

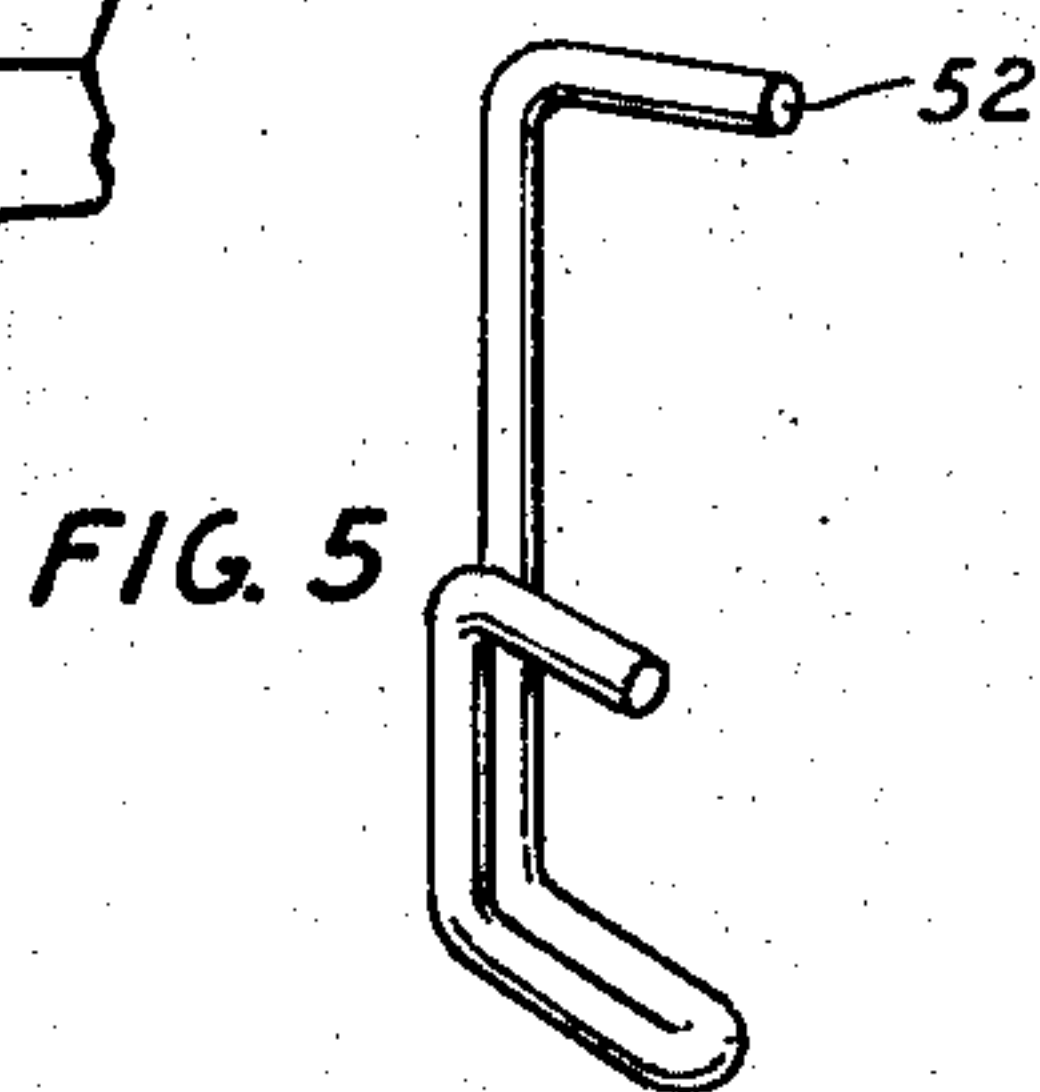
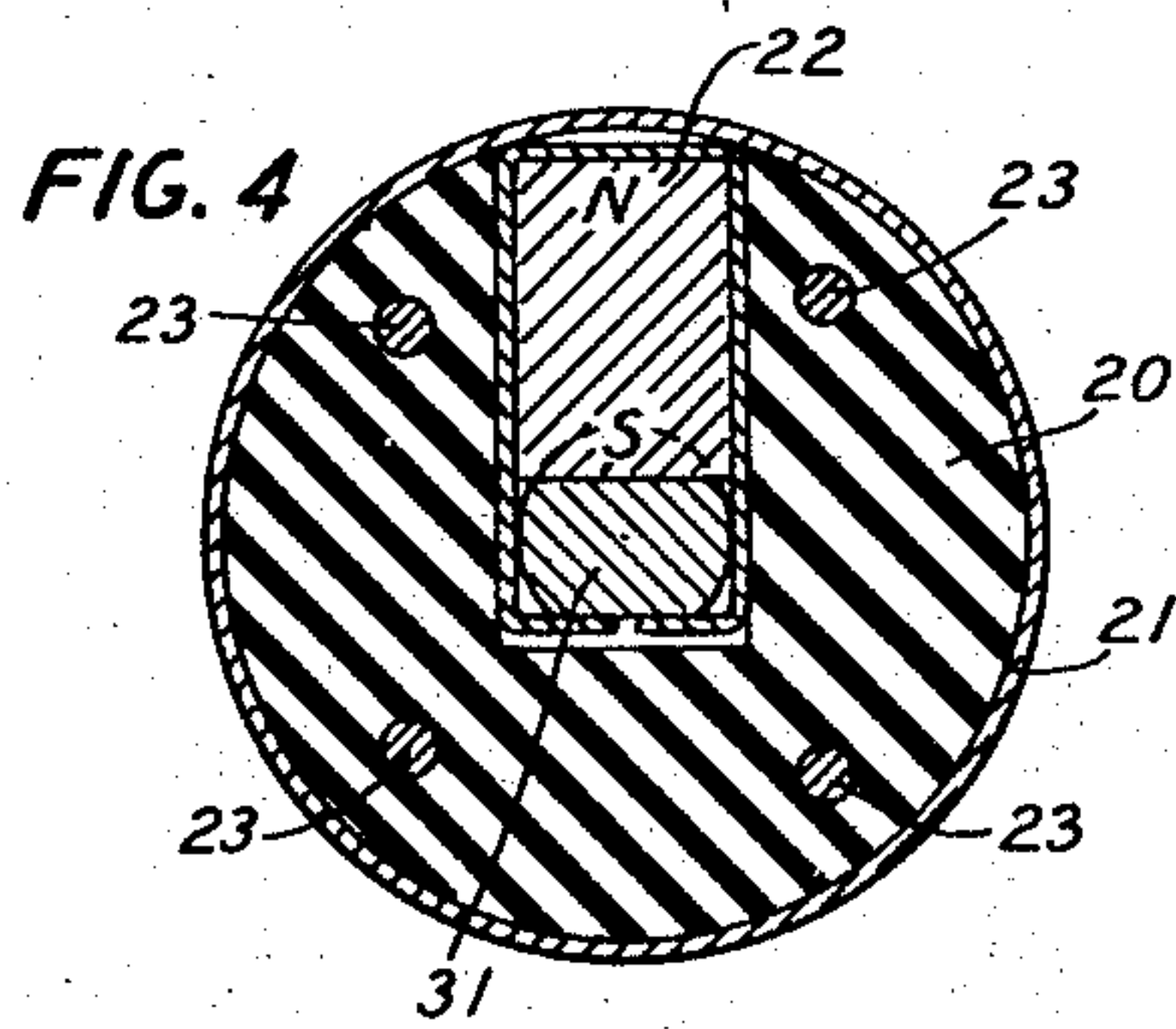
