No. 639,447. Patented Dec. 19, 1899.

W. M. SCOTT.

POLYPHASE ALTERNATING CURRENT MAGNET.

(Application filed June 11, 1898.)

(No Model.)

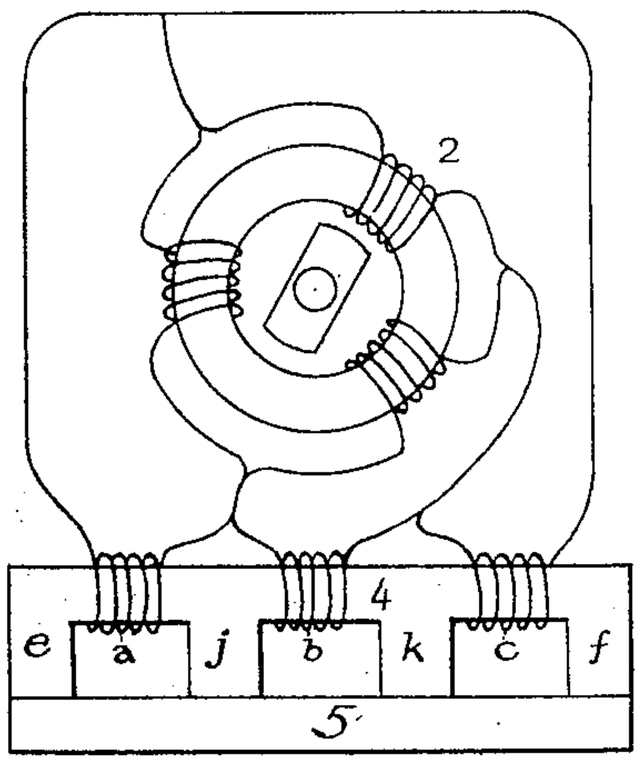

FIG 1

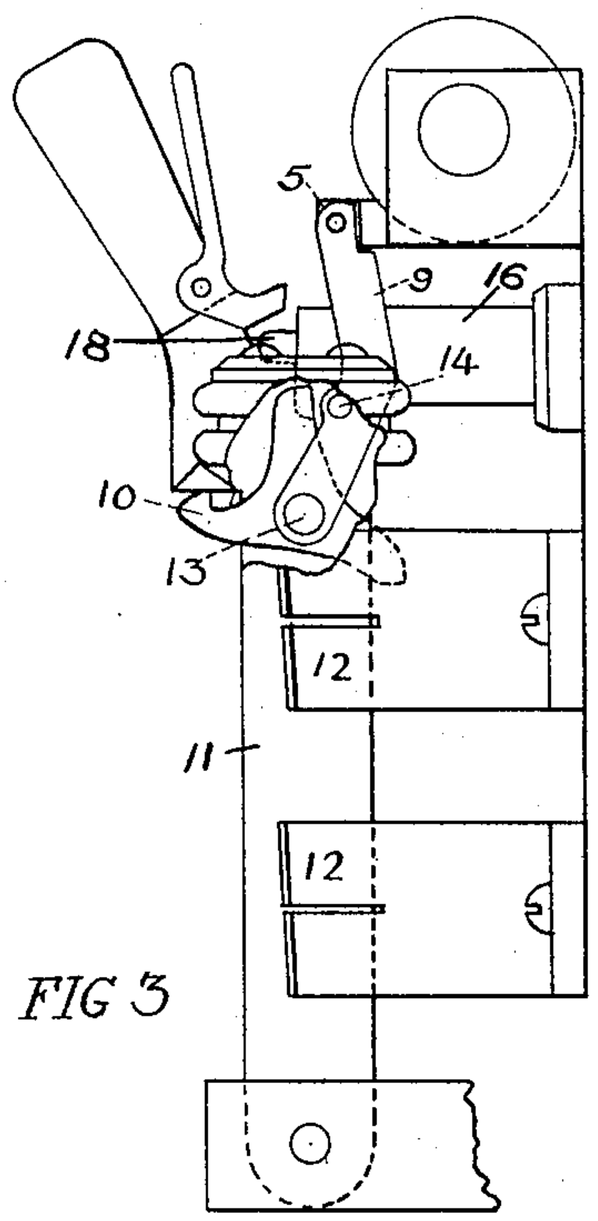

FIG 3

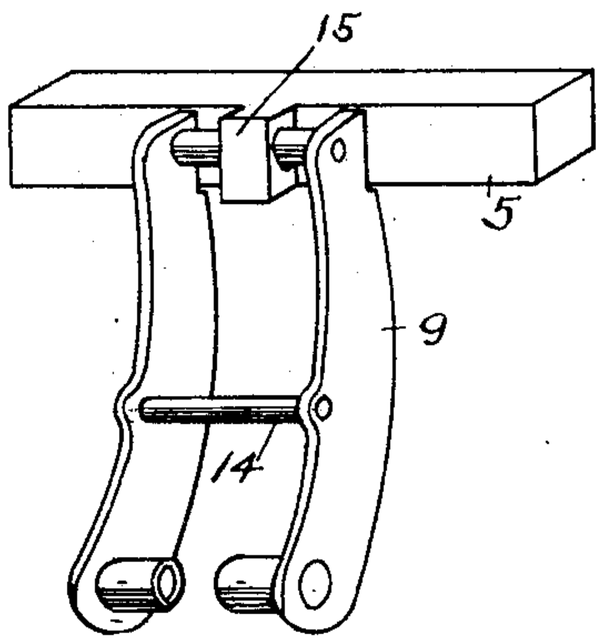

FIG 4

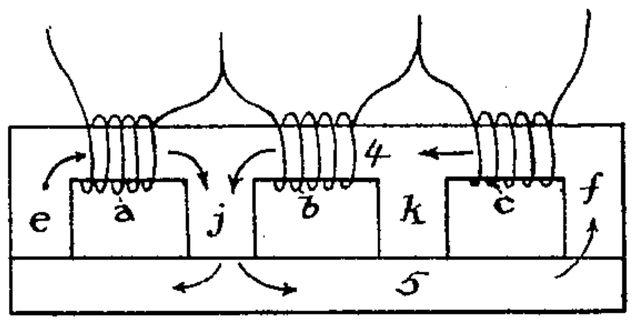

FIG 2

WITNESSES:

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POLYPHASE ALTERNATING-CURRENT MAGNET.

SPECIFICATION forming part of Letters Patent No. 639,447, dated December 19, 1899.

Application filed June 11, 1898. Serial No. 683,172. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM M. SCOTT, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented an Improvement in Polyphase Alternating-Current Magnets, of which the following is a specification.

My invention relates to improvements in electromagnets, especially with respect to their use with alternating currents.

If to the exciting-coils of the ordinary type of electromagnet employing an armature adapted to be held to its poles against gravity or spring tension by flow of direct or continuous current through the coils I apply an alternating current instead of a continuous current the magnetism will vary as the current varies in passing through points of positive maximum, zero, negative maximum, and zero again practically in unison with the current-wave. The pull exerted between the armature and pole-pieces will vary with the magnetism. It will then be obvious that during each cycle of the current there are two instants at which the pull is zero. When the magnet is sustaining strain, such as might be imposed by spring force tending to separate the armature from the pole-pieces, such separation will occur at these points of zero pull, and if the current is strong enough as the magnetic pull increases the armature will be drawn back sharply against the pole-pieces, the frequency of these blows depending upon the frequency of the alternations of the current. For this reason it is obvious that the ordinary electromagnet is unsatisfactory for use with alternating currents.

The object of my invention is to overcome this objection and is accomplished by supplying the exciting-coils with currents, not all (or both) in the same phase, and, further, by providing the core or armature with such projections as will serve to allow the individual magnetic streams set up by each coil to unite and form a resultant stream or streams of uninterrupted flow whose continuity is independent of the relative directions of the component streams.

By the proper winding of the coils and a proper selection of the phase difference of the exciting-currents the magnetic flux through the armature can be made to approach a constant value.

