United States Patent

Rovnyak

[15] **3,678,423**

[45] **July 18, 1972**

[54] WINDINGS FOR OPERATING EFFICIENTLY CONTACTS OF REEDS WITH CONSTRICTED AREAS

[72] Inventor: **Richard M. Rovnyak,** Hanover Park, Ill.

[73] Assignee: **Automatic Electric Laboratories, Inc.,** Northlake, Ill.

[22] Filed: **Aug. 31, 1970**

[21] Appl. No.: **68,288**

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

[51] **Int. Cl.** **H01h 51/28**

[58] **Field of Search** 335/83, 134, 151, 152, 154

[56] **References Cited**

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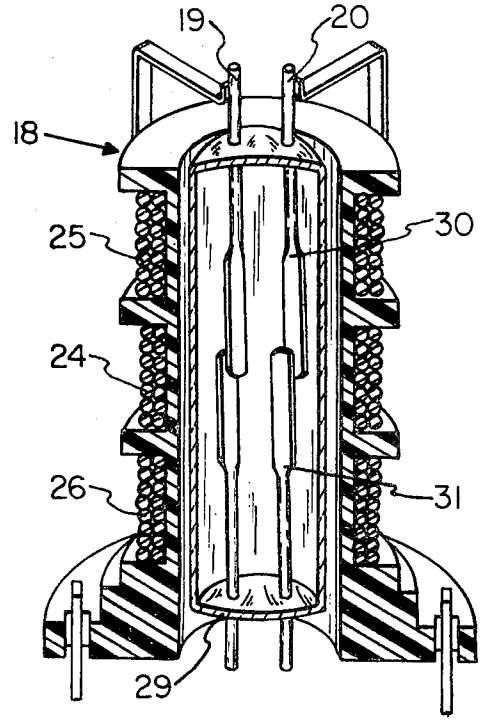
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Primary Examiner—George Harris
Assistant Examiner—R. N. Envall, Jr.
Attorney—K. Mullerheim, B. E. Franz and David W. Heid

[57] **ABSTRACT**

The length of an operating winding is related to the positions of constricted areas that result incidentally from formations of a blade from round wire at one end of each reed. Since sensitivity of a winding for operating the reeds is found to decrease rapidly as the winding becomes longer than the distance between the constricted areas, a sectional winding for operating the reeds is centered over the contacts between the constricted areas, and hold windings, effective after the reluctance of the path has been decreased by closure of the contacts, are positioned in an adjacent winding space.