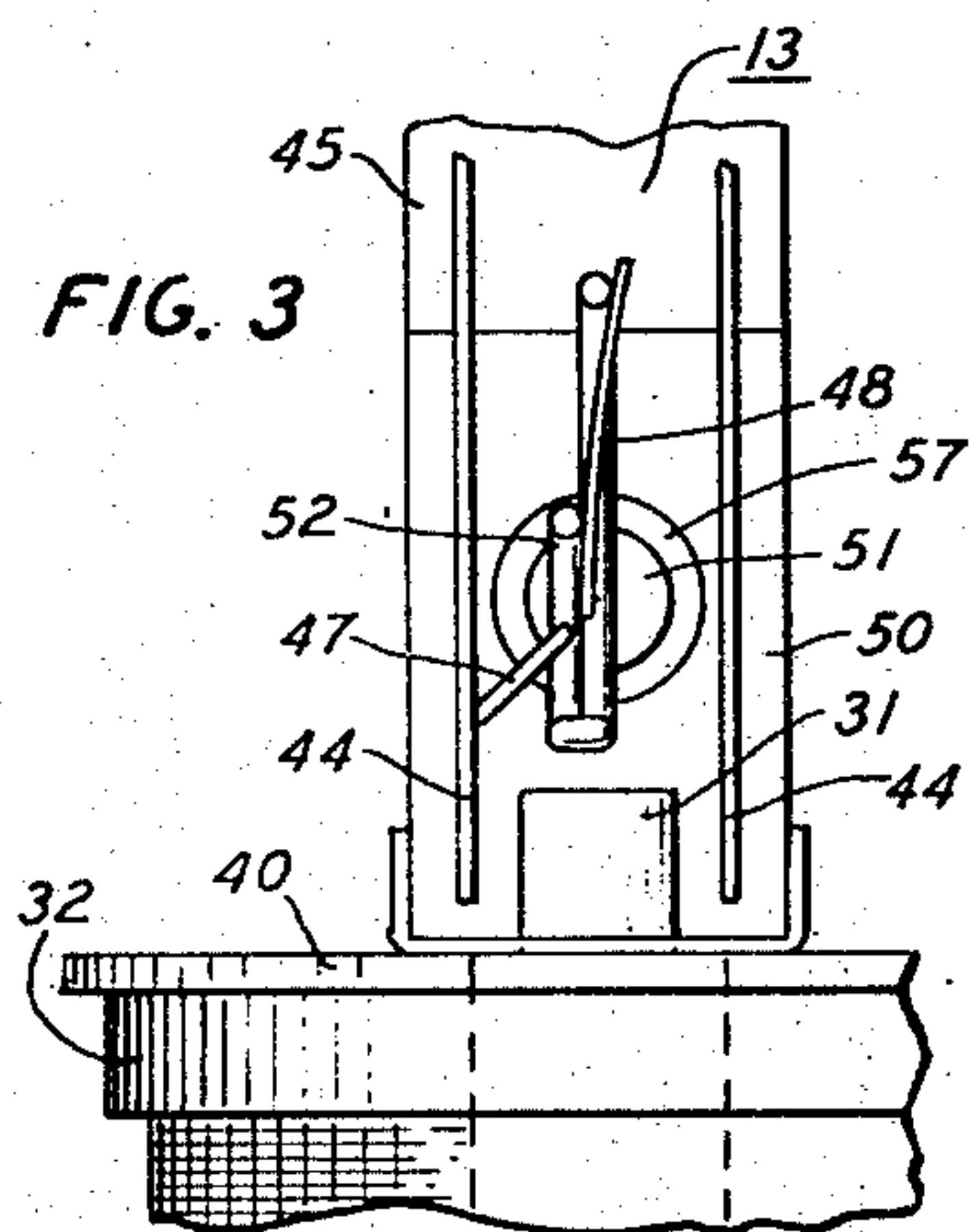
