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D. LARSON.

ALTERNATING CURRENT MAGNETIC APPARATUS.

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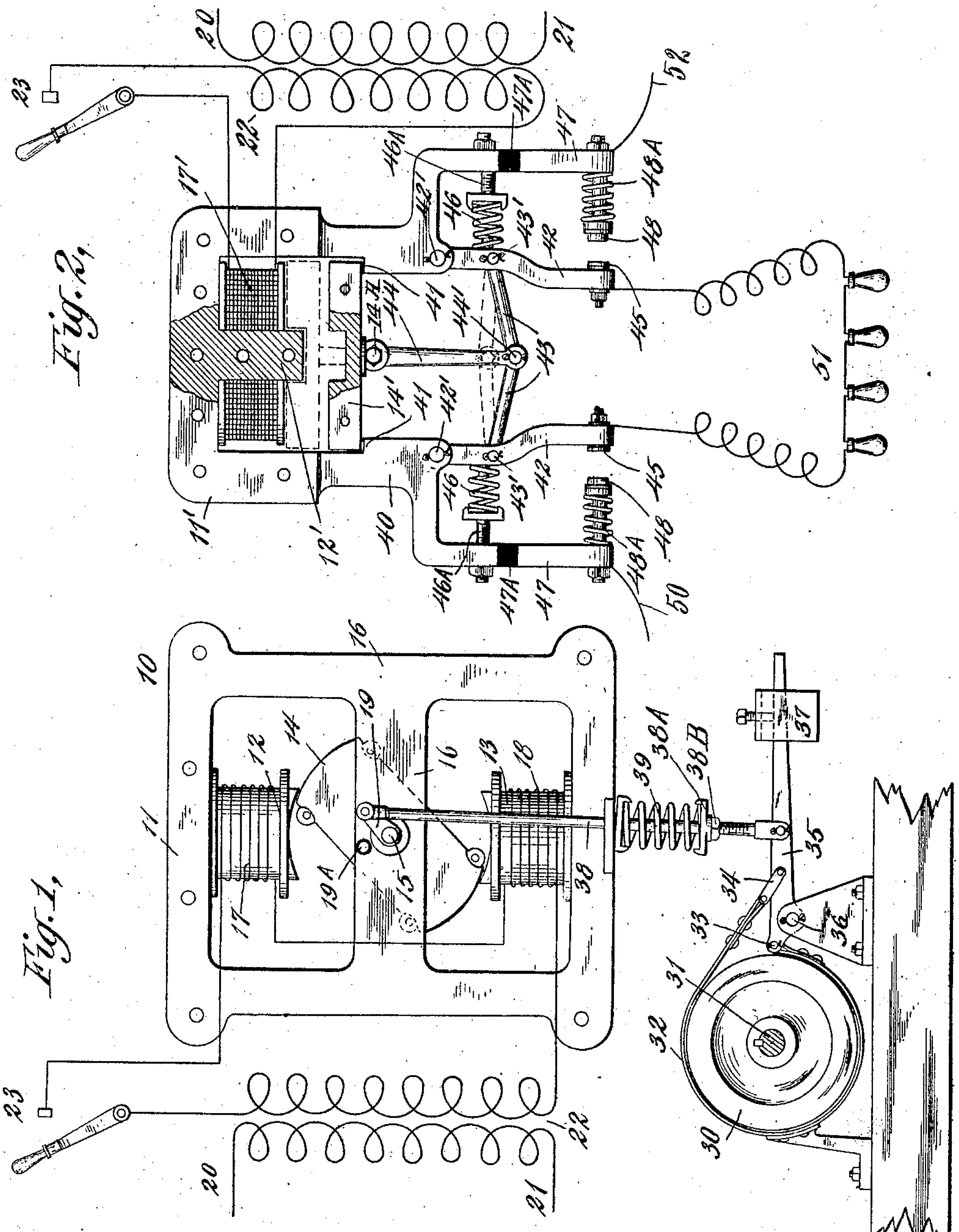

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ALTERNATING-CURRENT MAGNETIC APPARATUS.

No. 837,854. Specification of Letters Patent. Patented Dec. 4, 1906.

