June 11, 1968 W. PARISOE 3,388,360

ELECTRICAL RELAY

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FIG. 1

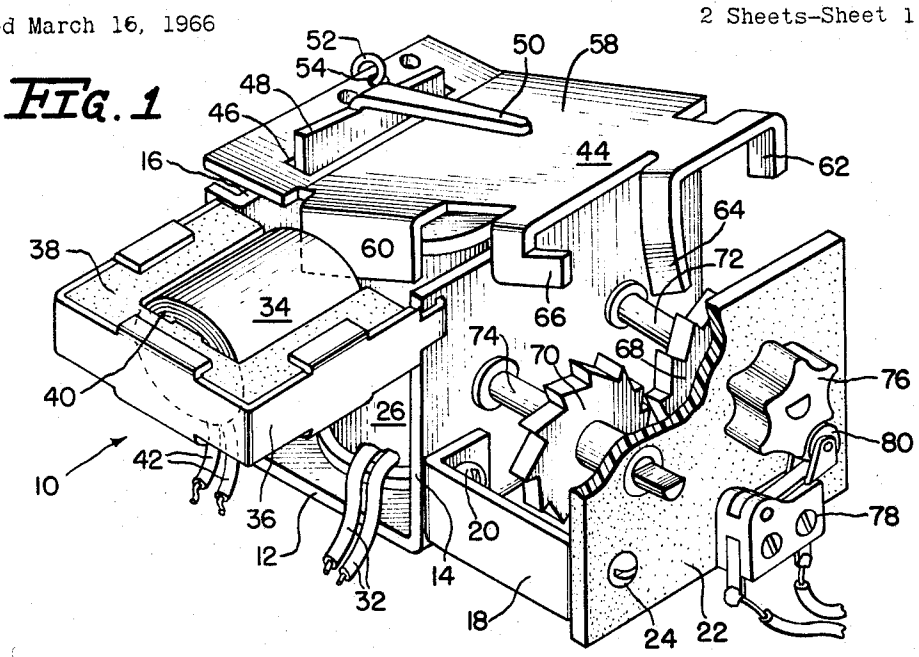


FIG. 3a

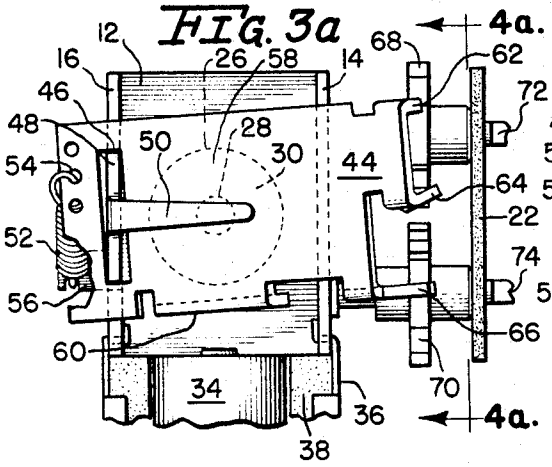


FIG. 3b

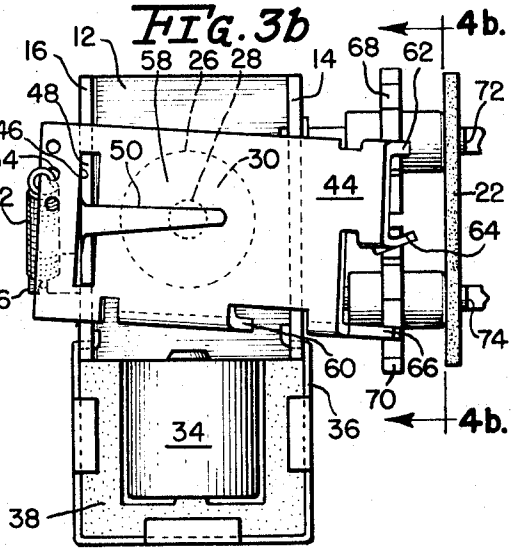
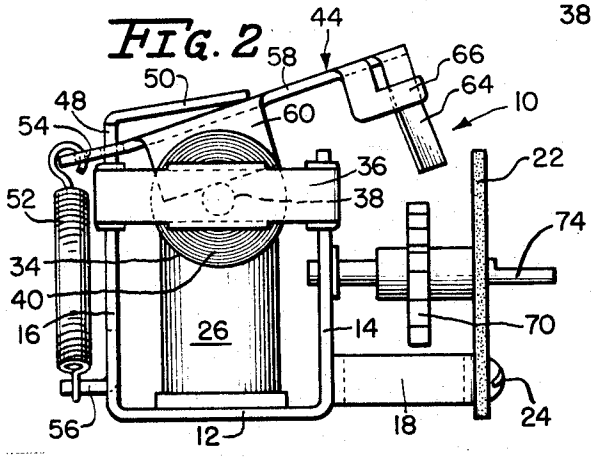


