D. L. LINDQUIST.

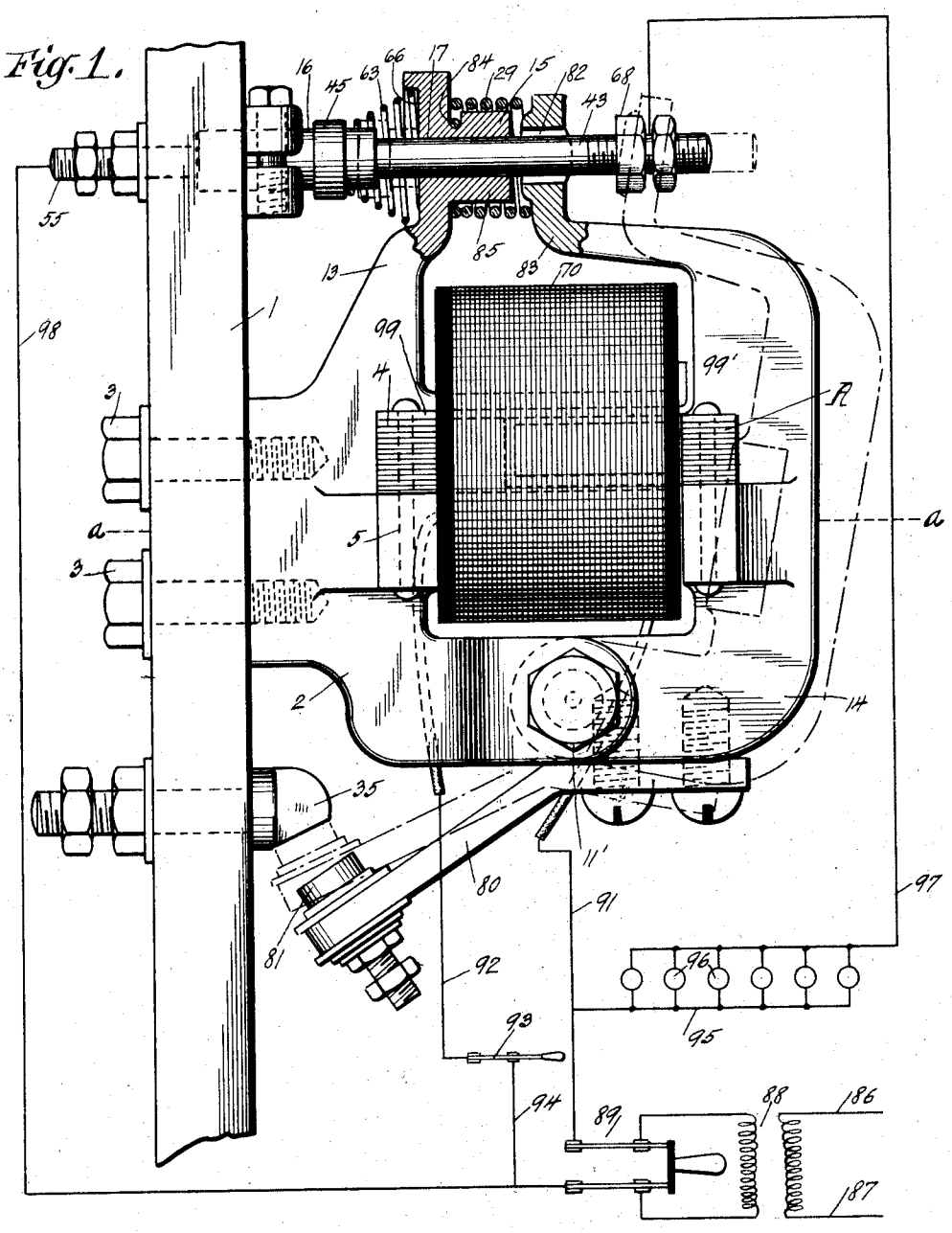
ALTERNATING CURRENT ELECTROMAGNETIC SWITCH.

APPLICATION FILED MAY 7, 1908.

981,931. Patented Jan. 17, 1911.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

St. Crocheron

James G. Bethell

INVENTOR

David L. Lindquist

BY

C. M. Nissen

ATTORNEY

D. L. LINDQUIST.

ALTERNATING CURRENT ELECTROMAGNETIC SWITCH.

