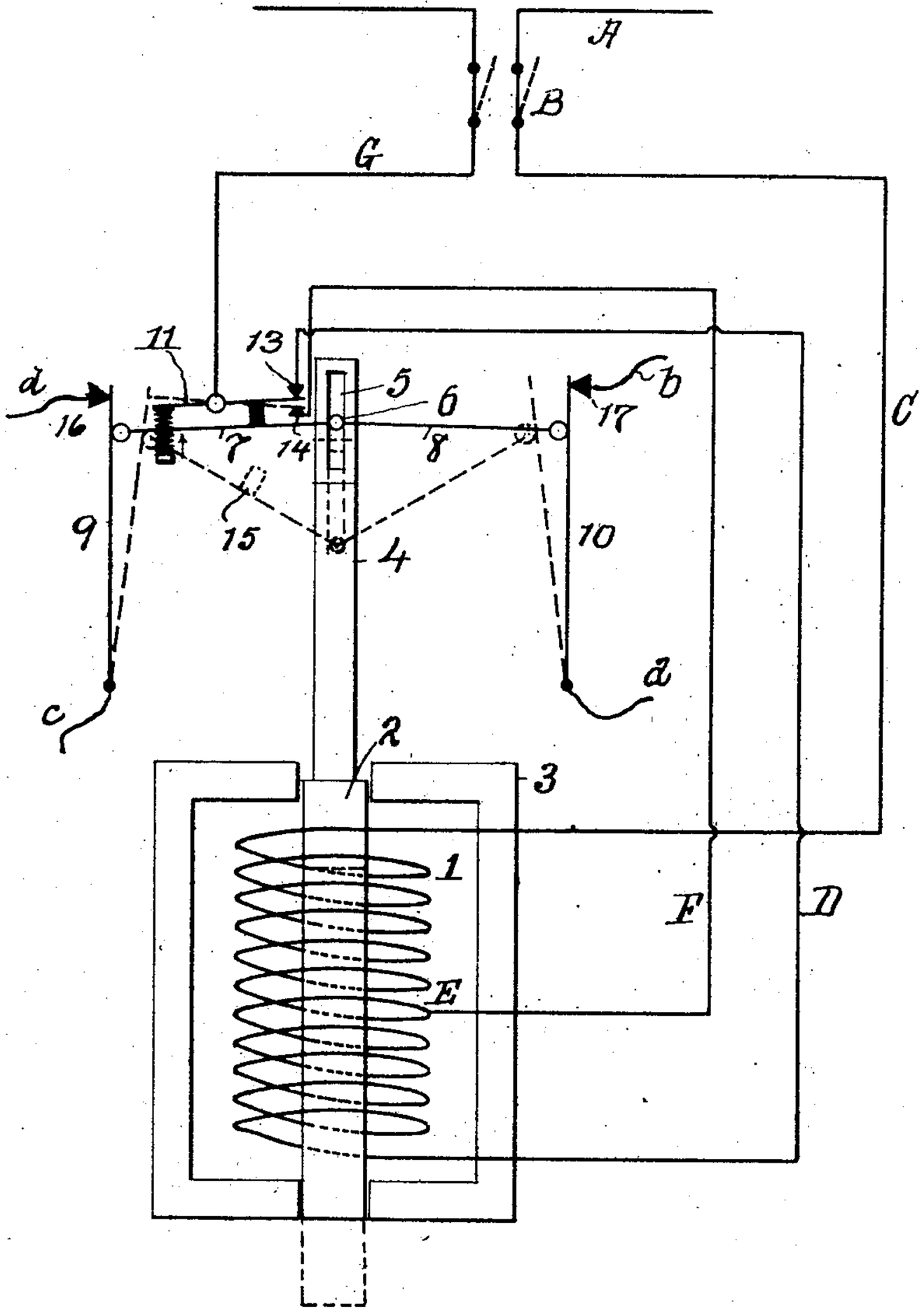
L. LARSEN.

ALTERNATING CURRENT ELECTROMAGNET.

APPLICATION FILED MAY 25, 1907.

954,745. Patented Apr. 12, 1910.



