United States Patent

Bopp et al.

[15] **3,638,149**

[45] **Jan. 25, 1972**

[54] VIBRATING REED SELECTOR HAVING IMPROVED COMPONENT STRUCTURE

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[22] Filed: **Dec. 24, 1970**

[21] Appl. No.: **101,307**

[52] **U.S. Cl.** **335/91**, 335/202

[51] **Int. Cl.** **H01h 51/34**

[58] **Field of Search** ..... 335/87, 88, 89, 90, 91, 92, 335/93, 94, 95, 96, 97, 98, 199, 202; 200/166 PC; 317/101 C; 310/25

[56] **References Cited**

UNITED STATES PATENTS

2,877,319	3/1959	Bostwick et al.	335/92
3,076,878	2/1963	Koda	335/199
3,344,374	9/1967	White	335/92
3,387,240	6/1968	Koppensteiner	335/202

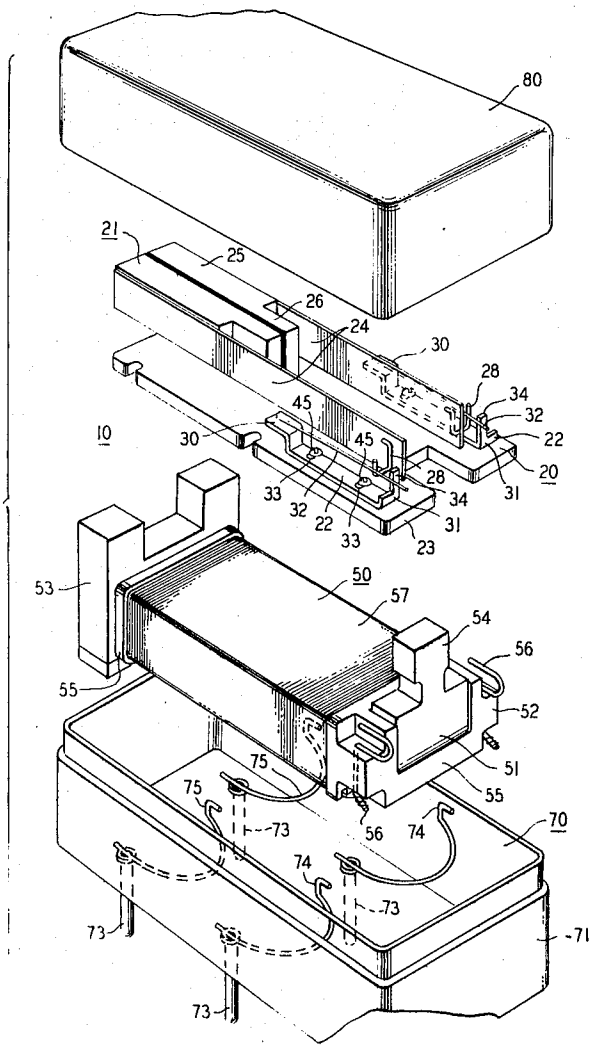
Primary Examiner—Harold Broome

Attorney—R. J. Guenther and Edwin B. Cave

[57] **ABSTRACT**

A vibrating reed selector is disclosed in which a unitary motor-contact unit is encapsulated in a protective housing. The motor-contact unit contains a contact assembly, a motor assembly and an end magnet all of which are joined in a rigid structure. The contact assembly includes a ceramic circuit board rigidly attached to the end magnet at one end, two vibrating tines which carry two moving contacts and two contact brackets which carry two fixed contacts. The motor assembly includes a coil wound bobbin and a core which extends through the bobbin and which is rigidly attached to the end magnet at one end and the circuit board at the other.

