A. T. DAWSON AND G. T. BUCKHAM.

ELECTRICAL APPARATUS FOR TRANSMITTING OR RECEIVING SIGNALS.

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1,306,410.

Patented June 10, 1919.

Fig. 1.

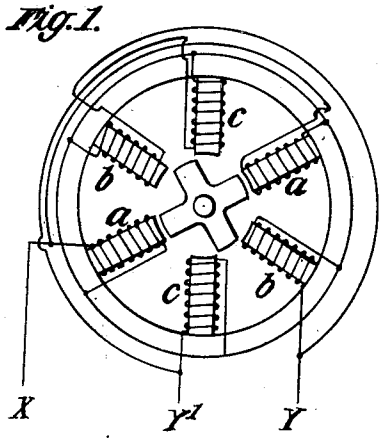


Fig. 1a

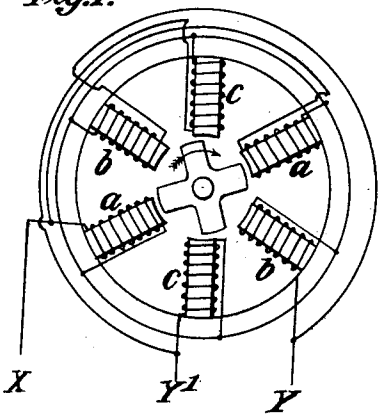


Fig. 2.

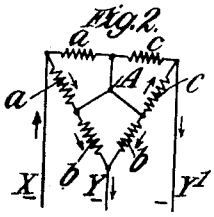
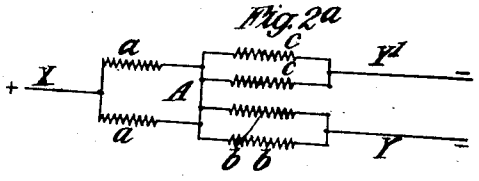


Fig. 2a



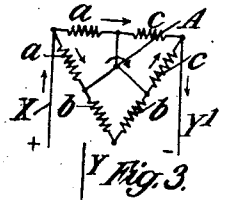


Fig. 3.

Fig. 3a

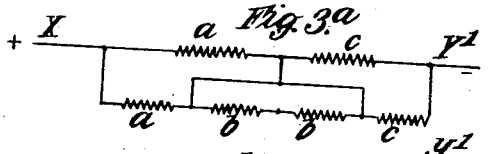


Fig. 4.

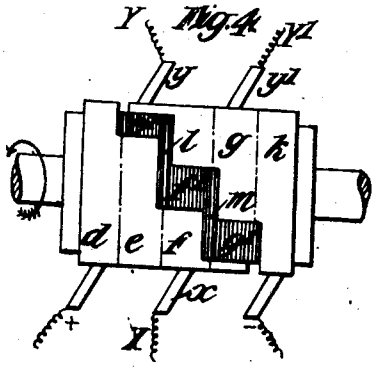
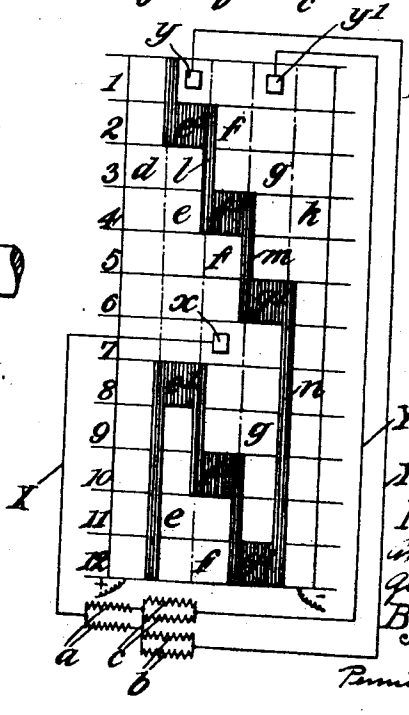


Fig. 5.



