July 7, 1959 C. N. BREWER 2,894,181

ELECTROMECHANICAL DEVICE AND IMPROVED ARMATURE THEREFOR

Filed March 8, 1957

Fig. 1

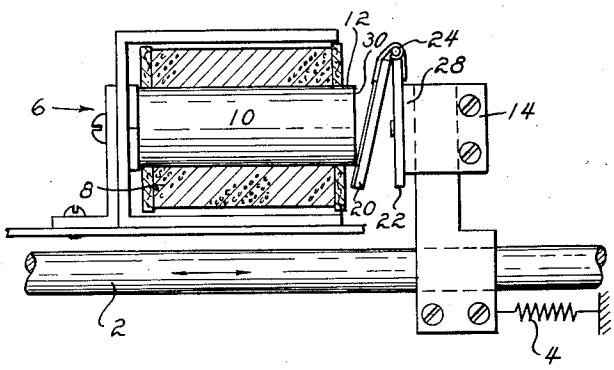


Fig. 2

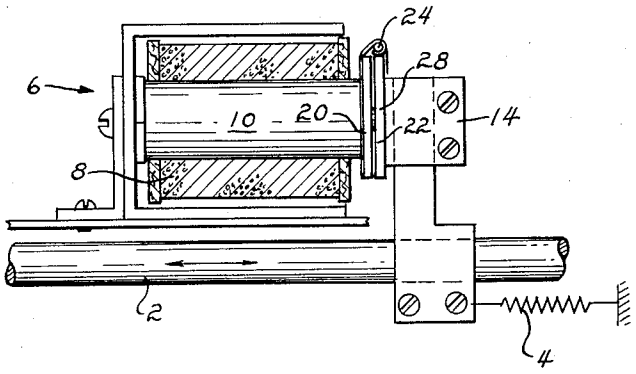
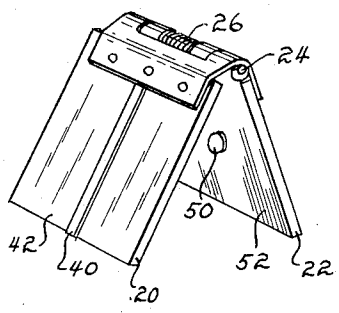


Fig. 3



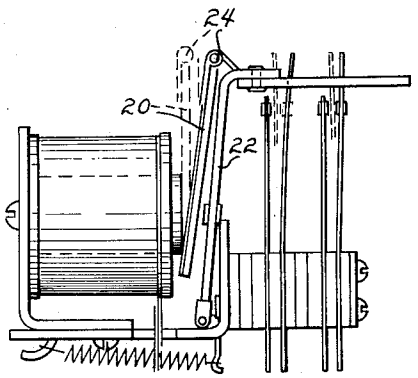


Fig. 4

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1 Claim. (Cl. 317—165)

This invention relates broadly to electromechanical devices which are operative to cause the movement of a part upon energization of an electrical device such as a magnet or the like, and also to armatures for such devices.

The operation of movable parts such as rods, links, relay armatures and the like has heretofore often been effected by solenoids or magnets. If such parts are operated by the movable plunger of a solenoid it has been found that the operation is often sluggish and delayed, particularly if a relatively heavy load is to be moved, and this can be overcome according to known practice only by increasing the size of the solenoid with consequent increase in initial and operating costs. It has also been found, and is well known, that the movable plungers of solenoid devices tend to stick within the coil, thus further adding to the difficulties of causing movement by the use of such devices. In place of solenoid devices it has been proposed to connect an armature to the bar, link or other part which is to be moved and to cause such movement by means of a magnet operatively associated with the armature. In such devices difficulties are caused by the air gap which necessarily exists between the magnet or its core and the part to be moved. It will be understood that if the required movement is large the air gap must be correspondingly large, thus either reducing the force exerted by the magnet on the part to be moved or requiring the provision of a larger, stronger and more expensive magnet.

This invention has had for its general object the provision of electrically operated means for moving any part or device to which movement must be imparted, which means will not be subject to the operating difficulties and disadvantages of known solenoid and magnet devices which are briefly described above. It has been a particular object of the invention to provide an electrical operating device of the type and character described which will be more effective than known devices in the movement of parts which are separated more than a normal distance from the electrical operating device, thus increasing the effective power of the electrical device and doing away with the necessity to increase its size and cost in order to secure an increase in its effective power.

The invention is described in the following specification and embodiments thereof are illustrated in the accompanying drawings, in which:

Fig. 1 is a side elevational view of an electromechanical device according to the invention, the parts of the device being shown in the positions and relations occupied before energization of the electrical device;

Fig. 2 is a view which is similar to Fig. 1, showing the parts thereof after energization of the electrical device;

Fig. 3 is a perspective view of an armature according to the invention, and

Fig. 4 is a side view of a relay of usual type and construction, modified by the provision therein of an armature according to the present invention.

In Figs.1, 2 and 3 of the drawings there is disclosed

an electromechanical device comprising a movable part, such as the link or bar **2**, which is constantly urged in one direction by a spring **4** and which is adapted and intended to be moved in the opposite direction, against the force of the spring, by operation of an electromagnet **6**. The electromagnet, which may be supported on any fixed part as shown, comprises a coil **8** wound about a core **10** to provide an electromagnet of conventional construction and operation. The exposed end **12** of core **10** is positioned adjacent, but spaced from, a lug or part **14** which is rigidly connected to the movable part **2**.