10 Claims, 21 Drawing Figures

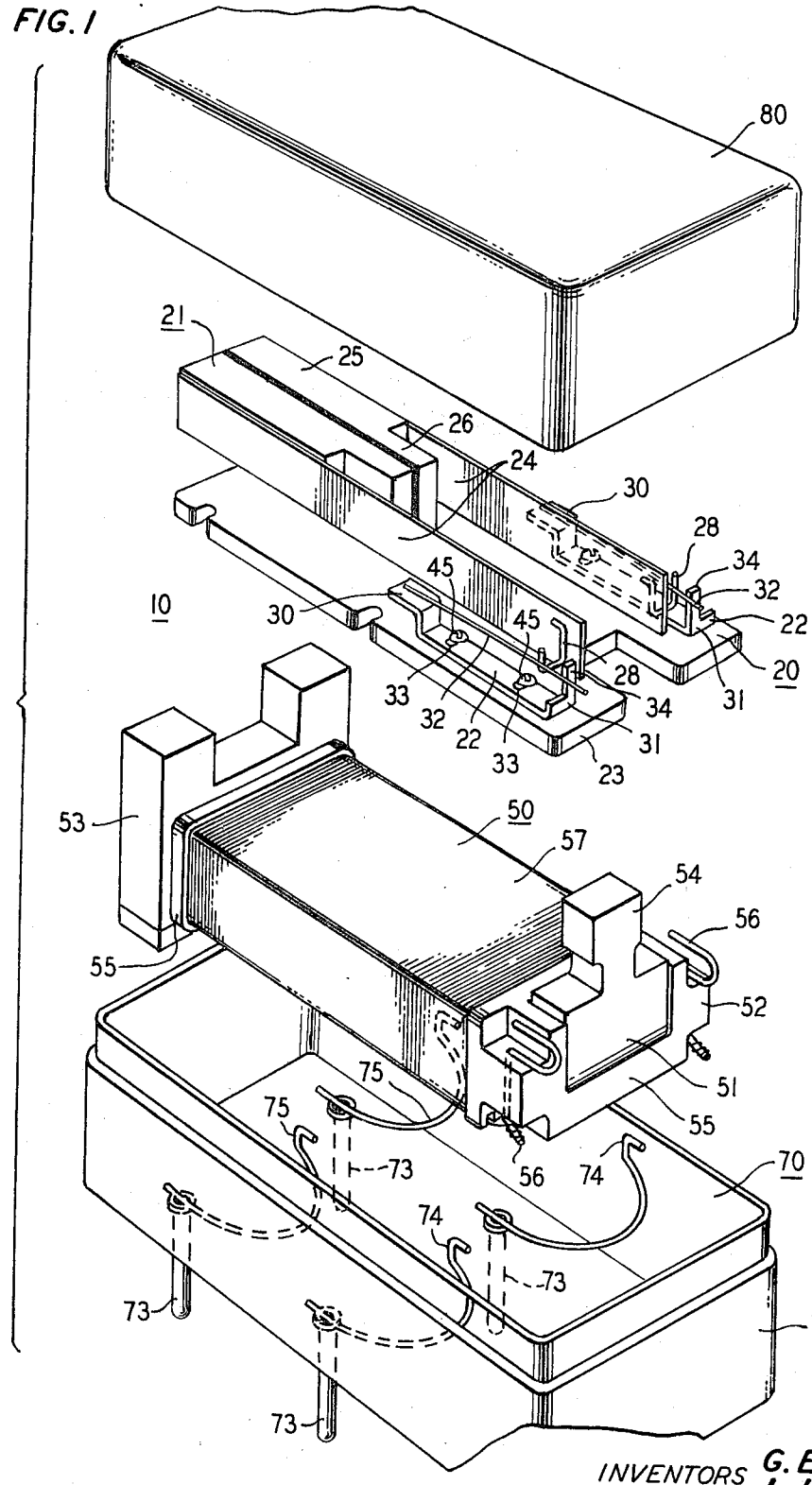


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SHEET 1 OF 4

FIG. 1



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BY

ATTORNEY

FIG. 2

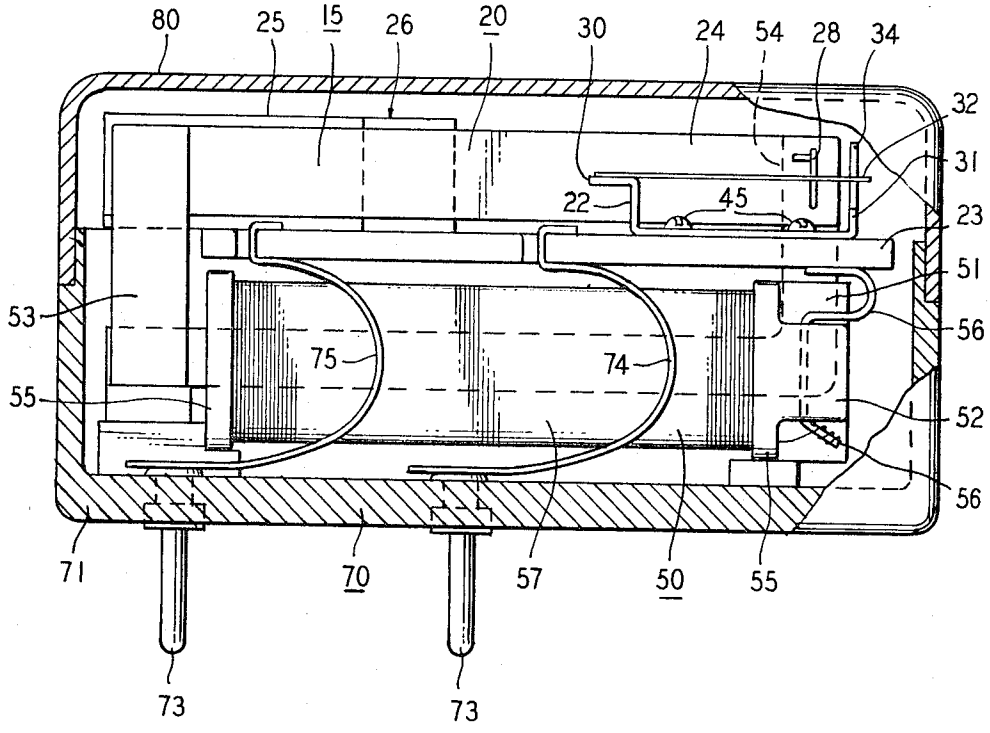

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FIG. 3

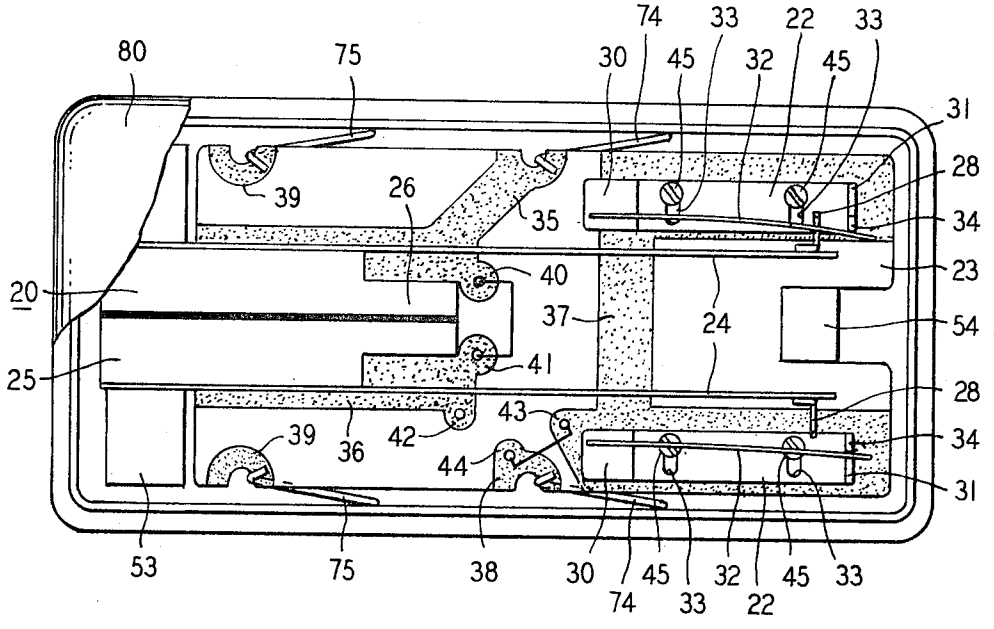

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FIG. 4A

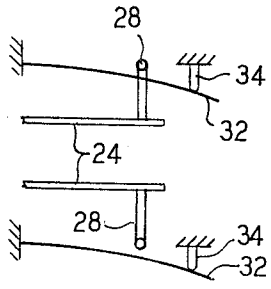


FIG. 4B

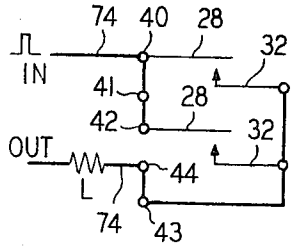


FIG. 5A

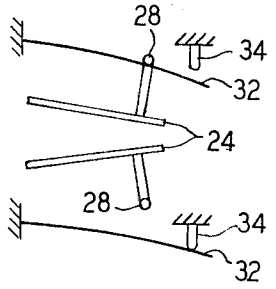


FIG. 5B

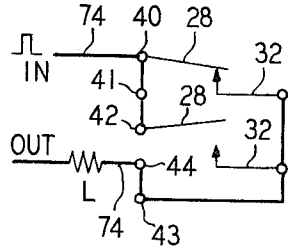


FIG. 6A

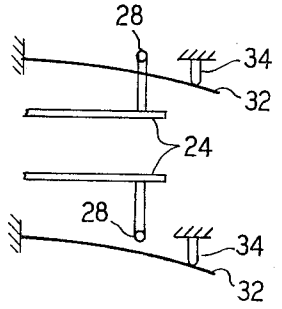


FIG. 6B

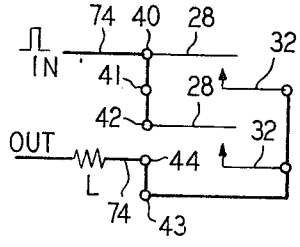


FIG. 7A

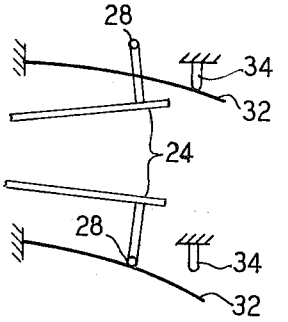


FIG. 7B

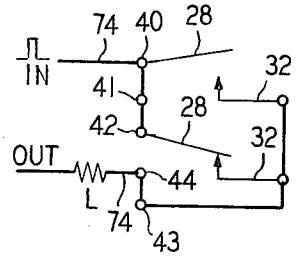


FIG. 8

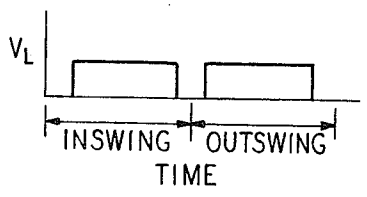


FIG. 9A

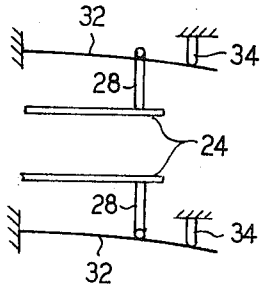


FIG. 9B

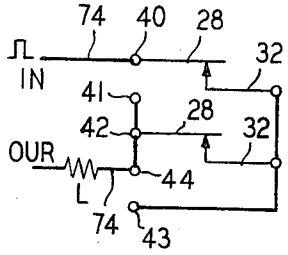


FIG. 10A

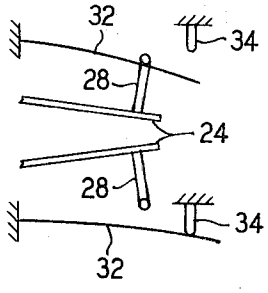


FIG. 10B

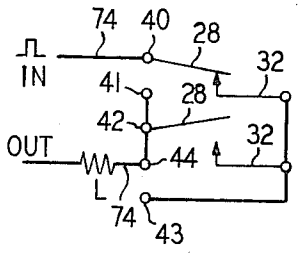


FIG. 11A

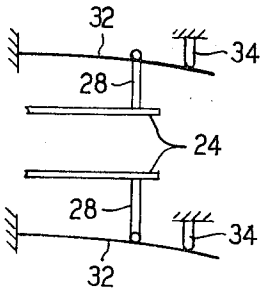


FIG. 11B

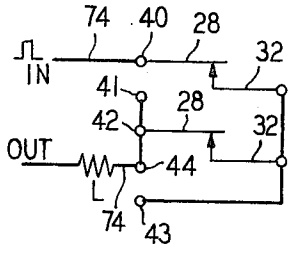


FIG. 12A

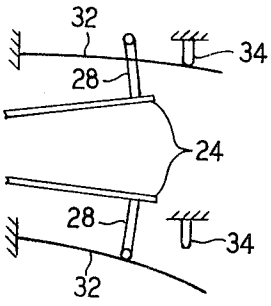


FIG. 12B

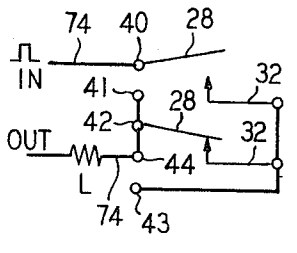
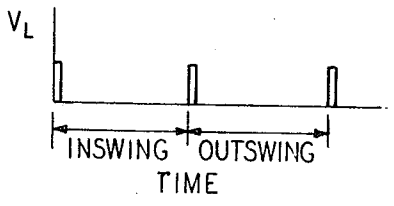


FIG. 13



VIBRATING REED SELECTOR HAVING IMPROVED COMPONENT STRUCTURE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to vibrating reed selectors and pertains in particular to those in which the contacts are activated by a pair of magnetically responsive tines.

2. Description of the Prior Art

In general, a vibrating reed selector is a frequency sensitive electromechanical device in which resonant excitation can be detected in various ways. Once detected, resonant excitation can readily be used to perform control functions; i.e., to cyclically open and close electrical contacts. When electrical contacts are used and the selector is electromagnetically driven, it may conveniently be characterized for design purposes by its resonant frequency, bandwidth and just-operate current.