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ALTERNATING-CURRENT ELECTROMAGNET.

954,745. Specification of Letters Patent. Patented Apr. 12, 1910.

Application filed May 25, 1907. Serial No. 375,590.

To all whom it may concern:

Be it known that I, LOUIS LARSEN, a citizen of the United States residing at New York, in the county of New York and State of New York, have invented a certain new and useful Improvement in Alternating-Current Electromagnets, of which the following is a specification.

The invention relates to alternating current electro-magnets, and consists in an apparatus embodying and illustrative of the following principle.

To vary the magnetic field in the coil of the electro-magnet by a moving part controlled by said magnet, whereby the maximum magnetic density in the magnet coil is established during the movement of said part to actuate a certain device: and thereafter and during the continuance of said device in operation, said magnetic field is changed whereby said magnetic density can be reduced by a further movement of said part to a degree sufficient to maintain said part in magnetic equilibrium, and vibration of said part due to current alternations in said magnet coil is not transmitted mechanically to said operated device.

In an application for Letters Patent, Serial No. 375,591 filed simultaneously herewith by myself and Frank W. Smith, there is shown and described in detail an alternating current switch in which the freely moving core of a solenoid actuates a toggle joint to operate circuit closers and thereafter assumes a position of magnetic equilibrium; and is prevented from communicating its vibrations due to alternations in the energizing current of the coil to said circuit closers. This apparatus is here illustrated diagrammatically, and constitutes the specific instrument to which my present invention is represented as applied. None of the subject matter of said joint application is herein claimed by me.

The accompanying drawing illustrates the apparatus and circuit connections embodying my invention diagrammatically.

1 is an electromagnet, here in solenoid form. 2 is a freely movable core therein.

3 is a frame of magnetic material surrounding the magnet coil and having openings in its upper and lower members through which the core 2 passes. Extending from the end of the core is a bar 4, having near its end a slot 5, through which passes the connecting pin 6 of toggle arms 7, 8. The outer ends of the toggle arms 7, 8, are jointed to the pivoted levers 9, 10.

At 11 is a pivoted lever, the end of which is received between two fixed contacts 13, 14. Acting on the opposite end of lever 11 is a helical spring which normally tends to keep said lever against contact 14. On the toggle arm 7, is a projection 15, preferably of rubber, or other elastic material, which is adapted to strike the pivoted lever 11. In the path of movement of pivoted levers 9, 10 are fixed contacts 16, 17.

The circuits proceed as follows: from main A, through switch B, by wire C, to one terminal of solenoid 1. From the other terminal of said solenoid by wire D, to contact 13. From the solenoid at some intermediate point of its coil as E, by wire F to contact 14. From the pivot point of lever 11 by wire G through switch B to main A.

The operation of the apparatus is as follows: Switch B, being open, the solenoid 1 is deënergized, the core 2 drops to its lowest point and together with the toggle joint and associated levers assumes the position shown in dotted lines in the drawing. On the closing of switch B circuit proceeds from main A by wire G to lever 11, to contact 14, by wire F, to and through a fraction only of the coil 1, and by wire C to main A. A fraction of the solenoid coil thus being cut out the magnetic field is changed, the magnetic density in the solenoid being increased. The core is rapidly lifted, the bottom of the slot 5 meeting the toggle pin 6 and carrying it upward until it reaches a point, as shown in full lines in the drawing, a little above the horizontal line joining the points at which toggle arms 7, 8, are pivoted to levers 9, 10. Just before the core reaches the end of its upward path, the projection 15 on arm 7 strikes the lever 11 and moves it away from contact 14 and against contact 13. Meanwhile the levers 9, 10, are moved to the position shown in full lines, thus meeting contacts 16, 17, and closing circuit from terminal *a* through lever 10 to contact 17 and terminal *b*, and

from terminal *c* through lever 9 to contact 16 and terminal *d*. The toggle joint now remains in the position above described, while the core falls back into a position of magnetic equilibrium. The circuit in the apparatus is now as follows: from main A by wire C through the whole of solenoid coil 1, by wire D, to contact 13, to lever 11, and so by wire G to main A. The magnetic field in solenoid coil is thus changed, the magnetic density being decreased. By reason of the slot 5, moving freely on the pin 6, the core 2 may now vibrate under the influence of an alternating current traversing the solenoid coil 1, without transmitting its vibration to the toggle joint and circuit closing levers, and hence any chattering or other noises of levers 9, 10, against the contacts 16, 17, are prevented.