FIG. 2



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FIG. 4a

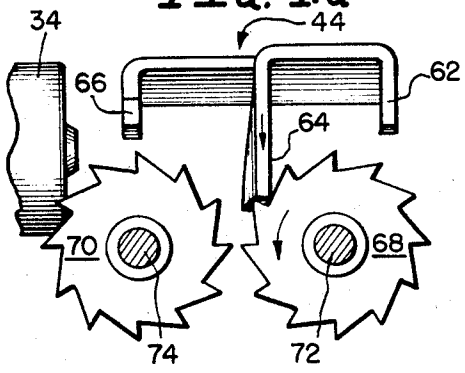


FIG. 4b

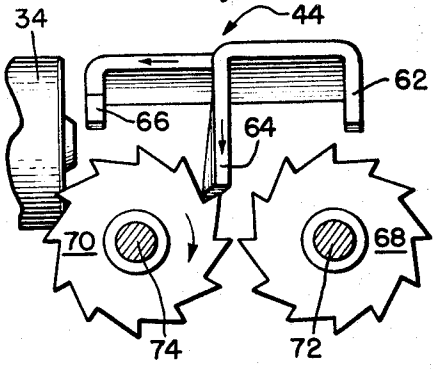


FIG. 5

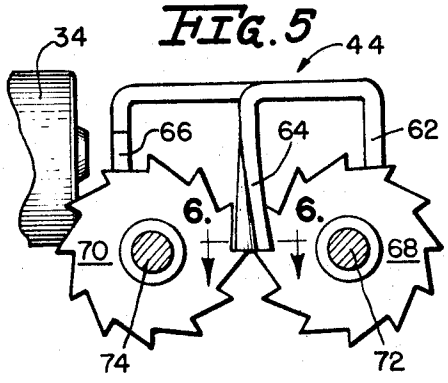


FIG. 6

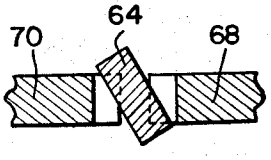
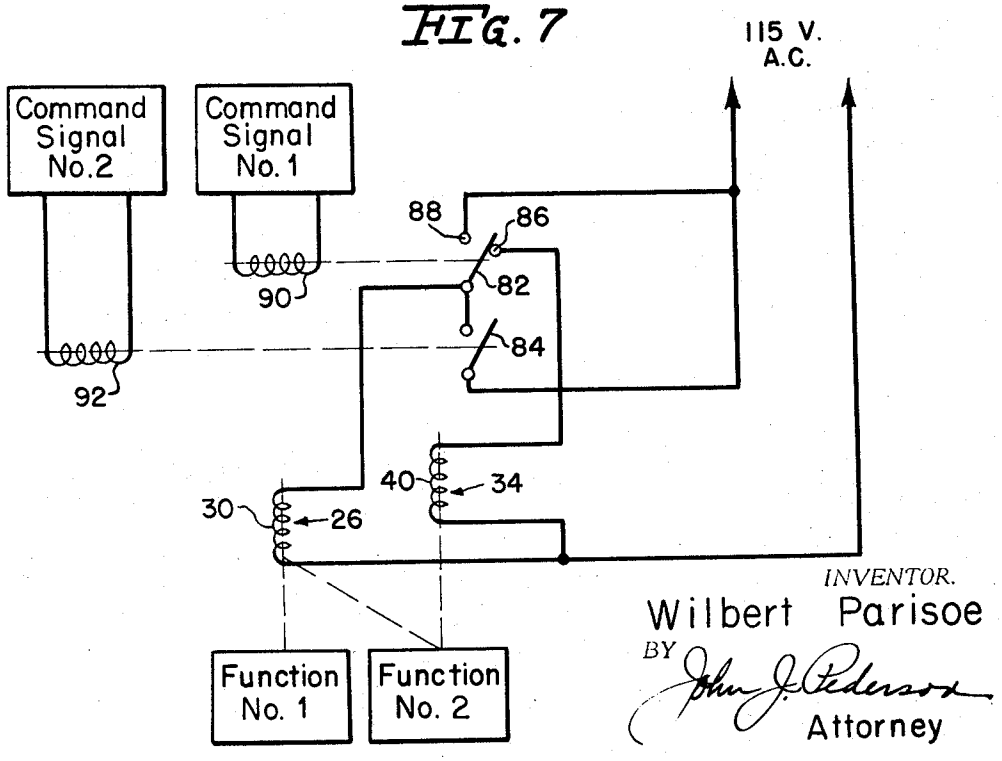


