the posts **102**. Also, any desired number or arrangement of contact stems or switch members may be attached to the actuator **130** for operation thereby.

Figures 7, 8, 9, and 10 show a support structure **140** similar in most respects to the support structures **16** and **100**, above described. The support structure **140** has a pair of front mounting feet **141** and a pair of rear mounting feet **143**. These feet **141** and **143** are formed in the manner discussed with respect to the feet **30** of the support structure **16**. However, the support structure **140** has a pair of core members as shown in Figure 8, there being a core member **142** which is bent upwardly at the central portion of the support structure **140** and is severed from the forward portion thereof. A core member **144** is disposed adjacent the core **142**, parallel therewith and is severed from the rearward portion of the support structure **140**. A coil **146** encircles the core members **142** and **144** and is carried by a support plate **148**, portions of which encircle posts **150**. The coil **146** is carried by the support plate **148** in a manner similar to that described with respect to the coils **52** and **109**, discussed above.

A cover plate **152** is carried by forward and rearward walls of the support structure **140**. The cover plate **152** is provided with an aperture **154** through which the core members **142** and **144** extend. Attached to the end of the core member **142** in any suitable manner is a shading coil **155** which encircles the core member **142**. The shading coil **155** is made of any suitable conductor material such as copper or brass or the like and serves in a well known manner to cause a time relationship between the magnetic flux generated in the core **142** with respect to the magnetic flux in the core **144** when an alternating voltage is applied to the coil **146**.

The posts **150** are provided with a plurality of spacer members **156** which are interposed among contact stems **158, 160,** and **162**, there being one contact stem **158, 160,** and **162** attached to each of the posts **150**, as shown in Figures 8 and 9.

Attached to each of the contact stems **160** is an actuator block **164** which may be similar to the actuator block **90** shown in Figures 1, 2, and 3. Thus, upon energization of the coil **146** the actuator blocks **164** are brought into engagement with the core members **142** and **144** as the actuator members **164** bridge between the core members **142** and **144** and the cover plate **152**, as shown in Figure 10.

Figures 11 and 12 show a modification of the switch assembly of this invention. An actuator plate **170** is attached to a pair of contact stems or switch members **172**. The actuator plate **170** is constructed of magnetizable current carrying material. However, the actuator plate **170** is insulated from the contact stems **172** by means of insulator members **174**, one of which is attached to each of the contact stems **172** and is also attached to the actuator plate **170**. Thus, when the actuator plate **170** is magnetized and moved toward a core member **176** by energization of a coil **178**, the contact stems **172** are resiliently bent so that they are moved from engagement with contact stems **180** and are moved into engagement with contact stems **182**.

Thus, it is understood that the switch mechanism of this invention is one in which the magnetizable actuator member is connected to the movable switch element and carried thereby for operation thereof. No support for the actuator member or armature, other than attachment to a switch member or members, is required.

The actuator blocks or armatures **90, 130,** or **164** may be made of a permanently magnetized material or of a material which is only momentarily magnetizable.

The permanently magnetized material is particularly suitable for devices which are referred to in the trade as polarized relays. Such devices have positive actuation upon energization of an operating coil by current flow in one direction but are not positively affected by current flow in the opposite direction.

Due to the fact that the actuator blocks **90, 132,** and **164** consist of a material which has the characteristic of an effective residual air gap therewithin the necessity of providing the customary air gap in the magnetic circuit of the assembly is eliminated.

It is also understood that the switch assembly of this invention may be readily constructed by means of automatically operating equipment, all of the elements thereof being assembled by movement in one direction.

Due to the fact that the actuator or armature is the only element which is bodily movable and due to the fact that no frictional forces occur upon the actuator member during the movement thereof, the switch assembly of this invention is long lived.

Furthermore, it is understood that the switch assembly of this invention has elements thereof which may be constructed in minimum dimensions. Each armature or actuator has minimum mass and is therefore capable of rapid operation.

Although the preferred embodiment of the device has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claims.

Having thus described my invention, I claim:

1. A low cost high speed switch assembly having support structure, a magnetizable core carried by the support structure, a coil encircling the core, a movable current carrying switch member adjacent the core, the combination comprising an actuator of magnetizable electrical insulator material directly attached to the switch member and carried thereby for movement thereof, the actuator being of material of the general formula of

$(M)OFe_2O_3$ wherein M represents a divalent metallic atom, the actuator being magnetizable by magnetization of the core through energization of the coil, such magnetization resulting in movement of the actuator into engagement with the core.

