United States Patent [19]

Shlesinger, Jr. et al.

[11] **3,893,051**

[45] **July 1, 1975**

[54] **ELECTROMAGNETIC REED SWITCH**

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[21] Appl. No.: **452,505**

[52] **U.S. Cl.** **335/151**; 335/152; 335/154

[51] **Int. Cl.** **H01h 1/66**

[58] **Field of Search** 335/151, 152, 154

[56] **References Cited**

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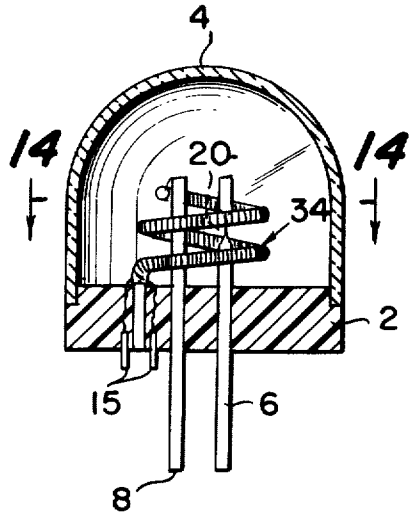
Primary Examiner—G. Harris

Attorney, Agent, or Firm—Shlesinger, Arkwright, Garvey & Dinsmore

[57] **ABSTRACT**

A reed switch comprising a base plate, an electromagnet and a magnetic reed having portions supported by the base plate and in close proximity to each other, the electromagnet including a core and a coil, conductor means supported by the based plate and including a contact portion, the magnetic reed including a free end having a thin hinge facing the core, and the magnetic reed including a contact portion, the conductor means contact portion and the magnetic reed contact portion being positioned for contact engagement and disengagement with each other, whereby upon activation of the electromagnet, the magnetic reed contact portion will be drawn to or away from the conductor means contact portion by virtue of the hinge to open or close a circuit.

59 Claims, 26 Drawing Figures



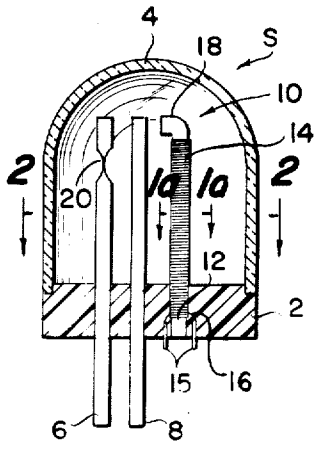


Fig. 1

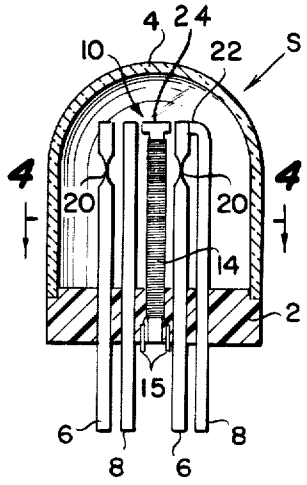


Fig. 3

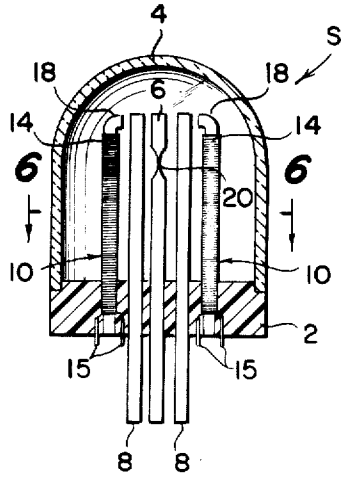


Fig. 5

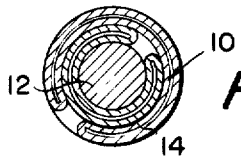


Fig. 1a

Fig. 2

Fig. 6

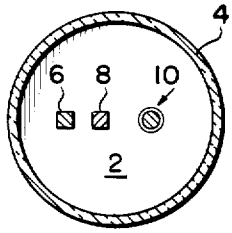
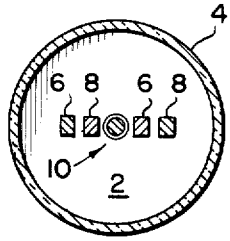
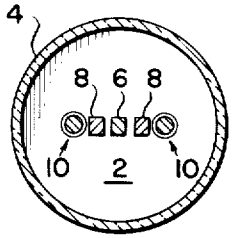