1 Claim, 5 Drawing Figures



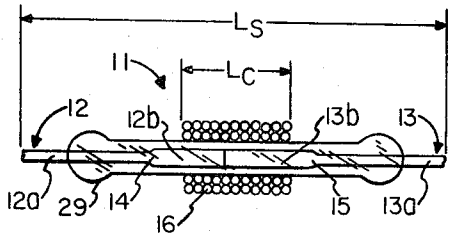


FIG. 1

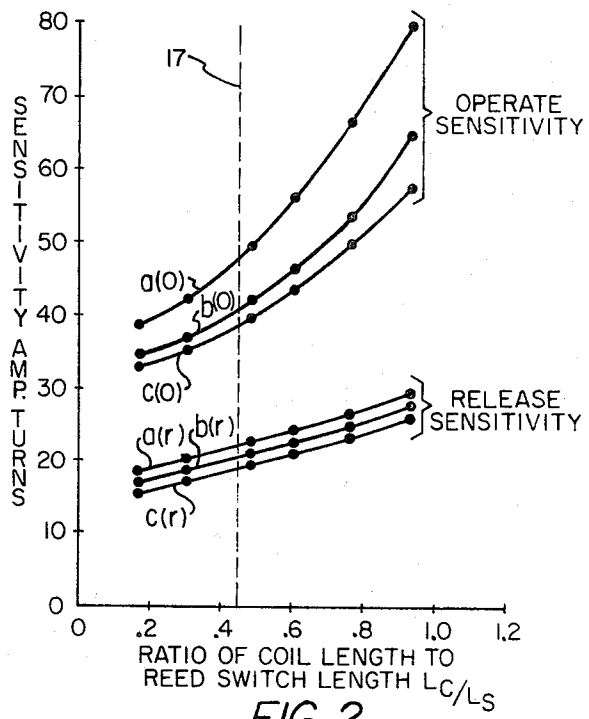


FIG. 2

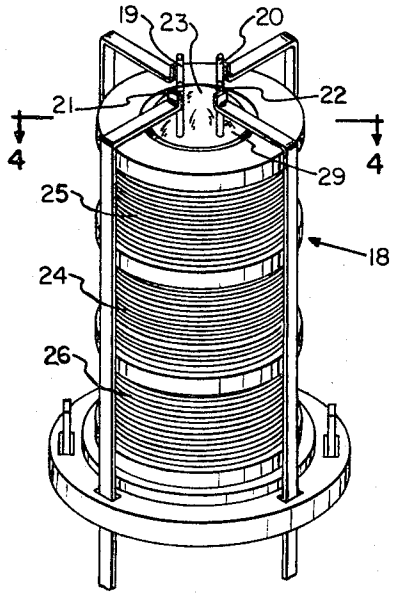


FIG. 3

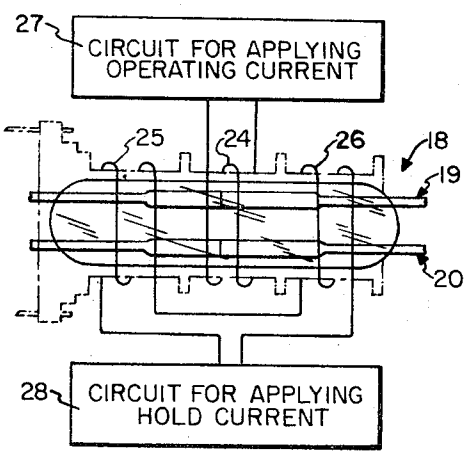


FIG. 5

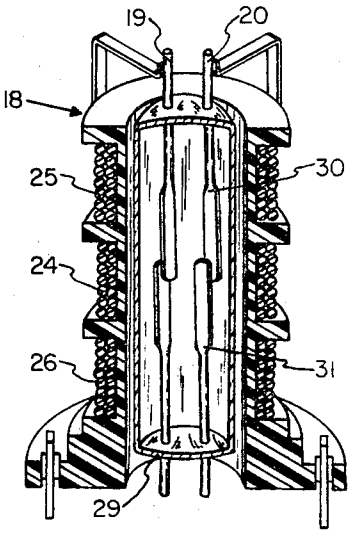


FIG. 4

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WINDINGS FOR OPERATING EFFICIENTLY CONTACTS OF REEDS WITH CONSTRICTED AREAS

BACKGROUND OF THE INVENTION

This invention relates to electromagnetic switching devices and particularly to relays having windings around encapsulated reed switches.

Commonly, a reed relay includes a pair of similar reeds projecting inwardly from the ends of a capsule, and the inward ends of the reeds overlap to function as a pair of normally open contacts. Typically, each of the reeds has two different cross sections along its length, a portion with round cross section is sealed in the end of the capsule and extends outward as a terminal; a portion within the capsule is flattened to form a blade. Conventionally, the length of the blade is less than one-half the length of the reed.

The reed is precisely formed from round wire. The forming by machine inherently decreases the cross-sectional area at the point of transition from round wire to a flattened blade. In response to the flow of current through an operating winding about the reed switch, this constricted area tends to be the first part of the reed to become saturated, and therefore retards the flow of magnetic flux between the contacts of the reeds. To compensate for the tendency to retard flux, the ampere-turns of the operating winding must be increased. The practice is to have the operating winding extend almost from end to end of the reeds. The winding therefore extends at both ends beyond the constricted areas of the reeds.

In order to operate the reeds, the magnetic flux ought to be concentrated in the air gap separating the reed contacting surfaces. An arrangement using magnetic guide members and two separated coils for concentrating flux at the contacts is described in U.S. Patent No. 3,253,097 issued to H. N. Wagar on May 24, 1966.

SUMMARY OF THE INVENTION

A preferred embodiment of the present reed relay has three sectional windings. One of the windings is centered around the contacts and is energized to close the contacts; the other windings are positioned adjacent opposite ends of the operating winding and are used to hold the contacts closed after the operating winding is no longer energized. The advantage of this arrangement is that the entire center winding is located between the constrictions of the reeds; and therefore requires less ampere-turns or power than a longer winding to operate the contacts of the reeds.

Tests show that the use of space outside the constrictions is substantially less efficient, and therefore a longer winding requires additional copper wire that increases the diameter of the relay and also makes it more expensive. The use of a short winding centered over the contacts as an operating winding is particularly advantageous in a reed relay that contains multiple reeds. Sectional windings arranged to favor an operating winding provide the additional required magnetizing force to ensure operation of all contacts without requiring excessive winding space.

