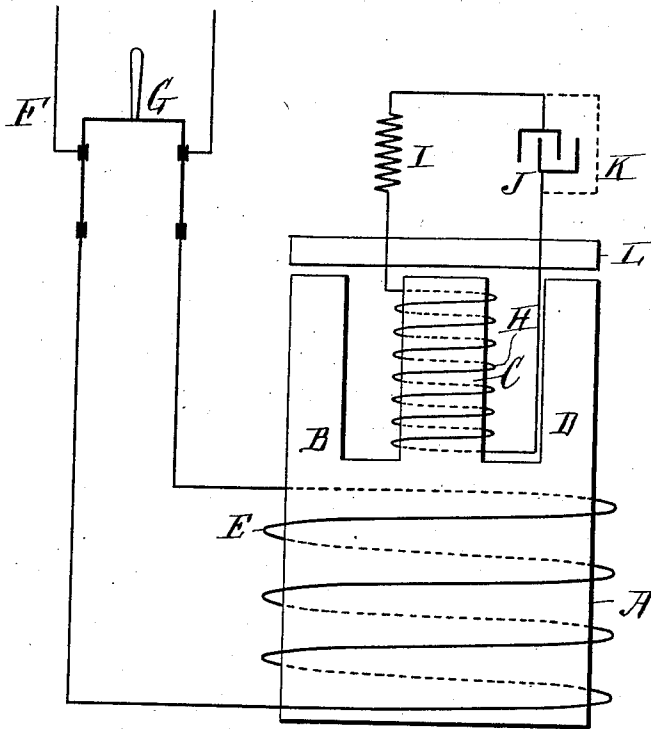


D. L. LINDQUIST.
 ALTERNATING CURRENT ELECTROMAGNET.
 APPLICATION FILED FEB. 9, 1910.

1,005,856.

Patented Oct. 17, 1911.



Witnesses
 May T. McCarry
 Gertrude T. Porter.

Inventor
 David L. Lindquist
 by Paul Benjamin
 his Attorney

UNITED STATES PATENT OFFICE.

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

ALTERNATING-CURRENT ELECTROMAGNET.

1,005,856.

Specification of Letters Patent.

Patented Oct. 17, 1911.

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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 certain new and useful Improvement in Alternating-Current Electromagnets, of which the following is a specification.

The invention is an alternating current electro-magnet comprising primary and secondary circuits wherein the currents differ in phase, so that at no instant is the resultant magnetic traction reduced to zero. In circuit with the secondary is an ohmic resistance, or an ohmic resistance and a capacity, by adjustment of which maximum traction is obtained and the phase angle between the fluxes is approximated as near as possible to ninety degrees. As a consequence, the armature is held to the magnet with a constant and maximum pull, whereby chattering of said armature due to current alternations is prevented.

The accompanying drawing is a diagram, showing the magnet and its connections.

A is the magnet core having at its polar extremity three legs B, C, D. The primary coil E which surrounds the body of the magnet is to be connected with any suitable source of alternating current by the conductors F, between which and said coil any suitable circuit closing switch G may be interposed.

A secondary coil H surrounds the middle leg C, and includes an ohmic resistance I and a condenser J. The condenser J, under circumstances hereinafter explained, may be omitted, the circuit then proceeding as indicated by dotted lines at K. So also, under certain conditions, the resistance I may be omitted, leaving only the condenser in circuit.

When the primary coil E is energized by an alternating current, the secondary current caused in the coil H produces an electromotive force which throws the magnetization of legs B and D out of phase with that of leg C. Hence minimum and maximum traction of legs B, D upon an armature, as L, does not synchronize with the minimum and maximum traction of leg C. Hence the resultant mechanical effort upon the armature will never be zero at any instant, and hence the armature will be held to the mag-

net core without chattering due to the current alternations.

In order to obtain a constant magnetic pull, it is obvious that the ideal phase angle between the primary and secondary fluxes is 90° , when the magnet becomes the same as a two phase magnet. It is desirable, therefore, to bring the phase angle between the fluxes to as near an approximation to 90° as possible. This is the function of the capacity J introduced into the secondary circuit, in connection with the resistance I. With said resistance arbitrarily selected at the outset, the amount of capacity required can be readily determined from the following data: (1) the reluctance of the two magnetic circuits, (2) the iron losses in the circuits and (3) the self induction and resistance of the primary and secondary coils.

When resistance is used alone, without the introduced capacity, its amount may also be determined from the above data. In this way it is possible from a predetermined current to obtain the highest possible minimum pull for the whole magnet.

Generally speaking, the geometrical sum of the resistance and capacity must be such as to allow a current in the secondary core sufficient to give a flux which will cause the same pull by the secondary magnet circuit as by the primary magnet circuit, and the relation between the resistance and capacity must be such as to give as near an approximation as possible to 90° phase difference between the primary and secondary fluxes.

While this electro-magnet is more especially intended to give constant pull, it may be used in circumstances where constant pull is not desired, but where the object is a very small current expenditure. In such event, the capacity J only may be introduced in the secondary circuit. The condenser current then flows partly in the opposite direction to the magnetizing current, and therefore the resultant current may, under favorable conditions, be considerably less than the magnetizing current alone—iron losses not being considered. Theoretically with no losses in the system, the resultant current may be zero, which is, of course, practically unattainable.

The secondary coil C is preferably of copper wire, so as to reduce space and heating within the magnet.

I claim:

1. An alternating current electro-magnet comprising conductively independent primary and secondary circuits, means for causing the magnetic fluxes due to the currents in said circuits to differ in phase, and a selected ohmic resistance interposed in said secondary circuit.

2. An alternating current electro-magnet comprising conductively independent primary and secondary coils, means for causing the magnetic fluxes due to the currents in said coils to differ in phase, and a selected ohmic resistance external to said secondary coil and interposed in the circuit thereof.

3. An alternating current electro-magnet comprising primary and secondary circuits, means for causing the magnetic fluxes due to the currents in said circuits to differ in phase, and a selected capacity interposed in said secondary circuit.

4. An alternating current electro-magnet comprising primary and secondary circuits, means for causing the magnetic fluxes due to the currents in said circuits to differ in phase, and an ohmic resistance and a selected capacity interposed in said secondary circuit.

5. An alternating current electro-magnet comprising primary and secondary coils, means for causing the magnetic fluxes due to the currents in said coils to differ in phase, and a selected ohmic resistance and a selected capacity external to said secondary coil and in circuit therewith.

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

DAVID L. LINDQUIST.

Witnesses:

GERTRUDE T. PORTER,
MAY T. MCGARRY.