Fig. 4





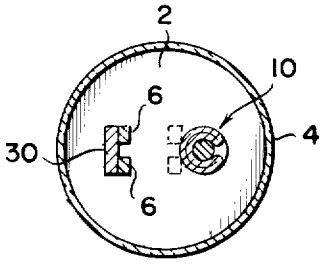


Fig. 7

Fig. 8

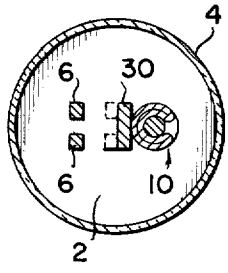
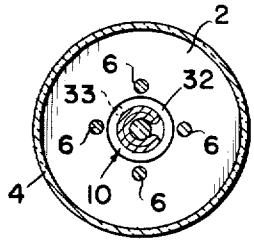


Fig. 9



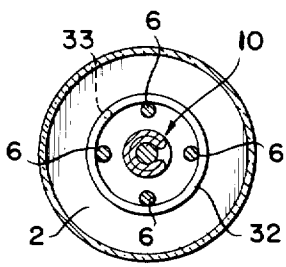


Fig. 10

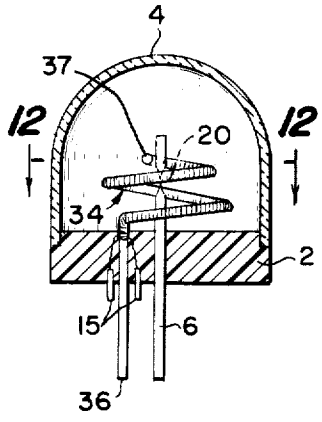


Fig. 11

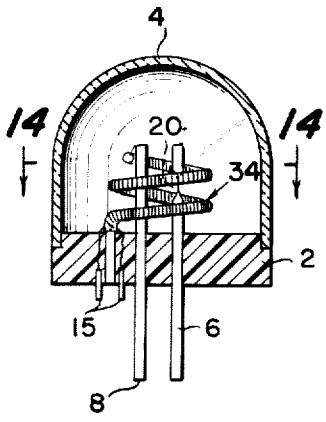


Fig. 13

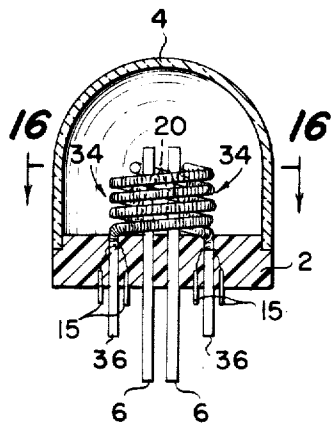


Fig. 15

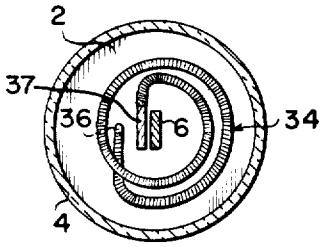


Fig. 12

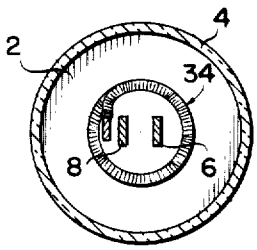


Fig. 14

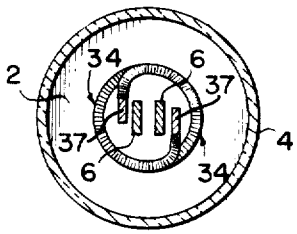
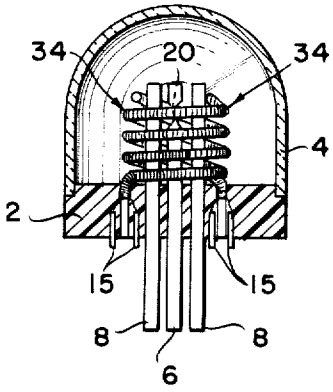