APPLICATION FILED MAY 7, 1908.

981,931. **Patented Jan. 17, 1911.**

2 SHEETS—SHEET 2.

Fig. 2.

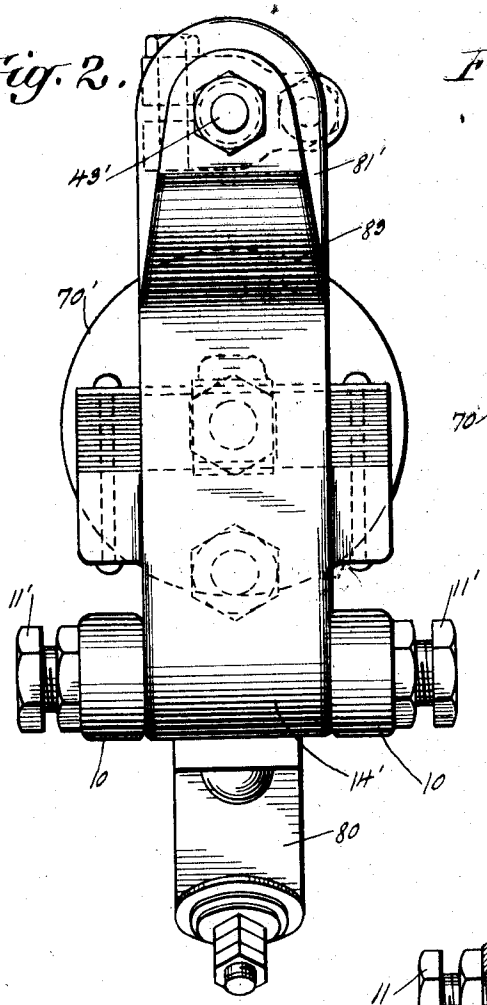


Fig. 3

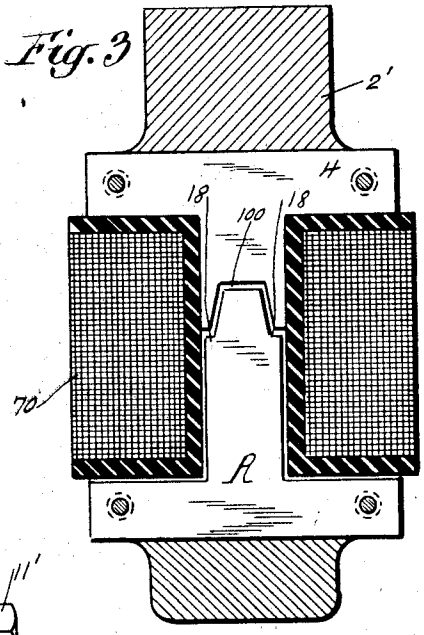
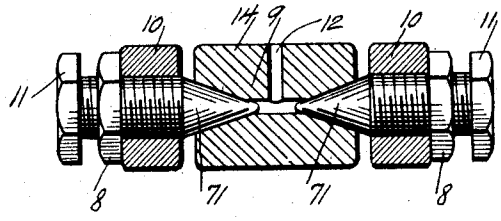


Fig. 4.



WITNESSES

St. L. Crocker

James G. Bethell

INVENTOR

David L. Lindquist

BY

C. M. Nissen

ATTORNEY

UNITED STATES PATENT OFFICE.

DAVID L. LINDQUIST, OF YONKERS, NEW YORK, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

ALTERNATING-CURRENT ELECTROMAGNETIC SWITCH.

981,931. Specification of Letters Patent. Patented Jan. 17, 1911.

Application filed May 7, 1908. Serial No. 431,502.

To all whom it may concern:

Be it known that I, DAVID L. LINDQUIST, a subject of the King of Sweden, residing at Yonkers, in the county of Westchester and State of New York, have invented a new and useful Improvement in Alternating-Current Electromagnetic Switches, of which the following is a specification.

My invention relates to electromagnetic switches or circuit-closers particularly adapted for use in connection with alternating or intermittent currents.

One of the objects of the invention is the provision of a compact construction in which the chattering due to a pulsating current is greatly minimized.

