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Nov. 7, 1933. L. G. JACOBSON 1,933,911

RECTILINEAR ELECTROMAGNETIC MOTOR

Filed May 27, 1931

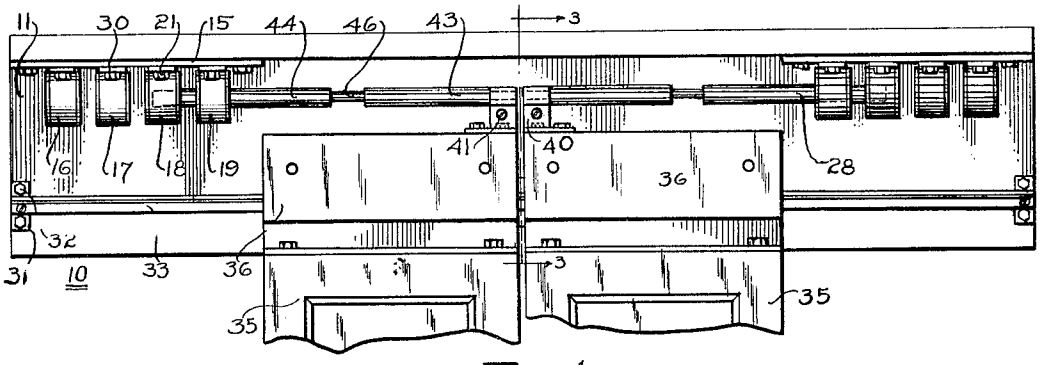


FIG 1

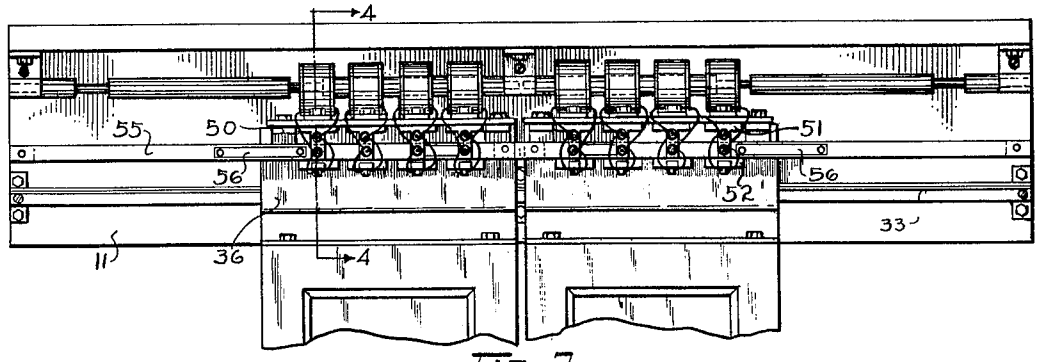


FIG 2

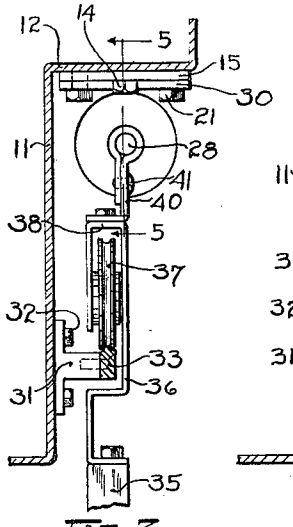


FIG 3

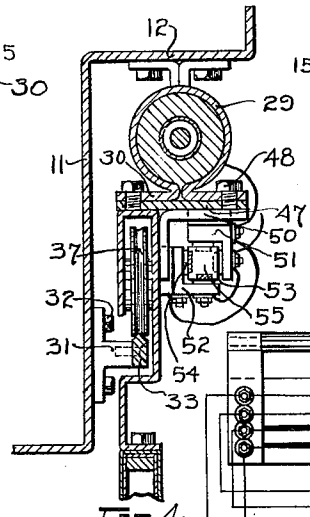


FIG 4

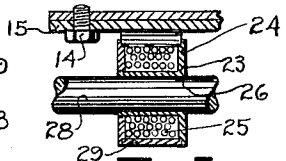


FIG 5

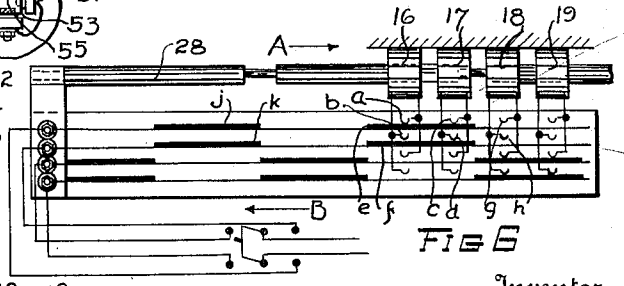


FIG 6

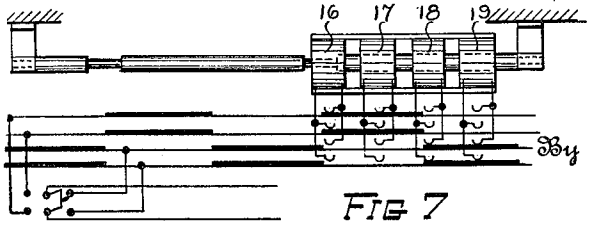


FIG 7

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RECTILINEAR ELECTROMAGNETIC MOTOR

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Application May 27, 1931. Serial No. 540,365

5 Claims. (Cl. 172—290)

This invention relates to an improvement in an electro-magnetic motor for producing translating motion, being a modification of the electro-magnetic motor described in my pending application Serial No. 350,794.

The preferred embodiment of this invention discloses an electro-magnetic motor comprised of four coils and a multiple segment armature. An electro-magnetic force is set up by which to cause translation of the armature relative to said coils. Two coils are in circuit at all times. When the limit of magnetic influence upon one armature segment is reached by one coil, the circuit of said coil is opened simultaneously with the closing of the second adjacent coil circuit. Opening and closing of the circuits is had through the use of a commutator which, in the present showing, is adapted to travel with the movable element of the motor. In my co-pending application in which two coils and a segmental armature are shown, a continuous and unbroken magnetic force is not obtainable. But in the present disclosure end, through the use of four coils, it is possible to produce a translating force which is continuous and at the same time substantially uniform.