Efficient operation of a contact-containing selector demands high-power sensitivity and high selectivity; i.e., high Q. If the selector is not stable, however, power sensitivity and selectivity can readily be degraded. For example, the smallest changes in the relative positions of the magnetic circuit components will upset flux levels and can readily produce wide changes in resonant frequency. Similarly, slight changes in contact spacing can reduce or even eliminate contact closure. As a result, the current passing through the contacts will be reduced thereby adversely affecting power sensitivity. In extreme cases, lack of stability can degrade selector performance below usefulness.

Accordingly, one object of this invention is to improve the stability of design characteristics in vibrating reed selectors.

Heretofore, vibrating reed selectors have been advantageously used in paging devices. When so used, a selector ordinarily contains one or more tines which vibrate in response to the application of an appropriate magnetic flux.

Vibrating reed selectors used in paging devices such as, BELLBOY or the like, ordinarily contain two tines. One tine is part of a contact set comprising the tine, a fixed contact and a moving contact, while the other is arranged merely to vibrate in tandem with the first. The tine in the contact set carries the moving contact and swings toward and away from the other tine as both vibrate. As vibration approaches resonance, the moving contact engages the fixed contact thereby causing the contact set to close. When the contact set closes, a tone generating circuit is enabled and a paging signal is emitted in the form of an audible tone.