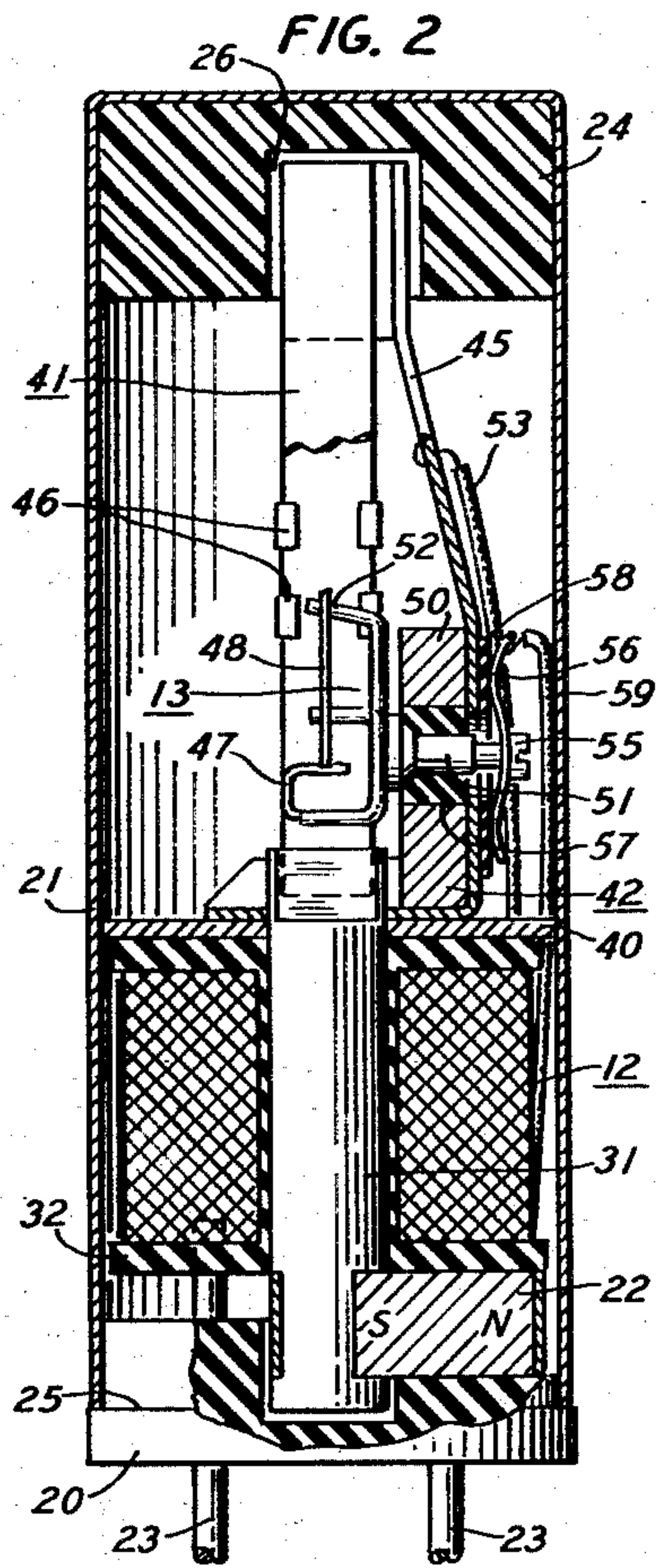
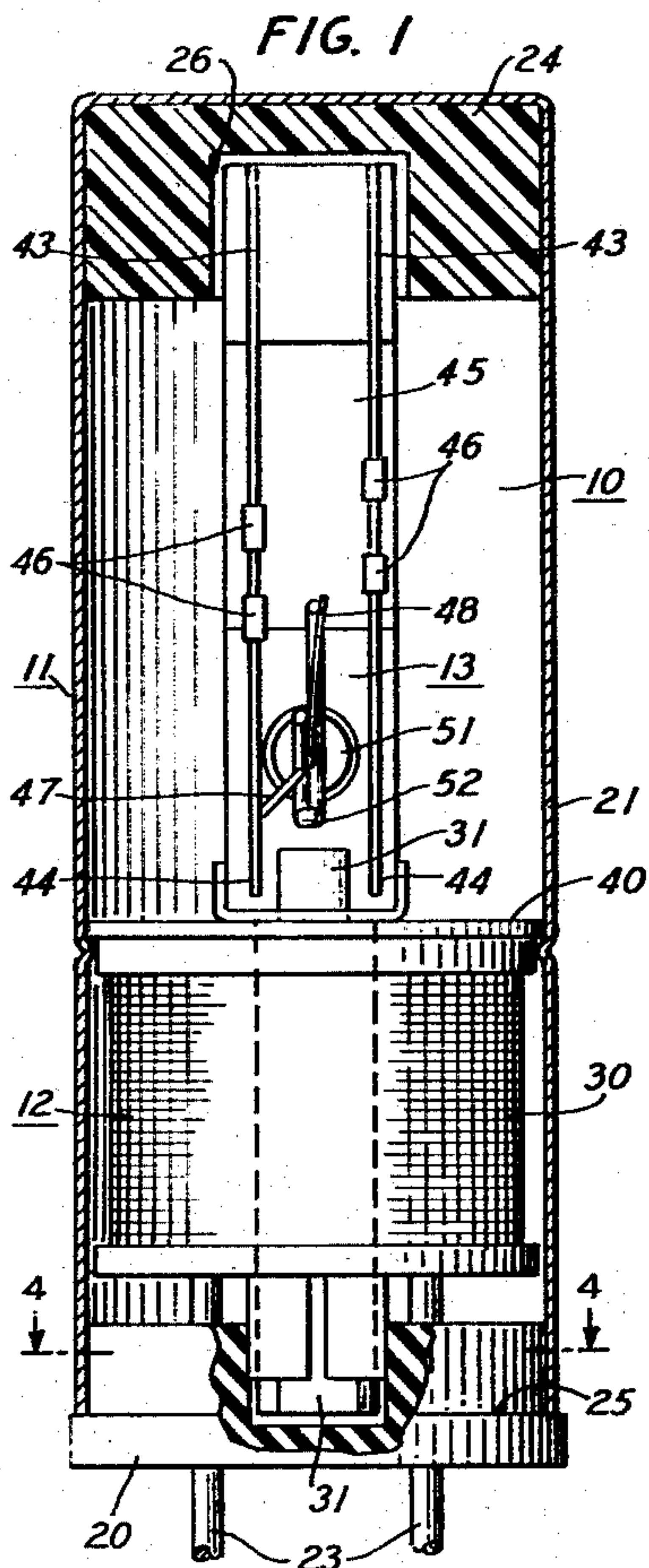
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S. D. WHITE

