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1,909,470

MECHANICAL MOVEMENT

Filed March 28, 1929

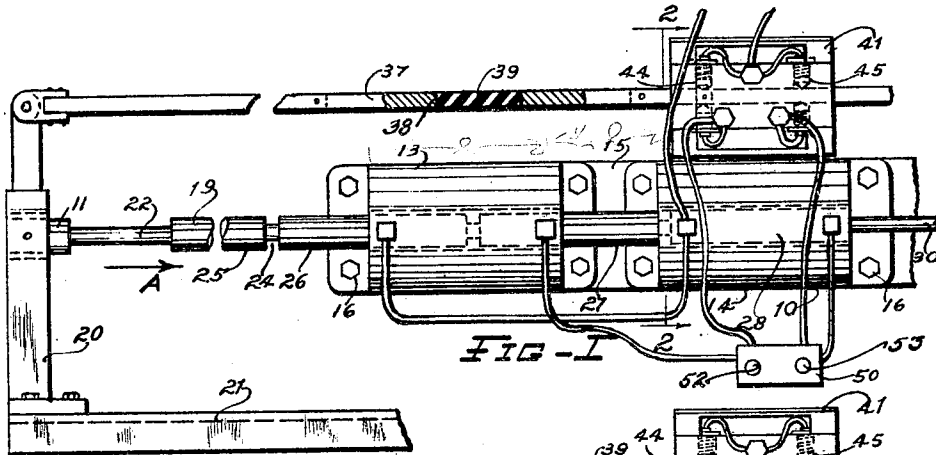


FIG-1

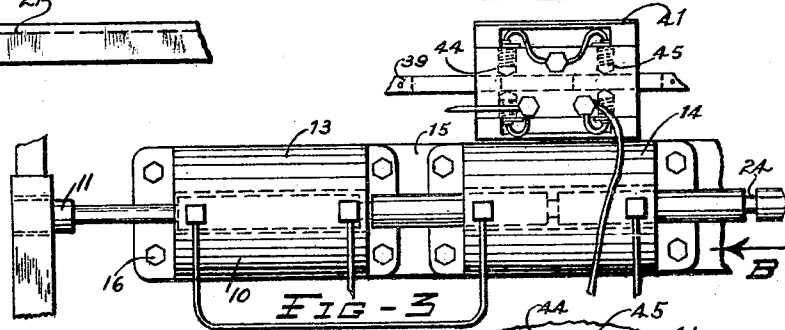


FIG-3

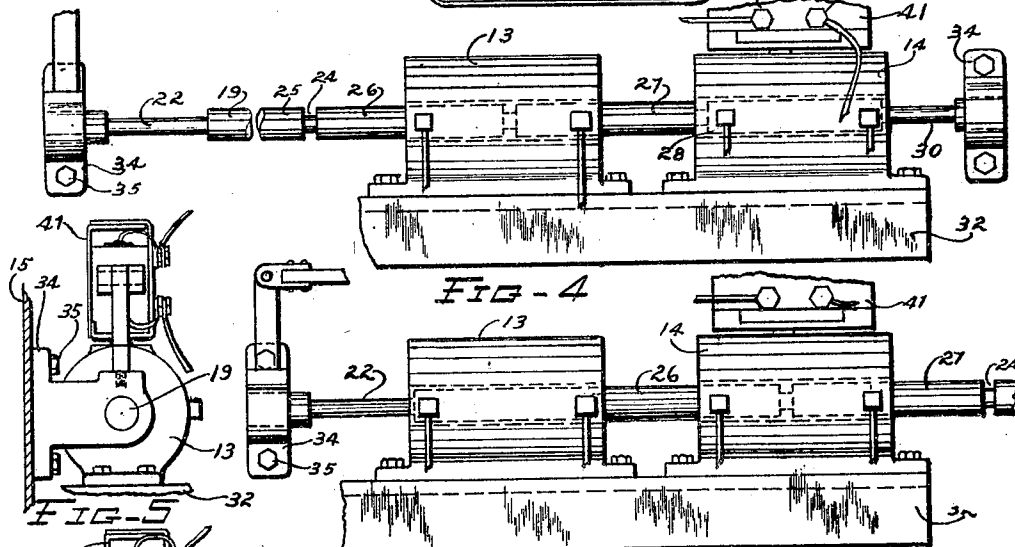


FIG-4

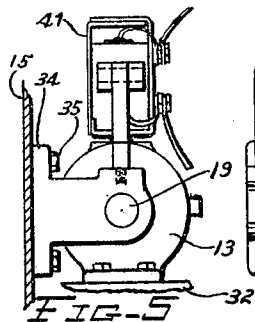


FIG-5

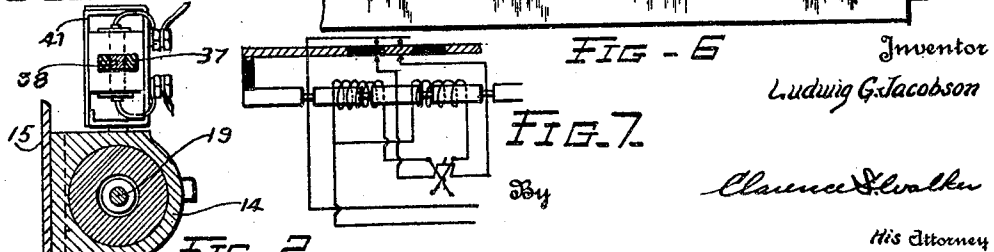


FIG-6

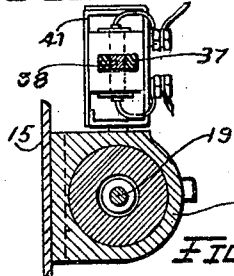


FIG-7

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UNITED STATES PATENT OFFICE

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MECHANICAL MOVEMENT

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This invention relates to a mechanical movement and particularly to one created through the use of electromagnetic helices.

In its preferred embodiment this invention is directed to the provision of two or more helices supported upon or supporting a rod formed to create a plurality of small armatures. Controlled electrical current, when supplied to the helices, causes the rod relative longitudinal movement of said helices, over a distance limited only by the length of said rod.

Prior to this invention little attempt has been made to create a practical working force through the use of electro-magnetic helices. This was largely due to the belief that helices could not be so arranged with relation to their armatures as to be capable of exerting a continuous and unbroken force applicable for useful work. It is true that helices have been and are now in common use upon commercial devices such as drilling machines, automatic switches, etc., but in none of these structures is there shown any method of creating a continuous force. Many years ago attempts were made to produce a continuous force through successive action of a plurality of helices upon an armature but the problem of providing such a multiplicity of helices or relying upon the momentum of the moving armature to reach the next adjacent magnetic field was at that time never satisfactorily solved.

