T. E. BARNUM.

ELECTROMAGNETIC SWITCH.

APPLICATION FILED JULY 5, 1906.

905,782.

Patented Dec. 1, 1908.

2 SHEETS—SHEET 1.

Fig. 1.

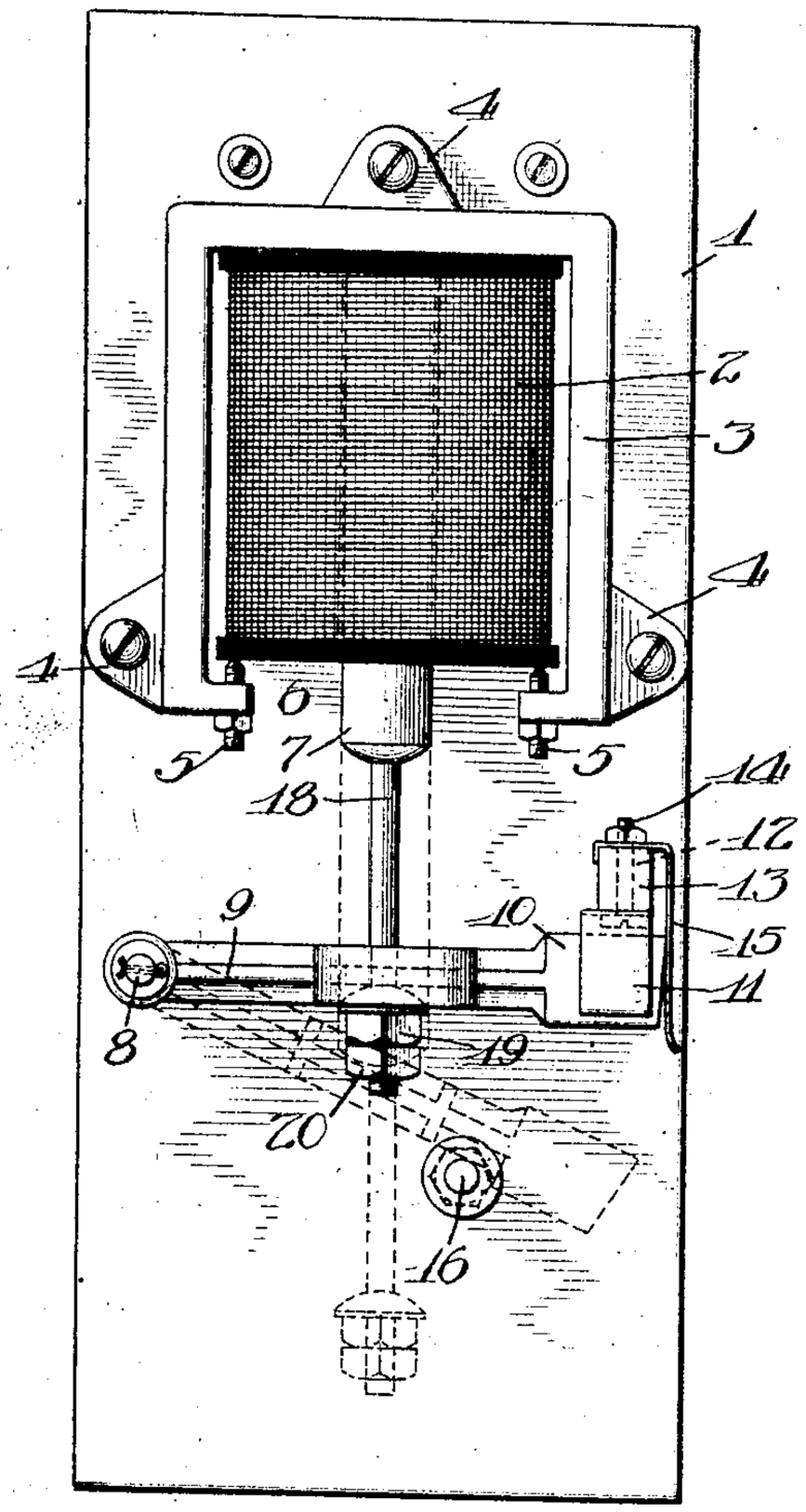


Fig. 2.