Fig. 16

Fig. 17



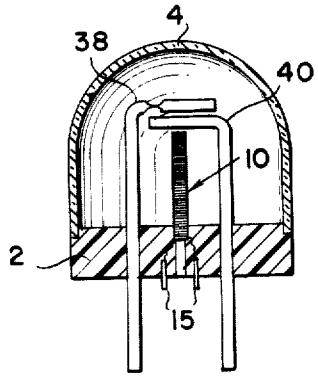


Fig. 18

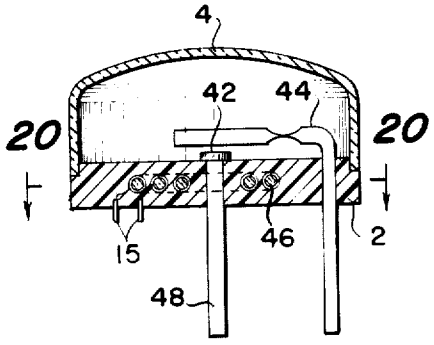


Fig. 19

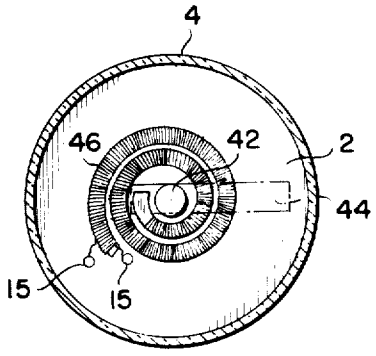


Fig. 20

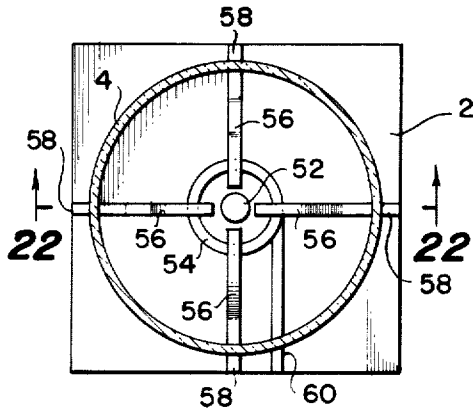


Fig. 21

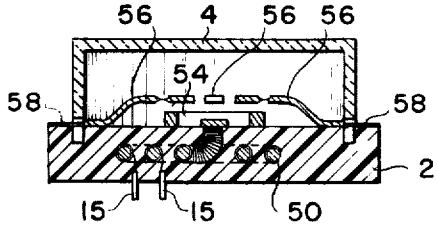


Fig. 22

Fig. 23

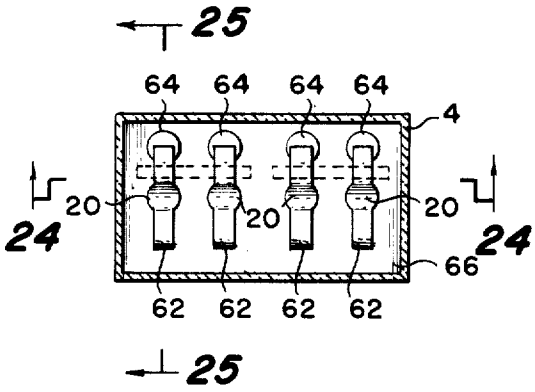
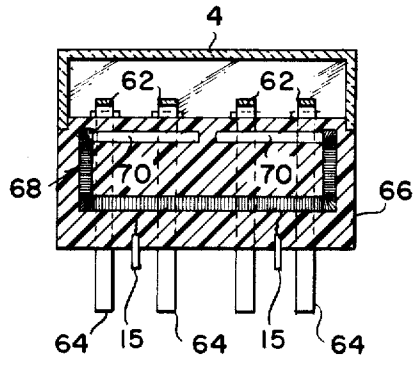


Fig. 24



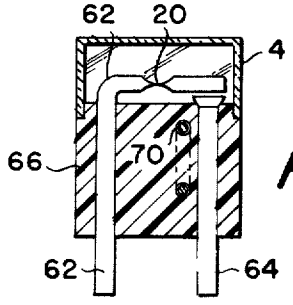


Fig. 25

ELECTROMAGNETIC REED SWITCH

This invention relates in general to reed switch devices as illustrated in our co-pending application filed Oct. 9, 1973, Ser. No. 404,612.

HISTORICAL BACKGROUND

In the past, electromagnetic reed switches have been quite complex and bulky. For the most part, the electroreed devices include a coil but do not have a core, and the coil is disassociated with the support envelope of the reeds. Typical devices of this type are illustrated in Patents to Peek, Jr., No. 2,898,422; Gomperts et al., No. 3,218,406; Juptner, No. 2,957,961; Kalb, No. 2,303,474 and Brown et al., No. 2,653,199 among others.

