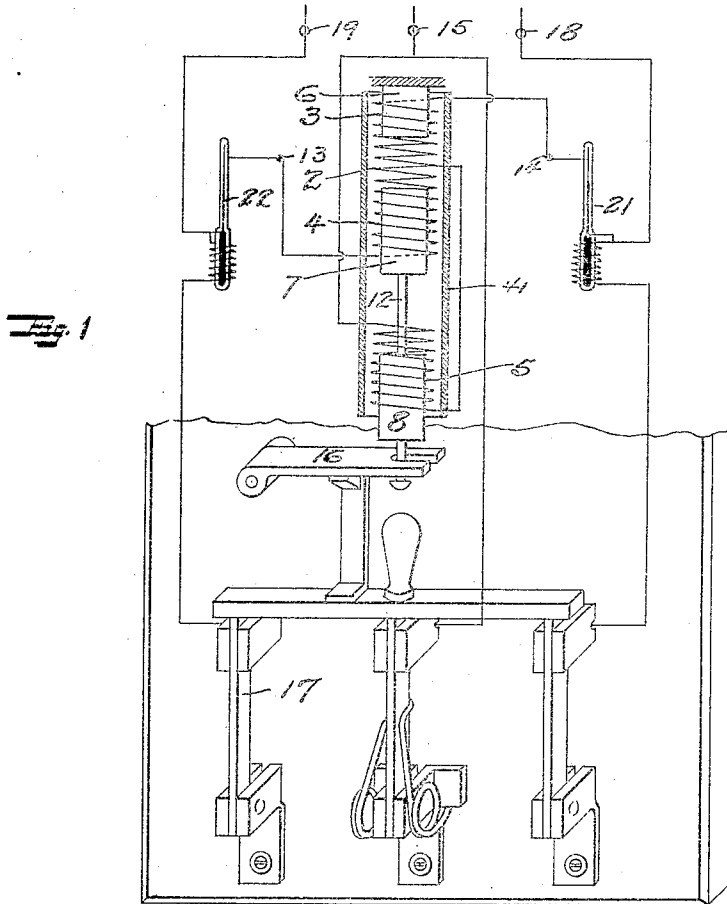
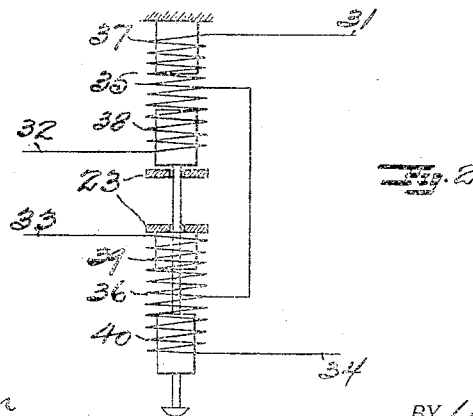


S. N. BARUCH.
ALTERNATING CURRENT SOLENOID.
APPLICATION FILED AUG. 31, 1916.

1,259,202.

Patented Mar. 12, 1918.



WITNESS

J. B. Gardner

INVENTOR.

S. N. BARUCH

BY *White Frost*

HIS ATTORNEYS

UNITED STATES PATENT OFFICE.

SYDNEY N. BARUCH, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO BARUCH ELECTRIC CONTROLLER CORPORATION, OF SAN FRANCISCO, CALIFORNIA, A CORPORATION OF CALIFORNIA.

ALTERNATING-CURRENT SOLENOID.

1,259,202.

Specification of Letters Patent.

Patented Mar. 12, 1918.

Application filed August 31, 1916. Serial No. 117,867.

To all whom it may concern:

Be it known that I, SYDNEY N. BARUCH, a citizen of the United States, and a resident of the city and county of San Francisco, State of California, have invented certain new and useful Alternating-Current Solenoids, of which the following is a specification.

The invention relates to alternating current solenoids or electro-magnets.

An object of the invention is to provide a polyphase solenoid in which the tractive efforts of all of the phases are exerted in one line or axis.

Another object of the invention is to provide a polyphase solenoid in which the pull on the core remains substantially constant during the period of an alternation.

Another object of the invention is to provide a polyphase solenoid in which a common movable element is moved by the passage of current in any phase, or all phases.

The invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description, where I shall outline in full that form of the invention which I have selected for illustration in the drawing accompanying and forming part of the present specification. In the drawings I have shown one specific form of solenoid of my invention, but it is to be understood that I do not limit myself to such form, since I may adopt many variations within the scope of my invention as expressed in the succeeding claims. In the drawings I have shown one of the uses to which the solenoid of my invention may be put, but it is to be understood that it may be used in polyphase circuits for all purposes for which its functions are adapted.

Referring to said drawings:

Figure 1 is a diagrammatic representation of one form of solenoid of my invention applied to a circuit opening mechanism and operated by thermal relays.

Fig. 2 is a diagrammatic representation of a modified form of solenoid.

The solenoid of my invention consists of a plurality of solenoid sections connected to different phases of the polyphase circuit ar-

ranged in axial alinement and separated so that interfering fluxes are avoided, and plungers or cores arranged to be acted on by the separate or combined fluxes. The solenoid is formed of coil sections arranged on a single axis and spaced apart from each other and preferably consists of two coils, as shown in Fig. 1, one coil 2 comprising the two solenoid section coils 3—4, one section coil being wound over or superposed on the other so that the fields of the two sections are coincident and the other coil 5 being spaced apart axially therefrom, all of said coils being arranged in axial alinement. Coil 5 is connected to the middle point of coil 2 or in other words, to the point of connection of superposed coils 3 and 4, thereby producing a solenoid with the three-phase solenoid section windings connected in star fashion, although the solenoid sections may be connected in closed delta connection when desired.

