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ELECTROMAGNETIC DEVICE.

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1,292,003.

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Fig. 1.

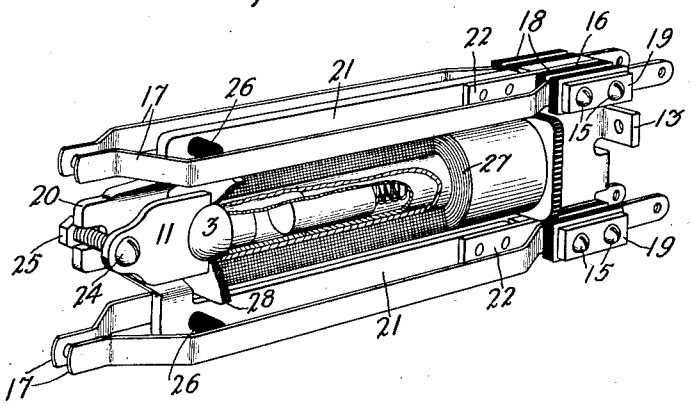
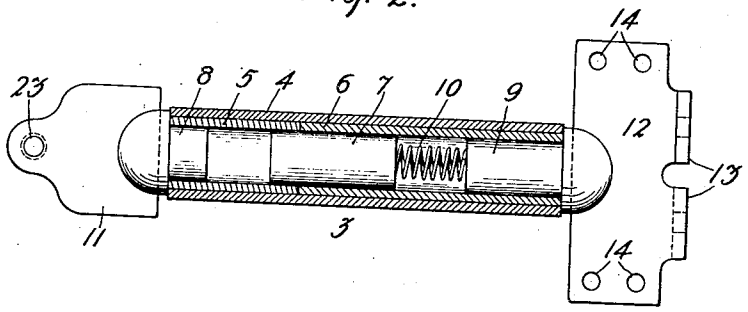


Fig. 2.



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UNITED STATES PATENT OFFICE.

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ELECTROMAGNETIC DEVICE.

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To all whom it may concern:

Be it known that I, DANIEL D. MILLER, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Electromagnetic Devices, of which the following is a full, clear, concise, and exact description.

This invention relates to electromagnetic devices, and in particular to the type of electromagnetic devices known as slow acting.

It is very often a requirement, especially in signaling or telephone circuits that a certain electromagnetic device be slow in operation, as compared with another, in order to insure the latter sufficient time to complete its function before operation of the former occurs.

In devices of this type it has been a common practice to retard the operation by placing a copper sleeve or jacket about the core and by the use of various spring arrangements. These constructions, however, are not satisfactory since, in many cases, they do not bring about the required lag in operation, especially under conditions of maximum operating current, and, in addition, the use of a spring arrangement is objectionable in that it necessitates an adjustment which is often difficult to make and does not remain permanent under service conditions.

It is, therefore, the object of the present invention to provide a slow-operating electromagnetic device arranged to give the desired slowness of operation, and one in which the result is obtained without resorting to the use of a delicate spring adjustment.

A further object is to provide for such a device, a simple construction which can be manufactured at a moderate cost, and which, moreover, will be efficient in operation.

To attain these objects, the invention provides a construction comprising a special type of core which normally introduces a comparatively large air gap in the operating or main magnetic circuit of the device. This core consists of an iron plunger slidable within a tube which is partly magnetic and partly non-magnetic, the latter part constituting a part of the gap in the magnetic circuit. The entire tube is inclosed practically air tight by a copper sleeve provided with an iron plug at either end. Upon the flow of current through the winding surrounding this core, the iron plunger moves slowly to close the gap in the magnetic circuit, after which the device operates in the well known manner to perform its regular function. The slow movement of the plunger is due not only to the inherent slowness of the solenoid, but also to the dash pot effect and the action of a retractile spring provided to restore the plunger to its initial position after the winding is deënergized.