FIG. 7



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3,388,360
ELECTRICAL RELAY

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10 Claims. (Cl. 335—268)

The present invention relates to electrical relays and more particularly to an electromagnetic relay capable of selectively performing multiple control functions.

In the prior art there are many different types of electromagnetic relays, each essentially being comprised of an electromagnet, an armature actuated by the electromagnet and, in the case of a stepping relay, a ratchet wheel which is caused to rotate or index by the action of a pawl affixed to the armature. Although such relays have generally served the purpose, they have been somewhat limited in their application because they are relatively expensive. Such relays have been able to accomplish but a single control function and, therefore, when it is necessary to perform several functions, several separate relays must be used. This, of course, greatly increases the cost of a device requiring the performance of a plurality of functions. An example of such a device is the remotely controlled television receiver wherein a hand held transmitter is used to remotely control a plurality of functions, such as volume level and channel selection. In a television of this type, a small receiver, tuned to the frequency of the hand held transmitter, is utilized to actuate a plurality of relays which in turn mechanically actuate the respective controls. Therefore, a separate relay is necessary for each separate function that is remotely controlled. With the advent of color television the number of functions which may be remotely controlled has greatly increased so that a modern color television set may utilize as many as four or five separate relays actuating separate controls. In addition to increasing the cost of the television, these relays require a considerable amount of space which, due to the trend towards compactness, is always at a premium.

The general purpose of this invention therefore is to provide a relay which embraces all of the advantages of similarly employed devices but which permits control of multiple functions with a single relay.

Accordingly, an object of the present invention is the provision of a relay which is capable of performing multiple functions.

Another object is to provide an electromagnetic stepping relay which is capable of selectively engaging and actuating one of a plurality of utilization devices.

A further object of the invention is the provision of an electromagnetic stepping relay which materially reduces the cost and space required to perform a given number of functions.

Still another object is to provide an electromagnetic stepping relay which is characterized by simplicity of construction, high reliability and low maintenance.

The present invention provides an electrical relay which is selectively actuable in either of two different modes to perform either of a pair of independent control functions. The relay comprises first and second electromagnets responsive to an applied electric current to develop attracting forces along first and second skewed predetermined axes and a common armature having two portions of ferromagnetic material respectively intersecting the first and second axes. The armature is mounted for movement in a first mode in response to energization of the first electromagnet and for movement in a second and different mode in response to concurrent energization of the first and second electromagnets. In addition, a pair

of independent utilization devices are provided which are respectively and individually engageable by the armature upon movement thereof in its respective first and second modes.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The organization and manner of operation of the invention, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in the several figures of which like reference numbers identify like elements, and in which:

FIGURE 1 is a perspective view, partly broken away, of a preferred embodiment of the relay;

FIGURE 2 is a side elevation view of the relay shown in FIGURE 1;

FIGURE 3*a* is a partial plan view of the relay in a first actuating position;

FIGURE 3*b* is a plan view similar to FIGURE 3*a* showing the relay in a second actuating position;

FIGURE 4*a* is a front view of the relay taken on the line 4*a*—4*a* of FIGURE 3*a* looking in the direction of the arrows;

FIGURE 4*b* is a view similar to FIGURE 4*a* taken on the lines 4*b*—4*b* of FIGURE 3*b*;

FIGURE 5 is a partial front view of the relay;

FIGURE 6 is a sectional view taken along the lines 6—6 of FIGURE 5 looking in the direction of the arrows; and

FIGURE 7 is a schematic diagram of the relay and a control circuit therefor.