Paging devices are typically designed to be carried on a user's person. Consequently, they must be small, light and extremely sensitive. Extreme sensitivity, however, has heretofore made manufacture difficult and expensive. In fact, most assembly steps have required manual performance by highly skilled personnel. As a consequence, large labor costs and lengthy assembly time have combined to increase manufacturing costs to high levels.

Accordingly, another object of this invention is to simplify assembly and reduce the cost of manufacturing vibrating reed selectors.

The life of a vibrating reed selector can be limited by the condition of the contacts. For example, if the contacts become worn, faulty operation can result. Heretofore, faulty operation due to worn contacts could be corrected only by replacing the entire device or by replacing the contacts. Either alternative, however, is inherently expensive and inconvenient. Accordingly, another object of this invention is to achieve increased contact life in a convenient and inexpensive manner.

SUMMARY OF THE INVENTION

According to a preferred embodiment of this invention, a magnetic core, a circuit board supporting two tines and a linking end magnet are combined to simplify assembly and improve the stability of design parameters in a vibrating reed selector.

According to one feature of this invention, assembly is simplified and mechanical stability is achieved by rigidly attaching the two tines to one side of the circuit board, positioning the core on the other side of the circuit board, rigidly attaching one end of the core to one end of the circuit board and rigidly attaching one end of the end magnet to the other tines and one end to the other end of the core.

According to another feature of this invention, thermal compatibility is improved by fabricating the tines from a material having a coefficient of thermal expansion on the order of 7.0×10^{-6} and fabricating the circuit board from a ceramic material having a coefficient of thermal expansion on the order of 6.0×10^{-6}.