In the accompanying drawings, Figure 1 is a diagrammatic view of a magnet with plurality of poles, single armature, and exciting-coils capable of acting independently and excited by currents not all in the same phase. Fig. 2 is a diagram of electromagnet with direction of magnetomotive forces at a given instant indicated by arrows. Fig. 3 is a side elevation of a portion of an automatic magnetic circuit-breaker employing such a magnet. Fig. 4 is a view in perspective of improved means of securing the armature to the pivoted or flexible supporting member.

In Fig. 1, 2 represents a triphase generator, 4 the core, and 5 the armature, and *a*, *b*, and *c* the coils of the electromagnet. The coils are separated from each other by alternative magnetic paths *j* and *k* for the formation of poles upon the coöperation of opposed magnetic streams therthrough—that is, the coils tend to cause magnetic streams of different phase, which when they flow in the same direction unite and flow in a single stream and when opposed coöperate in forming consequent poles. Thus when magnetic flow in sections *a*, *b*, and *c* is induced in the same direction it will unite to set up a magnetic stream, the major portion of which will pass from armature to core, or vice versa at *e* and *f*. While this condition prevails, the members *j* and *k* could be removed without sensibly altering the efficiency of the magnet. Suppose, however, these members being removed, that the magnetomotive force set up by the coil *a* should be equal to and in the opposite direction to the combined magnetomotive force of the coils *b* and *c*. There will then be no magnetic flow, the magnetomotive forces neutralizing each other. The insertion of the magnetizable member *j*, however, provides a path along which these magnetomotive forces may coöperate, as indicated by the diagram in Fig. 2. It is evident that the insertion of another member will provide a path

for the magnetic streams set up when the magnetomotive forces in *b* and *c* are in opposite directions.

The pivoted armature 5 of the electromagnet above described is pivoted to the flexible or swinging member 9, which is actuated by springs wound about its pivotal bearings 13, but not shown, and adapted upon below normal flow of current through the magnet to carry the armature away from the pole-pieces. The cross-rod 14 is adapted to encounter the upper member of the latch 10 to cause its actuation to release the movable switch 11 to permit its separation from the fixed contacts 12 in response to the actuation of spring-piston 18, which projects from cylinder 16 and bears against the upper part of switch member 11.

An improved method of securing the armature 5 to its pivoted or flexible supporting member 9 is shown in Fig. 4. The armature is provided with a shank or projection 15 on its rear side, by means of which it is loosely pivoted to said supporting member 9, so that it will have sufficient vertical and horizontal play to permit its contacting face to coincide with the plane of the contacting faces of the pole-pieces, thus securing perfect contact between them and without the necessity of nice adjustment of said supporting member and the consequent danger of injury by accidental impairment of said adjustment.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In combination with an automatic magnetic actuating device and an electromagnet for the control of its actuation consisting of a magnetic core having three or more legs, coils wound on the core between and separated from each other by the legs and adapted to carry alternating currents, the currents in adjacent coils in different phase, and an armature adapted to coöperate with the legs.

2. In an automatic magnetic circuit-breaker having separable coöperative contacts, means for causing their separation, means for restraining said separating means, and an electromagnet as means for controlling the actuation of said restraining means consisting of a magnetic core having three or more legs, coils wound on the core between and separated from each other by the legs and adapted to carry alternating currents, the currents in adjacent coils in different phase, and an armature adapted to coöperate with the legs, substantially as described.

3. In an automatic magnetic circuit-breaker, having separable coöperative contacts, means for causing their separation, means for normally restraining the separating means, a magnetic core having three or more legs, coils wound on the core between and separated by the legs, and adapted to carry alternating currents, the currents in adjacent coils in different phase, and an armature cooperating therewith as means for carrying magnetic streams not in phase with each other and providing alternative paths adapted for the maintenance of a continuous magnetic flow through the armature and core, the armature carried upon a spring-actuated lever which is adapted upon subnormal flow through the said electromagnet to actuate the above-mentioned restraining means, substantially as described.

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