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Shlesinger, Jr.

[11] **3,760,312**
[45] **Sept. 18, 1973**

[54] **MAGNETICALLY ACTUATED REED SWITCH ASSEMBLY**

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[21] Appl. No.: **299,273**

Related U.S. Application Data

[62] Division of Ser. No. 236,598, March 21, 1972.

[52] **U.S. Cl.** **335/205,** 335/206
[51] **Int. Cl.** **H01h 19/00,** H01h 36/00
[58] **Field of Search** 335/205–207

[56] **References Cited**

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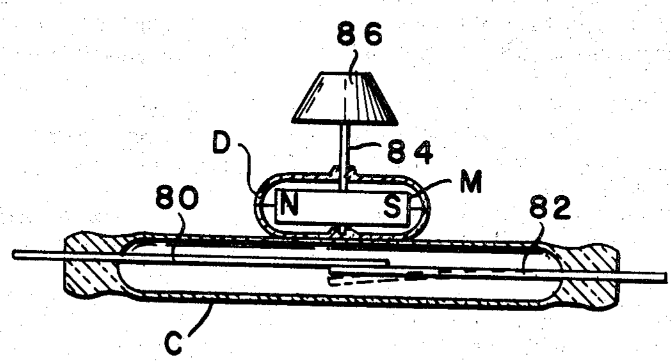
Primary Examiner—Roy N. Envall, Jr.
Attorney—B. Edward Shlesinger, Jr. et al.

[57] **ABSTRACT**

A magnetically actuated reed switch assembly comprising contact means including first and second cooperating magnetically actuated reeds in spaced relation to each other, a permanent magnet rotatable about an axis transverse to the longitudinal axis of the reeds and positioned with respect to the contact means so that its force field at certain positions of its rotation operates to influence the contact means to open or close, the contact means and magnet being encased in a housing assembly including contact and magnet supporting chambers.

47 Claims, 25 Drawing Figures



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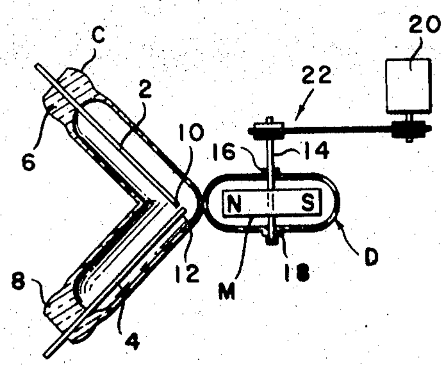


Fig. 1

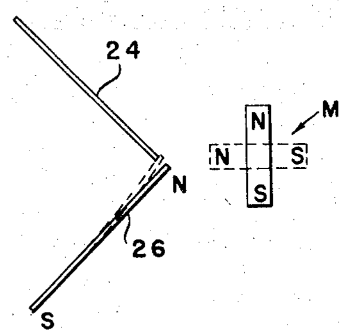


Fig. 2

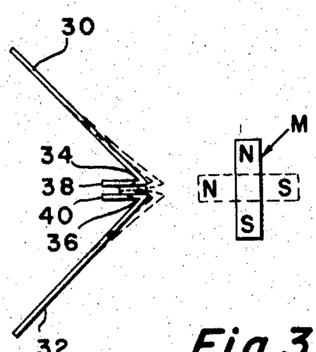


Fig. 3

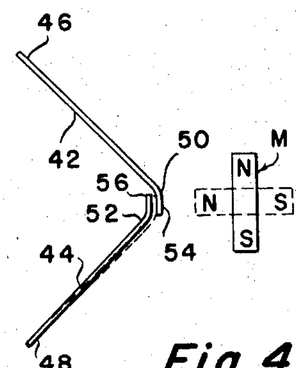


Fig. 4

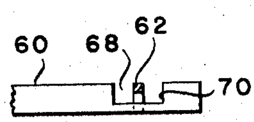


Fig. 5a

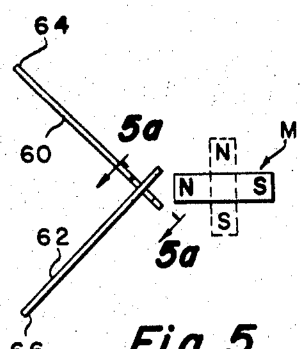


Fig. 5

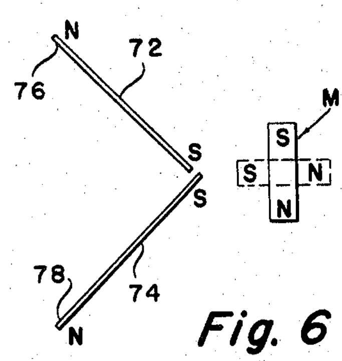
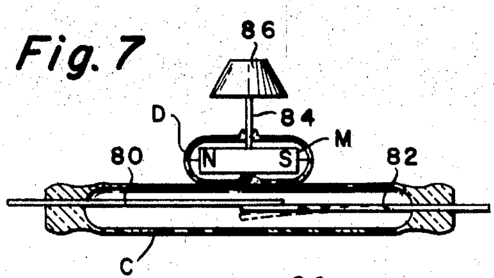