According to another feature of this invention, magnetic efficiency is improved and assembly is further simplified by shaping the end magnet into an H-configuration.

According to another feature of this invention, each tine is combined with a moving contact and a fixed contact to form two contact sets and adjustment of the contact sets is facilitated by mounting each fixed contact on a contact bracket adjustably attached to the circuit board.

According to another feature of this invention, increased contact life is achieved by equipping each contact bracket with a shoulder and attaching a finger contact to the contact bracket so that it can readily be deflected to one side or the other of the shoulder.

DESCRIPTION OF THE DRAWING

FIG. **1** is an exploded view taken in perspective of a vibrating reed selector embodying this invention;

FIG. **2** is a side elevation view with portions broken away and taken in section to show interior details of the selector shown in FIG. **1**;

FIG. **3** is a plan view of the selector shown in FIG. **2** with portions broken away to show interior details;

FIGS. **4A** through **7B** schematically illustrate the mechanical interaction and electrical equivalent of the contact sets in the parallel mode of operation of the selector;

FIG. **8** illustrates the output from the sequence shown in FIGS. **4** through **7** as it would appear over a hypothetical load L;

FIGS. **9A** through **12B** schematically illustrate the mechanical interaction and electrical equivalent of the contacts in the series mode of operation of the selector; and

FIG. **13** illustrates the output from the sequence shown in FIGS. **9** through **12** as it would appear over a hypothetical load L.

DETAILED DESCRIPTION

Referring to FIG. **1**, a vibrating reed selector **10** is disclosed which comprises a motor-contact unit **15**, a housing assembly **70** and a cover **80**. These components are combined to form a paging device which emits a paging signal in response to a triggering pulse.

The motor-contact unit **15**, as best seen in FIG. **2**, is a unitary or modular assembly comprising a contact assembly **20** and a motor assembly **50**. The contact assembly **20**, as can be seen from FIGS. **1**, **2** and **3**, comprises a fork assembly **21**, two contact brackets **22** and a circuit board **23**. The fork assembly **21** is rigidly attached to the circuit board **23** as by brazing or soldering to metallic circuit paths thereon. It includes two tines **24** rigidly attached at one end to opposite sides of a spacer block **25**. Advantageously, the spacer block **25** is divided into two parts which are separated by an insulator and includes a shoulder **26** located between the two tines **24**. The tines **24** are made of a magnetic material having a coefficient of thermal expansion on the order of 7.0×10^{-6} such as Vibraloy, while the spacer block **25** is made of a magnetic material such as Permaloy. The tines **24**, moreover, are flexible, magnetically responsive and tuned to vibrate in the presence of a magnetic field pulsating at the tuned frequency. The free ends of the tines **24** each has a hook contact **28** attached thereto. As best

seen in FIG. 1, each hook contact 28 is substantially U-shaped and is rigidly attached to the flat side of its supporting tine 24, as by welding. Advantageously, it is 0.005 mils in diameter and is formed from a piece of contact material such as rhodium contact wire. Each, moreover, is shaped and located on its supporting tine so as to balance out torsional rotation forces as far as possible.

Each contact bracket 22, as shown in FIG. 1, is bent up at both ends to form a finger base 30 and a finger stop 31, respectively. Each is advantageously made of a material such as brass and each includes a finger 32. The two fingers 32 function as fixed contacts and are advantageously made of rhodium contact wire 0.002 mils in diameter. As best seen from FIGS. 1 and 3, the fingers 32 are paired with the two tines 24 and the two hook contacts 28 to form two individual contact sets.

The midsection of each contact bracket 22 includes several slots 33 and each finger stop 31 is notched to form a shoulder 34. As best seen in FIG. 1, each finger 32 is rigidly fastened at one end to the finger base 30 as, for example, by welding and the other end is deflected so as to be pretensioned against a shoulder 34.

If desired, the finger 32 can be attached to the finger base 30 so that at rest it tangentually touches one side of the shoulder 34. In such a case, deflecting the free end of the finger 32 to the other side of the shoulder 34 introduces the pretensioning force. Alternatively, as shown in FIG. 3, the finger 32 may be attached to the finger base 30 so that it lies on a line passing through the center of the shoulder 34. In that case, positioning the finger 32 on one side or the other of the shoulder 34 will again cause the finger to be deflected and thus internally biased. As will be made clear later, the specific position of each finger 32 with respect to its shoulder 34 is determined by the particular mode of operation selected and the condition of the mating surfaces on the finger 32 and its associated hook contact 28.

The circuit board 23 is made from a ceramic material and supports the fork assembly 21 and the contact brackets 22 in operative relationship to each other. By using a ceramic material, thermal characteristics are improved. While many ceramic materials will be suitable, it has been discovered that one with a coefficient of thermal expansion on the order of $6.0\times10^{-}$B&6, such as Alsigmag 771, is most advantageous.