Further, most reed switches which are not operated by a permanent magnet but use a field coil are mounted with the reeds extending from opposite ends of the envelope. Exceptions to this are shown in Patents to Van Wagnerer et al., No. 3,247,343; Gomperts et al., No. 3,218,406 and DeFalco, No. 3,283,274. In general these patents disclose parallel reeds extending from the same end of the envelope and mounted adjacent one another in a single base. In the past, it has been the custom to form both reeds from magnetic material. Further, it has been known in the past to produce additional flexibility to the reed by forming a portion of lesser thickness than the main reed portion as disclosed in DeFalco and Gomperts referred to above as well as Patent Scheepstra et al., No. 3,258,557. It has, however, not been the custom to mount an electromagnet which includes the coil and the core so as to extend in the same general direction and in adjacent relationship with a reed such as a non-magnetic reed and a magnetic reed.

Thus, for the most part, it should be noted that the application of a coil is common but the use of a coil and a core in conjunction with the reeds themselves is uncommon. The purpose of having two reeds of magnetic material is obvious in that they themselves act as the core for transferring flux from one through the other and thus drawing them together in contact engagement. The use of a core in conjunction with a coil and a reed is broadly implied in Patents to Brown et al., No. 2,653,199 and Kalb, No. 2,303,474. The devices illustrated by these latter two patents, however, do not in any way permit any sufficient reduction in size from what is presently known in the art today nor do they teach the relationship of core, coil and reed of this invention.

In addition to the above, electromagnets, when used in switching, generally have been quite complex with little ability to focus the magnetic field. For the most part, the coils have been used only to produce a large flux field within the area encompassed by the coil. Very little attempt has been made to concentrate the flux field at a specific point. Patent to Brown et al., No. 2,653,199 makes some attempt to do this. Magnetic coils used in reed switching have generally, with the possible exception of Brown, not attempted to utilize a core member which will concentrate the flux field. Patent to Rypinsky, No. 1,972,319 shows the idea of wrapping a coil of wire about a central core member each being insulated one from the other. It could be said that the coil in Rypinsky would act about the inner core member although in this instance there is no attempt to utilize the principle for directing a flux field to a point in the manner of this invention.

OBJECTS AND SUMMARY

It is therefore an object of this invention to provide an electromagnetic reed switch which allows for greater reduction in size and an increase in low carrying capacities substantially greater than heretofor.

It is a further object of this invention to provide an electromagnetic reed switch which can be inexpensively and readily manufactured.

Another object of this invention is to provide an electromagnetic reed switch which has great durability and can take severe strain and stress.

Yet a further object of this invention is to provide an electromagnetic reed switch which incorporates therein a magnetic conductive reed and a non-magnetic conductive reed thereby providing for rapid make and break unachieveable with prior reed switches in which the reeds are both of magnetic conductive material.

Still a further object of this invention is to provide an electromagnetic reed switch which is substantially planar utilizing primarily two dimensions.

A still further object of this invention is to provide an electromagnetic reed switch having many options of operation including various on-off combinations.

It is a further object of this invention to provide an electromagnetic reed switch which has an extremely rapid closing time.

Yet another object of this invention is to provide an electromagnetic reed switch in which the spring element of the reed has been cold-worked so as to completely change the crystalline structure of the metal in the area of the cold-work to provide a spring which is durable and extremely flexible.

Yet another object of this invention is to provide an electromagnetic reed switch having contacts at the same end of the capsule thereby permitting substantial reduction in size.

Yet another object of this invention is to provide an electromagnetic reed switch which incorporates plural electromagnets for on and off operation.

Another object of this invention is to provide an electromagnetic reed switch which has a strong snap action so as to crunch or otherwise break through any outside build-up increasing the longevity of the switch and eliminate malfunction due to carbon build-up.

Yet a further object of this invention is to provide an electromagnetic reed switch which has good contact wipe characteristics.

Still a further object of this invention is to provide a reed switch which improves conductivity characteristics with use.

A further object of this invention is to provide an electromagnetic reed switch which can be adapted to many shapes and forms.

Still a further object of this invention is to provide an electromagnetic reed switch capable of being used in linear and radial configurations and combinations.

Still a further object of this invention is to provide an electromagnet for use with reed switch devices whereby the force field can be concentrated in a specific point for reed contact operation.

Another object of this invention is to provide an electromagnet for reed switches having a core with a coil wrapped around which can be bent or formed to coni-

cal, cylindrical or other configurations and whereby the end of the core will act as the focusing point for the magnetic field.

A further object of this invention is to provide an electromagnet for reed switches having a core and coil winding about said core in which the electromagnet forms an Archimedes spiral or ring with at least one end of the core positioned so as to direct the magnetic field in order to switch a magnetic reed.