The electro-magnetic motor hereinafter described is shown, for purposes of illustration, attached to and adapted to actuate one or more sliding doors.

The principal object of the invention lies in the provision of an electro-magnetic motor capable of producing continuous and unbroken translating motion.

Another object of the invention is to provide a device of this class in which either element, that is, the coil group or armature, may constitute the translating element.

Other and further objects of the invention will be more clearly understood from a consideration of the following specification which is taken in conjunction with the accompanying drawing, and in which

Fig. 1 is a rear elevation of one modification of this invention, showing fixed coils with relatively movable armatures attached to sliding doors;

Fig. 2 is a rear elevation of a further modification of the invention in which the coils are attached to the doors and constitute the moving elements and the armature the fixed elements;

Fig. 3 is an enlarged vertical sectional view, showing the method of mounting the armature on a door hanger, being taken substantially on the line 3—3 of Figure 1;

Fig. 4 is an enlarged vertical sectional view showing the coils attached to the door pendent plate, including details of a commutator, being taken substantially on the line 4—4 of Figure 2;

Fig. 5 is a vertical sectional view taken through one of the coils substantially as indicated at 5—5 of Figure 3;

Fig. 6 is a diagrammatic view showing the arrangement of the commutator in connection with the modification shown in Figure 1; and

Fig. 7 is a diagram showing the commutator arrangement in connection with the modification in Figure 2.

