Feb. 19, 1946. R. R. COLE 2,395,164

SOLENOID LOCK ACTUATOR

Filed May 22, 1943

Fig. 1.

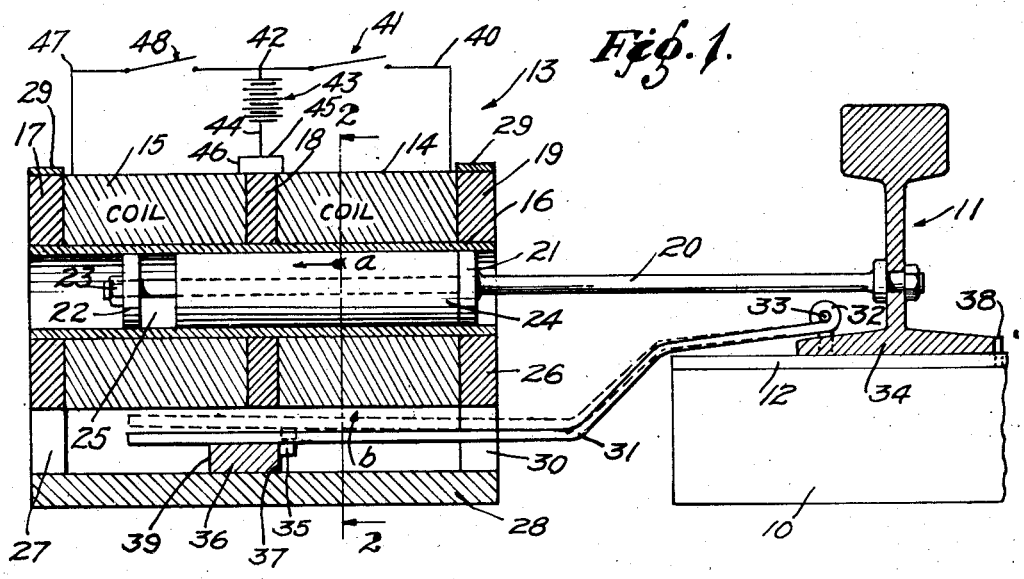
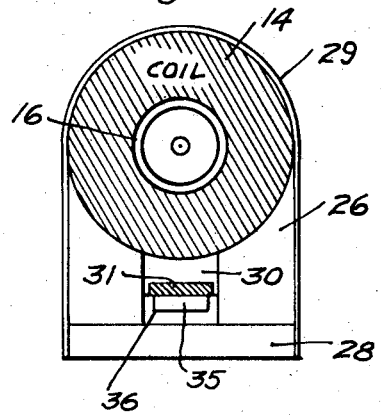


Fig. 2.



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SOLENOID LOCK ACTUATOR

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4 Claims. (Cl. 175—335)

This invention relates to electric apparatus and particularly pertains to a solenoid lock actuator.

In the operation of various types of mechanism it is desirable to move a part from one position to another and thereafter to restore it to its original position by force applied by an electric solenoid. In such structures it is often desirable to lock the moved parts in either of their set positions. An example of this type of structure would be a railway switch which would be shifted from open to closed position, and reverse, and which would be locked in its open or closed position. Often a complicated relay system is required for initiating movement of the rail element and for locking it in its extreme positions. It is desirable, therefore, to provide simple and inexpensive means whereby one solenoid structure will act both to move an element and to lock it, and it is the principal object of the present invention to provide a solenoid lock actuating mechanism which may be attached to a moving element and which when electrically energized will simultaneously release, move, and lock an element in a desired position.

The present invention contemplates the provision of a dual solenoid coil unit, the coils of which may be separately and selectively energized, a movable core being disposed within the well of the solenoid and attached to an element to be actuated in a manner to permit a predetermined amount of lost motion between the core and said element, the structure further being provided with a lock bar adapted to be moved toward and away from a locking position, said bar being influenced by the magnetic field induced around the solenoid coils when either of them is energized.

The invention is illustrated by way of example in the accompanying drawing, in which:

Figure 1 is a view in vertical section and elevation showing the application of the present invention to a railroad switch and indicating by dotted lines the releasing movement of the solenoid.

