

Dec. 13, 1927.

1,652,490

D. D. MILLER
ELECTROMAGNETIC DEVICE

Filed March 26, 1926

Fig. 1

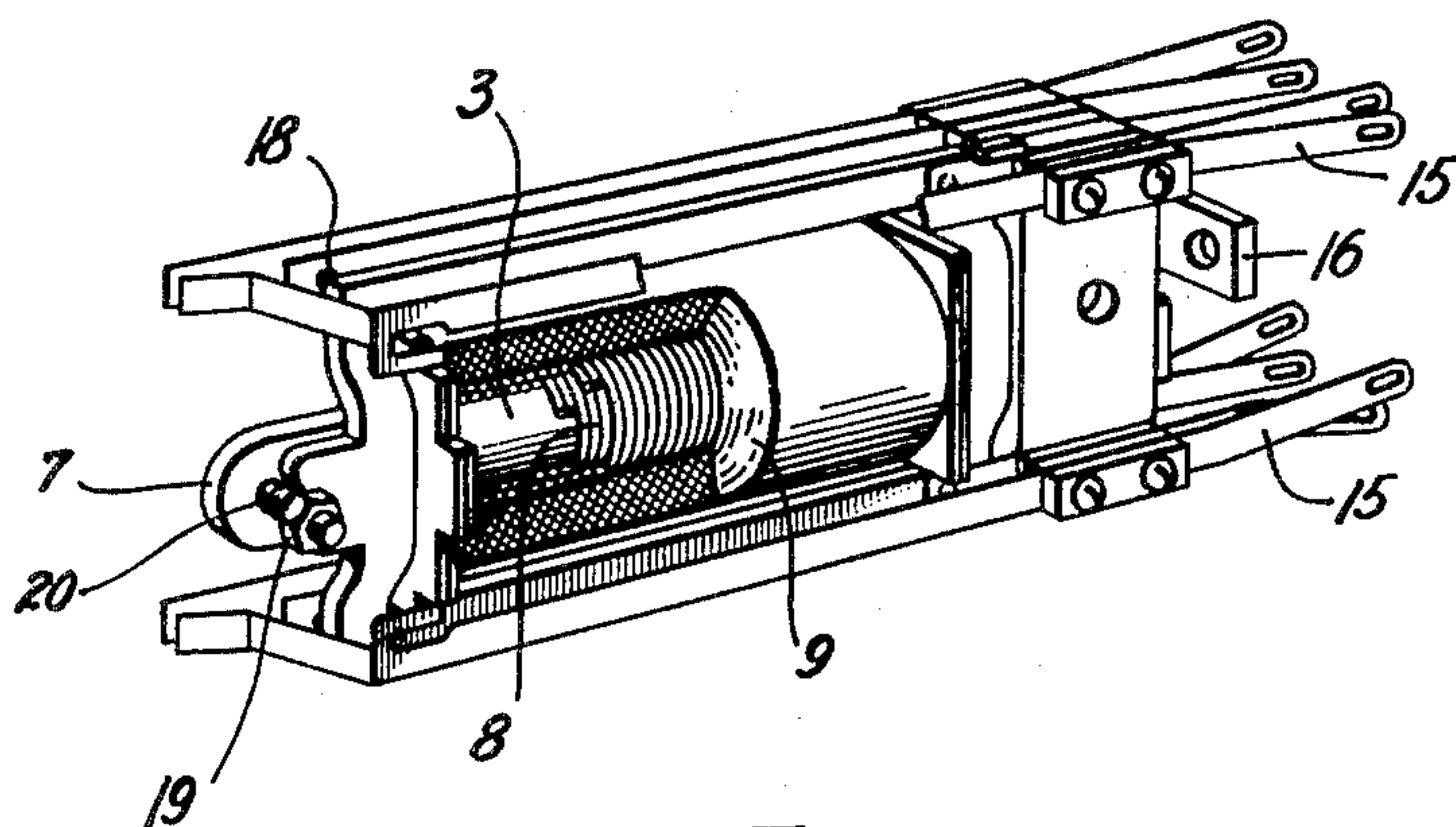
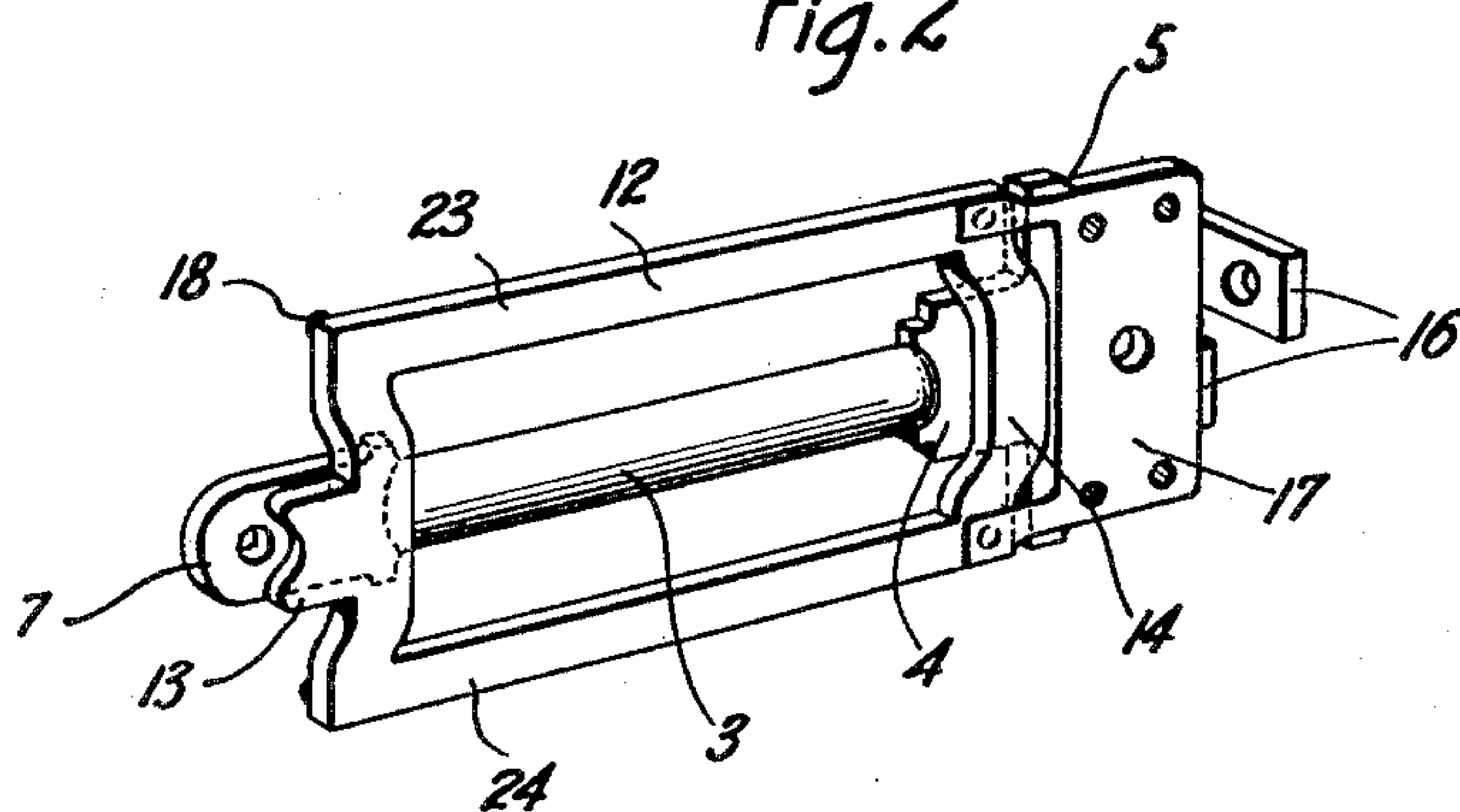