Fig. 6

Fig. 7



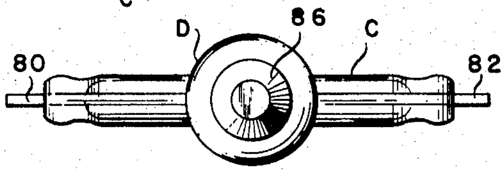


Fig. 7a

Fig. 8

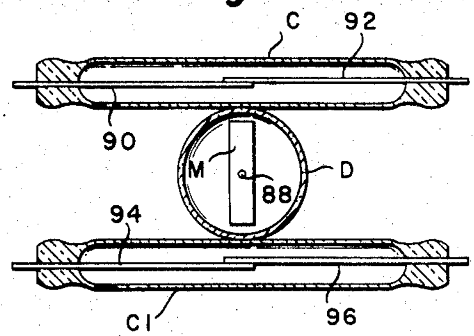
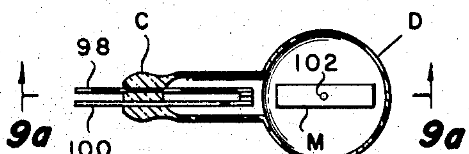


Fig. 9



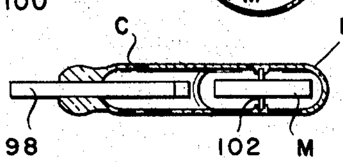
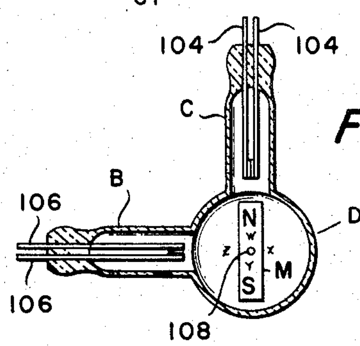


Fig. 9a

Fig. 10



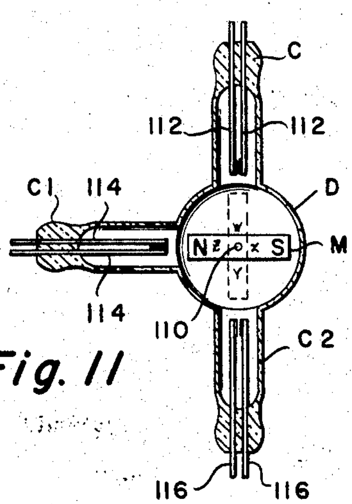


Fig. 11

Fig. 12

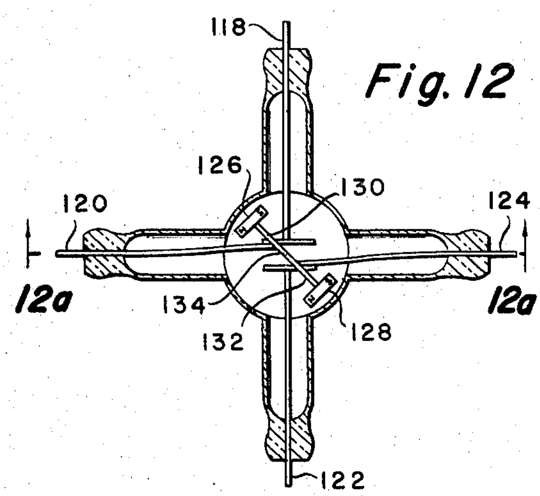
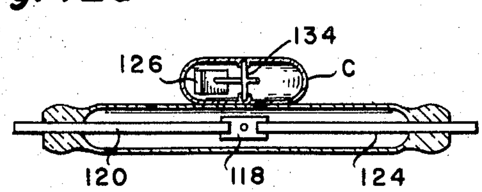