The space adjacent to the centrally located operating winding is used for hold windings. The placement of the hold windings for concentrating flux through the contacts has greater latitude than the placement of the operating winding because the reluctance of the magnetic path has been decreased by closure of contacts.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional view of a reed switch and its operate winding to show dimensions for determining the ordinates of FIG. 2;

FIG. 2 is a set of experimental curves to show change in effectiveness of the operate coil as its length becomes greater than the distance between constricted areas of a pair of reeds;

FIG. 3 is a top oblique view of a relay having multiple reeds and three sectional windings;

FIG. 4 is a cross section of the relay of FIG. 3 to show clearly the relative placement of the windings to the reeds; and

FIG. 5 is a diagrammatic wiring diagram to show use of the three sectional windings of the relay.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A reed relay according to this invention as shown in FIG. 3 can be better understood by referring first to FIGS. 1 and 2. In FIG. 1, a reed switch 11 has an envelope 29 that supports a pair of identical reeds 12 and 13 such that their ends overlap to form a normally open pair of contacts at the center of the envelope. Each of the reeds has been formed from round magnetic wire by flattening approximately one-half of their length to provide a blade that has its tip plated to form a good make contact with the overlapping portion of the other reed. The round portions 12*a* and 13*a* of the reeds 12 and 13 respectively are sealed in the envelope 29 and extend outwardly to provide terminals, and the flattened portions 12*b* and 13*b* extend inwardly to form the contacts. Constrictions 14 and 15 as described above are located at the transitions from the round wire to the flattened blades of the reeds 12 and 13 respectively. A winding 16 for operating the reeds is centered about the overlapping portions of the reeds and has a length L_c, and the reed switch has an overall length L_s between the ends of its terminals.

The curves in FIG. 2 show the results of sensitivity of three different reed switches *a*, *b*, and *c* that correspond to reed switch 11 of FIG. 1 for different windings 16 having the lengths designated in the ordinates. The ordinates are the ratios of the length L_c of the winding 16 to the overall lengths L_s of the reed switch 11. The ordinate of the vertical dashed line 17 is approximately 0.45 to indicate the distance between the restrictions 14 and 15 of FIG. 1. The sensitivity of the relays is measured in ampere-turns as designated. The top three curves designated $a(o)$, $b(o)$, and $c(o)$ indicate the ampere-turns required to operate the respective reed switches, and the lower three curves $a(r)$, $b(r)$, and $c(r)$ designate the ampere-turns at which the respective reed switches are released. The increasing slopes of the curves for the windings as they become longer that the distance 17 between the constrictions show the inefficiency of using long windings for operating purposes.

In order to obtain efficient operation as taught by the curves of FIG. 2, sectional windings have been used on the relay 18 of FIG. 3. A winding of the smallest, practical size is desired to operate the multiple switches 19, 20, 21, and 22 that are contained within a single envelope 23. An operate winding 24 is centered over the contacts of the switches 19–22, and adjacent windings 26 and 25 are used as hold windings. The relative placements of the windings 24–26 with respect to the reeds are shown more clearly in the cross section of FIG. 4 The winding 24 is centered over the contacts of the reed switches, and its length is less than the distance between the constrictions 30 and 31 of the reed switches 19–22. The windings 25 and 26 that are adjacent opposite ends of the winding 24 are placed opposite those portions of the reed switches that are mostly outside the constrictions 30 and 31.

A preferred arrangement for connecting the windings is shown in FIG. 5. The center winding 24 is connected to a circuit 27 for applying operating current, and the two end windings 25 and 26 are connected to a circuit 28 for applying current to hold the relay operated after the circuit for applying current to the winding 24 has been opened.

The design of the operate winding for optimum length is probably easier by empirical methods than by the application of theoretical formulas. The use of three sectional windings when both an operate and a hold winding are required decreases the amount of copper wire required and also eliminates careful insulation that is required between an operate winding and a hold winding where the hold winding is wound over the operate winding. The time required to wind the coils is decreased when a winding machine is arranged to wind the windings simultaneously.

I claim:

1. A reed relay assembly comprising:

an encapsulated reed switch having at least one pair of cooperating magnetic reeds each having a constricted cross-sectional area at a point intermediate its ends and the two reeds overlapping each other at one of their ends to form a pair of contacts;

an operate winding and a hold winding, both concentrically wound around said switch, said operate winding being adapted to close said contacts in response to the flow of an electrical current therethrough and said hold winding being adapted to maintain said contacts closed in response to the flow of an electrical current therethrough

in the absence of said electrical current in said operate winding;

said operate winding being centered over the overlapping portions of said reeds and proportioned such that its length is less than the distance between said constricted cross-sectional areas;

said hold winding having two sections, one of said sections being disposed adjacent one end of said operate winding, and the other of said sections being disposed adjacent the other end of said operate winding.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,678,423 Dated July 18, 1972

Inventor(s) RICHARD M. ROVYNAK

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the front page, item [73] Assignee, delete "AUTOMATIC ELECTRIC LABORATORIES, INC." and add -- GTE AUTOMATIC ELECTRIC LABORATORIES INCORPORATED --.

Signed and sealed this 17th day of April 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

11/20/72

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