Fig. 2



Inventor:
Daniel D. Miller

by *J. E. Roberts* Att'y.

Patented Dec. 13, 1927.

1,652,490

UNITED STATES PATENT OFFICE.

DANIEL D. MILLER, OF NEW YORK, N. Y., ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ELECTROMAGNETIC DEVICE.

Application filed March 26, 1926. Serial No. 97,653.

This invention relates to electromagnetic devices and more particularly to improvements in the so-called slow release type relays.

5 It is an object of this invention to improve the electrical operating characteristics of electromagnetic devices of this type in which the releasing of the armature lags appreciably behind the opening of the circuit supplying the energizing current to the winding.

10 The slow release relay now in common use employs iron in its magnetic circuit and has a copper sleeve or short-circuited winding positioned about the core to render the relay 15 slow in releasing in accordance with the theory well known to those familiar with the art. It would naturally be expected that the use, in such a relay, of a core material possessing a high degree of coercivity, would be 20 desirable in order to render the relay slower in releasing. However, this is not necessarily the case, since if such a relay is adjusted to the desired condition for the attraction of the armature, the time required for its re- 25 lease is found to be of variable duration and too great a value, in extreme cases the armature not being released but sticking permanently to the core. Furthermore, if such a relay is adjusted for the desired releasing 30 time, it may be found to be very sluggish in operating. This inefficiency of operation is no doubt largely due to the fact that the material of high coercive force has a high hysteresis loss and a comparatively low per- 35 meability.