Fig. 12a



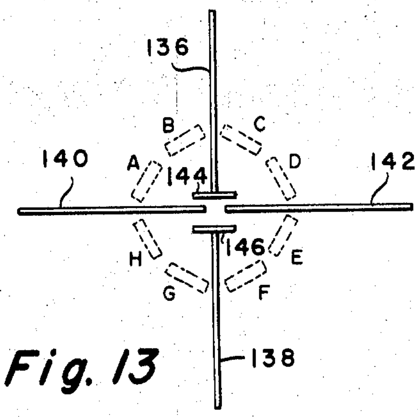


Fig. 13

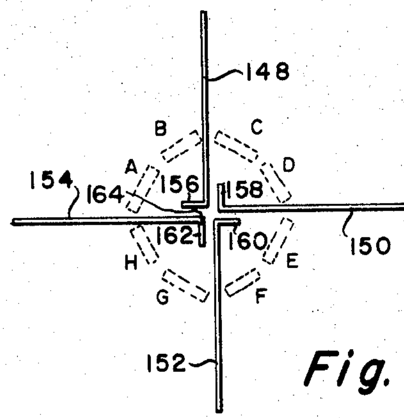


Fig. 14

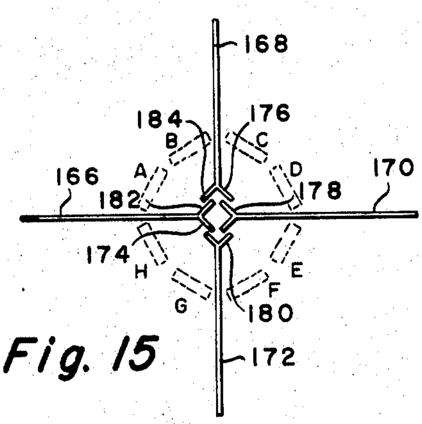


Fig. 15

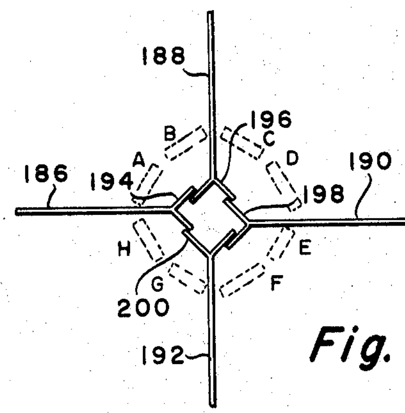


Fig. 16

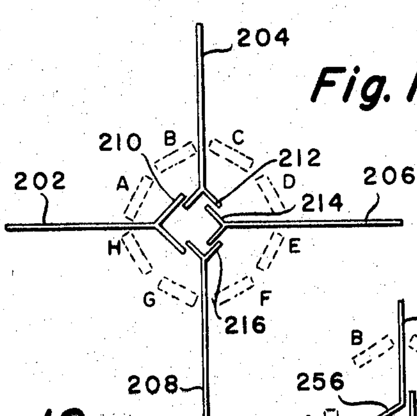


Fig. 17

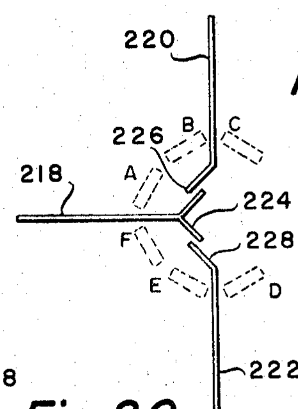


Fig. 18

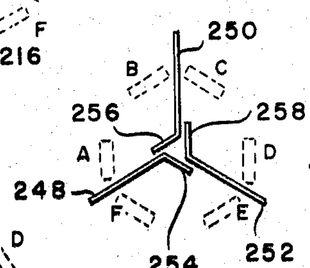


Fig. 20

Fig. 19

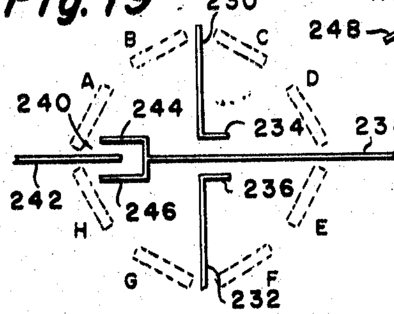
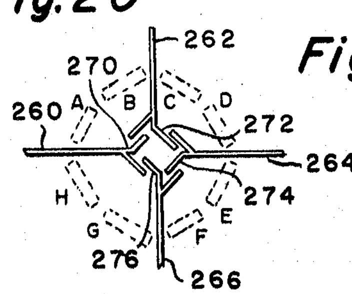


Fig. 21



MAGNETICALLY ACTUATED REED SWITCH ASSEMBLY

This is a division, of application Ser. No. 236,598, filed Mar. 21, 1972.

HISTORICAL BACKGROUND

In the past, many electrical devices have employed reed switches comprising a pair of magnetically actuated reed contacts sealed within a glass envelope and operated by a permanent magnet. Also, stepping switches using a plurality of reed switches and a rotating magnet are old. Hammond U.S. Pat. No. 3,418,610, Palmer U.S. Pat. No. 3,328,732 and Posey U.S. Pat. No. 3,559,124 are examples of these types of devices.

One difficulty with the switch assemblies in the prior art is that they are susceptible to corrosive and otherwise damaging effects produced by contact with the ambient atmosphere. Another drawback is that they tend to be complex in structure and require relatively elaborate means to provide for their installation.

OBJECTS AND SUMMARY

It is therefore an object of this invention to provide a magnetically actuated reed switch assembly in which both the reed contacts and the rotating magnet are encased in a housing.

It is a further object of this invention to provide a magnetically actuated reed switch assembly which is unitary in structure.

It is a further object of this invention to provide a magnetically actuated reed switch assembly which is capable of precisely timed actuation.

Still a further object of this invention is to provide a magnetically actuated reed switch assembly in which both the reed contacts and the rotating magnet are sealed from the ambient atmosphere thereby precluding the corrosion of mechanically cooperating components.

A further object of this invention is to provide a magnetically actuated reed switch assembly capable of low cost manufacture and ease of installation.

Yet another object of this invention is to provide a magnetically actuated reed switch assembly in which frictional effects are minimized.

Still a further object of this invention is to provide a magnetically actuated reed switch assembly which is capable of functioning as a rotary stepping switch.

A still further object of this invention is to provide a magnetically actuated reed switch assembly wherein the axis of rotation of the magnet is transverse to the axes of the reeds.

These and other objects of this invention will be apparent from the following description and claims.

In the accompanying drawing which illustrates by way of example various embodiments of this invention:

FIG. 1 is a plan view of the invention;

FIGS. 2 through 4, 5 and 6 are schematic views showing other embodiments of the invention with portions shown in dotted lines to illustrate various positions of several of the reeds;

FIG. 5a is a cross sectional view of an enlarged portion of the embodiment shown in FIG. 5;

FIG. 7 is a side elevational view in section of a further embodiment of the invention;

FIG. 7a is a top view of the embodiment shown in FIG. 7;

FIGS. 8, 9, 10, 11 and 12 are plan views of various other embodiments of the invention;

FIG. 9a is a sectional view of the embodiment shown in FIG. 9 taken along lines 9a—9a and viewed in the direction of the arrows;

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

FIGS. 13 through 21 illustrate still further embodiments of the invention shown schematically.