Fig. 2 is a view in transverse section through the coil unit as seen on the line 2—2 of Fig. 1 and discloses the relation of the lock bar to the solenoid coils.

Referring more particularly to the drawing, 10 indicates the support for a rail 11. This rail is slidable upon a plate 12, the rail and plate forming a part of a conventional type switch structure. It is to be understood, however, that while this device is shown in connection with the actuation of a railway switch that it may be used in any place where alternate movement of an element is required and in connection with which the element is to be locked in either of its extreme set positions. Disposed in a suitable position adjacent to the element to be used, such as the switch rail 11, is a dual solenoid 13 formed with coils 14 and 15. These coils are wound upon a tubular armature sleeve 16. The sleeve carries the usual collars 17, 18 and 19. In some instances coils of this character have been made in which the armature sleeve 16 and the collars 17, 18 and 19 are made of non-metallic material. It has been found, however, that for efficient functioning of the solenoid coils in the present installation it is desirable to make the sleeve and the collars of soft iron. Extending into the armature sleeve 16 is an operating rod 20. This rod is formed with a collar 21 which has a sliding fit within the sleeve 16. A portion of the rod extends beyond the collar and has a reduced end portion which receives a disc 22 held in position by a nut 23. Mounted slidably on the length of rod between the collar 21 and the disc 22 is a cylindrical core element 24. The length of this core is less than the distance between the opposing faces of the collar 21 and the disc 22. This provides a lost motion space between the ends of the core 24 and the collar and disc, as indicated at 25, for a purpose to be hereinafter set forth. The coil structure is mounted upon supporting elements 26 and 27 at the opposite ends of a base 28. Straps 29 may be provided to hold the coils in their mounted positions. A vertical opening 30 occurs between the supports 26 and 27 and accommodates a lock bar 31. The lock bar extends substantially horizontally and may be fitted with an eye 32 at its outer end to receive a U-bolt 33. The U-bolt 33 is secured to the foot portion 34 of the rail 11 or any other desired object which is to be moved. The lock bar 31 is bent to a suitable configuration so that it may swing vertically upon the pivot afforded by the U-bolt 33. A stop lug 35 is disposed upon the lower face of the lock bar 31 and extends transversely thereof. It may engage alternate vertical faces of a fixed stop 36 which is secured upon the base portion 28 of the structure. The width of the fixed stop 36 represents substantially the length of the stroke of the operating rod 20 and the bar 31. Thus, when the lock lug 35 is in engagement with the vertical face 37 of the fixed stop 36 the rail 11 will be held against a stop plate 38 on the plate 12, and when it has moved to a point of engagement with a face 39 on the stop plate 36 the member 11 will be held in its other extreme position. Attention is directed to the fact that the bar 31 extends parallel and beneath the under surface of a portion of the two coils 14 and 15, and that it is spaced therefrom. This makes it possible for the bar to swing upwardly when subjected to the action of the magnetic field of either of the coils so that the stop lug 35 will swing clear of the fixed stop 36, as indicated by dotted lines

in Fig. 1 of the drawing, and will allow the rod 31 to move longitudinally.