40 A feature of this invention is a magnetic circuit for slow release relays which is composed of a material characterized by high permeability, at low magnetizing forces, of the order of .2 gauss, low coercive force and low hysteresis loss. A preferred form of material is a nickel-iron alloy, known as permalloy, which is described in detail in a copending application of G. W. Elmen, Serial No. 45 473,877, filed May 11, 1921. Particularly good results have been obtained with such an alloy consisting of approximately 45% nickel and 55% iron. While an alloy of these proportions of nickel and iron does not have a 50 minimum hysteresis loss or a maximum permeability, it does have the advantage of approaching saturation at a higher magnetic induction and is for that reason better adapted for use in the magnetic circuit of a relay 55 of this type. It is preferable to employ this

material in both the armature and core of the relay but considerable improvement is realized even though this material is used in only a part of the magnetic circuit. In order to gain the maximum advantage from the 60 use of the magnetic material of high permeability, it is preferable to employ in this relay a magnetic circuit of low reluctance. A relay employing a structure of this type is disclosed in my copending application, 65 Serial No. 98,652 filed March 31, 1926. The structure disclosed in this application provides for magnetically cooperating portions of the core and armature having sharply defined adjacent surfaces and greater cross 70 sectional areas than the other portions of these parts and so arranged and proportioned in relation to the other portions of the core and armature that the passage of the magnetic lines of force between the armature and 75 core is largely confined to these cooperating portions.

The invention may be more clearly understood by reference to the accompanying drawing, in which Fig. 1 is a perspective 80 view of a complete relay partly in cross section and Fig. 2 is a perspective view of the magnetic structure of the same relay.

Referring to the drawing, the core 3 preferably composed of a nickel-iron alloy, has 85 a flat enlarged pole piece 4 and a cross piece 5 at one end, thus forming a substantially T-shaped structure. The other end of the core 3 is shaped to form the flat enlarged pole piece 7. The short-circuited secondary 90 8, which is shown as a winding of bare copper wire but may equally well be in the form of a copper sleeve, is positioned about the core 3 between the spool heads and an energizing winding 9 of insulated wire is 95 placed on the short-circuited secondary 8 between the spool heads 10 and 11 which are fitted on the core 3. The armature 12 is a rectangular shaped flat punching, preferably of nickel-iron alloy, having the shanks 100 23 and 24, and at one end an enlarged pole piece 13 cooperating with the core pole piece 7, and at its opposite end an enlarged pole piece 14 cooperating with the pole piece 4. The cross piece 5 serves as a mounting plate 105 for the contact spring pile-ups 15 and for mounting the relay itself to a suitable support by means of the bent up portions 16. The armature 12 is also secured to the cross 110 piece 5 by means of a resilient sheet metal

plate 17 riveted to the cross piece and having projections riveted to the armature substantially as shown. This metal plate acts as a hinge between the armature and the core.

The contact springs are arranged to be controlled and operated by the movement of the armature through the medium of the insulating stud 18. The adjustment of the air gap between pole piece 13 of the armature and pole piece 7 is regulated by means of the split adjusting nut 19 threaded on screw 20 passing through the pole piece 7.

Upon opening the circuit through the winding 9 a current is induced in the short-circuited winding 8, thereby effectively maintaining the flux in the core 3 over a period of time. The armature thus remains in its attracted position until the flux through the magnetic circuit is decreased sufficiently to allow the pressure of the contact springs 15 to release it. The reluctance of the magnetic circuit of this relay is greatly reduced due to the use of a nickel-iron alloy of high permeability as the material for the armature and core and to the use of the enlarged pole pieces 13 and 14 of the armature in cooperation with the enlarged pole pieces 7 and 5, respectively, of the core. Because of this decrease in reluctance of the magnetic cir-

cuit, the flux generated in the core due to the current induced in the secondary winding 8, upon opening of the operating circuit, is greatly increased, thus increasing the time lag between the opening of the operating circuit and the release of the armature. Upon closing the circuit through the operating winding, the efficiency of operation is also increased due to the low hysteresis and high permeability of this material and since the reduced reluctance of the magnetic circuit results in an increased value of flux flowing through the core. The low coercivity of permalloy, furthermore, renders the relay stable in respect to its operating and releasing characteristics.

What is claimed is:

A relay constructed and arranged to be slow to release characterized by the provision of a core piece, a sleeve of low electrical resistance placed about said core, and a flat rectangular shaped armature having enlarged areas at the points where it closes the magnetic circuit with said core, said core and said armature being made of magnetic material having higher permeability and lower coercivity than iron.

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

DANIEL D. MILLER.