FIGURES 1 THROUGH 6

In FIG. 1, the capsule C forms the housing for reeds 2 and 4. The capsule C may be made of glass, plastic or any other material capable of sealing the reeds from the ambient atmosphere and not affecting a magnetic field. The reeds 2 and 4 are anchored at one end in the solid end portions 6 and 8 of capsule C. These end portions 6 and 3 may be glass seals in the case of a glass capsule or any other appropriate means for sealing off the interior of the capsule C such as a plug, cap, etc. The reeds 2 and 4 extend into the capsule C and have their respective ends 10 and 12 located in proximate relationship to each other and separated by a small distance. The reeds 2 and 4 are made of a material having good magnetic characteristics and electrical conductivity. Alternatively, the reeds 2 and 4 may be coated with a conductor such as copper, gold, etc. In the latter alternative the core of the coated reeds could be made of non-conductive ferromagnetic material. The reeds must also be capable of relative spatial displacement under the influence of a sufficiently strong magnetic field. To accomplish this several alternative constructions are possible; one or both reeds may be flexible, or the reeds may be rigid with at least one of them being achored in a resilient mounting. Other possibilities for providing for the necessary freedom of movement will be obvious.

Encased in a second capsule D, is a permanent magnet M rigidly mounted on a shaft 14 and capsule of rotation on shaft 14 within capsule D. Shaft 14 passes through capsule D and is rotatably mounted at bearings 16 and 18. Shaft 14 and magnet M may be rotated by any appropriate means such as motor 20 and pulley and belt assembly 22.

The embodiments shown in FIG. 2 through 6 are similar to that shown in FIG. 1 with the exception that the encapsulation means and rotation means are not shown. In the embodiment shown in FIG. 2, magnetically actuated reed 24 is rigid and non-polarized while reed 26 is flexible and polarized such that its north pole N is nearest reed 24. The reeds are normally in an open position. As magnet M is rotated to its dotted line position, reed 26 will be repelled by the north pole of magnet M and moved into contact with reed 24 as in the dotted line position. When the magnet is in the solid line position or any position except the dotted line position, the magnetic field at the north pole of reed 26 will not be sufficiently strong to cause reed 26 to be actuated into contact with reed 24. While the reeds 24 and 26 are shown positioned transversely to each other, it is obvious that other reed configurations are possible.

In FIG. 3, magnetically actuated flexible reeds 30 and 32 have acute bends 34 and 36, respectively, therein, near what would be their encapsulated ends. The reeds 30 and 32 are positioned such that contact feet 38 and 40 are parallel to each other and separated by a small distance. When rotatable magnet M is in the dotted line position, the magnetic field at bends 34 and 36 will be sufficiently strong to cause reeds 30 and 32 to move to their dotted line positions. When this occurs, the individual reeds 30 and 32 each follow arcuate paths about the point where they would be anchored in their sealing capsules (not shown). Since the contact feet 38 and 40 also follow somewhat arcuate paths, they will come into contact with each other in the manner shown in the dotted line reed positions. Since the reeds 30 and 32 are not polarized, a similar closing action will occur when the south pole S of magnet M is in the position closest to the reeds 30 and 32. When the magnet is in the solid line position, the magnet field at bends 34 and 36 is no longer sufficiently strong to attract the reeds 30 and 32 to their closed position.

It may be mentioned that, in all of the embodiments of this invention, the point of the rotation of the magnet where the reeds are actuated to open or close is dependent on various factors such as the ferromagnetic properties of the reeds, the strength of the permanent magnet, the spatial relationship of the magnet and the reeds, and others. Variants of any of these factors will cause a difference in the actuation pattern of the reeds with respect to the rotation of the magnet.

The embodiment shown in FIG. 4 comprises of a pair of magnetically actuated flexible reeds 42 and 44 enclosed in a housing or capsule (not shown) and anchored at their respective ends 46 and 48. The reeds 42 and 44 have obtuse bends 50 and 52 therein near their encapsulated ends forming a pair of contact feet 54 and 56. The reeds 42 and 44 are positioned such that contact feet 54 and 56 are substantially parallel and separated by a small distance. Reed 42 is rigid and nonpolarized whereas reed 44 is flexible and unpolarized. When permanent magnet M is in the dotted line position, the magnetic field at contact 56 is sufficiently strong to move reed 44 into contact with reed 42. When magnet M is in the solid line position, the magnetic field at contact foot 56 is not sufficient to move it from its normal position and the reeds 42 and 44 remain open. In this manner, the reeds 42 and 44 will close once per 180° revolution of magnet M. A variation of this embodiment would have reed 44 rigid and unpolarized and reed 42 flexible and polarized. In this case, when the magnet M is in the dotted line position and the polarity of contact foot 54 is the same polarity as the proximate end of magnet M, reed 42 will be repelled by magnet M and moved into contact with reed 44. In this manner, the reeds will close once per rotation of magnet M. Other variations of this embodiment will be obvious.