2. A low cost high speed switch mechanism, comprising a base, a core integral with the base substantially at the center thereof and normal thereto, a coil encircling the core, a post integral with the base and normal thereto in spaced relation from the core, a current carrying switch member carried by the post and having a movable portion adjacent the core, a stationary current carrying switch member carried by the post adjacent the first said switch member, the stationary switch member having a portion engageable by the movable portion of the first said switch member, an actuator block firmly attached to the movable portion of the first said switch member and supported thereby, the actuator block consisting of an electrical insulator magnetizable material of the general formula of $(M)OFe_2O_3$ wherein M represents a divalent metallic atom, the actuator block being magnetized with magnetization of the core, the block being movable into engagement with the core upon magnetization thereof causing relative movement between the movable portion of the first said switch member and the stationary switch member.

3. An electric relay mechanism comprising support structure, the support structure including a base, a pair of spaced-apart wall members attached to the base and extending angularly therefrom, a core member integral with the base and extending therefrom, the core member being substantially equidistant from each of the wall members, a coil encircling the core member, a plate rigidly attached to the wall members, the plate extending from one wall member to the opposite wall member, the plate having an aperture therein through which the core member extends, there being a space between the core member and the plate, there thus being a magnetic air gap between the core member and the plate, a plurality of switch members carried by one of the wall members, each of the switch members extending parallel to the plate, a magnetizable armature attached to at least one of the switch members and carried thereby for operation thereof, the armature being movable toward and away from the core member, the armature being of sufficient size to be engageable with the core member and the plate at the same time, the armature being brought into firm engagement with the core member and with the plate upon energization of the coil, the armature thus closing the magnetic air gap between the core member and the plate so that there is no magnetic air gap when the armature is in engagement with the core member and the plate.

4. A low cost high speed switch mechanism particularly adapted for use with alternating current energy comprising a base, a pair of magnetizable core members integral with the base and normal thereto, a coil encircling both of the core members, a disc of electric conductor material encompassing one of the core members and attached thereto, a support member attached to the base integral therewith and normal thereto, a magnetizable plate in firm engagement with the support member and extending therefrom, the plate having an opening therein encompassing the core members and the disc, there being a space between the core members and the plate, a current conductive switch member carried by the support member, a magnetizable actuator member carried by the switch member and movable into firm engagement with the core members upon magnetization thereof, the actuator member closing the space between the core members and the plate, the actuator member consisting of an electrical insulator material, movement of the actuator member causing operation of the switch member.

5. A low cost high speed switch mechanism, comprising a base, a plurality of post members carried by the base normal thereto, a plurality of movable contact members and a plurality of stationary contact members carried by each post member, a magnetizable actuator block, the actuator block being attached to all of the movable contact members and supported thereby, a core member attached to the base and extending toward the actuator block, a coil encircling the core member, energization of the coil causing magnetization of the core member and the actuator block causing the actuator block to move into engagement with the core member carrying therewith all of the movable contact members so that all of the movable contact members are moved with respect to the stationary contact members.

6. An electric switch assembly comprising support structure, a plurality of movable contact members and a plurality of stationary contact members carried by the support structure, a magnetizable actuator block attached to all of the movable contact members and supported thereby, magnetizable means carried by the support structure adjacent the actuator block, magnetization of the magnetizable means causing movement of the actuator block toward the magnetizable means carrying therewith all of the movable contact members so that all of the movable contact members are moved with respect to the stationary contact members.

7. An electric switch assembly comprising support structure, a movable contact member carried by the support structure, a stationary contact member carried by the support structure adjacent the movable contact member and engageable thereby, a permanently magnetized actuator member directly attached to the movable contact member and supported thereby, the actuator member consisting of electrical insulator material of the general formula of $(M)OFe_2O_3$ wherein M represents a divalent metallic atom, a magnetizable core carried by the support structure, a coil encircling the core, the actuator member moving into engagement with the core when electric current flows through the coil in one direction.

8. An electric relay mechanism comprising a magnetizable support structure a portion of which serves as a magnetic circuit, all of the stationary elements of the magnetic circuit being rigidly attached together except for a small space between two elements in the magnetic circuit leaving an opening in the magnetic circuit, a switch member carried by the support structure, a magnetizable actuator carried by the switch member for operation thereof, the actuator being constructed of material of the general formula of $(M)OFe_2O_3$ wherein M represents a divalent metallic atom which has an effective magnetic air gap therewithin so that a conventional magnetic air gap in the magnetic circuit of the support structure is not required, the actuator being movable into firm engagement with said two elements of the magnetic circuit upon magnetization thereof, the actuator thus firmly closing the opening in the magnetic circuit so that there is no air gap in the magnetic circuit when the actuator is in engagement with said two elements.