More particularly it is the object of the present invention to bring into proximity to each other the resilient device for absorbing vibrations of the armature and the spring for closing the switch independently of any part connected to the armature.

Other objects of my invention will appear hereinafter, the novel combinations of elements being set forth in the appended claims.

In the accompanying drawings, Figure 1 is a side elevation of my improved construction; Fig. 2 is a front elevation thereof; Fig. 3 is a horizontal plan sectional view on the line *a a* of Fig. 1; and Fig. 4 is a detail view of the conical bearings for the armature lever

The various parts of the electromagnetic switch are mounted on a board or base 1 of insulating material, preferably slate. A bracket 2 which also constitutes a frame of the electromagnet in this instance, is secured to the base 1 by means of bolts 3. To the intermediate portion of this frame are rigidly connected laminations 4 in any suitable manner, as by means of a plate 99 and rods 5. The plate 99 has an extension 99′ bent substantially at right angles thereto, to prevent the solenoid 70 from slipping out of position after it has once been placed as shown in the drawings. The armature lever 14 which is pivoted to the lower portion of the frame 2 carries at its intermediate portion a laminated armature A which projects into the solenoid 70 as indicated in Fig. 3. The space within the solenoid is sufficient to permit free play of this armature. It should be noted that by reason of the projection 99′ and the armature A the solenoid 70 cannot be removed at all so long as the armature lever is connected to the magnet frame, although the solenoid is only loosely held in position. When the armature A is removed, however, then the solenoid may be easily tipped up and removed from the projection 99′ and another solenoid substituted if desired.

As indicated in Figs. 2 and 4, the lower portion of the frame 2 is bifurcated so as to be provided with symmetrical arms or supports 10, 10 for the conical bearings 71, 71. These bearings are in the form of bolts and their positions may be adjusted by turning the heads 11 and then clamping them in position by means of the nuts 8, 8. The inner ends of these bolts are conical, as shown, and fit into corresponding recesses in the sides of the lower end of the armature lever 14. A channel 9 connects these recesses and an additional channel 12 permits lubricating material to be inserted for application to these bearings.

Rigid with the frame 2, and in this instance integral therewith, is an upwardly projecting arm 13 which is provided with a circular recess 66 at the side toward the board 1, and with a cylindrical projection 15 on its front side. One end of a strong, comparatively unyielding spring 29 is wedged tightly in the recess 84 in the projection 15, as shown in Fig. 1. This strong spring is preferably made of steel, and projects forwardly a sufficient distance so as to act as a resilient abutment for the upper end 83 of the armature lever 14. This resilient abutment 29 is so arranged that when the arm 83 engages the same, the inner end of the armature A will enter the recess 100 of the laminations 4, but will not come in contact therewith. This is indicated in Fig. 3.

Connected rigidly to the board 1 is a conducting contact 16. A stem 43 passes through an opening 17 in the upper end of the arm 13. This opening is substantially perpendicular to the board 1. The inner end of the stem 43 carries a contact 45 which is pressed by the spring 63 into engagement with the contact 16 when the magnet is energized, but occupies the dotted line position when the magnet is deënergized. Although the stem 43 fits snugly in the opening 17, it does not come into contact with any portion of the arm 83 when the magnet is energized and the switch comprising the

contacts 16 and 45 is closed. When the magnet is deënergized, however, the weight of the armature lever 14 will swing the arm 83 to its dotted line position against the adjustable nuts 68, sufficient clearance 82 around the stem 43 being provided to prevent binding. It should be noted that the spring 63 is conically arranged so that it may be pressed flat or nearly so in the recess 66. This permits the magnet to be placed closer to the board 1 than ordinarily.

The lower end of the armature lever 14 carries an extension 80 provided with an adjustable buffer 81 which is arranged to come into engagement with the stop 35 to limit the outward movement of the armature lever to its dotted line position.