The embodiments shown in FIG. 5 includes two magnetically actuated reeds 60 and 62 anchored at their respective ends 64 and 66. Reed 60 may be flexible and has a notch 68 therein. Reed 62, which is flexible in the plane of the reeds 60 and 62 overlaps reed 60 at notch 68 and is partially disposed therein as shown in FIG. 5a. When magnet M is in the solid line position, reed 62 will be attracted toward magnet M and make contact with wall 70 of notch 68. When magnet M is in the dotted line position, the magnetic field at reed 62 is substantially less and it will return to its normally open position because of its inherent elasticity. In this manner, reeds 60 and 62 make contact once every 180° rotation of magnet M.

In FIG. 6, reeds 72 and 74, anchored at their respective ends 76 and 78 are each permanently polarized with the encapsulated ends having opposing polarities. Reed 74 is flexible and reed 72 may be either rigid or flexible. Accordingly, reeds 72 and 74 will come into contact with each other when the magnet M is in the dotted line position. In this position, the opposing magnetic field created by the south pole S of magnet M, will move reed 74 into contact with reed 72 if the field created by magnet M is sufficient to overcome the opposing field created by the south pole of reed 72.

Another variation of this embodiment would be to have reeds 72 and 74 polarized so that their encapsulated ends have opposite polarities and are normally closed. Reeds 72 and 74 would be opened once per revolution of the magnet M when the proximate pole of magnet M has a polarity identical to the encapsulated end of reed 74.

FIGS. 7 AND 8

An alternate embodiment of the invention would comprise a pair of magnetically actuated reeds 80 and 82 sealed in a elongated capsule C similar to the embodiment shown in FIG. 1. The permanent magnet M is likewise sealed in a capsule D and rigidly mounted on a shaft 84 which may be rotated by a knob 86 or any other means.

The second capsule D and magnet M are positioned so that the axis or rotation of magnet M passes through the point where reeds 80 and 82 make contact. With this configuration, the reeds 80 and 82 will close once per revolution of magnet M when the axis of polarity of the magnet is parallel to the longitudinal axis of the reeds.

In FIG. 8, cpasule D contains a permanent magnet M mounted for rotation about a shaft 88. Disposed radially from the axis of rotation of magnet M are two pairs of magnetically actuated reed contacts 90, 92 and 94, 96. They are each sealed in elongated capsules C and C1 which are fused or otherwise connected to capsule D. Since reeds 90, 92, 94 and 96 are polarized and flexible, each of the contact pairs 90, 92 and 94, 96 would be actuated to a closed position when the magnet M is in the position shown. In this manner, each of the contact pairs 90, 92 and 94, 96 will close simultaneously once per 180° revolution of magnet M.

FIGS. 9, 10 AND 11

FIG. 9 shows a further embodiment of the invention wherein the rotatable permanent magnet M is sealed in a capsule D and parallel magnetically actuated reeds 98 and 100 are sealed in a second capsule C. It is obvious that capsules C and D may be integral with each other, in open communication with each other, or sealed from each other without affecting the functioning of the system. As magnet M rotates about shaft 102 the reeds 98 and 100 will close once every 180° revolution. This occurs when the magnet M is in the position shown.

In FIG. 10, capsules C and D, containing reed contact pairs 104 and 106 are disposed about the perimeter of capsule D. Permanent magnet M rotates within capsule D about shaft 108. As magnet M rotates and the north pole of the magnet M sequentially moves to positions W, X, Y and Z, the contacts pairs 104 and 106 are actuated according to the following table:

TABLE 1

Contact Pair 0=Open, 1=Closed Position of North Pole	104	106
W	1	0
X	0	1
Y	1	0
Z	0	1

FIG. 11 shows a capsule D containing a permanent magnet M rotatable about shaft **110** with reed capsules C, C1 and C2 disposed about its perimeter. Capsule C contains reed contact pair **112**, capsule C1 contains reed contact pair **114** and capsule C2 contains reed contact pair **116**. As magnet M rotates about shaft **110** and north pole N sequentially moves to positions W, X, Y and Z, the contact pairs **112, 114,** and **116** are actuated according to the following table:

TABLE 2

Contact Pair 0=Open, 1=Closed Position of North Pole	112	114	116
W	1	0	1
X	0	1	0
Y	1	0	1
Z	0	1	0

FIG. 12

FIG. **12** shows an embodiment of the invention comprising a capsule or housing C which encases a number of cooperating, magnetically actuated reeds **118, 120, 122, 124** and a pair of rotating magnets **126** and **128.** The magnets **126** and **128** are connected to armatures **130** and **132**, respectively, which are rigidly connected to rotatable shaft **134.** As shown in FIG. **12***a*, the rotating magnet assembly **126, 130, 132, 128** is positioned so as to rotate in a plane parallel to and above the plane defined by the reeds **118–124.**

As one of the magnets **126** or **128** passes in proximity to flexible reed **120** or flexible reed **124**, the magnetic attraction will urge that reed into contact with either of stationary reeds **118** or **122.** It is obvious that the flexible reeds **120** and **124** will not be actuated to make contact with reeds **118** or **122** when either magnet **126** or **128** is positioned directly above the flexible reeds **120** or **124,** but only when the magnets **126** and **128** are positioned to either side of them.

A more complete description of the switching pattern of this reed configuration will be discussed in the next section.

FIGS. 13 THROUGH 21

FIGS. **13** through **21** illustrate various reed configurations which may be used in the rotating magnet system shown in FIG. **12.** In all instances, the magnetically actuated reeds are anchored at their outermost ends in a capsule or housing similar to the embodiments previously discussed. Their operation will be described for use in conjunction with a single rotating magnet capable of assuming the various positions shown in dotted lines, but are not limited to this specific combination.