Applicant has provided a simple structure including a plurality of helices arranged to be alternately actuated to induce a rod, of any desired length and formed to provide a plurality of small armatures, to move there-through in a reciprocal manner.

The principal object of this invention is therefore to create a reciprocal mechanical movement through the use of a plurality of electro-magnetic helices and a multiple armature rod.

Another object of this invention is to provide a device of this class in which the movable element is, substantially at all times during movement, under the influence of an electro-magnetic force.

A further object of this invention is to

provide a device of this class, the structure of which permits either of the relatively movable elements to become the movable and work producing element.

Another object of this invention is to provide a device of this class in which one element comprises a plurality of armatures insulated from each other.

Other objects and advantages of this invention will appear from a consideration of the following specification when taken in conjunction with the accompanying drawing; and in which

Fig. 1 is a front elevation of one modification of this invention showing a pair of rigidly mounted helices in conjunction with a reciprocable multiple armature rod;

Fig. 2 is a sectional view taken on the line 2—2 of Figure 1, showing one of the helices with the reciprocable rod therein;

Fig. 3 is a front elevation of the modification in Figure 1, showing the relative position of the helices and rod at the end of movement of said rod in one direction;

Fig. 4 is a front elevation of a slight modification of this invention showing a fixed multiple armature rod in conjunction with a reciprocable pair of helices;

Fig. 5 is an end view of Figure 4 and shows the manner of supporting the armature rod as well as the manner of mounting the helices;

Fig. 6 is a front elevation showing the limit of travel in one direction of the helices in accordance with the modification of Figure 4; and

Fig. 7 is a wiring diagram.