A still further object of this invention is to provide an electromagnet for reed switches having a coil and core in which the ends of the core are directed towards each other for the purpose of actuating reed devices.

Still another object of this invention is to provide an electromagnet having a core which is conductive and is itself a conductor and which core has one end so directed as to concentrate a flux for pulling a magnetic reed towards the core end which core end is itself a contact surface for the magnetic reed.

In summary therefore, this invention is directed to electromagnetic reed switches and electromagnets therefore including a coil, core, and a reed therefor which permit substantial reduction in size over present reed switch devices while maintaining substantially the same capabilities and capacities and these and other objects of this invention will be apparent from the following description and claims.

In the accompanying drawings which illustrate by way of example various embodiments of this invention:

FIG. **1** is a side elevational view shown in cross section of the invention;

FIG. **1A** is an enlarged fragmentary cross sectional view of the embodiment shown in FIG. **1** taken along the lines **1A—1A** and viewed in the direction of the arrows;

FIG. **2** is a cross sectional view of the embodiment shown in FIG. **1** taken along the lines **2—2** and viewed in the direction of the arrows;

FIG. **3** is a side elevational view in cross section showing another embodiment of the invention;

FIG. **4** is a sectional view of the embodiment shown in FIG. **3** taken along the lines **4—4** and viewed in the direction of the arrows;

FIG. **5** is a side elevational view in cross section of another embodiment of the invention;

FIG. **6** is a sectional view of the embodiment shown in FIG. **5** taken along the lines **6—6** and viewed in the direction of the arrows;

FIGS. **7, 8, 9** and **10** are sectional views of additional embodiments of this invention;

FIG. **11** is another embodiment of this invention in cross section;

FIG. **12** is a sectional view of the embodiment shown in FIG. **11** taken along the lines **12—12** and viewed in the direction of the arrows;

FIG. **13** is an elevational view shown in cross section of yet a further embodiment of the invention;

FIG. **14** is a sectional view of the embodiment shown in FIG. **13** taken along the lines **14—14** and viewed in the direction of the arrows;

FIG. **15** is an elevational view in cross section showing yet a further embodiment of the invention;

FIG. **16** is a sectional view of the embodiment shown in FIG. **15** taken along the line **16—16** and viewed in the direction of the arrows;

FIGS. **17, 18** and **19** are elevational views in cross section showing still further embodiments of the invention;

FIG. **20** is a sectional view of the embodiment shown in FIG. **19** taken along the lines **20—20** and viewed in the direction of the arrows;

FIG. **21** is a fragmentary top plan view of still a further embodiment of this invention;

FIG. **22** is a sectional view of the embodiment shown in FIG. **21** taken along the lines **22—22** and viewed in the direction of the arrows;

FIG. **23** is a cross sectional top plan view of a further embodiment of this invention. The cross section is taken below the top surface of the cover;

FIGS. **24** and **25** are cross sectional views of the embodiment shown in FIG. **23** taken along the lines **24—24** and **25—25** respectively and viewed in the direction of the arrows. In these figures, the top surface of the cover is shown.

FIGURES 1 THROUGH 18

In FIG. **1**, the switch capsule is generally designated by S. The capsule S comprises a base **2** and a cover **4**. The base **2** and cover **4** may be ceramic, plastic, or glass or the like. In the base **2** is a conductive magnetic reed **6** and a conductive non-magnetic reed **8** in side-by-side generally parallel relationship. Adjacent the non-magnetic reed is mounted an electromagnet **10** comprising a core **12** having wrapped thereon a coil **14** terminating in pins **15** of the leads **16**. The coil **14** is a wrapping of typical electromagnet insulated wire with the desired number of turns wrapped around the core **12** in order to produce a sufficient magnetic field at the end **18** of the core **12**. The core itself is of any typical electromagnetic core material such as iron, nickel or the like alloys. The core material may have substantial conductivity characteristics or be coated with a conductive material for purposes here and after described.

The magnetic reed **6** includes a foil thin hinge **20** of less than 0.003 inch thickness of the type disclosed in our co-pending application referred to above.

It will be noted that the reeds **6** and **8** extend through the base **2** for purposes of electrical connection.

It will now be obvious that upon energization of the coil **14**, the core **12** will be magnetized and the force field will be concentrated about the end **18** so as to draw the magnetic reed **6** towards the non-magnetic reed **8** thereby to close a circuit.