3,344,374

ELECTROMAGNETIC VIBRATOR HAVING AN IMPROVED CONTACT SUPPORT

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INVENTOR
S. D. WHITE

BY

[Signature]
ATTORNEY

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ELECTROMAGNETIC VIBRATOR HAVING AN IMPROVED CONTACT SUPPORT

Samuel D. White, Edison, N.J., assignor to Bell Telephone Laboratories, Incorporated, Berkeley Heights, N.J. a corporation of New York

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This invention relates to mechanical devices which operate contacts in response to selected frequencies and pertains particularly to devices for supporting the contacts therein.

It is broadly the object of this invention to reduce manufacturing complexities and to improve operating stability of frequency responsive switching devices.

Frequency responsive switching devices are available in many different types. One type which has proved particularly useful is disclosed in Patent 2,877,319 issued to L. G. Bostwick et al. on Mar. 10, 1959. The device disclosed therein is generally referred to as a vibrating reed selector and it is used in the well-known Bellboy signaling device marketed by the Bell System.

Although the design of the vibrating reed selector has proven to be satisfactory, a difficulty involving contact support apparatus has been encountered. Operation of the selector involves the interaction of two contacts. One of the contacts is mounted on a vibrating tine while the other is mounted on a ring-shaped contact support located at the end of an adjusting stud. The geometry of the ring-shaped contact support, however, has proved to be inconvenient to manufacture. Specifically, the support must be bent in various planes as well as being curved. As a result, its fabrication is complicated and relatively difficult.

It is therefore an object of this invention to simplify the manufacture of the selector in general and the contact support in particular.

According to one feature of this invention, manufacture of the selector is simplified when the geometry of the contact support takes the form of an E.

According to another feature of this invention, manufacture of the contact support is simplified when the contact support is a wire which has been bent double and then bent up at its ends.

Another problem encountered in the vibrating reed selector is its susceptibility to maladjustment from severe mechanical shock. The spacing between the contacts requires precise adjustment and, when the selector is dropped, the shock causes the contact adjustment to change. As a result, operation is adversely affected.

Another object of this invention, therefore, is to protect the contact adjustment from the effects of shock.

When the contact support is out of balance with respect to the adjusting stud, both tend to rotate in response to mechanical shock. This rotation is what changes the spacing between the contacts and causes changes in the power required to operate the selector.

