May 17, 1927. 1,628,666

H. C. HARRISON

ELECTROMAGNETIC DEVICE

Filed May 24, 1926

Fig.1

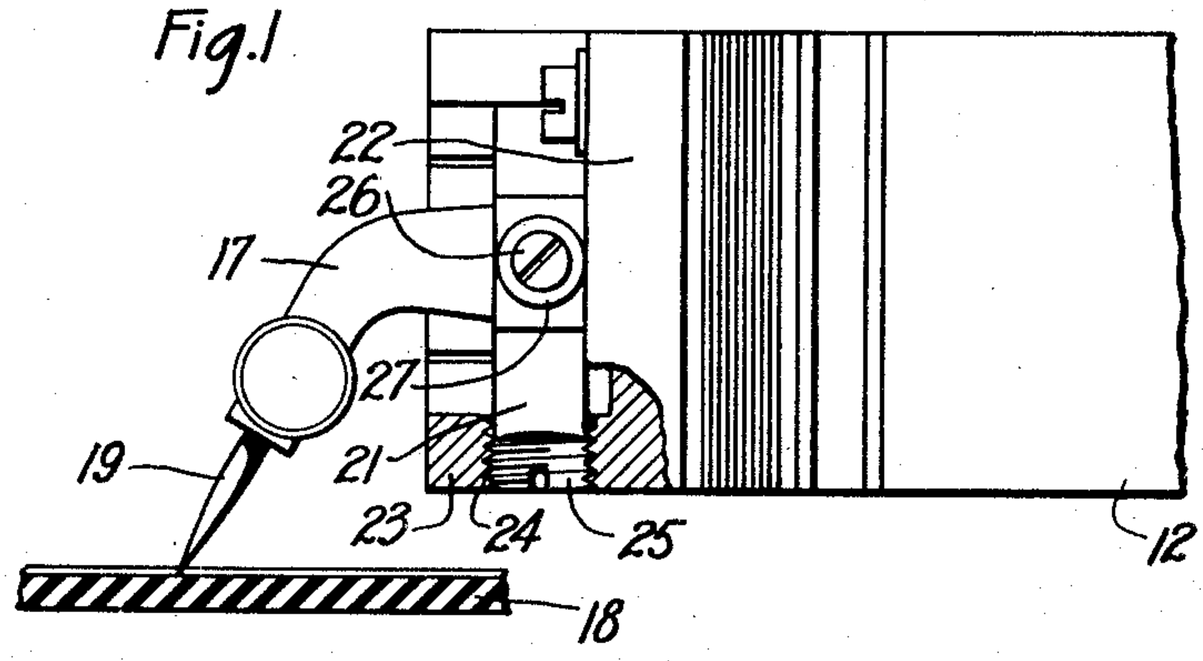