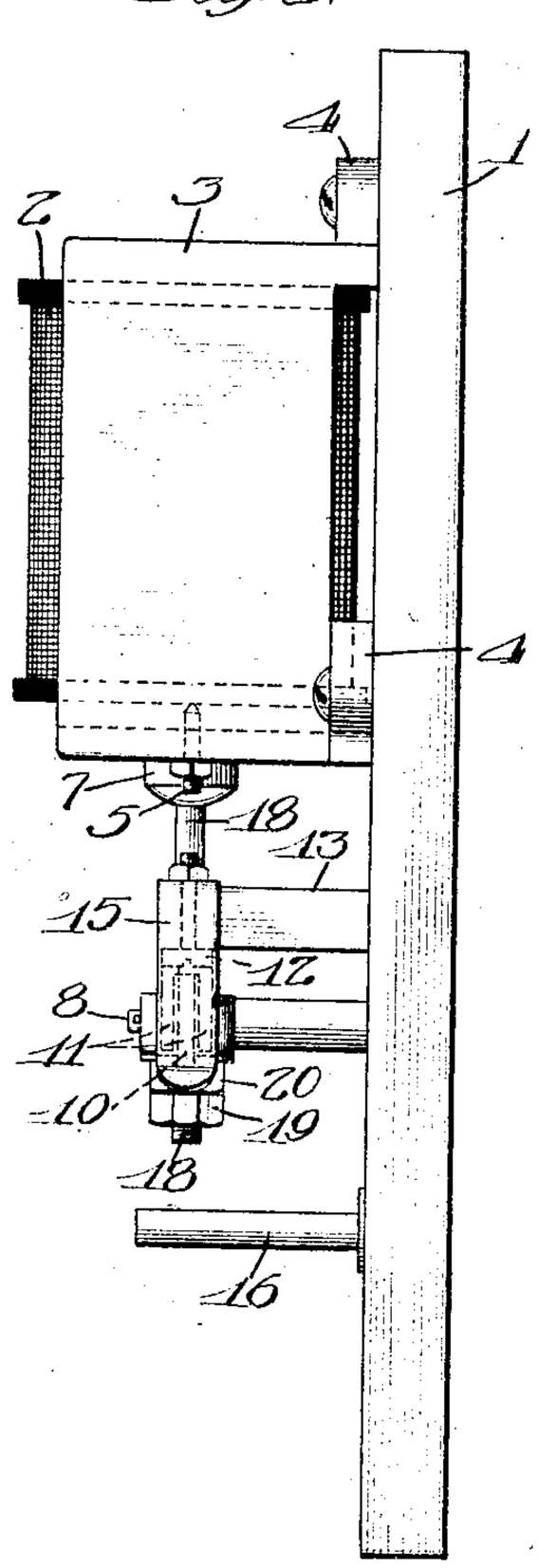
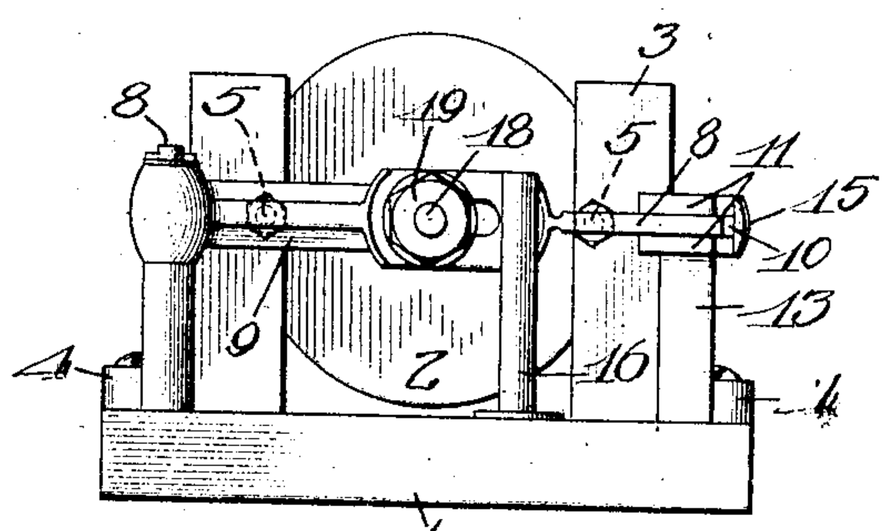