FIG. **13** illustrates a reed configuration identical to that shown in FIG. **12.** Reeds **136** and **138** are unpolarized and may be rigid or flexible. Flexible reeds **140** and **142** are also unpolarized and have their respective encapsulated ends disposed between contact feet **144** and **146** of reeds **136** and **138**, respectively, Since reeds **140** and **142** are flexible and magnetically actuated, they will be moved into contact with either contact foot

144 or **146** when the rotatable magnet (not shown) is in an actuating position on either side of reeds **140** and **142.** These actuating positions are A, H, E, and D. As the magnet (not shown) rotates and sequentially assumes positions A through H, the reeds **136, 132, 138** and **140** will be in the following positions relative to each other:

TABLE 3

Contact Pair 0=Open, 1=Closed Position of Magnet	136–142	142–138	138–140	140–136
A	0	0	0	1
B	0	0	0	0
C	0	0	0	0
D	1	0	0	0
E	0	1	0	0
F	0	0	0	0
G	0	0	0	0
H	0	0	1	0

The reed configuration shown in FIG. **14** comprises flexible reeds **148, 150, 152** and **154** having transverse contact feet **156, 158, 160** and **162** respectively. When a rotatable permanent magnet (not shown) is in a position adjacent to the long portion of each of the reeds **148, 150, 152** or **154,** the encapsulated end of that reed will be moved from its normal position in a direction parallel to the plane of the reeds. If the magnet (not shown) is on the side of the reed which is adjacent to the contact foot of the subsequent reed (such as position A), the heel portion (e.g., **164**) of the first mentioned reed (e.g., **154**) will move into contact with the contact foot (e.g., **156**) of the subsequent reed (e.g., **148**). As the permanent magnet (not shown) is sequentially rotated to position A through H, the reeds **148, 150, 152** and **154** will assume the following positions:

TABLE 4

Contact Pair 0=Open, 1=Closed Position of Magnet	154–148	148–150	150–152	152–154
A	1	0	0	0
B	0	0	0	0
C	0	1	0	0
D	0	0	0	0
E	0	0	1	0
F	0	0	0	0
G	0	0	0	1
H	0	0	0	0

FIG. **15** illustrates a reed configuration comprising flexible reeds **166, 168, 170** and **172** having bifurcated portions **174, 176, 178, 180** respectively, at their encapsulated ends. When a permanent magnet (not shown) assumes a position adjacent to one of reeds **166, 168, 170, 172,** that reed will be moved from its normal position towards the magnet (not shown) and in the plan defined by the reeds. To illustrate this, assume that the permanent magnet (not shown) is in position A. This will cause reed **166** to move toward position A and furcation **182** will move into contact with furcation **184.** As the permanent magnet (not shown) sequentially assumes positions A through H, the reeds **168, 170, 172** and **166** will be in the following positions:

TABLE 5

Contact Pair 0=Open, 1=Closed Position of Magnet	166–168	168–170	170–172	172–166
A	1	0	0	0
B	0	1	0	0
C	1	0	0	0
D	0	1	0	0
E	0	0	1	0
F	0	0	0	1

G	0	0	1	0
H	0	0		

FIG. 16 illustrates a reed configuration comprising flexible reeds **186, 188, 190** and **192** having bifurcated portions **194, 196, 198** and **200**, respectively, at their encapsulated ends. As was the case in the embodiment shown in FIG. **15**, each of the bifurcated portions **194–200** will be actuated into contact with its cooperating bifurcated portion when the magnet (not shown) assumes a position adjacent some of the reeds **186–192**. As the magnet (not shown) rotates through positions A through H, the reeds will be actuated in the following manner:

TABLE 6

Contact Pair 0=Open, 1=Closed Position of Magnet	186–188	188–190	190–192	192–186
A	0	0	0	0
B	1	1	0	0
C	0	0	0	0
D	0	1	1	0
E	0	0	0	0
F	0	0	1	1
G	0	0	0	0
H	1	0	0	1

FIG. **17** illustrates another variation on the reed configuration shown in FIGS. **15** and **16**. It includes flexible reeds **202, 204, 206** and **208** having bifurcated portions **210, 212, 214** and **216**, respectively, at their encapsulated ends. Reeds actuation is accomplished in the same manner as in the embodiments shown in FIGS. **15** and **15**. As the magnet (not shown) sequentially assumes positions A through H, the reeds will be actuated in the following manner:

TABLE 7

Contact Pair 0=Open, 1=Closed Position of Magnet	202–204	204–206	206–208	208–202
A	0	0	0	1
B	1	1	0	0
C	0	0	0	0
D	0	1	0	0
E	0	0	1	0
F	0	0	0	0
G	0	0	1	1
H	1	0	0	0

FIG. **18** shows a reed configuration comprising flexible reeds **218, 220** and **222**. Reed **218** has a bifurcated portion **224** at its encapsulated ends and reeds **220** and **222** have transverse contact feet **226** and **228**, respectively, in a manner similar to the embodiments shown in FIGS. **15, 16**, and **17**, the reeds **218, 220** and **222** assume the following positions as the magnet (not shown) rotates through positions A through F:

TABLE 8

Contact Pair 0=Open, 1=Closed Position of Magnet	218–220	218–222
A	1	0
B	0	0
C	1	0
D	0	1
E	0	0
F	0	1