Fig.2

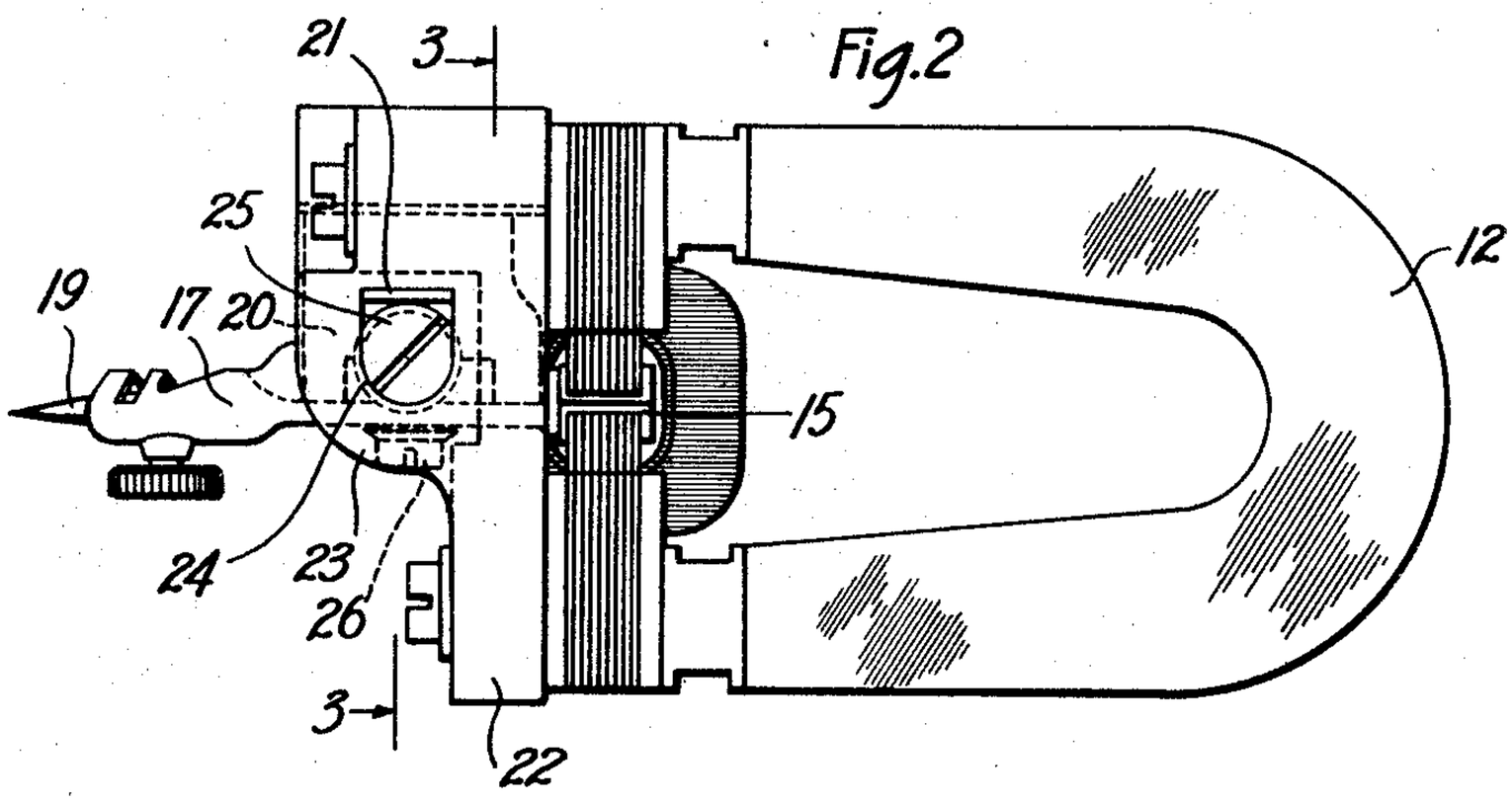
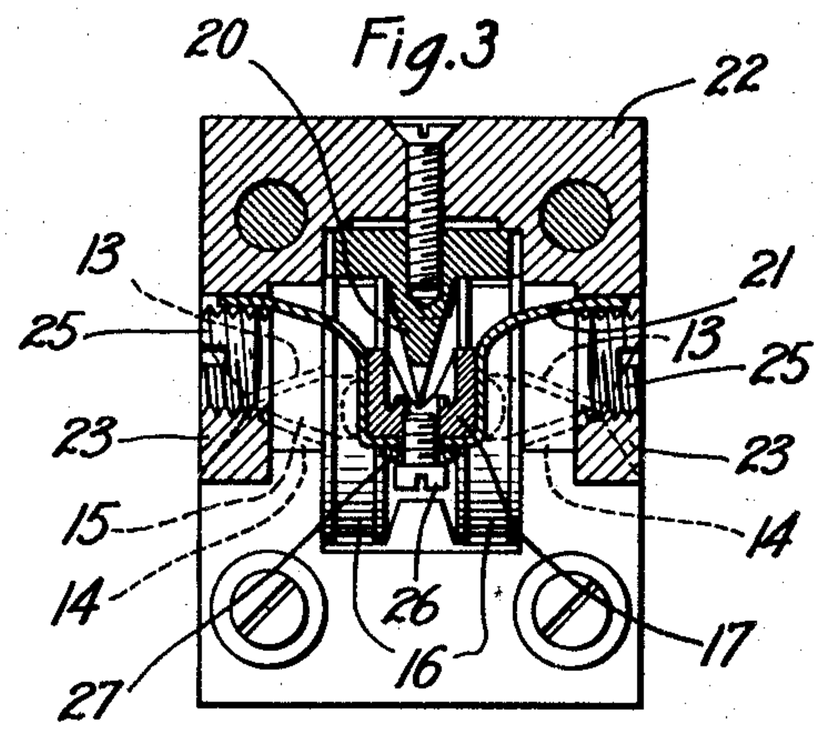