In order to illustrate in a simple manner the operation of the magnet and switch, I have shown conductors 86, 87 which may be connected between the transformer 88 and a suitable source of alternating current supply; also a main line switch 89, and auxiliary switch 93, incandescent lamps 96, and the conductors as indicated. If the switch 93 is open the solenoid 70 cannot receive current, and even when the switch 89 is closed the translating devices 96 cannot receive current, for the reason that the switch comprising the contacts 45 and 16 is held open by the arm 83 pressing against the nuts 68 and holding the contact 45 away from the contact 16, or in its dotted line position. When, however, the switch 93 is closed, a circuit through the solenoid including the conductors 91, 92 and 94 will at once be completed. The solenoid will therefore energize its core and the armature and the arm 83 will be drawn up against the stiff spring 29 which, as before stated, absorbs the vibrations of the armature and armature lever to minimize humming and chattering noises, and also prevents the armature from coming into contact with any portion of the inner fixed pole of the magnet. When the stem 43 is thus released the spring 63 at once moves the contact 45 against the contact 16 and holds it there independently of any moving part of the arm 83. A circuit may then be traced through the conductor 95, translating devices 96, conductor 97, stem 43, contacts 45, 16, binding post 55, conductor 98 to the other side of the mains.

The armature A is designed to have an approximately uniform pull exerted thereon by the electromagnet throughout its range of movement. To accomplish this result, the inner end of the armature is made a peculiar shape, such that the central portion moves into a corresponding recess in the inner pole, while flat portions 18, 18 are brought into proximity to the flat ends of said pole when the armature is in its attracted position, as shown in Fig. 3. Even when the armature is in its dotted line position, the air gap is very small and changes but little during the motion to attracted position. A wider range of movement of the armature is therefore obtained, while at the same time the magnetic flux and the resulting self-induction are at their maximum while the current through the solenoid is reduced to a minimum.

It should be noted that the laminations 4 and those of the armature A are arranged horizontally so that after the parts have been put in proper position to secure symmetry between the recess 100 and the inner end of the armature, the armature may be magnetically balanced with respect to the pole by means of the adjustable conical bearings. Due to irregularity of the recess and the inner end of the armature, the magnetic pull is not exactly equal on both sides, and therefore there is a tendency for vibrations and humming noises to be produced. By loosening the nuts 8, 8, however, and turning the heads 11, 11 in the same direction, the lever 14 may be moved to one side or the other so as to adjust the position of the armature A where the humming is greatly reduced. This arrangement of the laminations in a horizontal position to enable the use of the conical bearings to secure magnetic balance is not my invention.

It should be noted that I have arranged the entire magnetic switch on one side of the board where the parts are readily accessible. It will also be apparent that by employing a single arm 13 for supporting the heavy spring 29 and the actuating spring 63 and the movable contact and its stem 43, I have greatly simplified the construction of electromagnetic switches of the character referred to, in that the necessary material has been reduced by the elimination of parts and bringing the remaining parts into a compact arrangement.

Having thus described my invention, what I claim and desire to have protected by Letters Patent of the United States is:—

1. The combination with an electromagnet, of an armature, an armature lever, an electric switch comprising a movable member, an actuating device connected to said movable member and having a straight line movement, said actuating device being engaged by the armature lever to open the switch when the magnet is deënergized, and means for closing said switch independently of said lever when the latter releases said actuating device.

2. The combination with an electromagnet, of an armature, an armature lever, a resilient device for absorbing the vibrations of the armature lever, an electric switch comprising a movable contact, a stem carrying said movable contact and having a straight line movement, a device carried by

said stem to be engaged by said lever to open the switch when the magnet is deënergized, and a spring for closing the switch independently of said lever when the latter releases said stem.

3. The combination with an electromagnet, of an armature, an armature lever, a rigid support, a buffer spring for the lever and carried by said support, an electric switch comprising a movable contact, a stem carrying said movable contact and slidable through said support, said buffer spring being positioned to form a stop for the said lever while the switch is closed, and a spring between said support and said movable contact.

4. The combination with an electromagnet, of an armature, an armature lever, a strong buffer spring for said lever, a rigid support for said spring, an electric switch comprising a movable contact, a stem carrying said contact and slidable through said support and said buffer spring, and an actuating spring between said support and said movable contact.

5. The combination with an electric switch, of means for opening said switch, a strong spring acting as a resilient abutment for said means while the switch is closed, a spring for closing the switch when released by said means, and a single support for both of said springs.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

DAVID L. LINDQUIST.

Witnesses:
CHAS. M. NISSEN,
JAMES D. IVERS.