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ARTHUR TREVOR DAWSON AND GEORGE THOMAS BUCKHAM, OF WESTMINSTER, LONDON, ENGLAND, ASSIGNORS TO VICKERS LIMITED, OF WESTMINSTER, LONDON, ENGLAND.

ELECTRICAL APPARATUS FOR TRANSMITTING OR RECEIVING SIGNALS.

1,306,410. Specification of Letters Patent. Patented June 10, 1919.

Application filed June 16, 1915. Serial No. 34,544.

To all whom it may concern:

Be it known that we, Sir ARTHUR T. DAWSON, knight, and GEORGE T. BUCKHAM, both subjects of the King of Great Britain, residing at and whose post-office address is Vickers House, Broadway, Westminster, in the county of London, England, have invented certain new and useful Improvements in or Relating to Electrical Apparatus for Transmitting or Receiving Signals; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to electrical apparatus for transmitting and receiving signals and is intended particularly for use in connection with the transmission of orders or information respecting the working of guns. The type of electrical apparatus to which the present invention relates comprises a transmitting switch controlling a number of electric motors so energized that the armatures perform intermittent or step-by-step movements which are imparted to counting or indicating mechanism. The step-by-step electric motors we employ are of the kind in which the armature comprises an even number of pairs of unwound pole pieces, and in which an odd number of pairs of field magnets are energized in diametrical pairs and in a certain order by current supplied preferably on the three-wire system. A common construction of motor of this character has two pairs of unwound armature pole pieces and three pairs of field magnets so energized that the armature performs twelve, or alternatively twenty-four, step-by-step movements to one complete rotation. The chief object of the present invention is to provide in apparatus of the kind indicated an improved system of connections for energizing the motor field magnets, and a simple and reliable transmitting or controlling switch, in order to increase the permissible working speed and the reliability at high speeds, and to reduce the sparking at the switch to a minimum.

According to the present invention the windings of the field magnets are so arranged as to reduce as far as possible the self-induction of the circuits. With this object the field magnet windings of each diametrical pair of magnets, instead of being connected in series as is usual, are connected in parallel, and the alternating changes in the character of the field excitation for effecting the step-by-step movements of the armature are such as to obtain the maximum number of parallel connections of the field magnets energized at any step thereby reducing the self-induction of the motor and allowing the current to "build up" at each step rapidly and thus afford reliability and a high working speed.

The internal connections of the motor are so arranged on a three-wire system that all the separate field magnet windings have a common junction, for the purpose of rendering one pair of the field magnets idle at alternate steps when said pair is disconnected from the current source. This common junction also provides a connecting path for the working current on the alternate steps such that all the windings are energized when all three line wires are energized, thus tending to equalize the drop in volts in the line wires on alternate steps, and reducing the average percentage drop, these being important factors in this class of apparatus.

The transmitting switch according to the invention is in the form of a rotary drum the surface of the drum being composed of two outer conducting rings and three intervening portions each composed of semicircular arcs or segments the ends of which are separated from one another by insulated portions in stepped or staggered relationship.

In order that the invention may be clearly understood and readily carried into effect, the same will now be described more fully with reference to the accompanying drawings, in which:—

Figure 1 represents a motor having two pairs of armature pole pieces, and three pairs of field magnets, the windings of the latter being connected with supply wires in accordance with the present invention.

Fig. 1[a] represents the same motor with the armature in a different position.

Figs. 2 and 3 represent diagrammatically two stages of excitation of the field magnets of the motor corresponding to two of its step-by-step movements.

Figs. 2[a] and 3[a] also represent diagrammatically but in a different manner the same

two stages of excitation of the field magnets illustrated by Figs. 2 and 3.

Fig. 4 is a side elevation of the transmitting switch, and Fig. 5 is a development of the switch surface, showing also the circuits of the windings of the field magnets.