In FIG. **3**, it will be noted that a pair of reeds **6** are used in conjunction with a pair of reeds **8** on either side of the electromagnet **10**. On the left, the non-magnetic reed **8** is positioned between the electromagnet **10** and the magnetic reed **6** whereas on the right, the magnetic reed is positioned between the electromagnet **10** and the non-magnetic reed **8**. The non-magnetic reed **8** has a bent end **22**.

Upon activation of the electromagnet **10**, the magnetic reeds **6** will be drawn towards the electromagnet **10** to close a circuit on the left and to open a circuit on the right. The core **12** may have its end **24** flattened or otherwise shaped to form a T to provide a better force field.

In FIG. **5**, the base **2** includes two electromagnets **10**. A magnetic reed **6** is positioned between two non-magnetic reeds **8** with the electromagnets **10** facing each other and outside of the non-magnetic reeds **8**. In operation, the magnetic reed **6** is drawn either to the

left or to the right of the non-magnetic reed depending upon which of the two electromagnets **10** are activated.

In the arrangement shown in FIG. **7**, a conductive non-magnetic reed **30** is shown to be wider than magnetic reeds **6** and an engagement therewith. The dotted line position indicates the position of the magnetic reeds **6** when the electromagnet **10** is turned on. FIG. **8** shows a reversal of the position of the magnetic reeds **6** and the non-magnetic reed **30**. In FIG. **7**, the circuits are broken whereas in FIG. **8**, the circuits are made. It is obvious that the magnetic reed **6** may be a wide reed **30** operating against or away from two or more non-magnetic reeds **8**.

In FIGS. **9** and **10**, the reeds **6** make contact as in FIG. **9** or break contact as in FIG. **10** with a sleeve **32**. The sleeve **32** is conductive and connected to an electrical lead **33** extending through base **2**. Instead of a sleeve **32**, a cage, or ring supported by posts might be used.

In FIGS. **11** through **17**, the electromagnets **34** instead of being post-like as in FIGS. **1** through **10**, are coiled or helically shaped. FIGS. **11** and **12** show the electromagnet **34** as being conically shaped. The core of the electromagnet **34** provided with a conductive terminal end **36** and the core itself is conductive. Note also that the electromagnets in FIGS. **15** and **16** also have ends **36** which project for connection to electrical leads, the electromagnets **34** having conductive cores. In FIGS. **11** and **12** and **15** and **16**, the magnetic reeds **6** close against the contact ends **37** of the conductive cores of the electromagnets **34** to make a circuit. In FIGS. **13**, **14** and **17**, the magnetic reed **6** engages a non-magnetic reed or magnetic reeds **8** as the case may be to close a circuit. The coiling of the electromagnet **34** permits a much smaller package. Though the overall length of the core is the same, the height can be reduced from a post-like configuration as shown in FIGS. **1** through **10**.

The operation of the devices shown in FIGS. **11** through **17** is similar to that described in FIGS. **1** through **10**.

FIGURES 18 THROUGH 22

In FIG. **18**, a magnetic reed **38** is L-shaped and extends above an L-shaped non-magnetic reed **40**. The action is in a downward direction upon activation of the electromagnet **10**. In FIG. **19**, instead of there being a non-magnetic reed, there is a contact button **42** for the L-shaped magnetic reed **44**. It will be noted that rather than having a post electromagnet **10**, the electromagnet is a flat Archimedes coil **46** as best shown in FIG. **20**. The contact button **42** is secured to a conductor **48** extending through the base **2**. The configuration shown in FIGS. **19** and **20** allows for a very low profile switch package.

In FIGS. **21** and **22**, the electromagnet **50** has the core end **52** projecting upwardly within a conductive non-magnetic ring **54**. Above the conductive magnetic ring are mounted a series of magnetic reed fingers **56**. The reed fingers are terminated in printed circuitry **58**. The non-magnetic ring conductor **54** is also terminated in printed circuitry **60** and other printed circuits may be provided for the electromagnet **50** in place of the standard pin conductors **15**.

FIGURES 23 THROUGH 25

In FIGS. **23** through **25**, a series of magnetic reeds **62** are provided in an in-line arrangement. The magnetic reeds close on a series of conductors **64** also in an in-line arrangement.

Mounted in the support base or plate **66** is an electromagnet **68** of a generally C-configuration with the ends **70** positioned directly beneath the magnetic reeds **62**. It will be obvious that upon activation of the electromagnet **68**, the magnetic reed **62** will be drawn downward towards the ends **70** to close upon the conductors **64**.