As best seen in FIG. 3, the circuit board 23 includes circuit paths 35,36, 37, 38 and 39 which are advantageously made from nickel which is plated on the surface thereof. When the fork assembly 21 is mounted on the circuit board 23, the circuit paths 35 and 36 will be electrically in contact with the tines 24. Similarly, the circuit path 37 will be electrically in contact with both contact brackets 22. Finally, the circuit paths 35, 38 and 39 are all electrically linked to connector pins in the housing assembly 60. Advantageously, each of the circuit paths 35, 38 and 39 encompasses a notch cut in the circuit board 23. Additional circuit paths (not shown) are associated with both circuit paths 39 and extend along the undersurface of the circuit board 23 to a position approximately beneath the contact brackets 22.

All of the circuit paths except 39 include strapping terminals; i.e., the circuit path 35 includes a strapping terminal 40, the circuit path 36 includes two strapping terminals 41 and 42, respectively, the circuit path 37 includes a strapping terminal 43 and the circuit path 38 includes a strapping terminal 44. By appropriately connecting the strapping terminals, the two contact sets in the contact assembly 20 can readily be connected in parallel or in series electrically.

The circuit board 23, is slotted at one end to facilitate assembly with the motor assembly 50. It serves as support for the contact brackets 22 which can be soldered in place or held by screws. Where screws are used, the circuit board 23 is tapped to accommodate four mounting screws 45. The mounting screws 45 fit in the slots 33 and hold the contact brackets 22 adjustably on the circuit board 23 and electrically in contact with the circuit paths 37. When the contact brackets 22 and the fork assembly 21 are attached to the circuit board 23, the contact assembly 20 becomes a single unit which is readily adapted for modular use by itself or in combination with the motor assembly 50 to form the motor-contact unit 15.

The motor assembly 50, as shown in FIG. 1, comprises a core 51 and a bobbin 52. The core 51 is associated with an end magnet 53 and includes a pole piece 54. Both are made of a magnetic material and the end magnet 53 advantageously has an H-configuration to efficiently use flux and accommodate, at opposite ends, the core 51 and the tines 24, respectively.

The core 51 is made of a magnetic material such as Permaloy and is substantially L-shaped to form the pole piece 54. The pole piece 54, as best seen in FIGS. 1 and 3, is notched to accommodate the slot in the circuit board 23 so as to hold one end of the contact assembly 20 in place. Moreover, it is soldered or brazed to the metallized portions of the circuit board 23 so that both are rigidly joined together. As an additional advantage, the notches tend to improve tine performance. Specifically, the density of flux emissions from the upper portion of the pole piece 54 tends to be lowest nearest the notches. Consequently, there is less tendency to cause torsional twisting of the tines 24 as they respond to the emanated flux.

The other end of the core 51, like the spacer block 25, has cross-sectional dimensions such that it will fit snugly in one of the spaces between the legs of the H-shaped end magnet 53. The end magnet 53, therefore, serves to physically join the other end of the contact assembly 20 to the motor assembly 50, while magnetically linking the core 51 and spacer block 25 and tines 24.

The bobbin 52 has a hollow center to accommodate a portion of the core 51 extending away from the end magnet 53 and includes two end flanges 55 and two terminal pins 56. One of the end flanges 55 is notched to accommodate the terminal pins 56 as well as portions of the core 51 in the vicinity of the pole piece 54. The terminal pins 56 are advantageously made of a flexible material such as phosphor bronze. As best seen in FIG. 1, one end serves as a terminus for a coil 57, while the other end is curved to engage one of the circuit paths previously described as being located on the underside of the circuit board 23 and which is associated with the circuit paths 39. Advantageously, the curved ends of the terminal pins 56 are soldered to their respective circuit paths on the circuit board 23. When the motor assembly 50 is to be used as a separate entity, however, the connection may be a pressure or friction contact if desired. The coil 57 is wound over the bobbin 42 and is designed to supply a magnetic flux to the core 41 when current flows into one of the circuit paths 39 and out the other in response to an appropriate triggering signal.

When the contact assembly 20 and the motor assembly 50 are joined together by the pole piece 54 and the end magnet 53, respectively, to form the motor-contact unit 15, the result is a rigid, unitary structure. The resulting assembly, therefore, is readily manipulated or handled for further adjustments; i.e., placement in a jig or the like.

Nearly the last steps in assembling the selector 10 are tine adjustment for resonant frequency and spacing of the contacts. With the arrangement disclosed, these adjustments can be made after the motor-contact unit 15 is assembled. Because of the rigid construction of the unit, the required adjustments will not change after having once been made. Consequently, the finished selector exhibits a particularly high degree of stability and reliability.

The housing assembly 70 accommodates the finished motor-contact unit 15. As best seen in FIG. 1, it comprises a body shell 71 adapted to receive the cover 80. Both the body shell 71 and the cover 80 are made of an insulating plastic and the body shell 71 includes a shoulder or lip which fits inside the cover 80 when the cover 80 is installed. As best seen in FIG. 1, the body shell 71 is equipped with four connector pins 73 which are linked electrically to the contact assembly 20 by four wire leads 74 and 75, respectively.

The wire leads 74 and 75 are all made of an electrically conducting material such as phosphor bronze. Moreover, they are curved at one end and have a hook at the other. The curved end is adapted to be fixedly attached to a connector pin 73 as by soldering and the hooked end is adapted to engage one of the notches on the circuit board 23. As shown in FIG. 3, the wire leads 74 are associated with the circuit paths 39 and the wire leads 75 are associated with the circuit paths 35 and 38, respectively. As described earlier, the circuit paths 39 are electrically linked to the coil 57 through the terminal pins 56.