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4.

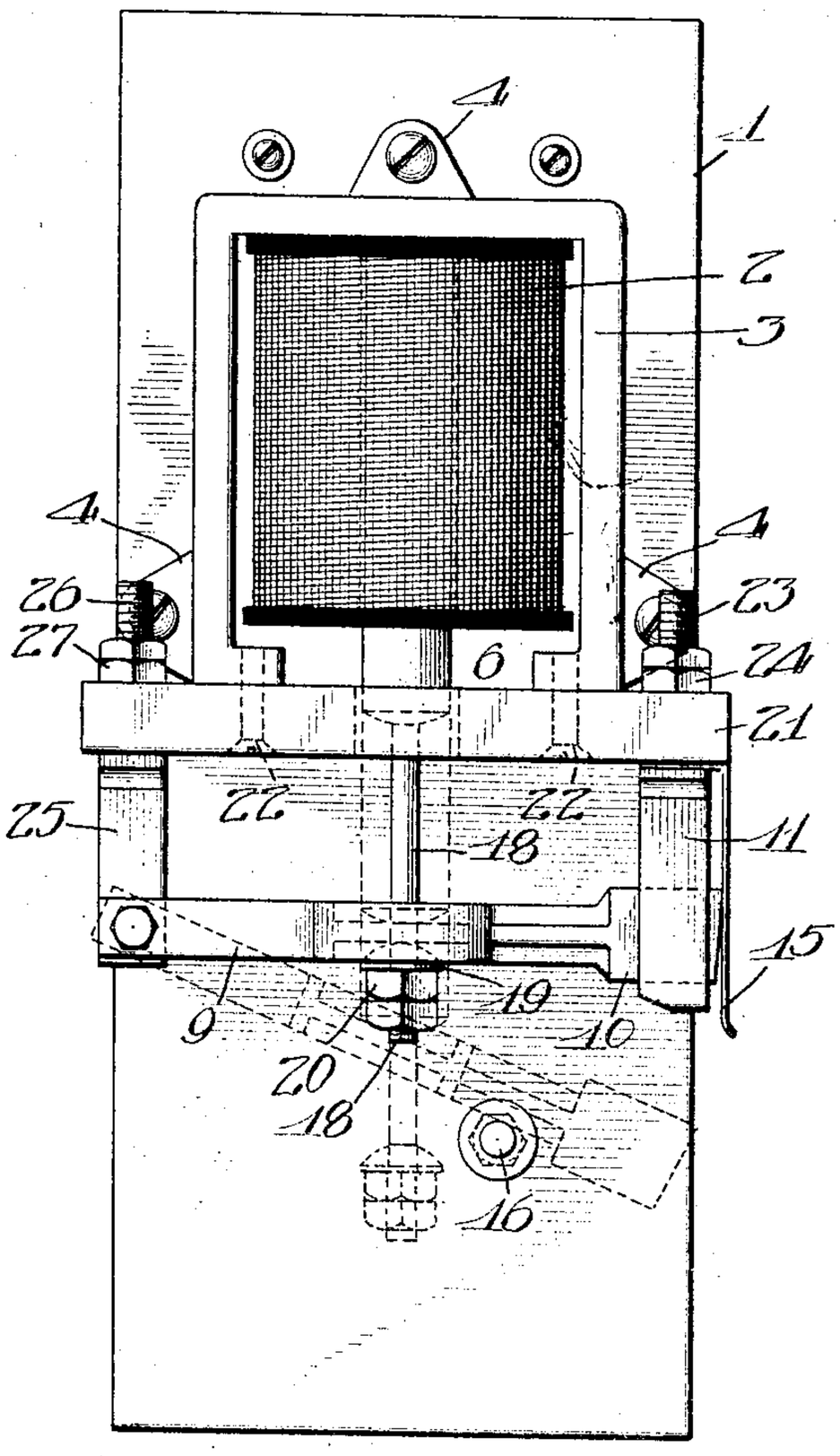