Application filed November 22, 1905. Serial No. 288,511.

To all whom it may concern:

Be it known that I, David Larson, a subject of the King of Sweden, and a resident of the city of Yonkers, Westchester county, New York State, have invented certain new and useful Improvements in Alternating-Current Magnetic Apparatus, of which the following is a specification.

My invention relates to electromagnetic apparatus for use in conjunction with alternating intermittent or pulsating currents; and its object is to provide simple and efficient apparatus of this kind which will be free from the chattering noise which is usually found in alternating-current apparatus and which will have other advantages which will be pointed out hereinafter.

I will now describe my invention in the following specification and point out the novel features thereof in claims.

Referring to the drawings, Figure 1 represents in side elevation an electromagnetic apparatus constructed according to my invention and connected to actuate a brake. Fig. 2 represents in side elevation, partly in section, a modification of my invention, connected in this case to operate a circuit-closer.

Like characters of reference represent corresponding parts in both figures.

10 designates an electromagnet which comprises a frame 11, preferably constructed of laminated magnetic material. This frame has two pole-pieces 12 and 13, between which a rotatable armature 14 is placed. This armature is pivoted at 15 to a bracket 16, which is a part of a frame which supports the magnet-frame 11. This armature 14 is also preferably constructed of laminated magnetic material. Upon pole-piece 12 is a winding 17, and upon pole-piece 13 is a winding 18.

20 and 21 designate mains from a suitable source of electrical supply which, after passing through a transformer 22, may be connected to the windings 17 and 18 or disconnected from these windings by a manually-operated circuit-closer 23.

30 designates a brake-pulley rigidly mounted upon a shaft 31 and partially surrounded by a brake-strap 32. This brake-strap may be connected, as shown at 33 and 34, to a brake-lever 35, which is pivoted at 36 between the points 33 and 34. An adjustable weight 37 may be provided upon the brake-lever 35. Brake-lever 35 may be connected to a short crank-arm 19, which is rigidly attached to the pivot 15 of armature 14, and the lever is arranged to move with the armature 14 by means of a connecting-rod 38. A spring 39 may also be provided for the purpose of coöperating with weight 37 in applying the brake-strap 32 to the brake-pulley 30. This spring 39 bears upon the lower part of magnet-frame 11 and upon a collar 38^A, which is mounted upon connecting-rod 38 and the position of which may be adjusted by means of a nut 38^B to adjust the pressure of spring 39 upon brake-lever 35. A stop-piece 19^A may be provided upon bracket 16 of the electromagnet to stop the movement of the short arm 19 in one direction.

In Fig. 2 the frame 11′ of the electromagnet is made in a different form, as is also its armature 14′. In this case the magnet-frame is substantially of the form of the letter **E** with the three projecting portions forming magnetic poles. Upon the center of these projecting portions 12′ a winding 17′ is provided. The armature 14′ in this case is arranged to have a vertical movement. When the magnet is not energized, this armature 14′ is arranged to rest upon two projections 41 41, which are integral portions of a metallic frame 40, which may be arranged to hold the magnetic frame 11 together and also to support the various other parts of the apparatus, which I will now describe. Levers 42 42, which are pivoted at 42′ 42′, are connected together by two connecting-levers 43, which are pivotally attached to levers 42 42 at 43′ 43′ and which are pivotally connected together and to a connecting-rod 44 at 44′. This connecting-rod is connected at 14^A to the armature 14′. The lower ends of levers 42 42 carry upon them insulated contacts 45 45. Springs 46 46 may be arranged to bear against the pivoted arms or levers 42 42, and their tension may be adjusted by means of adjustable stops 46^A 46^A, which are screwed into a portion of the frame 40. The lower ends 47 47 of frame 40 are insulated from the rest of the frame, as shown at 47^A 47^A and arranged to carry contacts 48 48. These contacts may be rigidly connected to the portions 47 47; but I prefer to provide springs 48^A 48^A between the contacts and their supports, so that the contacts may have a resilient support.