Referring to the drawing, the door enclosure on which this invention is mounted is generally indicated by the reference numeral 10. Forming part of the enclosure is a header 11 having a horizontal flange 12. Attached to the flange 12, by bolts 14, is a plate 15 on which is mounted a set of four coils 16, 17, 18 and 19. These coils are spaced apart a distance equal to half the coil width, being secured on the plate by bolts 21. The structure of each coil is substantially as shown in Figure 5 and comprises a suitable core 23, having outwardly turned flanges 24 in which the windings 25 are located. The core opening 26 receives an armature 28. The strap 29, which encloses the windings 25, terminates in flanges 30 by means of which the coil is mounted through bolts 21. Regardless of whether the coils are suspended from the header as shown in Figure 1 or mounted on the door pendent plate as shown in Figure 2, the spacing and structure thereof is the same.

Brackets 31, mounted on the header by means of bolts 32, support a track 33. Doors 35 are supported through pendent plates 36 and rollers 37 upon the track 33. Joined to the horizontal flange 38 of the pendent plate 36 is a bracket 40. This bracket projects upwardly and encircles one end of the armature 28, being return bent and engaged with itself by the screw 41. It will be noted that the armature is comprised of one or more segments 43. Should the required travel of the moving element be greater than the length of one segment, a plurality of segments may be provided, the extent of which is governed entirely by the desired travel. In the present instance one segment is insufficient to move the door from one position to the other and, consequently, a further segment 44 is provided. These segments are each equal in length to the over-all length of the groups of coils mounted on the plate 15, being connected by an annularly reduced portion 46, the length of which is equal to the width of one of the coils.

In Figure 2 of the drawing the relatively fixed and movable elements are shown in transposed position, i. e., that coils are mounted on the pendent plate 36 and the armature attached to the header 11. Mounted on the horizontal flange 38 of the pendent plate is a plate 47 to which are secured, by bolts 48, the flanges 30 of the coil enclosing straps 29. Attached both to the under face of the plate 47 and the pendent plate are angle brackets 50 which are adapted to support the plate 47 which constitutes the base or support for the coils. These brackets are located adjacent the ends of the pendent plate as indicated in Figure 2. Between the brackets and attached to the plate 47 are insulated blocks 51, one being provided for each coil. Corresponding blocks 52 are attached to the vertical wall of the pendent plate. The blocks 51 and 52 are reversely disposed to provide a rectangular space 53. Projecting into the space 53 from opposite faces of blocks 51 and 52 are brushes 54. Supported on the header is a suitable commutator 55, to which current is supplied. Outwardly projecting contacts 56 are formed on the commutator, the two on the lower and inner sides being staggeredly arranged relative to those on the upper and outer sides. The length of the commutator contacts is such that said contacts engage the brushes 54 on two adjacent blocks 52 or 51. The connection from a suitable source of current supply through the commutator and to the coils is clearly shown in Figure 7 of the drawing and inasmuch as the commutator disclosed is for the sole purpose of showing one operative arrangement, further reference thereto is believed to be unnecessary.

Reference is now had to the diagram of Figure 6 for a description of the operation of the device. In this diagram terminals *a* and *b* of coil 16 and *c*, *d* of coil 17 are shown in contact with the commutator contacts *e* and *f*. In this modification the armature 28 constitutes the moving element of the device and has connected therewith a movable commutator. When coils 16 and 17 are energized, as described, a magnetic influence is exerted upon that segment of the armature lying within these coils, tending to move said armature until the segment under consideration balances. When the center of the segment passes the center of coil 16, current supply ceases by reason of the commutator contacts *e* and *f*, passing out of contact with the terminals *a* and *b*. Simultaneously with cutting off current to coil 16, the commutator has moved to engage contacts *g* and *h*, thus energizing coil 18 and causing it to exert a magnetic pull upon the armature segment. Further movement of the armature and commutator breaks the circuit of coil 17 and brings into circuit coil 19. When current is cut from coil 18, the commutator contacts *j* and *k* move to bring coil 16, through terminals *a* and *b*, into circuit. The commutator contacts *e*, *f* and *j*, *k* control current supply to the coils by which to move the armature 28 in the direction of the arrow A. The lower set of contacts are for the purpose of moving the armature in the opposite direction indicated by the arrow B. It is pointed out that the commutator contacts, length of armature segments, gaps between said segments, coil length and coil spacing are such that the direction of the moving element, in the first modification the armature and in the second modification the coils, may be caused to move in one direction or the other at the will of the operator and from any point within the travel limits. It is further pointed out that, through the use of four coils, two of said coils are at all times acting upon the armature so that a continuous and substantially uniform pull is exerted upon said armature.