Arranged within the superposed section coils 3 on 4 and extending therein for substantially one-third the length of the double coil, is a fixed core 6 and extending into double solenoid from the opposite direction is a movable core or plunger 7. Extending into coil 5 in the same direction as core 7, is a movable core or plunger 8, which is connected to plunger 9 by a rod 12 of non-magnetic material or material of great reluctance. Coils 5 and 3—4 are spaced apart a sufficient distance to prevent material interference of the fluxes therein, and the rod is made of non-magnetic material for the same purpose.

When three-phase alternating electromotive force is applied to the three terminals 13, 14 and 15, current will flow through the three solenoid sections 3, 4 and 5. The magneto-motive forces in solenoid sections 3 and 4 will differ in phase position by approximately 60° and the resultant magneto-motive force will be continuous and will cause a magnetic flux across the gap between the core 6 and plunger 7 and a consequent tractive force tending to lift the plunger. At the same time the current in solenoid section 5 will set up a magnetic flux through plunger 8, tending to lift the plun-

ger to the center of the solenoid section, and the two tractive forces are added due to the connection of the solenoid sections. The magneto-motive forces of solenoid section 5 is 90° out of phase with the resultant magneto-motive force of solenoid sections 3 and 4 and hence the coils are separated to prevent flux interference.

If single phase electro-motive force is applied between any two of the terminals 13, 14 and 15, the plunger or moving element will be lifted. In the drawing I have shown the solenoid installed in a circuit opening device, wherein it is intended to be operated by a single phase E. M. F. impressed on any two terminals. The plunger is connected to a latch 16, which when lifted releases the spring-pressed switch 17 and opens the circuit, and the solenoid is designed to operate to release the switch, when the current in any phase becomes excessive or deleterious. Solenoid 5 is directly connected to terminal 15, and solenoids 3 and 4 are connected to terminals 18 and 19 through thermal relays 21 and 22 respectively. When the current in any phase becomes excessive to such a degree as to endanger burning out the windings in the electrical apparatus being operated, the mercury in the thermal relay in that phase rises and closes the circuit through the solenoid, causing the switch to be opened. Regardless of which circuit is closed through the solenoid, two of the coils thereof are energized and the M. M. F. produced by any two coils is sufficient to operate the plunger.

I am aware that the device would be operative if solenoid 5 were omitted and the plunger 8 removed and the juncture of solenoids 3 and 4 were connected directly to terminal 15, but the unbalance of the phases under these conditions would be material. Either excessive current must flow in either solenoid 3 or 4 to produce the same tractive effect of solenoids 3 and 4 together or with the normal current the tractive force would be correspondingly weak. In some cases this is a serious objection, as for example, when it is desired that the device shall take only a safe current at a given voltage and still be effective at 25% of this voltage. Without solenoid 5, the force resulting from a given voltage applied to either coil will be approximately one-fourth of the force derived from the same voltage applied to two of the solenoids. By the introduction of solenoid 5, the tractive effort of all of the phases are substantially equal. In practice I find that in order to accomplish this, it is advisable to wind approximately 15% more turns on solenoid 5 than on either solenoid 3 or 4, due to the grouping of solenoids 3 and 4, and the spacing of solenoid 5.

Instead of spacing the solenoids 3—4 and

5 apart a sufficient distance so that the air gap between the two prevents magnetic interference, flux keepers 23 of magnetic material may be placed adjacent the ends of the coils and the distance between the coils lessened.

In Fig. 2 I have shown a solenoid for use on a two-phase four-wire circuit, the terminals 31—32 being connected to one phase and terminals 33—34 being connected to the other, and the mid-points of solenoids 35—36 being interconnected. Current may flow through the solenoid from any two terminals and produce an effective magneto-motive force. In this construction coil 37 is superimposed on coil 38 and coil 39 is superimposed on coil 40, and the two double coils are separated as before stated. While herein I have shown the solenoid arranged to control a switch, it is to be understood that it may be used in any instance when a pull or push is necessary, such as in elevator brake control and other instances. The several solenoid sections are preferably surrounded by a common casing 41 of flux-conducting material which acts as a flux conductor for the exterior field, for reasons that are obvious to those skilled in the art.

I claim:

1. An alternating current solenoid, comprising a plurality of coils arranged on a common axis and disposed in sections spaced apart longitudinally of said axis, one of said sections comprising two coils, one superimposed on the other, and connected to different phases.
2. An alternating current solenoid, comprising a plurality of coils arranged on a common axis and disposed in sections spaced apart longitudinally of said axis, one of said sections comprising two coils, one superimposed on the other and connected in series, and a conductor connecting the juncture of said two coils with the spaced section.
3. An alternating current solenoid, comprising a plurality of coils arranged on a common axis and arranged in sections so disposed that no flux interference between the sections occurs, one of said sections comprising two coils one superimposed on the other and connected at their ends to leads of two of the phases, and connected at their juncture to the other section, which is connected to the third phase lead.
4. An alternating current solenoid, comprising a double solenoid, a fixed core in one end and a movable core in the other end of said solenoid, a second solenoid axially aligned with and spaced from said first solenoid and connected to the mid-point of said first solenoid winding, a movable core in said second solenoid and means for fastening the movable cores together.

5. An alternating current solenoid comprising a plurality of coils arranged on a common axis and disposed in sections longitudinally of said axis, one of said sections
5 comprising two coils connected in series and a conductor connecting the juncture of said two coils with the spaced section.

In testimony whereof, I have hereunto set my hand at San Francisco, California, this 25th day of August, 1916.

SYDNEY N. BARUCH.

In presence of—
H. G. Prost.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."