Referring now to Fig. 1, I will describe the operation of this device: When the magnet is not energized, the various parts are in the relative positions in which they are shown in the drawings, with the weight 37 and spring 39 through their connected mechanism applying the brake-strap 32 to the brake-pulley 30. It may be seen that when the parts are in this position the mechanical work, which is accomplished by weight 37 and spring 39 and which is controlled by electromagnet 10, is at a maximum degree of effectiveness. Now when the circuit-closer 23 is closed the magnet-windings 17 and 18 will receive a current from the lines 20 and 21 and will thereby become energized. This will set up magnet-lines in the magnet-frame 11. The pivoted armature 14 is now in such position as to be within the field of attraction of the magnetic lines which flow between the pole-pieces 12 and 13 and will be attracted thereby. This will cause it to rotate in such direction as to include as many of the magnetic lines as possible and in so doing it will move the crank-arm 19 to the left and through connecting-rod 38 will compress spring 39 and raise brake-lever 35 and weight 37. This releases the brake-strap 32 from the brake-pulley 30. It is desirable to stop the movement of the crank-arm 19 before it reaches a vertical position, so that when the magnet is deënergized the load upon the arm causes it to return to its original position and for this purpose the stop 19^A is provided. It may be seen that during this operation above described the pivoted armature 14 will be moved into a state of magnetic equilibrium and will come to rest at a point where the magnetic attraction and mechanical forces, which act upon this magnet 14, balance each other. The magnetic pull will gradually decrease as magnet 14 comes to the state of equilibrium, and with the parts arranged as described the mechanical pull upon connecting-rod 38, which is connected to magnet 14 in the manner described, will also decrease during this movement of magnet 14. Another effect of this arrangement is that as armature 14 moves into a vertical position between poles 12 and 13 and includes more and more of the magnetic lines it will short-circuit these magnetic lines and have a choking effect upon the current passing through windings 17 and 18. This, of course, will reduce the current in these windings after they have done their work, and with the parts as arranged the load upon the armature will itself be decreased at the same time. This will allow armature 14 to more completely short-circuit the magnetic lines and to come to a state of equilibrium between the poles 12 and 13 in nearly the same position that it would take if it were not arranged to do any outside mechanical work. The effect of this is to decrease any possibility of noise in the various parts and to increase the efficiency of the apparatus as a whole. The magnet's load during the operation becomes shifted off from the armature 14 and onto the mechanical supports previously described. The load itself then will have a tendency to hold the various parts from vibrating. If the mechanical pull were still upon magnet 14 after it had reached its state of magnetic balance, as it is in other apparatus of this character, it would tend to increase the vibrations of the parts due to current fluctuations in the magnet. When the circuit-closer 23 is opened and current is thereby cut off from the windings 17 and 18, the various parts will return to the positions in which they are shown in the drawings, and the brake-strap 32 will again be applied to brake-pulley 30 with a maximum pressure.

The operation of the device shown in Fig. 2 is similar. When circuit-closer 23 is closed, so that a current passes through winding 17′ and energizes magnet-frame 11′, the armature 14′ will be attracted thereby and will move vertically upward until it reaches a state of magnetic equilibrium. The effect of this upward movement will be to move the levers 43 44 and their connected levers 42 42 into the positions shown by dotted lines. These levers form a toggle, and it may be seen that the effect of the load, which in this case is the weight of armature 14′, and the pressure of springs 46 46 will be decreased during this movement, for as soon as the point 44′ has been raised above the level of pivots 43′ 43′ the springs 46 46 assist in supporting the weight of armature 14′. The magnet-armature when in its raised position is preferably arranged to come to a state of equilibrium without being in contact with any of the parts, so that all chattering noise due to current alternations is obviated. The levers 42 42 may be connected to move any desired mechanism—for example, to close contacts 45 45 against contacts 48 48, and to thereby close a circuit from the conductor 50 through a circuit 51 and to a conductor 52. The pressure of springs 46 46 should be so adjusted that when circuit-closer 23 is opened the weight of armature 14 will be sufficient to compress these springs and allow the parts to resume their original positions. In this arrangement, as in the one previously described, the armature when it comes to a state of equilibrium will be in position to short-circuit the magnetic lines in magnet-frame 11′, and will therefore cut down the current consumption in winding 17′. As has already been seen, the mechanical load upon armature 14′ in this case is not only released from the armature 14′, but is so shifted as to support the armature 14′ through the toggle-joint arrangement of the levers.