9. An electric relay mechanism comprising a magnetizable base, a pair of magnetizable wall members attached to the base integral therewith and normal thereto, a magnetizable core member integral with the base normal thereto and disposed intermediate the wall members, a coil carried by one of the wall members and encircling the core member, a magnetizable plate attached to the wall members normal thereto, the plate being disposed so that the coil is intermediate the plate and the base, the plate having an aperture therein through which the core member extends, there being a space between the core member and the plate thus providing a magnetic air gap between the core member and the plate, a post integral with one of the wall members and extending therefrom, a current conductive switch member carried by the post, a magnetizable actuator block carried by the switch member and supported thereby for op-

eration thereof, the actuator block consisting of electrical insulator material of the general formula of $(M)OFe_2O_3$ wherein M represents a divalent metallic atom, energization of the coil causing magnetization of the core member and the base and the wall members and the plate, such magnetization causing movement of the actuator block into direct firm engagement with the core member and with the plate, the actuator block thus bridging the magnetic air gap between the core member and the plate so that there is no air gap in the magnetic circuit when the block is in engagement with the core member and the plate, movement of the actuator block causing operation of the switch member.

10. A low cost high speed actuator assembly particularly adapted for use with alternating current energy comprising a magnetizable base, a pair of core members integral with the base and extending laterally therefrom intermediate the edges thereof, an electric coil encircling the core members, a closed coil of electric conductor material closely encircling one of the core members and attached thereto, a magnetizable armature movably disposed adjacent the core members and movable into engagement with the core members upon energization of the coil, energization of the coil causing magnetization of the core members.

11. An actuator assembly including support structure, a magnetizable core integrally attached to the support structure, an electric coil encircling the core, an electric conductor member movably carried by the support structure, a body of magnetizable electric insulator material of the general formula of $(M)OFe_2O_3$ wherein M represents a divalent metallic atom attached to said conductor member and carried thereby for movement thereof, a portion of the body of magnetizable material being adjacent the core, the member being moved toward the core by the body of magnetizable material upon magnetization of the core through energization of the coil.

12. An electric relay mechanism comprising a magnetizable support structure a portion of which serves as a magnetic circuit, all of the stationary elements of the magnetic circuit being rigidly attached together, the magnetic circuit including a plate having an aperture therein, a magnetic core extending through the aperture, the core being considerably smaller than the aperture so that a magnetic air gap exists between the core and the plate, a coil encompassing the core, a magnetizable actuator movably carried adjacent the core, the actuator being movable into engagement with the core and the plate upon energization of the coil, the actuator thus firmly closing the air gap between the core and the plate, the actuator being constructed of material of the general formula of $(M)OFe_2O_3$ wherein M represents a divalent metallic atom which has an effective magnetic air gap therewithin so that a conventional magnetic air gap in the magnetic circuit of the support structure is not required, there thus being no air gap in the magnetic circuit when the actuator is in engagement with the core and the plate, the actuator readily moving from engagement with the core and the plate upon deenergization of the coil.

13. An electric relay comprising support structure including a base member, a pair of wall members integral with the base member and extending laterally therefrom, a plate attached to the wall members in spaced apart relation from the base member, the plate having an aperture therethrough, a core member integral with the base member and extending laterally therefrom, the core member extending through the aperture of the plate, a coil encircling the core member, a switch member carried by the support structure, a magnetizable actuator attached to the switch member and carried thereby for operation thereof, the actuator being moved into engagement with the core member and the plate upon energization of the coil thus causing operation of the switch member.

14. An electrically operable mechanism comprising a magnetizable base, a pair of magnetizable core members integral with the base and extending laterally therefrom, means for magnetization of the core members, a pair of wall members integral with the base and extending therefrom, a plate attached to the wall members, the plate having an aperture therethrough, the core members extending through the aperture of the plate, a magnetizable actuator movably disposed adjacent the core members and the plate, the actuator being movable into engagement with the core members and the plate upon energization of the means for magnetization of the core members.

15. An electric switch assembly comprising support structure, a movable contact member carried by the support structure, a stationary contact member carried by the support structure adjacent the movable contact member and engageable thereby, a permanently magnetized actuator member of a material of the general formula of $(M)OFe_2O_3$ wherein M represents a divalent metallic atom, the actuator being attached to the movable contact member and supported thereby, a magnetizable core carried by the support structure, a coil encircling the core, the actuator member moving toward the core when electric current flows through the coil in one direction.

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