Referring now to the drawings and more particularly to FIGURES 1 and 2, there is shown a relay, indicated generally by reference character **10**, having a frame of U-shaped configuration, the frame being comprised of a base **12**, a first upwardly projecting leg **14** and a second upwardly projecting leg **16**. A pair of brackets **18** are secured to the first leg **14** of the frame adjacent the base **12** by means of screws **20**, or the like, and a plate **22** is secured to the forward end of the bracket **18** also by means of screws **24**, or the like. A first electromagnet **26**, of conventional construction, is secured to the base **12** of the frame in a vertical plane along a first axis and is comprised of a core **28** of magnetic material and a winding **30** terminating in a pair of leads **32**. A second electromagnet **34**, also of conventional construction, is secured along a second axis to the side edge of the frame between the first and second upwardly projecting legs **14** and **16** by means of a U-shaped bracket **36**. The second electromagnet **34** is comprised of a core **38** of magnetic material of generally E-shaped configuration and a winding **40** terminating in a pair of leads **42**. The first and second axes of the respective electromagnets **26** and **34** are displaced or skewed from each other by at least 45°, but preferably by 90°.

An armature, generally indicated by reference character **44**, is loosely pivoted to the rear leg **16** of the frame for pivotal motion about both a horizontal and a vertical axis by providing a slot or window **46** near the rear edge of the armature **44** through which a projection **48** of the rear leg **16** passes. A tab **50** on the projection **48** is folded forward to act as an upper limit stop for the armature **44**. The armature **44** is urged toward its upper position, as best illustrated in FIGURE 2, by a tension spring **52** secured through one of a plurality of apertures **54** along the rear edge of the armature **44** and to an offset bracket **56** affixed to the rear leg **16** of the frame. The armature **44** is formed of a ferromagnetic material and is provided with a first generally flat surface **58** which intersects the axis of the first electromagnet **26**

and a second downwardly projecting flange surface 60 normal to the flat surface 58, the flange 60 intersecting the axis of the second electromagnet 34. In addition, first, second and third pawls 62, 64 and 66, respectively, are formed along the forward edge of the armature 44, the second pawl 64 being substantially longer than the first and third pawls 62 and 66 and being twisted about its longitudinal axis, the purpose of which will be hereinafter set forth.

A pair of ratchet wheel utilization devices 68 and 70 are respectively fixed to a pair of shafts 72 and 74 which are journaled for rotation between the forward leg 14 of the frame and the plate 22, the shafts 72, 74 being displaced substantially equal distances on either side of the longitudinal axis of the first electromagnet 26. The ends of the shafts 72 and 74 may be connected to any desired control function; for example, shaft 74 may be mechanically coupled to the tuner of a television receiver for providing channel selection while the shaft 72, as illustrated in FIGURE 1, may be coupled to a cam 76 which actuates an on-off-volume control switch 78 by means of a cam follower 80. It should be understood, of course, that the foregoing utilization devices and control functions are only exemplatory, and that many other types of devices may be controlled by the relay.