I have shown that this invention is applicable to several forms of apparatus; but it is by no means limited to those herein described.

It is believed that the combination herein shown for gradually reducing the load which is moved or carried by an electromagnetic armature, which is attracted by magnetic lines into a state of equilibrium, where the magnetic effect will be such that when the armature has reached such a condition the load will have been removed from it, is new. The mechanical connections herein shown and described are such that when the magnet is deënergized and the parts are returned to their original position the effective load which the magnet controls will again be increased to its maximum.

This invention not only accomplishes the above results, but also increases the efficiency of alternating-current magnets and does away with the chattering noises usually found in apparatus of this kind.

What I claim is—

1. A source of alternating-current supply, a winding energized thereby, a movable body of laminated inductive material, a load upon said movable body, means dependent upon the current in the winding for magnetically attracting and balancing the body, and means for reducing the load upon said body as the body is moved.

2. A source of alternating-current supply, a winding energized thereby, an armature of laminated magnetic material pivoted in the field of said winding and rotatable thereby to a position of magnetic equilibrium, a load connected to said armature and means for reducing the load as the armature is rotated.

3. A source of alternating-current supply, two windings energized thereby, an armature pivoted between said windings and rotatable on the pivot to a position of magnetic equilibrium between said windings, a load for the armature, and intermediate mechanism connecting the load and the armature and arranged to reduce the effect of the load upon the armature as the armature is rotated.

4. An alternating-current magnet, an armature of laminated magnetic material therefor, a load for the armature, said armature being arranged to be brought into a state of magnetic equilibrium between the pull of the magnet and the load and means for reducing the effect of the load upon the armature as the armature is brought into the state of equilibrium.

5. An alternating-current magnet, a pivoted movable armature of laminated magnetic material therefor, a spring arranged to act upon the armature, said armature arranged to be brought into a state of magnetic equilibrium between the pull of the magnet and the action of the spring, and means for reducing the effect of the spring on the armature as the armature is moved.

6. An alternating-current magnet, an armature of laminated magnetic material arranged to be moved into a state of magnetic equilibrium thereby, means for mechanically opposing the pull of the magnet, said means being arranged to have less opposition effect to the pull of the magnet after the armature has been moved by the magnet.

7. An alternating-current magnet, an armature of laminated magnetic material arranged to be moved into a state of magnetic equilibrium thereby, means for mechanically opposing the pull of the magnet, said means being arranged to have its opposition effect to the pull of the magnet reduced from a maximum to a minimum during the movement of the armature.

8. An alternating-current magnet, an armature of laminated magnetic material arranged to be moved into a state of magnetic equilibrium thereby, a load connected to and carried by the armature, and means for reducing said load so that but part of it is carried by the armature after the armature has been moved by the magnet.

9. An alternating-current magnet, an armature of laminated magnetic material arranged to be moved into a state of magnetic equilibrium thereby, a load connected to and carried by the armature, and means for reducing said load from a maximum to a minimum as the armature is moved by the magnet.

10. An alternating-current magnet, an armature arranged to be moved into a state of magnetic equilibrium thereby, a load for the armature, intermediate mechanism connecting the load to the armature and arranged to diminish the effect of the load upon the armature as the armature is moved by the magnet.

11. An alternating-current magnet, an armature arranged to be moved into a state of magnetic equilibrium thereby, a load for the armature, intermediate mechanism connecting the load to the armature, and arranged to gradually diminish the effect of the load upon the armature as the armature is moved.

12. An alternating-current magnet, a pivoted armature of laminated magnetic material arranged to be moved into a state of magnetic equilibrium thereby, an adjustable load for the armature, connections upon the load and the armature arranged to diminish the effect of the load upon the armature as the armature is moved by the magnet.

13. An alternating-current magnet, a pivoted armature arranged to be moved into a state of magnetic equilibrium thereby, a load

for the armature, a crank-arm and a connecting-rod arranged to connect the load to the armature, said crank-arm and connecting-rod being arranged to diminish the effect of the load upon the armature as the armature is moved by the magnet.

