United States Patent [19]

Obszarny

[11] **3,735,296**

[45] **May 22, 1973**

[54] SEQUENCE RELAY

[75] Inventor: **Theodore J. Obszarny,** Chicago, Ill.

[73] Assignee: **Guardian Electric Manufacturing Company,** Chicago, Ill.

[22] Filed: **Aug. 3, 1972**

[21] Appl. No.: **277,767**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 185,240, Sept. 30, 1971, Pat. No. 3,689,857.

[52] **U.S. Cl.** **335/165,** 335/107, 335/253

[51] **Int. Cl.**.....**H01h 9/24**

[58] **Field of Search**.....335/165, 135, 187, 335/253, 123, 107, 164; 200/153 J

[56] **References Cited**

UNITED STATES PATENTS

2,992,303	7/1961	Murphy	335/107
3,448,420	6/1969	Lotspeich et al.	335/123
3,244,836	4/1966	Myers	335/253

Primary Examiner—Harold Broome

Attorney—A. W. Molinare, Allegretti, Newitt & Witcoff

[57] **ABSTRACT**

A sequence relay includes a coil mounted on a frame. Current through the coil will drive an armature from a first position to a second position. Attached to the frame is a biased lifter which may translate from a biased first position to a second position by operation of the armature. A pawl mounted on the frame engages the lifter in the second position to hold it in that position even though the armature is released by the coil. When the armature is subsequently operated, it engages and releases the pawl from the lifter, thereby permitting the biased lifter to assume its first position. Switching is effected by an extension of the lifter which engages contacts and moves them from a first to a second position.

3 Claims, 6 Drawing Figures

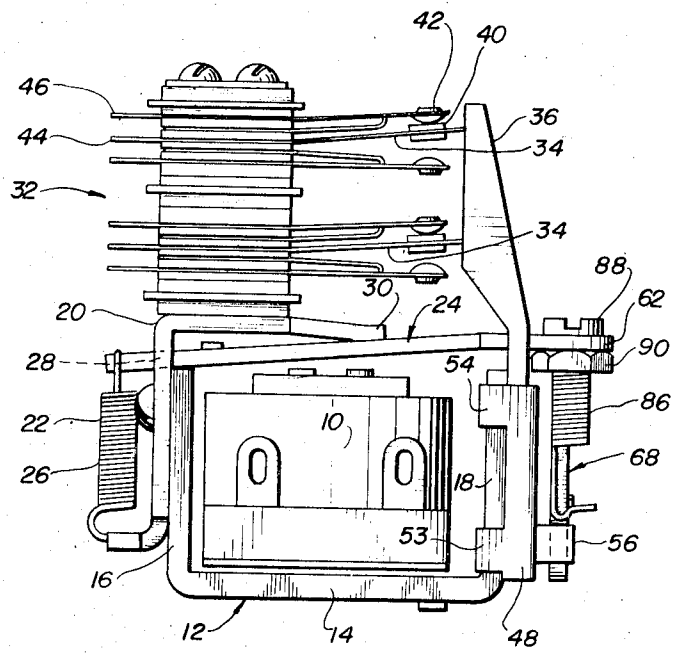


FIG. 1

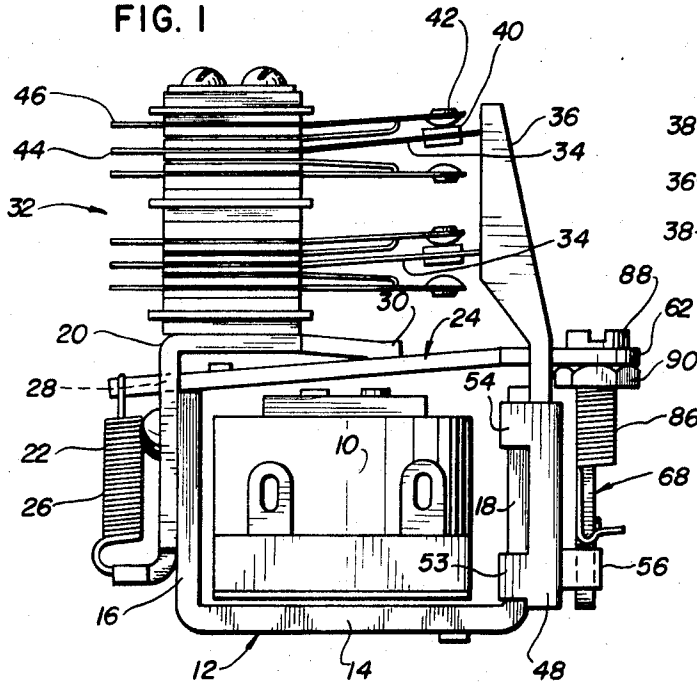
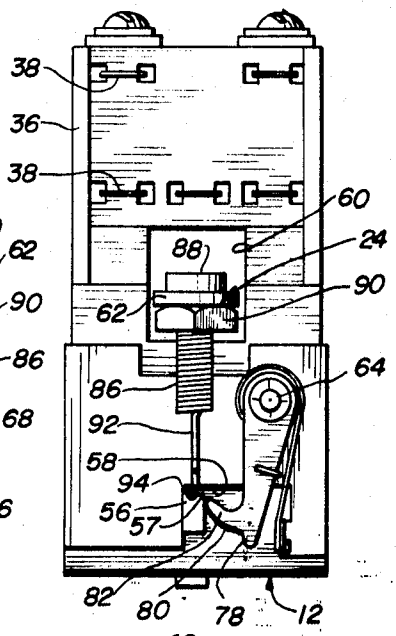