In operation of the present invention a dual solenoid structure, such as indicated at 13, is assembled and is formed with the metal collars 17, 18 and 19 as well as the armature sleeve 16. The iron core 24 is mounted upon the actuating rod 20. The rod 20 is connected to a member to be moved. The lock bar 31 is operatively connected to this same member. The coil 14 is provided with a conductor 40 leading to one side of a switch 41. A conductor 42 leads to one pole of the source of electric energy 43. The opposite pole of this source of energy is connected to a lead wire 44 provided with a conductor 45. The conductor 45 is connected with the opposite end of the coil 14 from that to which the conductor 40 is attached. A conductor 46 connects to the lead wire 44 with one end of the winding of the coil 15. The opposite end of the winding of this coil is connected to a conductor 47. This leads to one side of a switch 48. The opposite side of this switch is connected to the common lead wire 42. Assuming, therefore, that the parts are in the position shown by solid lines in Fig. 1 of the drawing, and that switch 48 is closed, it will be evident that the solenoid coil 15 will be energized. This will have two actions; one to move the core 24 in the direction of the arrow *a* through the sleeve 16, and the other to attract the lock bar 31 and swing it upwardly in the direction of the arrow *b*. When swung upwardly, the lock bar 31 will assume the position indicated by dotted lines as it swings around the axis afforded by U-bolt 33. Attention is directed to the fact that the core 24 has an initial free movement in the direction of the arrow *a* a distance represented by the space 25 occurring between the end of the core 24 and the washer 22. This space provides an interval of time sufficient to permit the magnetic field to lift the lock bar 31 before the core 24 engages either the disc 22 at one end of the actuating bar 20 or the collar 21 at its opposite end. Thus, the lock bar will release the actuating rod 20 initially, after which the coil energized will act upon the core 24 and the rod 20 to move them either in the direction of the arrow *a* or in a counter-direction. When the actuating rod 20 and the core 24 has reached the end of its stroke the switch 41 or 48, which had been closed, is then opened. This will interrupt current flow to the coil and will allow the lock bar 31 to fall by gravity so that the lug 35 will be either in engagement with the face 37 of the fixed stop 36 or the face 39.

It will thus be seen that the invention here disclosed provides simple and effective means whereby the selective control of two circuits will act to energize a solenoid coil by which an operating member is unlocked and then moved into sequence of operation controlled by one switch and the energization of one solenoid only, the structure being simple in its construction and inexpensive to manufacture.

While I have shown the preferred form of my invention as now known to me, it will be understood that various changes may be made in combination, construction and arrangement of parts by those skilled in the art, without departing from the spirit of my invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. An electrical actuating device, comprising a central tubular sleeve, a pair of solenoid coils wound on said sleeve, separate circuits, one for each of said coils, a core movable within said sleeve to alternate positions as said coils are separately electrically energized, an actuating member connected with said core, a magnetic lock bar mounted to move in unison with said actuating member and being disposed in the magnetic fields of said coils, and cooperating lock means for said lock bar whereby the actuating member and lock bar will be held in either of their extreme positions, said bar extending alongside the outer surface of the coils and within the external magnetic field thereof, whereby the bar will be drawn magnetically toward the coil as the core and actuating member move.

2. The structure of claim 1 including lost motion means between the core and actuating member causing the lock to be released in advance of the movement of the actuating member.

3. An electrical actuating device for moving an element to and from separate set positions, which comprises a central tubular member, a pair of separate electric coils disposed therearound in longitudinal alignment, separate controlled electric circuits for said coils, a rod extending longitudinally through said tubular member and connected with the element to be actuated and set, stop shoulders on said rod spaced from each other, a cylindrical core element mounted upon said rod within said tubular member and between said stop shoulders, said core element being of a length materially less than the distance between the opposing faces of the stop shoulders, whereby said core may have relative movement with the rod as it reciprocates within the tubular member and is influenced by the magnetic field of either of the coils therearound, thereby causing a predetermined amount of lost motion to occur between the time a coil is energized and the core moves against one of said stop shoulders preparatory to positively moving the rod, a latch member secured to move in unison with the element to be actuated and having a portion extending substantially parallel to the common axis of the coils and within the magnetic fields set up by them, means articulately connecting said latch member to the element to be actuated whereby the latch member will be drawn toward the magnetic coils as either of them is electrically energized, and cooperating stop means, one element of which is carried by the latch member and whereby the latch member will be normally held against longitudinal movement but will be lifted to a non-latching position as one of the coils is energized, during which time the latch may move to its other locking position.

4. An electrical actuating device, comprising a pair of solenoid coils disposed in longitudinal alignment, separate electric circuits, one for each of said coils, a core adapted to move alternately through the centers of said coils, an actuating member connected thereto, an actuated member engaged by the actuating member and movable therewith, a magnetic lock bar movable in unison with the actuated member and disposed on the outside and within the magnetic fields of the coils, cooperating means for holding the lock bar and the actuated member in either of their extreme positions, and whereby the energization of one of said coils to move the core will simultaneously act to release the lock bar magnetically, and a lost motion coupling between the core and the actuating member for causing the release of the lock bar to take place in advance of the movement of the actuating means.

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