It is another object of this invention, therefore, to prevent spurious rotation of the contact positioning components.

According to another feature of this invention, spurious rotation of the contact positioning components is prevented by mounting the contact support with its center of gravity coincident to the central axis of the adjusting stud.

In one embodiment of this invention, a vibrating reed selector includes a first contact, a vibrating member which responds to a selected frequency and which carries the first contact; a second contact; an adjusting stud; and an E-shaped contact support mounted on the adjusting

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post and arranged to hold the second contact in a predetermined position with respect to the first contact.

Because of its E shape, the contact support is readily mounted with its center of gravity coincident to the central axis of the adjusting post. When so mounted, it does not exert forces tending to change the contact adjustment. Thus, not only does its E-shaped configuration facilitate manufacture, but it also makes possible a mounting which protects contact adjustment from the effects of shock.

The above-noted and other objects and features of this invention will be understood more fully and clearly from the following detailed description when read in conjunction with the accompanying drawings in which:

FIG. 1 is a front elevation view partially in cross section of a vibrating reed selector;

FIG. 2 is a side elevation view partially in cross section of the vibrating reed selector shown in FIG. 1 with one of the tines partially broken away;

FIG. 3 is an enlarged detailed view of a portion of the vibrating reed selector shown in FIG. 1;

FIG. 4 is a cross-section view of the vibrating reed selector taken along the line 4-4 of FIG. 2; and

FIG. 5 is an enlarged detailed view of a contact support taken in perspective.

Referring now to FIG. 1, there is illustrated a vibrating reed selector 10. For descriptive purposes, the reed selector 10 can be conveniently divided into three parts; viz., a housing 11, a motor assembly 12, and a contact assembly 13.

The housing 11 includes a base 20, a cover 21, a permanent magnet 22, four terminals 23 and a shock absorber 24. The cover 21 is crimped over the base 20 and is held in place by a ridge 25. The base 20 is made of an insulating material such as plastic, and the cover 21 is made of a magnetic material such as Permalloy. The cover 21 acts as a magnetic return path and also as a shield against external magnetic flux.

As shown in FIG. 4, the permanent magnet 22 and the four terminals 23 are positioned in the base 20. The permanent magnet 22 is centrally located in a slot while the terminals 23 are spaced around the base 20 in a generally symmetrical arrangement.

As shown in FIGS. 1 and 2, the shock absorber 24 is positioned at the closed end of the cover 21. The shock absorber 24 includes a space 26 and it is made of a pre-polymer-polyol composition. Specifically, it is made of a prepolymer such as polyurethane which has been reacted with moisture-free castor oil in the presence of a catalyst. An especially suitable composition consists of polyurethane having a 10 percent NCO content which has been reacted with moisture-free castor oil in the presence of triethylenediamine. This composition produces a shock absorber having exceptional mechanical properties and which does not appear to give off contact contaminating vapors.

The motor assembly 12 comprises a coil 30, a pole piece 31 and a bobbin 32. The motor assembly 12 is located above the base 20 and is held in position by two of the terminals 23 and by the permanent magnet 22. The pole piece 31 is an extension of the central core of the coil 30 and protrudes out from one end thereof. The coil 30 is conveniently made by winding turns of wire on the plastic bobbin 32 and terminating the two ends on two of the terminals 23.

As shown in FIGS. 1, 2 and 3, the contact assembly 13 is a cantilevered structure which includes a spacer 40, a vibrator 41 and a support 42. Both the vibrator 41 and the support 42 are subassemblies which contain other components which are described hereafter in detail. One end of the contact assembly 13 is fastened to the motor assembly 12 and the other end fits in the space 26 in the

shock absorber 25. The shock absorber 25, therefore, will absorb any vibrations of the free end of the contact assembly 13.

The spacer 40 is positioned between the bobbin 32 and the support 42. Conveniently, it is made of plastic and has a rectangular shape from which the corners have been cut (not shown). Furthermore, it fits inside the cover 21 and presses against the inner walls thereof to hold the cantilever structure of the contact assembly 13 in place.