Fig.3



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UNITED STATES PATENT OFFICE.

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ELECTROMAGNETIC DEVICE.

Application filed May 24, 1926. Serial No. 111,209.

This invention relates to electromagnetic devices and more especially to such devices having a moving armature, for example, relays, phonograph reproducers and recorders, etc.

In devices of the above type where it is desired to have the armature remain in the neutral or balanced position, when not operating, a spring member or similar means is usually employed to position the armature. An example of an electromagnetic device of this type is disclosed in my copending application, Serial No. 66,624, filed November 3, 1925 and the present invention, while not limited to the use of the structure disclosed in the earlier filed application, is practically well adapted for such use.

An object of this invention is to provide improved spring means to position the armature of electromagnetic devices.

In accordance with this invention there is provided a novel spring means which in its preferred form is simple, inexpensive, easily adjustable and which holds the armature in close contact with its support. It is practically well suited to electromagnetic relays for signaling systems in that it eliminates or greatly reduces distortion ordinarily introduced by the spring element. When applied to a relay of the type disclosed in my above mentioned copending application there is produced an armature system in which slippage or creepage between the parts is prevented or greatly reduced. It has been observed that relays of this type sometimes become erratic in their action with use to the extent that they fail to reproduce with the necessary fidelity the wave forms impressed thereon. As a result of a careful research to discover the cause of this action it has been discovered that in course of time a microscopic slippage or creepage of the parts of the armature system which are intended to be in fixed relation, takes place. This slippage may take place between the armature and spring or between the spring and frame or between the armature and its support. Furthermore, the spring means in accordance with this invention is of a nature to withstand the severe conditions to which it is subjected.

In the spring means heretofore used in relays of the type above mentioned, a pair of spring elements or a divided spring has been employed, one spring element being lengthened while the other is shortened. This lengthening and shortening has been so minute that its effect has been overlooked and no attempt has therefore been made to eliminate it or reduce it to a minimum. It is this effect which has resulted in slow microscopic slippage of the parts of the system relative to other parts.

In accordance with this invention a spring means is used, which in effect consists of a spring which in its central portion is firmly fastened to the armature and has its ends firmly held by the framework of the electromagnetic structure and preferably by screw members which also act as the adjusting means. The end portions of the spring are gripped by a threaded surface of the screw members thereby forming a locking arrangement for these members. The two portions of the spring at either side of the central portion in contact with the armature constitute free spring elements, each of which is slightly bowed. The armature structure is pivoted on a knife edge which is midway between the spring elements and is in substantial alignment with the ends of each free spring element, that is, a straight line drawn through the two ends of either free element will pass through or near the knife edge. The two straight lines so defined are non-coincident, whereby the spring elements press the armature firmly against its support.

The invention, as applied to the device of the above mentioned application, is described hereinafter in connection with the attached drawing in which—

Fig. 1 is a top view in partial section of a device to which the invention has been applied;

Fig. 2 is a side view of the device, and

Fig. 3 is an end view along the line 3—3 of Fig. 2.

Referring to the drawing, a permanent electromagnet 12 is provided with pole pieces 13, 13 and 14, 14, the outlines of which are shown in dotted lines in Fig. 3. An armature 15, also shown in dotted lines in Fig. 3, is arranged to vibrate between the magnet pole pieces by the varying magnetic field set up by the coil 16, 16 when electric currents pass through the coils.

An arm 17 is fastened to the armature to transmit motion from the armature to a phonograph record 18 by means of needle 19 or to transmit motion from the record to the armature. The operation of this device both as a phonograph reproducer or recorder is well understood and is fully described in my above mentioned application.