The three pairs of field magnet windings are represented by *a*, *a*, *b*, *b*, and *c*, *c*, respectively, and the three wires by which they are supplied with current are designated X Y and Y'. The windings *a a* are connected together in parallel, the windings *b b* in parallel, and the windings *c c* in parallel. All the windings have a permanent common junction at A; the other ends of the pair of windings *a a* are connected to the wire X, and similar connections are made between the two pairs of windings *b b* and *c c* and the wires Y and Y' respectively.

The wires X Y and Y' are connected to brushes *x y* and *y'* respectively, which bear against the surface of the transmitting switch. The transmitting switch (shown in Figs. 4 and 5) is in the form of a rotary drum adapted to produce twelve step-by-step movements of the motor to one rotation thereof. The surface of the drum may be considered as being composed of two complete conducting rings *d* and *k*, and three intervening conducting rings *e*, *f*, and *g*, each composed of two approximately semi-circular arcs the ends of which are separated from one another by insulating portions *e'*, *e'*, *f'*, *f'*, and *g'*, *g'* respectively, the said insulating portions being in stepped or staggered relationship and connected to one another by arcuate insulating portions *l*, *m*, and *n* respectively, as shown clearly in Fig. 5.

The ring *d* and one set of the semi-circular ring sections *e f* and *g* are formed integrally or are electrically connected together, and the ring *k* and the other set of ring sections are also formed integrally or are electrically connected together. The rings *d* and *k* are in permanent connection with the positive and negative mains of a direct current supply.

From inspection of Fig. 5 and by imagining the drum surface to be moved upward step-by-step in the plane of the paper while the brushes *x*, *y*, and *y'* remain stationary, the successive states of excitation of the field magnets at each of the twelve steps can readily be ascertained. It will be observed that for one step the two windings of one pair of magnets in parallel with one another are connected in series with the other two pairs of windings, said other two pairs of windings being in parallel with each other, and for the next step the two windings of one pair of field magnets are disconnected.

The conditions corresponding to step 1 are shown in Figs. 2 and 2[a], the arrows on Fig. 2 showing also the path traversed by the current. Fig. 1 shows the corresponding position of the motor armature.

Figs. 3 and 3[a] show the conditions corresponding to step 2. Fig. 1[a] shows the corresponding position of the motor armature. The electrical conditions for the other steps may readily be traced by reference to Fig. 5. For example, at the third step, the pairs of coils *a*, *a* and *b*, *b* are in parallel and in series with the pair of coils *c*, *c*, two of the armature poles being then in line with the coils *c*, *c*. At the fourth step, the coils *a*, *a* are cut out and the pair of coils *b*, *b* is in series with the pairs of coils *c*, *c*. These two steps are similar in type to the first and second as are the successive alternating steps, allowing for the changes in the order of the coils so grouped.

What we claim and desire to secure by Letters Patent of the United States is:—

1. In a step-by-step electric motor, six field magnets arranged in three diametrical pairs, each magnet comprising a coil, the diametrically-opposite coils being connected in parallel, an unwound armature having four pole pieces, and means for energizing the coils so that at each alternate step in the movement of the armature, two diametrical pairs of the coils are in parallel with each other and in series with the remaining pair, and at each intermediate step, one diametrical pair of coils is disconnected and the other two pairs of coils are in series with each other.

2. A step-by-step electric motor comprising an unwound armature having an even number of pole pieces, an odd number of pairs of opposite field magnets with the windings of each pair of opposite field magnets electrically connected in parallel, a rotary drum for controlling the supply of electric current to the field magnets, said drum having two outer conducting rings and three intervening portions, each of said portions being composed of two semi-circular conductors, the ends of which are disposed in stepped relation and separated by insulating material, and brushes bearing on said semi-circular conductors and connected to the said field magnet windings.

In testimony whereof we affix our signatures.

ARTHUR TREVOR DAWSON.
GEORGE THOMAS BUCKHAM.