The vibrator 41 includes two tines mounted parallel to each other as cantilevers. As a consequence, each tine has a fixed end 43 and a free end 44. The fixed ends 43 of both tines are fastened to an arm 45 in the support 42, and the free ends 44 are disposed on opposite sides of the pole piece 31. The free ends 43, as shown in FIG. 3, are spaced from the pole piece 31 by an air gap.

Each tine includes one or more bands 46. The bands 46 are slidable on the tines and are used to tune the resonant frequency of the vibrator 41 to a desired value.

At least one of the tines includes a contact 47 which cooperates with a contact 48 on the support 42. In the form illustrated, the contact 47 is a wire which has been bent into a rectangular shape and then attached firmly to one tine at an angle. While the contact 47, as disclosed is a wire, it may take other forms as well, such as a button or the like.

The support 42 includes the arm 45, the contact 48, a block 50, an adjusting post 51 and a contact support 52. The block 50 supports the other components and is mounted on the arm 45.

The arm 45 is fastened to the pole piece 31 at one end and to the fixed end of the vibrator 41 at the other end. It is relatively flexible so as to decouple the vibrator 41 at the tuned frequency from the other components in the selector 10.

The arm 45, the tines in the vibrator 41 and the contact 47 are all electrically conducting. Moreover, they are joined serially in an electrically conducting path. A wire 53 is connected to the arm 45 at one end and to a terminal 23 at the other end (not shown). The wire 53 therefore serves to connect the contact 47 to a circuit external to the selector 10. Although not shown, in passing from the arm 45 to the terminal 23, the wire 53 rests against one of the cut corners of the spacer 40. As a result, it is held away from the contact assembly 13 and will therefore not interfere with the operation of the vibrator 41.

The contacts 47 and 48 are spaced from each other by an air gap and are arranged to engage each other in response to stimulation of the vibrator 41. The contact 48 mounts on the support 42 and is positioned with respect to the contact 47 by the adjusting post 51. It is held in position by the contact support 52.

As shown in detail in FIG. 5, the contact support 52 is E-shaped. It has one inner and two outer legs and it is mounted so that its center of gravity is coincident to the central axis of the adjusting post 51. As a consequence, it does not tend to rotate when subjected to mechanical shock.

The E-shape of the contact support 52 can be obtained in a number of different ways such as by stamping or the like. One technique, however, is especially suitable. Specifically, it is made by bending a wire until it doubles over. Next, the ends of the doubled-over wire are bent up at appropriate points to form an E-shape. By using this approach, the contact support 52 can be made from wires that are pre-cut to a precise length and which are then bent at specific points, or it can be made from random length wires which are doubled over and bent up and then trimmed to length.

The contact 48 is attached to the legs of the contact support 52. Specifically, it is fastened to one of the outer legs and its point of attachment is such that when it is braced against the inner leg it will be deflected in a curve.

As a consequence, it is pretensioned to exert a pressure against the contact 47 when the two come together.

The adjusting post 51 extends through the support 42 and terminates in a slotted head 55. It is held in position by a spring 56 and it is insulated from the support 42 by two insulators 57 and 58, respectively.

The spring 56 is bowed up under the slotted head 55 and exerts a force which both holds the adjusting post 51 in position and which makes a good electrical contact. A wire 59 is attached at one end to the spring 56 and at the other end to a terminal 23 (not shown). The wire 59, therefore, serves to connect the contact 48 to an electrical circuit external to the selector 10. Although not shown, in passing from the spring 56 to the terminal 23, the wire 59 rests against a cut corner of the spacer 40. As a result, it is held away from the contact assembly 13 and therefore does not interfere with operation thereof.

Rough spacing between the contact 47 and the contact 48 is achieved by bending the contact 47 away from the tine to which it is affixed. Fine spacing is achieved by rotating the adjusting post 51 as by inserting a screwdriver into the slotted head 55 and turning.

The selector 10 operates in a conventional manner. Generally, however, the permanent magnet 22 delivers a magnetic flux to the cover 21 which, in turn, delivers the magnetic flux to the vibrator 41. The magnetic flux returns to the permanent magnet 22 by traversing the vibrator 41 and crossing the air gap into the pole piece 31.