Referring to the drawing and particularly to Figures 1, 2 and 3 thereof, this invention is shown to include fixed and movable elements designated by the reference numerals 10 and 11. The fixed element 10 consists of a pair of helices 13 and 14 mounted upon a bracket 15 which in turn is secured by bolts 16 to any suitable fixture. The helices 13 are of equal length, magnetic capacity and bore and are spaced apart upon the bracket 15, a distance exactly one-half their length. The reason for thus spacing

the helices will later be brought out in connection with the operation of the device.

The movable element 11 here shown comprises a rod 19, rod support 20 and plate 21. Between the ends of the rod 19 and the supports 20, annularly reduced portions 22 are provided. It is pointed out that the helices are not required to individually move the rod 19 to its full length but only a distance substantially half the length of either helix. This is made possible by dividing up the rod 19 into a plurality of small armatures separated by annular air spaces 24. It is well known that air has low magnetic permeability and therefore by producing annularly reduced portions on the rod throughout its length, said rod is converted into a plurality of miniature armatures. Thus the element 11 consists of a plurality of armatures insulated from each other and may be built up by the use of a plurality of separate armatures suitably united and insulated from each other in any desired manner. For convenience of description of the operation of this device, the small armatures thus created in the rod 19 are numbered as follows: 25, 26, 27 and 28. It is to be understood that, although the rod 19, as shown in the drawing, is divided into four armatures, the number of armatures necessary is wholly dependent upon the length of said rod. In other words, should the rod 19 be twice the length shown in the drawing, eight armatures will be formed thereon, or if a different length helix be provided, the number of small armatures produced in the rod 19 will be equal to the number of times the length of one helix is contained in the length of said rod. The armature 28 has continuing therefrom a reduced portion 30 similar to the portion 22 adjacent the armature 25. This end of the rod 19 is mounted in a second support 20 (not shown) which in turn is secured to the other end of the plate 21. The plate 21 may be joined to any type of work requiring a reciprocating motion.

The modification shown in Figure 4 of the drawing is provided with fixed and movable elements similar to the above described modification. However, in this showing the movable element consists of helices 13 and 14 and mounted upon a support 32. The helices 13 and 14 are spaced from each other a distance substantially one-half their length. The fixed element includes the rod 19 which, adjacent the reduced portions 22 and 30, is mounted within brackets 34, secured to a suitable fixture through the use of bolts 35. Since the rod 19 in this modification is identical with the rod 19 shown and described above, the small armatures formed thereon bear like reference numerals. It will be understood from a consideration of the subsequent description of the operation of this device that the paramount difference

between the modifications shown in Figure 1 and Figure 4 is that in Figure 1 the rod 19 is the movable element and in Figure 4 the helices 13 and 14 constitute the movable element.

One of the supports 20 is continued upwardly above the point at which the rod 19 is secured and is adapted to form a pivotal mounting for the plate 37. The plate 37 is formed from any suitable insulating material such as formica, or fiber for example, and is provided with a plurality of longitudinally extending slots 38 therein. The slots 38 are fitted with metal contacts 39. As shown in Figure 1 of the drawing, the plate 37 is adapted to move through the switch 41 between two sets of spring pressure contacts 44 and 45. The contact 44 lies in the circuit of the helix 13 and the contact 45 in the circuit of the helix 14. The contacts 44 and 45 are spaced from each other a distance such that when the plate 37 is passing therethrough, one contact will be crossed through the metal contact 39 while the other is broken by the insulated plate 37. It is to be understood that the distance between the contacts 44 and 45, the length of the metal contacts 39 and the distance between them is dependent upon the length of the solenoids 13 and 14. In other words, the length of the solenoids and the armatures formed in the rod 19 control the size and spacing of the switch structure.

A second switch 50 either automatic or manual in operation and of a double contact, double throw type is provided. It is by means of this switch that the rod 19 can be made to move in one direction or another. The manner in which this is accomplished will be clearly set forth in the description of the operation of the device.