The operation of the electromagnetic stepping relay of the present invention is as follows. As best illustrated in FIGURES 3*a* and 4*a*, the armature 44 in its unactuated normal position is canted slightly about a vertical axis towards ratchet wheel 68 by means of the offset spring 52 so that the pawl 64 is in vertical alignment with the peripherally extending teeth on ratchet wheel 68. When the first electromagnet 26 is energized by the passage of an electric current therethrough, the armature is pivoted downwardly about the projection 48 by the attracting force developed along the first axis of the electromagnet 26, thereby causing the pawl 64 to engage the teeth of the ratchet wheel 68 and to rotate the same through a predetermined angular distance. As the pawl 64 moves downwardly after engaging the ratchet wheel, it rides around the periphery of the ratchet wheel 68 causing the armature 44 to pivot slightly about a vertical axis in opposition to urging of spring 52. The slot 46 is of sufficient dimension with respect to the projection 48 to provide adequate clearance for this purpose. At the bottom of the armature stroke, the first and third pawls 62 and 66 respectively engage the upper periphery of the ratchet wheels 68 and 70 and prevent ratchet wheel 68 from rotating any further. In addition the second pawl 64, being twisted about its longitudinal axis, engages ratchet wheel 70 to prevent inadvertent rotation thereof due to vibrations set up in the relay. The combination of the first and third pawls 62 and 66 and the twisted center pawl 64 provides complete control of the rotation of the ratchet wheels 68 and 70. The manner in which the center pawl 64 engages both of the ratchet wheels at the completion of its stroke is best illustrated in FIGURES 5 and 6. Of course, as the ratchet wheel 68 is rotated by the pawl 64, the shaft 72 is also rotated thereby actuating the desired function which, as illustrated in FIGURE 1, may be the control of switch 78.

When it is desired to actuate a control coupled to the shaft 74, both the first electromagnet 26 and the second electromagnet 34 are concurrently energized. As best illustrated in FIGURES 3*b* and 4*b*, upon the passage of an electric current through both the first and the second electromagnets 26 and 34, the armature 44 is simultaneously pivoted downwardly by the attracting force developed along the axis of the first electromagnet 26 acting on the surface 58 and laterally towards the second electromagnet 34 by the attracting force developed along the axis thereof acting on the flange surface 60. As the second pawl 64 is simultaneously pivoted downwardly and laterally, it is caused to engage the second ratchet wheel 70 and rotate it through a predetermined angular distance. As set forth above with reference to FIGURES 5 and 6, upon completion of the rotation of ratchet wheel 70 the third pawl 66 engages the teeth of the ratchet wheel 70 to prevent further rotation while the second pawl 64, being longitudinally twisted, engages and prevents inadvertent rotation of the ratchet wheel 68. Upon deenergization of both the first and second electromagnets 26 and 34, the armature 44 is pivoted upwardly and laterally by the tension spring 52 secured to the rear edge thereof. Since the tension spring 52 is offset with respect to the longitudinal axis of the armature 44 and the leg 16, the armature is brought to its initial rest position wherein the second pawl 64 is disposed vertically above the ratchet wheel 68.

An exemplary control circuit for selectively energizing either the first electromagnet 26 alone or both the first and the second electromagnets 26 and 34 concurrently is illustrated schematically in FIGURE 7. A pair of switches 82 and 84 are provided for selectively connecting a 115 volt AC source to either the winding 30 of the first electromagnet 26 or both the windings 30 and 40 of the first and second electromagnets 26 and 34. The first switch 82 may be a spring biased single pole double throw normally open switch adapted to be closed by a signal from command signal No. 1. Command signal No. 1 and command signal No. 2 may, for example in a television, be a receiver which actuates smaller relays indicated respectively by reference characters 90 and 92, these relays being mechanically coupled to the switches 82 and 84. As illustrated in FIGURE 7, function No. 1 is controlled by the electromagnet 26 while function No. 2 is controlled by both the electromagnets 26 and 34. When it is desired to actuate function No. 1, command signal No. 1 actuates relay 90 which in turn pivots lever 82 to contact 88 thereby placing coil 30 in series with 115 volt AC source. Upon the discontinuance of the command signal No. 1, the lever 82 is urged into engagement with contact 86 by the action of a spring, or the like, thereby interrupting the series circuit. When it is desired to actuate function No. 2, command signal No. 2 actuates the relay 92 which in turn closes the normally open switch 84 thereby placing the windings 30 and 40 in parallel with the 115 volt AC source. Upon discontinuance of the command signal No. 2 the switch 84 is opened by the action of a spring, or the like, and the parallel circuit is interrupted.

There has thus been described an electromagnetic stepping relay which is capable of selectively and independently engaging and rotating either of a pair of ratchet wheels to perform multiple functions. The relay of the present invention provides a major savings both in cost and space over similar devices yet is extremely reliable in operation and requires little if any maintainance.

While only a single embodiment of the invention has been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects, and, therefore, the aim of the appended claims is to cover all such changes and modifications that fall within the true spirit and scope of the invention.