The diagram of Figure 7 shows the connections when the coils constitute the moving element. In this instance the commutator is fixed, the coil contacts being made to move therealong.

Although applicant has shown and described but two modifications of his invention, it is obvious that other modifications, through the inclusion of an increased number of coils and slight rearrangement of commutator, may be made or the invention applied to other uses than the operation of sliding doors, and it is not intended that he be limited in the spirit and scope of the invention other than as defined in the hereunto annexed claims.

Having thus set forth my invention what I claim as new and for which I desire protection by Letters Patent is:

1. In a rectilinear electro-magnetic motor, a plurality of spaced coils, a rod projecting through said coils, a plurality of spaced armatures formed in said rod, said armatures being of a length equal to the over-all length of said coils, current supply means energizing said coils, a commutator connected to and movable with said armature rod, and means connecting said coils with said commutator, said commutator progressively connecting successive coils with said current supply means whereby to cause successive reaction of each of said coils with each of said armatures.

2. In a rectilinear electro-magnetic motor, a plurality of spaced coils, a rod projecting through said coils, a plurality of armatures formed in said rod, shoulders defining annularly reduced portions in said rod, said portions terminating said armatures and being of a length equal to that of one of said coils, said armature being of a length equal to the over-all length of said coils, current supply means, a commutator connected to said armature rod, and means connecting said coils with said commutator, said commutator progressively connecting successive coils with said current supply means whereby to cause successive reaction of each of said coils with each of said armatures.

3. In a rectilinear electro-magnetic motor, a plurality of uniform coils spaced apart a distance approximately one-half the length of one of said coils, a rod projecting through said coils, a plurality of spaced armatures formed in said rod, said armatures each being of a length equal to the over-all length of said coils, current supply means, a commutator connected to and movable with said armature rod, and means connecting said coils with said commutator, said commutator being adapted to progressively connect successive coils with said current supply means whereby to cause successive reaction of each of said coils with each of said armatures.

4. In a rectilinear electro-magnetic motor, a coaxially mounted coil group comprising a plurality of uniformly spaced coils, each of said coils being of a length equal to twice the space between adjacent coils, a rod projecting through said coils, a plurality of uniformly spaced armatures in said rod, said armatures being of a length equal to the over-all length of said coil group, current supply means, a commutator connected to and movable with said armature rod, and means connecting said coils with said commutator, said commutator progressively connecting successive coils with said current supply means whereby to cause succes-

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sive reaction of each of said coils with each of said armatures.

5. In a rectilinear electro-magnetic motor, a rod, mounting brackets engaging the ends of and supporting said rod, armatures formed in said rod, a plurality of spaced coils loosely surrounding said rod, movable means engaging and supporting said coils, contacts leading from and movable with said coils, a fixed commutator engaging said contacts, brackets engaging the ends of and supporting said commutator, current supply means for energizing said coils, said current supply means being connected to said commutator whereby to progressively energize adjacent pairs of coils to produce an unbroken and substantially uniform electro-magnetic force by which to cause travel of said coils in one direction or the other from any position on said rod.

LUDWIG G. JACOBSON.