Referring now to the drawing, Figure 1 is a perspective view, partly in section, of a standard type of electromagnetic relay having a core constructed in accordance with this invention; and Fig. 2 is an enlarged sectional view of a core as required for the relay illustrated in Fig. 1.

The core 3 consists of an outer tubular shell 4 of copper, within which at one end is a tube 5 of non-magnetic material, such as brass, and at the other end an iron tube 6. Within these inner tubes is an iron plunger 7, which is free to move and the diameter of which is such as to make a good sliding fit with the inner diameter of the tubes 5 and 6. Iron stops or plugs 8 and 9 are forced into the tubes at either end and serve to make the core practically air tight. A helical spring 10 is attached to plunger 7 and stop 9 serving to keep the plunger normally in the position as shown.

Securely attached to one end of the core is the core pole face 11, while secured at the other end is the extension part 12 provided with lugs 13, 13 by means of which the structure may be securely fastened to its support. This extension piece is also provided with perforations 14 adapted to receive the screws 15, by means of which the armature reed 16, contact springs 17, insulators 18 and plates 19 are clamped into a unitary structure.

The armature consists of a transverse or pole face portion 20 and two longitudinal arms 21, 21 which are securely fastened to extensions 22, 22 of the armature reed 16. To provide a means for adjusting the air gap between the core pole face 11 and the armature pole face 20, the former is provided with a threaded hole 23 adapted to engage the adjusting screw 24. This screw extends through a slot in armature pole face 20 and is provided with a nut 25 which acts

as a back-stop for the armature and determines the separation between the pole faces under the normal or unoperated condition. Armature studs 26, 26 of hard rubber or a similar material are secured to the armature as shown and serve to separate the contact springs upon attraction of the armature. Placed about core 3 is the energizing coil consisting of a winding 27 and spool heads 28, 28.

In the operation of the relay embodying this invention, the passage of current through the winding 27 does not at once cause the attraction of the armature because of the reluctance due to the large air gap in the magnetic circuit. Plunger 7, however, is caused to move slowly toward stop 8, and in so doing completes the magnetic circuit between stop 8 and tube 6. As has been stated heretofore, the movement of plunger 7 is made comparatively slow by the compression of air ahead of the plunger, or the dash pot effect and also by the action of the helical spring 10. Moreover, the copper tube 4 further slows down the operation of this relay by retarding the building up of the flux in the magnetic circuit. Upon the closing of the air gap between plunger 7 and stop 8, the reluctance of the magnetic circuit is decreased sufficiently to allow the armature pole face 20 to be attracted to the core pole face 11, thereby causing the operation of the contact springs in the well-known manner. Upon deënergization of the winding 27, pole face 20 is drawn back against the stop nut 25 by the resiliency of armature springs 17 bearing against studs 26 and plunger 7 is restored to its initial or unoperated position by the retractile spring 10.

What is claimed is:

1. In an electromagnetic device, a stationary core comprising separated sections of magnetic material, a magnetic plunger associated with one of said sections and movable toward another of said sections, and a surrounding sleeve therefor closed at one end to form a dash pot for said plunger.

2. In an electromagnetic device, a hollow stationary core comprising a magnetic section, a non-magnetic section, a tube surrounding said sections, a magnetic plug at each end of said tube, and a movable plunger secured to one of said plugs by means of a retractile spring and movable toward the other of said plugs.

3. In an electromagnetic device, an energizing winding and a magnetic circuit including a movable armature and a hollow stationary core, said core comprising a magnetic section, a non-magnetic section, a tube surrounding said sections, a magnetic plug at each end of said tube, and a movable plunger secured to one of said plugs by means of a retractile spring and movable toward the other of said plugs to bridge said non-magnetic section, whereby a complete magnetic circuit is provided upon the operation of said armature.

In witness whereof, I hereunto subscribe my name this 22d day of May A. D., 1917.

DANIEL D. MILLER.