I claim:

1. An electrical relay selectively actuable in either of two different modes to perform either of a pair of independent control functions, which relay comprises:

a first electromagnet responsive to an applied electric current to develop an attracting force along a first predetermined axis;

a second electromagnet responsive to an applied electric current to develop an attracting force along a second predetermined axis skewed to said first axis;

a common armature having two portions of ferromagnetic material respectively intersecting said first and second axes and mounted for movement in a first mode in response to energization of said first electromagnet and for movement in a second and different mode in response to concurrent energization of

said first and second electromagnets;

and a pair of independent utilization devices respectively and individually engageable by said armature upon movement thereof in said respective first and second modes.

2. An electrical relay in accordance with claim 1 wherein:

said first and second predetermined axes are displaced from each other at least 45° and said two armature portions are displaced from each other an amount substantially equal to the displacement between said predetermined axes.

3. An electrical relay in accordance with claim 2 wherein said first and second predetermined axes are mutually perpendicular.

4. An electrical relay in accordance with claim 3 wherein:

said armature is mounted for pivotal movement about a pair of mutually perpendicular axes.

5. An electrical relay in accordance with claim 1 which further comprises:

means for urging said armature away from said independent utilization devices upon deenergization of said electromagnets.

6. An electrical relay in accordance with claim 1 wherein:

said independent utilization devices comprise a pair of ratchet means mounted adjacent said armature;

and said armature is provided with pawl means for engaging said ratchet means.

7. An electrical relay in accordance with claim 6 wherein:

said ratchet means comprise respective ratchet wheels mounted for rotation about axes displaced substantially equal distances on both sides of said first predetermined axis;

and said pawl means is formed at one end of the armature for engaging said ratchet wheels between the axes of rotation thereof.

8. An electrical relay in accordance with claim 7 wherein:

said pawl means consists of a single pawl which is twisted about its longitudinal axis for engaging one of said ratchet wheels to prevent inadvertent rotation thereof after said pawl engages and rotates the other of said ratchet wheels.

9. An electrical relay adapted to selectively perform either of a pair of independent control functions, said relay comprising:

a frame having first and second electromagnets secured thereto, the longitudinal axes of said electromagnets being displaced at least 45° from each other, each of said electromagnets developing an attracting force along its longitudinal axis when energized;

first and second ratchet means mounted on said frame;

and an armature pivotally mounted on said frame adjacent said electromagnets, said armature being pivoted towards said first ratchet means upon energization of said first electromagnet and towards said second ratchet means upon concurrent energization of said first and second electromagnets to engage and actuate said first ratchet means when said first electromagnet is energized and said second ratchet means when said first and second electromagnets are concurrently energized.

10. An electrical relay adapted to selectively perform either of a pair of independent control functions, said relay comprising:

a frame having a base and a pair of upwardly projecting legs, said frame having a mounting bracket secured to a first of said legs adjacent the base;

a first electromagnet mounted in a first plane within the frame;

a second electromagnet secured in a plane perpendicular to said first plane to a side edge of said frame between said upwardly projecting legs;

an armature mounted on a second of said legs for pivotal motion about a pair of mutually perpendicular axes, said armature having a first surface adapted to coact with said first electromagnet for pivoting said armature about one of said axes and a second normally projecting flange surface adapted to coact with said second electromagnet for pivoting said armature about the other of said axes, said armature having first, second and third integrally formed pawls at one end thereof, said second pawl being twisted longitudinally and being longer than said first and third pawls;

first and second ratchet wheels adapted to respectively actuate the first and second control functions, said ratchet wheels being rotatably mounted between said mounting bracket and said first leg in a plane parallel to said first plane, the axes of rotation of said ratchet wheels being displaced an equal distance on either side of the longitudinal axis of said first electromagnet, said second pawl initially engaging and imparting rotation to said first ratchet wheel upon the energization of said first electromagnet and initially engaging and imparting rotation to said second ratchet wheel upon the concurrent energization of said first and second electromagnets, said first and third pawls subsequently engaging said ratchet wheels to stop said ratchet wheels after rotation through a predetermined angular distance;

and spring means secured to said second leg and to said armature for urging said pawls away from said ratchet wheels upon deenergization of said electromagnets.

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