FIG. 2



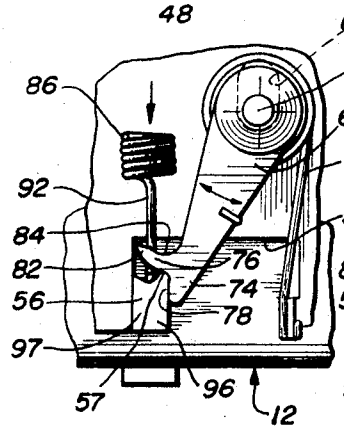


FIG. 3

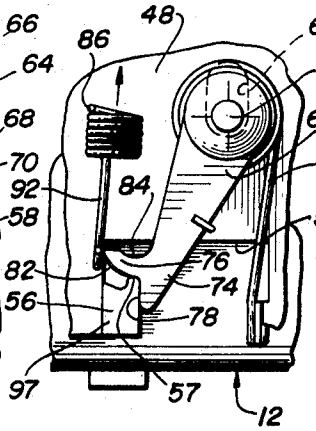


FIG. 4

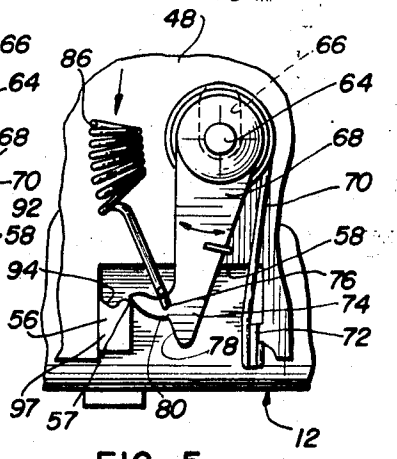


FIG. 5

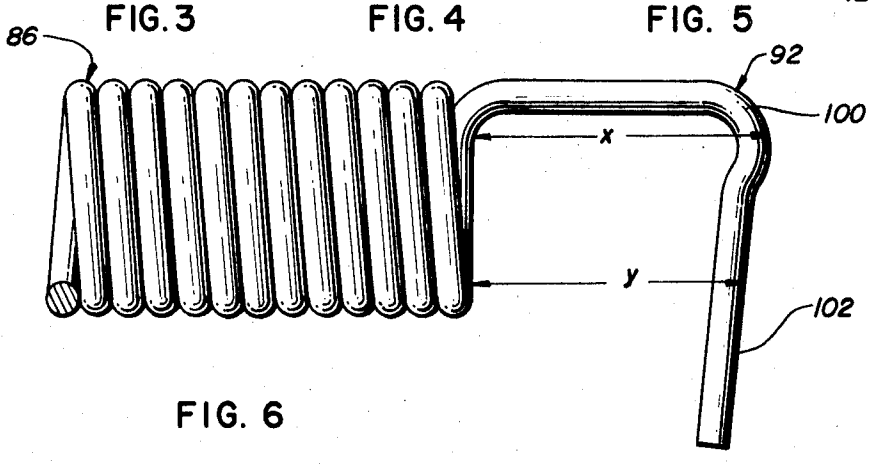


FIG. 6

SEQUENCE RELAY

CROSS REFERENCE TO A RELATED APPLICATION

This is a continuation-in-part of Ser. No. 185,240 filed Sept. 30, 1971, now U.S. Pat. No. 3,689,857.

BACKGROUND OF THE INVENTION

This invention relates to relays and, in particular, to a sequence relay of the type which provides an on/off, on/off repeated sequence. Applicant incorporates by reference to the entire specification and claims from the above-identified U.S. Pat. No. 3,689,857 (Ser. No. 185,240 filed Sept. 30, 1971) as background for this application. There, a sequence relay is disclosed with a coil spring attached to the free end of a pivoted armature of the relay. The end of the spring is engageable with a biased lifter or alternatively a pawl that holds the lifter. The end of the spring is L shaped for engagement with the lifter or pawl as the case may be.