While this invention has been described as having a preferred design, it will be understood that it is capable of further modification. This application is, therefore, intended to cover any variations, uses or adaptations of the invention following the general principles thereof and including such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and as may be applied to the essential features hereinbefore set forth and fall within the scope of this invention or the limits of the appended claims.

Having thus described our invention what we claim is:

1. A reed switch comprising:
a. a support,
b. an electromagnet and a magnetic reed having portions supported by said support and in close proximity to each other,
c. said electromagnet including a core and a coil,
d. conductor means supported by said support,
e. said conductor means including a contact portion,
f. said magnetic reed including a free end having a thin hinge facing said core,
g. said magnetic reed including a contact portion,
h. said conductor means contact portion and said magnetic reed contact portion being positioned for contact engagement and disengagement with each other,
i. whereby upon activation of said electromagnet said magnetic reed contact portion will be drawn to or away from said conductor means contact portion by virture of said hinge to open or close a circuit.

2. A reed switch as in claim **1** and wherein:
a. said conductor means includes said core.

3. A reed switch as in claim **2** and wherein:
a. said conductor means contact portion includes said core.

4. A reed switch as in claim **1** and including:
a. an envelope supported by said support and closing said electromagnet and said magnetic reed.

5. A reed switch as in claim **1** and wherein:
a. said core is a helix and said coil is wrapped about said helix.

6. A reed switch as in claim **5** and wherein:
a. said helix lies in a single plane.

7. A reed switch as in claim **5** and wherein:
a. said helix extends through more than a single plane.

8. A reed switch as in claim **5** and wherein:
a. said helix is generally conical.

9. A reed switch as in claim **5** and wherein:
a. said helix is generally cylindrical.

10. A reed switch as in claim **6** and wherein:
a. said magnetic reed has its free end extending over said helix and said magnetic reed contact portion moves in a direction substantially vertical to said support.

11. A reed switch as in claim 1 and wherein:
a. said magnetic reed's free end moves in a direction substantially horizontal to said support.
12. A reed switch as in claim 1 and wherein:
a. said conductor means contact portion is mounted in said support.
13. A reed switch as in claim 12 and wherein:
a. said conductor means is mounted adjacent said core.
14. A reed switch as in claim 13 and wherein:
a. said conductor means is positioned between said magnetic reed and said core.
15. A reed switch as in claim 12 and wherein:
a. said conductor means is mounted adjacent said magnetic reed.
16. A reed switch as in claim 15 and wherein:
a. said magnetic reed is positioned between said conductor means and said core.
17. A reed switch as in claim 1 and wherein:
a. said core, said magnetic reed, and said conductor means are supported in said support in substantially parallel relationship.
18. A reed switch as in claim 1 and wherein:
a. said core includes a tip portion bent in the direction of said magnetic reed.
19. A reed switch as in claim 1 and wherein:
a. said conductor means includes a non-magnetic reed.
20. A reed switch as in claim 19 and wherein:
a. said non-magnetic reed has a free end and said free end is in length approximately the length of said magnetic reed and extends in the same general direction as said magnetic reed and is substantially parallel thereto.
21. A reed switch as in claim 20 and wherein:
a. said core has a free end and said free end is in length approximately the length of one of said reeds and is substantially parallel thereto.
22. A reed switch as in claim 1 and including:
a. a plurality of said magnetic reeds disposed radially about said core.
23. A reed switch as in claim 22 and including:
a. said conductor means including a plurality of conductors disposed radially about said core.
24. A reed switch as in claim 23 and wherein:
a. at least one of said conductors is positioned between said core and said magnetic reeds.
25. A reed switch as in claim 23 and wherein:
a. at least one of said magnetic reeds is positioned between said core and one of said conductors.
26. A reed switch as in claim 19 and including:
a. a plurality of said non-magnetic reeds disposed radially about said core.
27. A reed switch as in claim 26 and wherein:
a. said non-magnetic reeds are positioned between said magnetic reed and said core.
28. A reed switch as in claim 26 and wherein:
a. said magnetic reed is positioned between said non-magnetic reeds and said core.
29. A reed switch as in claim 19 and including:
a. a plurality of magnetic reeds disposed radially about said core and between said core and said non-magnetic reed.
30. A reed switch as in claim 19 and including:
a. a plurality of magnetic reeds disposed radially about said core and said non-magnetic reed being disposed radially between said core and magnetic reeds.
31. A reed switch as in claim 1 and including:
a. a plurality of said electromagnets supported by said support each having a coil and a core.
b. said electromagnets being positioned on opposite sides of said magnetic reed.
32. A reed switch as in claim 31 and wherein:
a. said conductor means includes a plurality of non-magnetic reeds, and
b. at least one non-magnetic reed being positioned on opposite sides of said magnetic reed and each associated with one of said electromagnets.
33. A reed switch as in claim 19 and including:
a. a plurality of non-magnetic reeds, and
b. at least two of said electromagnets surrounding said reeds.
34. A reed switch as in claim 20 and wherein:
a. said magnetic and non-magnetic reeds have their free ends extending over said core and said magnetic reed tip moves in a vertical direction relative to said support.
35. A reed switch as in claim 34 and including:
a. a plurality of said magnetic reeds mounted above said non-magnetic reed.
36. A reed switch as in claim 34 and including:
a. a plurality of non-magnetic reeds mounted above at least one magnetic reed.
37. A reed switch as in claim 34 and including:
a. a plurality of non-magnetic and magnetic reeds operating in pairs.
38. A reed switch as in claim 37 and wherein:
a. said operating pairs of magnetic and non-magnetic reeds are radially displaced about said core.
39. A reed switch as in claim 37 and wherein:
a. said operating pairs of magnetic and non-magnetic reeds are arranged in a row.
40. A reed switch as in claim 34 and wherein:
a. said core is a helix lying in a single plane and mounted in the horizontal plane of said base.
41. A reed switch as in claim 1 and wherein:
a. said hinge is foil thin.
42. A reed switch as in claim 1 and wherein:
a. said hinge is less than 0.003 inches in thickness.
43. A reed switch as in claim 1 and including:
a. a plurality of said magnetic reeds engaging said contact means contact portion, and
b. at least two of said electromagnets surrounding said reeds.
44. A reed switch as in claim 29 and including:
a. a plurality of said electromagnets, and
b. said electromagnetic cores being intertwined.
45. A reed switch comprising:
a. a support,
b. an electromagnet and a magnetic reed having portions supported by said support and in close proximity to each other,
c. said electromagnet including a core and a coil,
d. said coil being wrapped about the surface of said core and conforming with the surface of said core in contact therewith,
e. conductor means supported by said support,
f. said conductor means including a contact portion,
g. said magnetic reed having a hinge of less than 0.003 inch thickness, and including a contact portion positioned for contact engagement and disen-