Fig. 5.

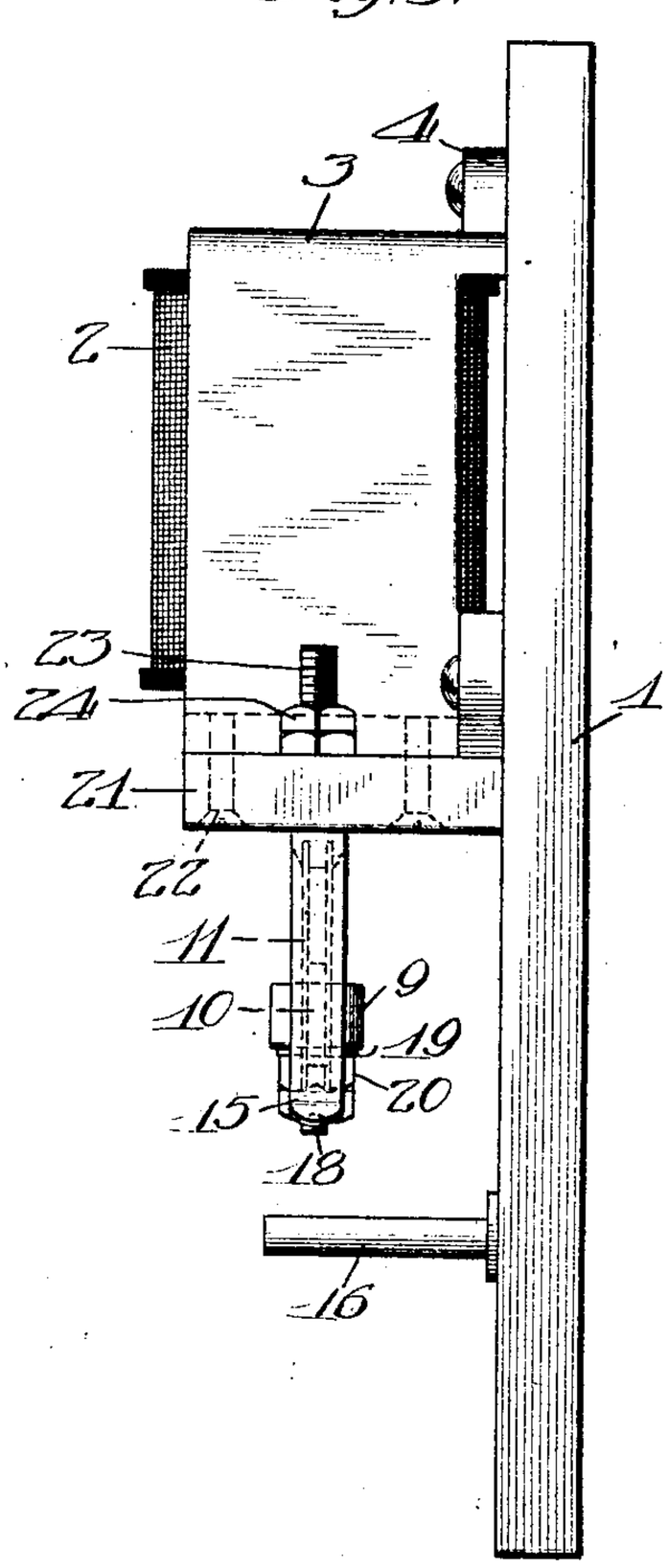
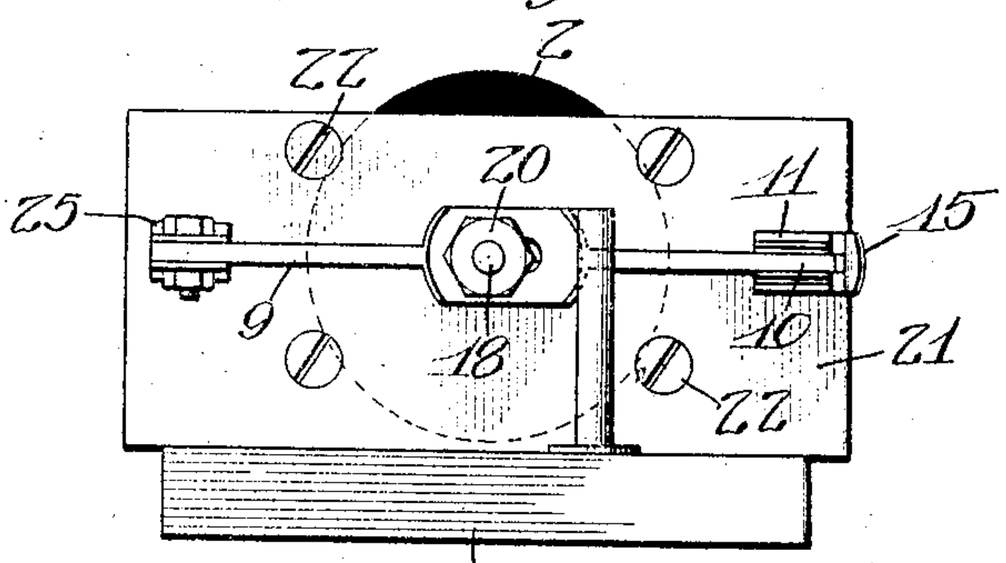