The above described structure, by which a reciprocal mechanical movement is created through the use of electro-magnetic helices, operates in the following manner. Referring to Figure 1 of the drawing, in which the rod 19 is shown with the armatures 26 and 27 located partly within the helix 13, it is desired to move said rod in the direction indicated by the arrow A. The switch 50 is closed by depressing the button 52, to cause the rod 19 to move in the direction indicated and an electrical current is transmitted to the helix 13 through the contact 44 of the switch 41. As a result, when an electro-magnetic force is set up by current in the helix, the armature 26 is drawn completely into said helix. As the armature 26 moves into complete engagement with the helix 13, the switch 41 breaks the electrical contact with said helix and creates a contact to transmit current through the contact 45 to the helix 14. It will be noted that the armature which is of a length substantially that of each helix has

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moved approximately one-half its length. For this reason, the armature 27 now lies slightly more than one-half within the helix 14 and as current enters said helix, the
5 electro-magnetic force created thereby draws the armature 27 completely thereinto. When this has occurred, the contact 45 of the switch 41 breaks and the contact 44 again closes causing current to enter the
10 helix 13 and at this point the armature 25 lies slightly over one-half within said helix. As the armature 25 moves completely into the helix 13, the travel of the rod 19 in the direction of the arrow A ends
15 and the relatively movable elements are in the position shown in Figure 3 of the drawing.

It is now desired to move the rod 19 in the opposite direction as indicated by the
20 arrow B (Fig. 3) and therefore the switch 50 is thrown in the opposite direction. The wiring of this switch is operated by depressing the button 53. The switch is so arranged that when thrown to cause move-
25 ment of the rod in the direction indicated by the arrow B, the contact 44 of the automatic switch 41 becomes the connecting means for the helix 14 and the contact 45 the connecting means for the helix 13. In
30 other words, the helices are reversely controlled by the contacts 44 and 45. Since the contact 44 in the last period of movement of the rod 19, in the direction indicated by the arrow A, supplied current to
35 the helix 13, it is now reversed and supplies current to the helix 14. Inasmuch as the armature 27 lies slightly more than half within the helix 14, it will be drawn completely thereinto when current is supplied
40 to said helix. The alternating pull exerted by each of the helices upon the armatures of the rod 19 continues in the new direction in a manner identical with that above described until said rod has moved to the end
45 of its travel.

Attention is directed to the fact that although applicant has shown but two helices alternately acting to cause a rod longitudinal reciprocation therethrough, it is contemplated to provide a set of three helices, each
50 of which successively act upon the multiple armature rod located therein. When using three helices the current would be supplied in the following order, first number one,
55 then two, three, two and one. In other words, the center helix would act twice to each action of an end helix.

The above disclosed invention is adaptable for use wherein a reciprocating move-
60 ment is required and it is contemplated therefore that this device may successfully furnish power or actuating means for various types of machinery as well as to operate various types of sliding doors. Although
65 applicant has shown and described but two

modifications of this invention, he is not limited thereto since it is obvious that other modifications and adaptations may be made without departing from the spirit and scope of this invention as set forth in the here-
70 unto annexed claims.

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

1. An electro-magnetic device for producing continuous and substantially un-
75 broken translation in one direction or the other comprising a pair of helices, a rod projecting through and movable relative to said helices, armature segments in said rod,
80 said segments being of a length and spacing to cause one segment to center with one of said helices when the space between any two other adjacent segments centers with the
85 other of said helices.

2. In an electro-magnetic device for producing translatory motion, a pair of helices, means spacedly mounting said helices, a rod projecting axially through said helices, arma-
90 tures spacedly mounted on said rod, a commutator comprising a plate having contacts staggeredly mounted thereon and brushes engageable with said plate and said contacts, certain of said brushes being connected to
95 a current supply means and certain other of said brushes being connected to said helices, said commutator connecting alternate of said helices to said current supply means whereby to produce continuous relative motion between said armatures and said helices.
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3. An electro-magnetic device for producing translatory motion comprising two helices, a rod projecting through said helices, said rod including a plurality of arma-
105 tures, an insulating bar having conducting inserts connected with said rod, said bar and said helices being relatively movable whereby said helices may be alternately energized from a source of current supply to act upon successive armatures.
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In testimony whereof I have affixed my signature.

LUDWIG G. JACOBSON.

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