The reed configuration illustrated in FIG. **19** comprises reeds **230** and **232**, which may be flexible or rigid, having contact feet **234** and **236**, respectively, a flexible reed **238** having a bifurcated portion **240**, and a flexible reed **242**. Reed **238** will move into contact with either contact foot **234** or **236** when a permanent magnet (not shown) is in positions D or E, respectively. Furcations **224** and **246** are spaced from each other a distance such that they will make contact with reed **242** also when the magnet (not shown) is in position D and E. When the magnet is in positions A through H, reed **242** will be actuated into contact with furcations **244** and **246**, respectively. As the permanent magnet (not shown) assumes positions A through H, the reeds will be actuated in the following manner:

TABLE 9

Contact Pair 0=Open, 1=Closed Position of Magnet	242–238	238–230	238–232
A	1	0	0
B	0	0	0
C	0	0	0
D	1	1	0
E	1	0	1
F	0	0	0
G	0	0	0
H	1	0	0

The reed configuration shown in FIG. **20** comprises flexible reeds **248, 250** and **252**, having transverse contact feet **254, 256** and **258**, respectively, at their encapsulated ends. The manner of actuation is similar to that embodiment shown in FIG. **14**. As the magnet (not shown) assumes positions A through F, the reeds will be actuated in the following manner:

TABLE 10

Contact Pair 0=Open, 1=Closed Position of Magnet	248–250	250–252	252–248
A	1	0	0
B	0	0	0
C	0	1	0
D	0	0	0
E	0	0	1
F	0	0	0

The reed configuration shown in FIG. **21** comprises flexible reeds **260, 262, 264** and **266** having bifurcated portions **270, 272, 274**, and **276**, respectively, at their encapsulated ends. The primary difference between this embodiment and that shown in FIG. **16** is that whereas reeds **286** and **190** (FIG. **16**) could not be axially aligned due to the V-shaped bifurcations, reeds **260** and **264** (FIG. **21**) may be axially aligned due to the irregularly shaped bifurcated portions **270, 272, 274** and **276**. As the magnet (not shown) is rotated through positions A through H, the reeds will assume the following positions:

TABLE 11

Contact Pair 0=Open, 1=Closed Position of Magnet	260–262	262–264	264–266	266–260
A	1	0	0	1
B	0	0	0	0
C	1	1	0	0
D	0	0	0	0
E	0	1	1	0
F	0	0	0	0
G	0	0	1	1
H	0	0	0	0

While specific reed configurations have been illustrated in FIGS. **13** through **21**, it is obvious that any number of reeds could be positioned in a manner similar to those described above without departing from the scope of this invention.

While the invention has been described in connection with various embodiments thereof, it will be understood that it is capable of further modification, and that this application is intended to cover any variations, uses, or adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure that 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 the invention or the limits of the appended claims.

What is claimed is:

1. A magnetically actuated reed switch assembly comprising:
a. contact means including first and second cooperating magnetically actuated reeds in spaced relation to each other,
b. a rotatable magnet positioned with respect to said contact means so that its force field at certain positions of its rotation operates to influence said contact means to open or close,
c. said magnet being polarized along a first axis and rotatable about an axis transverse to said first axis,
d. said contact means and said magnet being sealed in a housing assembly including contact and magnet supporting chambers, and
e. shaft means connected to said magnet and extending through said housing for rotating said magnet.

2. A magnetically actuated reed switch assembly as in claim **1** and wherein:
a. said chambers are interconnected capsules.

3. A magnetically actuated reed switch assembly as in claim **2** and wherein:
a. said first capsule is elongated.

4. A magnetically actuated reed switch assembly as in claim **3** and wherein:
a. said second capsule is positioned adjacent the long dimension of said first capsule.

5. A magnetically actuated reed switch assembly as in claim **2** and wherein:
a. said second capsule is disc shaped having top and bottom surfaces.

6. A magnetically actuated reed switch assembly as in claim **5** and wherein:
a. the edge of said second capsule is tangent to said first capsule.

7. A magnetically actuated reed switch assembly as in claim **5** and wherein:
a. one of said surfaces of said second capsule is tangent to said first capsule.

8. A magnetically actuated reed switch assembly as in claim **3** and wherein:
a. said second capsule is positioned adjacent the short dimension of said first capsule.

9. A magnetically actuated reed switch assembly as in claim **8** and wherein:
a. said second capsule is disc shaped.

10. A magnetically actuated reed switch assembly as in claim **9** and wherein:
a. the edge of said second capsule is tangent to said first capsule.

11. A magnetically actuated reed switch assembly as in claim **10** and including:
a. a plurality of said first capsules tangent to the edge of said second capsule.

12. A magnetically actuated reed switch assembly as in claim **2** and wherein:
a. said second capsule is disc shaped having top and bottom surfaces.

13. A magnetically actuated reed switch assembly as in claim **12** and wherein:
a. said first capsule is tangent to the edge of said second capsule.

14. A magnetically actuated reed switch assembly as in claim **13** and including:
a. a plurality of said first capsules tangent to the edge of said second capsule.

15. A magnetically actuated reed switch assembly as in claim **1** and including a plurality of said contact means.

16. A magnetically actuated reed switch assembly as in claim **15** and wherein:
a. said contact means are disposed along the arcuate path defined by the rotation of said magnet
b. thereby forming a rotary stepping switch.