The arm 17 is of channel section as shown in Fig. 3 and vibrates or oscillates about a knife edge bearing member 20 with which the arm is held in contact by means of a spring 21. In the form shown this spring is a flat strip substantially U-shaped near its central portion to conform to the shape of the arm.

An aluminum frame member 22 is provided with two extension pieces 23 which are drilled and tapped at 24 to receive screws 25. One portion of these holes is cut away to have a rectangular portion substantially as shown in Fig. 2. Before screws 25 are entered the end portions of spring 21 extend through holes 24, approximately at the center; the central portion of the spring being in contact with the arm throughout.

To enter the screws, the end portions of the spring are moved toward the flat sides of the holes 24. This bending of the spring causes it to contact with the arm more intensely thereby reducing the possibility of slippage. It also provides a sufficient pressure to hold the arm in firm engagement with the knife edge support as it is vibrated. The grip on the arm and the pressure on the knife edge are both somewhat increased as the screws enter further and, at the same time, since the length of the free portion of the spring is decreased its elasticity is increased.

Also as the screws enter, the spring forces the screws into the tapped threads of the holes with sufficient intensity to provide very effective locking means and at the same time the screws cut shallow threads in the spring and tightly clamp it so that there is no slippage between the spring and the frame.

To properly position the armature between the pole pieces one screw is advanced into the hole while the other is backed away thereby causing the armature to rock about the knife edge support and take up the position desired.

When the device is assembled and properly adjusted a straight line drawn through the ends of either free portion of the spring, that is, the portion between the arm 17 and the frame 22, should pass approximately through the point of support of the arm. Such an arrangement reduces to a minimum the components of the forces in the spring tending to cause it to slip.

It is important that there be no slip between the spring and either the arm or the frame for two reasons. One is that such slipping results in distortion and the second is that it prevents a close balancing of the elasticity of the magnetic field against that of the spring and therefore prevents full reproduction of low frequencies.

One means of avoiding slip between the arm and spring is to shape the central portion of the spring so that it closely embraces the arm. As another means of preventing any slipping of the spring, a screw 26 and washer 27 are provided, the screw passing through the spring and cooperating with threads in the arm as shown.

What is claimed is:

1. In an electromagnetic device, a vibrating armature, a spring member firmly attached thereto, and screw means having a threaded portion which cooperates with the surface of the spring for adjusting the free length thereof.

2. In an electromagnetic device, a permanent magnet, an armature arranged for vibration between the pole pieces of said magnet, and means to position said armature with reference to the pole pieces, said means comprising a spring member and screw means which cooperate with the surface of said spring member.

3. In an electromagnetic device, a vibrating armature, a spring therefor, and threaded means cooperating with said spring to adjust the elasticity thereof, certain of the threads coacting with said spring to form a locking arrangement for the threaded member.

4. In an electromagnetic device, a vibrating armature, a flat spring the central portion of which conforms to the shape of and closely embraces the armature at its pivotal point, and means for adjusting the elastic reactance of said spring.

5. In an electromagnetic device, a vibrating armature having a channel section near its point of support, a flat spring the central portion of which is substantially U-shaped and which closely embraces near its supporting point, and screw means cooperating with the surface of the end portions of the spring.

6. In an electromagnetic device, a vibrating armature, a spring member having its central portion firmly attached thereto, threaded members cooperating with the end portions of said spring in such a manner that the threaded members are locked in position and the spring is held against slipping.

7. In an electromagnetic device, a vibrating armature, a knife edge support therefor, a spring firmly attached to said armature, and screw means cooperating with the end portions of said spring, said parts being so positioned that a line drawn through the ends of either free portion of the spring

passes through the point of support of the armature.

8. In an electromagnetic device, a vibrating armature, a flat spring firmly attached thereto, flat bearing supports for the end portions of said spring and screw members the threaded portions of which cooperate with the surface of the end portions of the spring to hold them firmly fixed to the flat bearing supports.

In witness whereof, I hereunto subscribe my name this 22 day of May A. D., 1926.

HENRY C. HARRISON.