The radius of the curved end of the wire leads 74 and 75 is chosen to be large enough to permit connection of the wire leads 74 and 75 to the circuit board 23 when the motor-contact unit 15 is lifted out of the housing assembly 70 yet not so large as to make a short circuit when the motor-contact unit 15 is placed in the housing assembly 70.

Prior to inserting the motor-contact unit 15, a measured amount of silicone elastomer resin potting material is placed in the housing assembly 70. The motor-contact unit 15 is then positioned in the housing assembly 70 while the resin cures to form a shock damping support. Moreover, the disclosed design permits final adjustments of contact spacing and tine tuning to be readily performed after the resin has cured.

Alternatively, as best seen in FIG. 2, the wire leads 74 and 75 can be made of a rigid yet flexible material so that the curvature of each will exert a biasing force which draws the circuit board 23 into the body shell 71. In such an event, the contact assembly 20 and the motor assembly 50 will be simultaneously pulled together tightly and into the housing assembly 70. Thus, the wire leads 74 and 75 can be made to serve a dual function, i.e., to electrically link the connector pins 73 to the contact assembly 20 while simultaneously holding the components together. In such a case, the flexible nature of the wire leads 74 and 75 will exhibit a shock absorbing characteristic whereby stray forces can readily be absorbed which might otherwise tend to separate the contact assembly 20 and motor assembly 50 from each other or the housing assembly 70.

At least two modes of operation are possible with the embodiment described, i.e., with the two contact sets connected electrically in series or electrically in parallel. Selection of either configuration is readily made merely by appropriately strapping the circuit path terminals and adjusting the position of the contact brackets 22. Each configuration will produce a distinctive output.

In the configuration shown in FIG. 3, for example, the vibrating reed selector 10 is adapted for operation in the parallel mode. In parallel operation, straps have been added to electrically link the strapping terminals 40 and 41 and the strapping terminals 38 and 43, respectively. In addition, the contact brackets 22 are positioned on the circuit boards 23 so that the fingers 32 do not touch the hook contacts 28 and so that one finger is located between the contacting portion of one hook contact 28 and one tine 24, and the other hook contact 28 is located between the other finger 32 and the other tine 24.

With the contact brackets 22 positioned and the strapping terminals connected as described, the two contact sets will be electrically in parallel and current flowing into the circuit path 35 from one wire lead 74 will be divided between the two tines 24 by the strap linking the strapping terminals 40 and 41. Consequently, when the contact set containing either tine 24 is closed, the current will be returned to the other wire lead 74 by passing through the circuit paths 37 and 38 via the straps linking the strapping terminals 43 and 44.

The parallel mode of operation is schematically illustrated in FIGS. 4 through 7. FIGS. 4A through 7A, for example, illustrate the structural interaction of the two contact sets through one cycle of vibration. Similarly, FIGS. 4B through 7B illustrate the electrical equivalent of the situation illustrated in FIGS. 4A through 7A. FIG. 8 illustrates the electrical output for each condition in the foregoing sequence.

Energizing the coil 57 with the appropriate triggering pulses will drive the tines 24 toward resonant vibration in a conventional manner. In the sequency illustrated in FIGS. 4 through 7, the tines 24 are vibrating at or close to their resonant frequency. At the beginning of the vibration cycle, the fingers 32 are unequally spaced from the tines 24 and, as illustrated in FIG. 4A, there is no initial contact with the hook contacts 28. Thus, as can be seen from FIG. 4B, both contact sets are open and, as shown in FIG. 8, no current will flow through a hypothetical load L (such as a tone generating circuit).

As the tines 24 begin to vibrate, they first swing toward one another. As illustrated in FIG. 5A, the hook contact 28 which is located between its tine 24 and finger 32 will move in a direction away from engagement, while the other finger 32, which is located between its hook contact 28 and tine 24, will move into engagement with its hook contact 28 and thus close an electrically conducting path linking the wire leads 74.

At the completion of a half cycle, the tines 24 will return to their initial or normal position. As illustrated in FIGS. 6A and 6B, both contact sets will open so, as shown in FIG. 8, no current can flow through the hypothetical load L.

To complete the cycle, the tines 24 leave the initial position and begin to swing apart. As illustrated in FIG. 7A, the other hook contact 28 will now engage its finger 32, while the first hook contact 28 will move further away from its associated finger 32. Nevertheless, because the two contact sets are connected electrically in parallel, a current will again flow between the wire leads 74 and illustrated in FIG. 8.

From the foregoing, it is apparent that the contact sets in the disclosed embodiment close during both half-cycles of vibration. As a consequence, current will flow twice during each cycle thereby making available twice as much power as can be obtained from contact sets which close only once in each cycle. As an additional safety feature, moreover, if one contact set fails to close, the remaining one will still function. Thus, a substantial margin of safety is provided over conventional selectors which contain only a single contact set or contact sets which close simultaneously.

As indicated earlier, the disclosed vibrating reed selector 10 can also operate in at least one other mode, i.e., a series mode. The series mode of operation is schematically illustrated in FIGS. 9 through 12. FIGS. 9A through 12A, for example, illustrate the structural operation of the contact sets, while FIGS. 9B through 12B illustrate the electrical equivalence for each step in the sequence shown in FIGS. 9A through 12A. Finally, FIG. 13 displays the output over a hypothetical load L, such as a tone generating circuit, for each step in the illustrated sequence.