Means are provided by this invention for causing movement of movable part **2** upon energization of the electromagnet **6** and such means comprise an improved armature device. The device comprises two plates **20**, **22**, each of which may be rectangular in shape and both of which are formed of magnetic material. These plates are hingedly connected at adjacent edges by a hinge **24**, the pin of which has a spring **26** associated with it in known manner to constantly urge the two plates in opposite directions about their hinged connection. One of these plates **22** is rigidly connected in any suitable manner to a face or part **28** of the member **14** in such a position that it is adjacent, spaced from and substantially parallel to the outer face **30** of the exposed end **12** of the core **10**. The member **14** is normally spaced from the core face **30** and the second plate **20** of the armature is therefore held by spring **26** in spaced angular relation to plate **22** and in freely abutting but angular relation to the outer face **30** of core **10**. Expressed otherwise, when the parts are in their normal condition with the magnet coil de-energized the plates **20**, **22** form a dihedral angle at their hinge connection, plate **22** is rigidly mounted on member **14** and is substantially parallel to the outer face **30** of core **10**, and plate **20** forms an angle with plate **22** and with the outer face **30** of core **10** and abuts such outer face along a line contact at the lower edge of the outer face.

In the operation of the described device to move the member **2**, the electromagnet **6** is energized by supplying electrical energy to coil **8** whereupon the plate **20** is immediately pulled into face-to-face abutting engagement with the outer face **30** of core **10**, thereby pulling the second plate **22** into substantially face-to-face abutting relation to the plate **20**, as shown in Fig. 2, this movement of plates **20**, **22** being permitted and caused by the hinged connection of the two plates. The movement of plate **22** into face-to-face abutting engagement with plate **20** pulls member **14** and the connected movable part **2** toward the core **10** against the force of spring **4**, thus causing the desired movement of part **2**.

A preferred form and construction of the armature provided by the invention is illustrated in Fig. 3, and in this preferred embodiment a strop **40** of non-magnetic material is attached to, or embedded in, the outer surface **42** of plate **20**, which is the surface adjacent the outer surface **30** of core **10**, and is slightly raised above the plane of surface **42**. This strip preferably extends at approximately right angles to the hinge connection between the two plates and midway of the side edges of plate **20**. Also, a plug **50** of non-magnetic material is attached to, or embedded in, the inner surface **52** of plate **22**, which is the surface adjacent the plate **20**, and is slightly raised above the plane of surface **52**. The plug **50** is preferably circular in shape and is preferably positioned at the approximate center of plate **22**. The strip **40** has two important purposes. Frst, by engaging the end surface **30** of the core **10** it permits the plate to slide against and over the surface **30**, thereby preventing "freezing" of the plate and core surface over their area of contact. In the second place, the raised strip **40**, which itself engages the

outer surface of the core, causes an air space to be provided between the core and the outer surface 42 of plate 20, thereby preventing residual magnetism from holding the armature 20, 22 to the core after deenergization of the electromagnet. The non-magnetic plug 50 on the inner surface of plate 22 holds the two plates apart by a slight distance in the operated condition of the parts shown in Fig. 2, thereby again preventing residual magnetism from holding the two plates together after de-energization of the electromagnet. Because of the provision of the non-magnetic strip 40 and the non-magnetic plug 50 the movable member 2 will be returned to its normal position by spring 4 immediately upon de-energization of electro-magnet 6.

It is believed that the use and operation of the described device will be fully understood by those skilled in the arts to which it pertains. By reason of the provision of the two-part hinged armature between the electromagnet and the movable part to be operated, immediate operation of such part is provided upon energization of the electromagnet, without any sluggish action or sticking of parts. Further, the effective power of the magnet is increased by the use of the armature provided by the invention, thus permitting an electromagnet to exert greater force over a greater distance than would be possible with the use of known armature devices.

It will be understood by those skilled in the arts to which the invention relates that the armature provided by the invention may be used in any device in which it is desired or necessary to produce motion upon the energization of an electromagnet. Thus, as shown in Fig. 4 as an example, the hinged armature described hereinbefore may be incorporated in a relay of otherwise conventional design and construction with resultant advantages in operation and costs.

My invention consists not only in the provision of a two-part hinged armature but also in the provision of a device including an electromagnet, a part to be moved, and the two-part hinged armature.

While I have disclosed one embodiment of the two-part, hinged armature provided by the invention, and two electromechanical devices including such armature, it will be understood that other embodiments and devices, as well as modifications of those disclosed, may be made and practised without departing in any way from the spirit and scope of the invention, for the limits of which reference must be made to the appended claim.

What is claimed is:

A device for imparting linear movement to a movable part, comprising a fixed electromagnet normally disposed in spaced relation to the movable part and operative when energized to cause the part to move linearly toward the electromagnet, and an armature disposed between and operatively connecting the electromagnet and the movable part, said armature comprising two hinged parts formed of magnetic material, means constantly urging the parts of said armature away from each other about their hinged connection, one of the parts of said armature being rigidly connected to the movable part, and the second of the parts of said armature when the electromagnet is de-energized being angularly related to the first part at their hinged connection and freely engaging and angularly positioned with respect to the electromagnet.

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