Fig. 6.



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UNITED STATES PATENT OFFICE.

THOMAS E. BARNUM, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO CUTLER-HAMMER MANUFACTURING COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

ELECTROMAGNETIC SWITCH.

No. 905,782. Specification of Letters Patent. Patented Dec. 1, 1908.

Original application filed April 15, 1905, Serial No. 255,713. Divided and this application filed July 5, 1906. Serial No. 324,812.

To all whom it may concern:

Be it known that I, THOMAS E. BARNUM, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Electromagnetic Switches, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvements in magnets for use on alternating current circuits, my object being to provide a magnet which will be simple in construction, and at the same time self-protecting from over-heating after the magnet has attracted its armature.

My invention provides a pulling magnet in which, when the current is first admitted to the windings thereof, a large amount of current will flow and, consequently, exert a strong pull on the armature, but after the armature has been attracted to the coil, the amount of current flowing through the coil is greatly reduced.

A still further object of my invention is to provide means for connecting the armature of the magnet to a switch, whereby a "hammer" blow will be given in opening and closing the switch to more readily operate the same.

I have illustrated the preferred embodiment of my invention in the accompanying drawings, in which:

Figure 1 is a front elevation of my device showing the same operating a switch; Fig. 2 is a side elevation of the same; Fig. 3 is a bottom plan view of my device; Fig. 4 is a front elevation of a modification of my device; Fig. 5 is a side elevation thereof; and Fig. 6 is a bottom view.

In one form of the practical embodiment of my invention, upon a suitable base 1, made of insulating material, usually in the form of a marble slab, is mounted a solenoid winding 2 of the usual type, which is surrounded by and supported within an iron shroud 3 having projecting lugs 4, through which screws are passed to secure the same to the base 1. Suitable screws 5 pass through the lower side of the shroud to adjustably support the coil upon the same. The shroud 3, it will be noted, is not continuous and on its underside is cut away to form the air space 6. A core or plunger 7 is adapted to operate in the coil and be raised thereby when the current is admitted to the windings of the coil.