When an oscillating potential is applied to the coil 30, an oscillating magnetic flux is superimposed over that established by the permanent magnet 22. When the frequency of the oscillating potential is the same as the resonant frequency of the vibrator 41, enough vibration is produced to cause the contacts 47 and 48 to engage each other. As a result, an electrical circuit is closed.

In summary, there has been disclosed herein a vibrating reed selector in which the mechanical components cooperate to produce a stable device which is relatively simple to fabricate. It will be understood, however, that the embodiment disclosed is merely illustrative of the invention and that other embodiments falling within the scope of the invention will occur to others skilled in the art.

What is claimed is:

1. In a frequency responsive switching device including first and second contact members arranged to cooperate with each other to open and close an electrical connection, vibrating means for supporting said first contact and for moving said first contact in response to a selected frequency, and an adjusting means for positioning said second contact with respect to said first contact, the improvement comprising an E-shaped support mounted on said adjusting means for holding said second contact in position with respect to said first contact.

2. A switching device in accordance with claim 1 wherein said support comprises a doubled-over wire bent up at both ends.

3. In a switching device the combination comprising: vibrating means arranged to vibrate in response to a selected frequency, a first contact mounted on said vibrating means, a second contact arranged to make and break with said first contact, an adjusting post for positioning said second contact a predetermined distance from said first contact, and a contact support for holding said second contact in position, said contact support being mounted on said adjusting post with its center of gravity coincident to the central axis of said adjusting post.

4. A switching device in accordance with claim 3 wherein said contact support is E-shaped.

5. A switching device in accordance with claim 3 wherein said contact support comprises a doubled-over wire bent up at both ends.

6. A switching device in accordance with claim 3 wherein said contact support comprises a doubled-over

wire bent up at both ends into an E-shape and said contact support is mounted on said adjusting post with its legs parallel to the central axis of said adjusting post.

7. In a switching device the combination comprising: first means for vibrating in response to selected magnetic flux variations, second means for supplying magnetic flux to said first means, means for selectively varying the magnetic flux supplied to said first means by said second means, a first contact mounted on said first means, a second contact for interacting with said first contact to open and close an electrical circuit, adjusting means for locating said second contact in a desired position with respect to said first contact, said adjusting means having a central axis, and support means for holding said second contact in said desired position, said support means being disposed with its center of gravity coincident with said central axis of said adjusting means.

8. A device in accordance with claim 7 wherein said first means comprises a tine mounted with one end fixed and the other end adjacent to said second means.

9. A device in accordance with claim 7 wherein said first means comprises a pair of parallel tines and said second means comprises a pole piece disposed between said tines.

10. A device in accordance with claim 7 wherein said first means comprises a pair of parallel tines lying in a common plane, said second means comprises a pole piece disposed between said tines, said adjusting means comprises a post disposed perpendicular to said plane and said support means comprises a wire bent double with both of its ends bent up to form a substantially E-shaped configuration.

11. In a switching device, the combination comprising: a base, a source of magnetic flux mounted on said

base, a plurality of terminals mounted on said base, a coil mounted on said base and held in position by said source of magnetic flux and said terminals, a magnetically responsive vibrator tuned to vibrate in response to a selected frequency of interaction between magnetic flux from said coil and said source of magnetic flux, an arm having one end fastened to said coil and the other end fastened to said vibrator, said arm being arranged to decouple said coil and said vibrator from vibrations having a frequency substantially equal to said selected frequency, an adjusting post mounted on said arm, said adjusting post having a central axis, and E-shaped contact support mounted on said adjusting post with its center of gravity coincident to said central axis, a first contact mounted on said vibrator, and a second contact mounted on said contact support and spaced from said first contact by an air gap.

12. A switching device in accordance with claim 11 wherein said base includes a cover for enclosing the components of said switching device and for conducting magnetic flux from said coil and said source of magnetic flux to said vibrator, and said arm and said coil are separated by a spacer adapted to position said coil and said arm within said cover.

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BERNARD A. GILHEANY, *Primary Examiner*.

H. BROOME, *Assistant Examiner*.