As in the parallel mode of operation, the two contact sets are depicted at various stages throughout one cycle of vibration at or close to the resonant frequency. As shown in FIG. 9A, the contact brackets 22 have initially been adjusted so that the hook contacts 28 and the fingers 32 in both contact sets are in engagement and so that the fingers 32 are equally spaced from the tines 24. The strapping between strapping terminals, moreover, has been rearranged so that only the strapping terminals 42 and 44 are electrically linked.

When the contact sets are in the initial state, as described and illustrated in FIG. 9A, current from one wire lead 74 reaches the other by flowing in appropriate serial order through the circuit paths 35, 36, 37 and 38, the two fingers 32, the two tines 24 and the two hook contacts 28. When that occurs, current, as illustrated in FIG. 13, will flow from one lead wire 74 to the other.

During the inswing and outswing of the tines 24, as shown in FIGS. 10A and 12A, however, only one contact set at a time will be closed. Consequently, as shown in FIG. 13, no current will flow during either half of the vibration cycle.

At midcycle, however, the tines 24 will again return to their initial state and, as illustrated in FIG. 11A, the two contact sets will simultaneously close for an instant. As a consequence, the series circuit illustrated in FIG. 11B will be enabled and a short or spiked pulse will appear in a load L as shown in FIG. 13.

Alternative arrangements of the fingers **32** are readily possible. As is apparent from FIG. **3**, the fingers **32** are located on opposite sides of the shoulders **34**. That relationship, as will be seen by comparing FIGS. **4A** and **9A**, will not change regardless of the mode selected for operation. Instead, the contact brackets **22** need only be adjusted and minor strapping changes effected in order to change modes. Moreover, it will be recognized that so long as the relative positions of the fingers **32** are maintained, their respective positions can be reversed without any effect on operation. Consequently, surfaces which heretofore have not been involved in the contacting operation can be mated with corresponding new contacting surfaces on the respective hook contacts **28** merely by flipping the fingers **32** to the opposite sides of the shoulders **34** and readjusting the positions of the contact brackets **22**. As a result, longer contact life can readily be achieved with the configurations illustrated.

In summary, operations of the vibrating reed selector **10** in the parallel mode will increase the duration of contact engagement in each cycle of vibration thereby increasing selector efficiency. Moreover, the selector can readily be adapted to function in at least one other operating mode from which an entirely different output is readily obtained, i.e., a spiked pulse when operated in the series mode. Accordingly, the disclosed invention not only relieves design restrictions by increasing the duration of contact closure, but has inherent capabilities for use in other heretofore unavailable applications. While only two embodiments of the invention have been disclosed, it will be readily understood that they merely illustrate preferred applications of the principles of the invention and that other arrangements falling within the scope of the invention will readily occur to those skilled in the art.

What is claimed is:

1. A vibrating reed device including a support, two tines mounted on said support and arranged to vibrate when stimulated by a pulsing magnetic flux, a core mounted on said support and arranged to supply magnetic flux to said core in response to a triggering signal and magnetic means for supplying flux from said core to said tines characterized in that said support is a circuit board, said tines are rigidly attached to said circuit board, said tines and said core are located on opposite sides of said circuit board, one end of said core is rigidly attached to one end of said circuit board, and said magnetic means includes an end magnet rigidly linking said tines and the other end of said circuit board, and magnetically linking said core and said tines whereby the operating components of said vibrating reed device are held in a rigid, highly stable configuration.

2. A vibrating reed device in accordance with claim **1** wherein said circuit board is made of a ceramic material having a coefficient of thermal expansion of 6.0×10^{-6} and said tines are made of a magnetic material having a coefficient of thermal expansion of 7.0×10^{-6}.

3. A vibrating reed device in accordance with claim **1** wherein said tines are mechanically joined at their fixed ends by a spacer rigidly attached to said circuit board, said end magnet has an H-configuration and said spacer and said core have ends snugly fitted between the legs and on either side of the crossmember of said H-configurated end magnet.

4. A vibrating reed device in accordance with claim **3** wherein said core is notched and bent up at one end to form a pole piece and said circuit board has a slot for engaging the notch on said core.

5. A vibrating reed device in accordance with claim **4** wherein said core includes a bobbin, terminal pins molded in said bobbin and a coil wound on said bobbin and attached to said terminal pins, and said circuit board has circuit paths disposed adjacent to and in contact with each of said terminal pins.

6. A vibrating reed device in accordance with claim **1** wherein said tines cooperate with two fixed contacts and two moving contacts to form two moving contacts to form two contact sets.

7. A vibrating reed device in accordance with claim **6** wherein said fixed contacts are each mounted on a contact bracket.

8. A vibrating reed device in accordance with claim **7** wherein each contact bracket is a rectangular member having two ends bent up to form a finger base and a shoulder respectively, and each fixed contact is an elongated wire finger rigidly attached to a finger base at one end and deflected to press against a shoulder at the other end.

9. A vibrating reed device in accordance with claim **8** wherein the point of attachment between each finger and its associated finger base is centrally located with respect to the center of said shoulder.

10. A vibrating reed device in accordance with claim **9** wherein each contact bracket includes means for adjusting the position of said contact bracket on said circuit board.

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