17. A magnetically actuated reed switch assembly as in claim **16** and wherein:
a. at least two of said contact means are displaced from each other by 90°.

18. A magnetically actuated reed switch assembly as in claim **16** and wherein:
a. at least three of said contact means are displaced from each other by 90°.

19. A magnetically actuated reed switch assembly as in claim **16** and wherein:
a. at least four of said contact means are displaced from each other by 90°.

20. A magnetically actuated reed switch assembly as in claim **15** and wherein said contact means are disposed radially about the axis of rotation of said magnet.

21. A magnetically actuated reed switch assembly as in claim **1** and wherein:
a. the axes of said reeds are transverse to the axis of rotation.

22. A magnetically actuated reed switch assembly as in claim **1** and wherein:
a. said contact means includes a plurality of said cooperating magnetically actuated reeds.

23. A magnetically actuated reed switch assembly as in claim **1** and wherein:
a. said magnet has its axis of rotation substantially at the point where said reeds make contact with each other.

24. A magnetically actuated reed switch assembly as in claim **1** and wherein:
a. said magnet has its axis of rotation adjacent the point where said reeds make contact with each other.

25. A magnetically actuated reed switch assembly comprising:
a. contact means including at least three substantially coplanar cooperating magnetically actuated reeds in spaced relation to each other,
b. said reeds being disposed radially about a central axis in spoke-like fashion and angularly displaced from each other, and
c. a rotatable magnet positioned with respect to said contact means so that its force field at certain positions of its rotation operates to influence at least two of said angularly displaced cooperating reeds to open or close.

26. A magnetically actuated reed switch assembly as in claim **25** and wherein:
a. said contact means includes first, second and third cooperating reeds

b. said first reed is transverse to said second and third reeds and a portion thereof is disposed between said second and third reeds.

27. A magnetically actuated reed switch assembly as in claim **26** and wherein:

a. said second and third reeds are axially aligned and have cross bar contact means at their respective ends.

28. A magnetically actuated reed switch assembly as in claim **26** and wherein:

a. said contact means includes a fourth cooperating reed transverse to said second and third reeds, and

b. a portion of said fourth reed is disposed between said second and third reeds.

29. A magnetically actuated reed switch assembly as in claim **28** and including:

a. means on said first reed for making contact with both sides of said fourth reed.

30. A magnetically actuated reed switch assembly as in claim **28** and wherein:

a. said fourth reed is axially aligned with said first reed.

31. A magnetically actuated reed switch assembly as in claim **25** and including:

a. a plurality of rotatable magnets positioned with respect to said contact means so that their force fields at certain positions of their rotation operate to influence cooperating pairs of said reeds to open or close.

32. A magnetically actuated reed switch assembly as in claim **25** and wherein:

a. each of said reeds has a first portion and a second portion transverse to said first portion.

33. A magnetically actuated reed switch assembly as in claim **32** and wherein:

a. said first portion of one of said reeds cooperates with said second portion of the other of said reeds to form a contact pair.

34. A magnetically actuated reed switch assembly as in claim **33** and wherein:

a. each of said first portions are longer than each of said second portions, respectively.

35. A magnetically actuated reed switch assembly as in claim **32** and wherein:

a. said second portions cooperate with each other to form a contact pair.

36. A magnetically actuated reed switch assembly as in claim **35** and wherein:

a. each of said first portions are longer than each of said second portions, respectively.

37. A magnetically actuated reed switch assembly as in claim **32** and wherein:

a. each of said first portions are perpendicular to their respective said second portions.

38. A magnetically actuated reed switch assembly as in clain **25** and wherein:

a. each of said reeds has a first portion and a second portion transverse to said first portion.

39. A magnetically actuated reed switch assembly as in claim **38** and wherein:

a. each of said first portions are perpendicular to their respective said second portion.

40. A magnetically actuated reed switch assembly as in claim **25** and wherein:

a. said contact means includes first, second and third cooperating reeds

b. said first reed has a bifurcated portion disposed between said second and third reeds.

41. A magnetically actuated reed switch assembly as in claim **40** and wherein:

a. said second and third reeds each have bifurcated portions.

42. A magnetically actuated reed switch assembly as in claim **41** and wherein:

a. opposite first reed furcations are disposed within said second and third bifurcated portions, respectively.

43. A magnetically actuated reed switch assembly as in claim **42** and wherein:

a. said contact means includes a fourth cooperating reed having a bifurcated portion.

44. A magnetically actuated reed switch assembly as in claim **43** and wherein:

a. opposite fourth reed furcations are disposed within said second and third reed furcations, respectively.

45. A magnetically actuated reed switch assembly as in claim **43** and wherein:

a. opposite fourth reed furcations are adjacent second and third reed bifurcated portions, respectively.

46. A magnetically actuated reed switch assembly as in claim **25** and wherein:

a. each of said reeds has a bifurcated portion

b. said reeds are positioned such that a furcation of each reed cooperates with a furcation of another reed in one-to-one correspondence to form a plurality of contact pairs.

47. A magnetically actuated reed switch assembly as in claim **46** and wherein:

a. one of said furcations of each of said reeds is disposed within said bifurcated portion of one of its cooperating reeds and the other of said furcations of each of said reeds is disposed externally to said bifurcated portion of the other of its cooperating reeds in interleaving fashion.

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