The fixed air gap 6 between the sides of the plunger and the sides of the frame is so proportioned in relation to the variable air gap between the top of the plunger and the top of the frame, when the plunger is down, that the self-inductance of the magnet will be sufficiently small to permit enough current to flow to fully energize the magnet so as to close the switch, but not so small as to allow an excessive current to flow. The fixed air gap is also so proportioned that when the plunger is up, and consequently the variable air gap removed, the self-inductance of the magnet will be sufficiently large to prevent more than sufficient current to hold the plunger to flow, but not so large as to rob the magnet of current to the extent that the plunger will be released.

Projecting from the base 1, below the solenoid, is a pin 8, upon which is suitably pivoted a switch-arm 9 having its opposite end flattened, as at 10, and adapted, when in a closed position, to engage between the bifurcations 11 of a contact plate and be held in a closed position thereby. In order that this plate may be mounted in line with the outer end of the switch-arm, it is preferably secured by means of a screw 12 upon the outer end of a pin 13 projecting from the base. The screw 12 passes through the pin and a nut 14 upon the upper end thereof holds in position a spring 15, which extends below the lower ends of contact clips 11, so that the circuit is broken at this point last and the spring takes the arc resulting from opening the switch with the current passing. The downward movement of the switch-arm is limited by a stop 16 secured upon the base 1.

The central portion of the switch-arm is enlarged and has formed therein a slot 17, through which is adapted to pass a rod 18 secured at its upper end to the core or plunger 7. A nut 19 is screwed upon the lower end of the rod and is adapted, when the rod is raised by the core or plunger 7, to engage the switch-arm and move the same. A set-nut 20 is also provided upon the lower end of the rod to prevent the nut 19 from being displaced after it has once been adjusted.

In operation, assuming the switch to be open when the current has been admitted to the windings of the coil 2, the self-induction set up by the wires of the magnetized coil is so small, due to the gap in the magnetic circuit and to the external air gaps 6, that a large amount of current will flow through the coil and exert a strong pull upon the core to raise the same. As the nut 19 will not engage the switch-arm until after the core has been started in its upward movement, a "hammer" blow will be delivered to the switch-arm and the same will be readily raised by the core or plunger until the arm makes contact with the contact plate 11 and is engaged by the spring 15. As the core is sucked up into the coil, the air gap in the magnetic circuit will be decreased and the self-induction set up by the coils accordingly increased. When the core has reached its uppermost position, the magnet circuit is so nearly closed that the self-induction is so great that the amount of current flowing through the coil is reduced to just enough to maintain the core in the raised position. In practice, the current may be reduced to as low as one-tenth the amount which flowed when the plunger was in its lowermost position.

It will be noted that due to the fact that the switch-arm is supported in a closed position by the spring, very little current must pass through the winding of the coil, as only sufficient force must be exerted by the coil after the switch-arm is closed, to maintain its own core in a raised position.

When the switch is to be opened by cutting off the current through the coil, the plunger will be permitted to drop by its own weight and deliver a "hammer" blow upon the switch-arm, releasing the same from the retaining spring and permitting the arm to drop to its lowermost position.

In my Figs. 4 to 6, I have shown a slight modification of my device, in which an insulating plate 21 is secured at right angles to the base and maintained in position by screws 22 passing through the plate and screwing into the iron shroud 3 of the magnet. This plate forms a support for the contact 11, a bolt 23 passing through said contact and plate and held in position by nuts 24. The spring 15 is also supported and held in position by the bolt 23. A depending support 25 is also secured to said plate by a bolt 26 and nuts 27 and to the lower end of this support is pivoted the switch-arm 9.

This application is a division of my application Serial No. 255,713, filed April 15, 1905 for alternating current magnet.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. The combination with a solenoid, of a core therefor, a pivoted switch-arm, means for operatively connecting said core and said switch-arm in such manner that a hammer blow is struck upon the switch-arm when energization or deënergization of the switch takes place, a contact adapted to be engaged by the free end of said switch-arm, and a spring for engaging said free end of said switch-arm to retain the same in engagement with said contact.