Particular attention is now called to the following points: The maximum magnetic density in the solenoid is used only while the core is raising the toggle pin to a position where afterward the toggle joint sustains itself, holding the circuits closed at 16 and 17. Then the magnetic field is changed, the magnetic density in the solenoid being reduced to only such as may be necessary to hold the core in its equilibrated position. Because the core is thus equilibrated and because it is free to move over the toggle pin without acting thereon, no vibration of the core is transmitted to the circuit closing levers 9, 10. And in any event because the magnetic density in the solenoid is reduced the vibrations of the core due to alternations in the current are diminished in amplitude below those which would be caused if said density were not so reduced. And this change in magnetic field is produced automatically by a moving part of the apparatus, namely, the core,—in the embodiment of said apparatus here shown.

It will be obvious that the application of my aforesaid principle is not confined to my present apparatus, which is one practical and operative embodiment thereof, which I have made and used successfully. For the sake of simplicity here, I have illustrated my said apparatus as operating two circuit closing devices, namely, the levers 9, 10, and contacts 16, 17, with the described terminals *a*, *b*, and *c*, *d*, but, I do not limit myself in anywise to such devices as the thing to be controlled or operated. So also for the same reason I have shown the electromagnet as a solenoid operated by single phase current, but any electrician will readily see that a coil energized by poly-phase current may be as well employed.

I claim:

1. An electro-magnet coil constructed for both voltage and cycles, a moving member actuated thereby, and means controlled by said member for varying the number of effective turns of said magnet coil.

2. An electro-magnet coil constructed for both voltage and cycles, a moving member actuated thereby, and means controlled by said member for increasing the number of effective turns of said magnet coil.

3. An electro-magnet coil constructed for both voltage and cycles, a moving member actuated thereby, and means controlled by said member for closing circuit, first, through a certain number of the turns of said coil, second, breaking said circuit, and third, closing circuit through a greater number of said turns.

4. In combination with an electro-magnet coil constructed for both voltage and cycles, a free armature movable by said coil into a position of magnetic equilibrium and means controlled by said armature for reducing the magnetic density in said coil during maintenance by said armature of said equilibrated position.

5. In combination with an electro-magnet coil constructed for both voltage and cycles, a moving member actuated thereby, a device operated by said moving member, means controlled by said member for reducing the magnetic density in said coil after said device has been set in operation and means for preventing vibration of said member due to current alternations in said coil from being transmitted to said operated device.

6. In combination with an electro-magnet coil constructed for both voltage and cycles, an armature movable by said coil into a position of magnetic equilibrium, a device operated by said armature, means actuated by said armature for reducing the magnetic density in said coil during the maintenance by said armature of said equilibrated position and means for preventing vibration of said equilibrated armature due to current alternations in said coil from reaching said operated device.

7. In combination with an electro-magnet coil constructed for both voltage and cycles, a free movable core, a device operated by said core transmitting mechanism between said core and said device, and constructed to be operated by said core on said core reaching a movable abutment in its path, said core and windings being proportioned for magnetically equilibrating said core at a point distant from said abutment after said device shall have been operated and means controlled by said core for varying the magnetic field in said magnet coil.

8. In combination with an electro-magnet coil constructed for both voltage and cycles, a movable core therein, a circuit closing device, transmitting mechanism for operating said circuit closing device by said core to

close circuit, a loose joint in said mechanism for permitting said core to be vibrated by current alternations in the magnet coil without imparting motion to said circuit closing device and means controlled by said core for varying the magnetic field in said magnet coil.

In testimony whereof I have affixed my signature in presence of two witnesses.

LOUIS LARSEN.

Witnesses:
FRANK W. SMITH,
GERTRUDE T. PORTER.