gagement with said conductor means contact portion,
h. whereby upon activation of said electromagnet said magnetic reed contact portion will be drawn to or away from said conductor means contact portion to open or close a circuit.

46. A reed switch as in claim **45** and wherein:
a. said core is a post.

47. A reed switch as in claim **45** and wherein:
a. said core is a coil.

48. A reed switch as in claim **45** and wherein:
a. said core forms a conical helix.

49. A reed switch as in claim **45** and wherein:
a. said core forms a cylindrical helix.

50. A reed switch as in claim **45** and wherein:
a. said core is a spiral lying substantially in a single plane.

51. A reed switch as in claim **45** and wherein:
a. said core has at least one end unwrapped.

52. A reed switch as in claim **51** and wherein:
a. said one unwrapped end includes a bent portion directed toward said magnetic reed.

53. A reed switch comprising:
a. a support,
b. an electromagnet and a magnetic reed having portions supported by said support and in close proximity to each other,
c. said electromagnet including a core and a coil,
d. said coil being wrapped about the surface of said core and conforming with the surface of said core and in contact therewith.
e. conductor means supported by said support,
f. said conductor means including a contact portion,
g. said magnetic reed including a contact portion positioned for contact engagement and disengagement with said conductor means contact portion,
h. said electromagnet being coil shaped,
i. whereby upon activation of said electromagnet, said magnetic reed contact portion will be drawn away from or towards said conductor means contact portion to open or close a circuit.

54. A reed switch as in claim **53** and wherein:
a. said conductor means contact portion includes said core.

55. A reed switch as in claim **53** and wherein:
a. said conductor means includes said core, and
b. said electromagnet substantially encoils about said magnetic reed.

56. A reed switch as in claim **53** and wherein:
a. said electromagnet substantially encoils about said magnetic reed.

57. A reed switch as in claim **53** and wherein:
a. said electromagnet substantially encoils about said conductor means.

58. A reed switch as in claim **53** and wherein:
a. said electromagnet substantially encoils about said magnetic reed and said conductor means.

59. A reed switch as in claim **57** and wherein:
a. said magnetic reed is positioned outside of said electromagnet.

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