2. The combination with a solenoid, of a core therefor, a pivoted switch-arm, means for operatively connecting said core and said switch-arm in such manner that a hammer blow is struck upon the switch-arm when energization or deënergization of the switch takes place, contact mechanism for engagement by said switch-arm, and spring mechanism for association with said contact mechanism and the free end of said switch-arm for retaining said switch-arm in such engagement.

3. The combination with a solenoid, of a core therefor, a pivoted switch-arm operatively connected with said core in such manner that a hammer blow is struck upon the switch-arm when energization or deënergization of the switch takes place, contact mechanism for engagement by said switch-arm, and spring mechanism for association with said contact mechanism and the free end of said switch-arm for retaining said switch-arm in such engagement.

4. The combination of a main supporting member, a switch-arm pivoted upon said supporting member and having an opening therein, a contact, carried by said supporting member, for engagement by the free end of said switch-arm, spring means associated with said contact for retaining said switch-arm in engagement with said contact, a solenoid magnet mounted upon said supporting member, a core for said solenoid magnet, a reduced extension for said core passing through the opening of said switch-arm, and means on said reduced extension for engaging said switch-arm upon energization of the magnet.

5. The combination of a main supporting member, a switch-arm pivoted upon said supporting member and having an opening therein, a contact, carried by said supporting member, for engagement by the free end of said switch-arm, spring means associated with said contact for retaining said switch-arm in engagement with said contact, an iron shroud mounted upon said supporting member, a solenoid magnet disposed within said shroud, a core for said solenoid magnet, a reduced extension for said core passing through the opening of said switch-arm, and means on said reduced extension for engaging said switch-arm upon energization of the magnet.

6. The combination of a main supporting

member, an iron shroud mounted upon said supporting member, a solenoid magnet disposed within said shroud, a core for said solenoid magnet, a switch-arm pivoted upon said supporting member having an opening therein, a reduced extension for said core extending through the opening of said switch-arm, means on said reduced extension for engaging said switch-arm upon energization and deenergization of the magnet, a contact for engagement by the free end of said switch-arm mounted upon said supporting member, and spring means associated with said contact for retaining the said switch-arm in engagement with said contact.

7. The combination of a main supporting member, two pins projecting therefrom, a switch-arm pivoted upon one of said pins and having an aperture therein, a contact for engagement by the free end of said switch-arm mounted on the second of said pins, spring means associated with said contact for retaining said switch-arm in engagement with said contact, an iron shroud mounted upon said supporting member, a solenoid magnet disposed within said shroud, a core for said solenoid magnet disposed substantially in the plane of the tops of said pins, a reduced extension for said core passing through the opening of said switch-arm, and means on said reduced extension for engaging said switch-arm upon energization and deënergization of the magnet.

8. The combination of a main supporting member, a switch-arm pivoted upon said supporting member and having an opening therein and having its free end flattened, a forked contact member for receiving the flattened end of said switch-arm, spring means associated with said contact for retaining the flattened end of said switch-arm in the forked contact member, an iron shroud mounted upon said supporting member, a solenoid magnet disposed within said shroud, a core for said solenoid magnet, a reduced extension for said core passing through the opening of said switch-arm, and means on said reduced extension for engaging said switch-arm upon energization and deënergization of the magnet.

9. The combination of a main supporting member, a switch-arm pivoted upon said supporting member and having an opening therein and having its free end flattened, a forked contact member for receiving the flattened end of said switch-arm, spring means associated with said contact for retaining the flattened end of said switch-arm in the forked contact member, an iron shroud mounted upon said supporting member, a solenoid magnet disposed within said shroud, a core for said solenoid magnet, a reduced extension for said core passing through the opening of said switch-arm, and means on said reduced extension for striking a hammer blow on said switch-arm upon energization and deënergization of the magnet.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

THOMAS E. BARNUM.

Witnesses:
OSCAR A. KELLER,
A. H. BARNICKEL.