14. An alternating-current magnet constructed of laminated magnetic material, an armature arranged to be moved thereby into a state of magnetic equilibrium, said armature constructed of laminated magnetic material, a load for the armature, intermediate mechanism connecting the load to the armature and arranged to diminish the effect of the load upon the armature as the armature is moved by the magnet.

15. An alternating-current magnet, frames for said magnet, a laminated core between said frames having two pole-pieces, windings on said pole-pieces, an armature between said pole-pieces, a pivot for the armature supported by said frames, a load for the armature, intermediate mechanism connecting the load to the armature, said core being arranged to rotate the armature into a state of magnetic equilibrium, and said intermediate mechanism being arranged to diminish the effect of the load upon the armature when the armature is rotated.

16. An alternating-current magnet, a winding therefor, a source of single-phase alternating-current supply, means for connecting said winding to the source of supply, an armature of laminated magnetic material arranged to be moved into a state of equilibrium by the magnet and means for mechanically opposing the pull of the magnet, said means being arranged to have less opposition effect to the pull of the magnet after the armature has been moved by the magnet.

17. An alternating-current magnet, a winding therefor, a source of single-phase alternating-current supply, means for connecting and disconnecting said winding to and from the source of supply, an armature of laminated magnetic material arranged to be moved by the magnet into a state of magnetic equilibrium, an adjustable load for the armature, intermediate mechanism connecting the load to the armature and arranged to diminish the effect of the load upon the armature as the armature is moved by the magnet.

18. An alternating-current magnet constructed of laminated magnetic material, a winding therefor, a source of single-phase alternating-current supply, means for connecting and disconnecting said winding to and from said source of supply, an armature arranged to be moved by the magnet into a state of magnetic equilibrium, said armature being constructed of laminated magnetic material, an adjustable spring arranged to resist the pull of the armature, intermediate mechanism connecting the spring to the armature and arranged to diminish the effect of the spring upon the armature as the armature is moved by the magnet.

19. An alternating-current magnet constructed of laminated magnetic material, a winding therefor, a source of single-phase alternating-current supply, means for connecting and disconnecting said winding to and from said source of supply, an armature arranged to be moved by the magnet into a state of magnetic equilibrium, said armature being constructed of laminated magnetic material, an adjustable spring arranged to resist the pull of the armature, and intermediate mechanism connecting the spring to the armature and arranged to diminish the effect of the spring upon the armature as the armature is moved by the magnet, said armature being arranged to reduce the current in the winding after it has been moved by the magnet.

20. An alternating-current magnet, an armature of laminated magnetic material arranged to be moved into a state of magnetic equilibrium thereby, a load connected to and carried by the armature, and means for reducing said load so that but part of it is carried by the armature after the armature has been moved by the magnet, and for increasing the load to a maximum after the armature has been released by the magnet.

21. An alternating-current magnet, an armature arranged to be moved into a state of magnetic equilibrium thereby, a load for the armature, a crank-arm and connecting-rod connecting the load to the armature, said crank-arm and connecting-rod being arranged to reduce said load so that but part of it is carried by the armature after the armature has been moved by the magnet, and a stop for limiting the movement of the crank-arm.

22. An alternating-current magnet constructed of laminated magnetic material, an armature arranged to be moved into a state of magnetic equilibrium thereby, said armature also constructed of laminated magnetic material, a winding for the magnet, a current-supply for the winding, an adjustable spring connected to and opposing the movement of the armature, and means for reducing the opposing effect of the spring through the movement of the armature after the armature has been moved by the magnet.

23. An alternating-current magnet constructed of laminated magnetic material, an armature arranged to be moved into a state of magnetic equilibrium thereby, said armature also constructed of laminated magnetic material, a winding for the magnet, a current-supply for the winding, an adjustable spring connected to and opposing the movement of the armature, means for reducing the oppos-

ing effect of the spring through the movement of the armature after the armature has been moved by the magnet, said magnet and armature being arranged to automatically reduce the current in the winding when their relative position is changed by the movement of the armature.

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

DAVID LARSON.

Witnesses:

ALFRED C. BECHET,
ERNEST W. MARSHALL.