Because of the shape of the end of the spring and the path of travel by the lifter and pawl, the armature may be spaced an undesirable distance from the coil. To reduce the size of the coil and permit improved tolerances in the relay of the invention, the present improvement was made.

SUMMARY OF THE INVENTION

In a principal aspect, the present invention comprises an improved sequence relay of the type having a frame with an armature mounted on the frame and a coil for driving the armature in response to a signal input to the coil. Contact means are provided which are operated in response to movement of the armature. Improved means are provided for interconnecting the armature with the contact means and thereby provide the sequential operation of the relay. Generally, these improved means comprise a translatable lifter means movable between a first and a second position and means for locking the lifter means in one of the positions after it is driven there by operation of the armature. The next sequential operation of the armature disengages the locking means and permits the lifter means to be returned to its original position. Associated with the armature is means for driving the lifter and the locking means. The means for driving provides for differential paths of travel for driving the lifter and the locking means.

It is thus an object of the present invention to provide a sequence relay which provides an on/off repeat sequence.

It is a further object of the present invention to provide a sequence relay having a fewer number of parts than known prior art relays.

Still another object of the present invention is to provide a sequence relay which is a high-speed relay that can be mounted in any position and still be operated with completed reliability.

These and other objects, advantages and features of the invention will be set forth in greater detail in the description which follows.

BRIEF DESCRIPTION OF THE DRAWINGS

In the detailed description which follows, reference will be made to the drawing comprised of the following FIGS.:

FIG. 1 is a side, elevation view of the improved relay of the present invention wherein the relay is in the "first position;"

FIG. 2 is an end elevation of the relay as shown in FIg. 1;

FIG. 3 is an enlarged view of the improved drive and pawl mechanism incorporated as part of the sequence relay of the invention;

FIg. 4 illustrates the sequential operation of the drive and pawl mechanism shown in FIG. 3;

FIG. 5 illustrates the further sequential operation of the drive and pawl mechanism illustrated in FIG. 3; and

FIG. 6 is an enlarged view of the coil spring used to drive the pawl and lifter of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The sequential operation of the relay of the present invention is the same as set forth in the parent application to this application. That is, FIGS. 1 and 2 illustrate the first step or "first position" in the sequence of operation of the relay, these FIGURES being a side view and an end view respectively of the relay when in this first position. FIGS. 3, 4 and 5 represent separate steps in the sequence of operation of the relay. Of course, the starting point for the sequence of operation is arbitrary and depends upon the initial condition of the relay. In the following description, therefore, the component parts of the relay of the present invention will first be described. Following this description, an explanation of the operation of the relay will be set forth to further illustrate the construction as well as explain the operation of the relay.

Referring to the FIGURES then, the relay includes a coil **10** mounted on a field or frame **12.** The frame **12** includes a base run **14,** an armature attachment run **16** and a lifter attachment run **18.** An armature mounting bracket **20** is attached to run **16** by means of a screw **22.** An armature **24** is secured between bracket **20** and run **16,** and is normally biased into the first position illustrated in FIG. **1** by means of an armature biasing spring **26.** The armature **24** thus pivots about an axis defined by a slot **28** through the bracket **20** at the end of run **16.** The travel of armature **24,** due to the biasing action of spring **26** is limited by a forward extension **30** of bracket **20** as illustrated in FIG. **1.** FIG. **1** thus illustrates the "first position" of the armature as well as the other moving components of the relay.

Contact sets **32** are mounted on the bracket **20.** This particular arrangement of contact sets is by way of illustration only, and any desired arrangement of contact sets and the contacts comprising these sets may be utilized within the scope of this invention. The illustration is this not to be considered as limiting in any way.

In the present embodiment, however, the contact sets **32** do provide an additional function for the operation of the relay. That is, included as part of the contact sets is a movable contact blade **34.** This contact blade **34** engages a lifter **36.** The lifter **36** is mounted for translatable movement in a plane substantially perpendicular to the plane of the armature **24.** The contact blade **34** projects through an opening **38** in the lifter **36.** The lifter **36** is thus normally biased by the blade **34** into an upward or first position. It should be noted that in this first position, the contact blade **34** includes a contact **40** which engages a fixed contact **42** to thereby complete a circuit between blades **44** and **46** respectively.

The lifter **36** is maintained in a slidable, translatable position adjacent run **18** by a saddle **48.** The run **18** includes a plurality of notches engageable by tabs **53** and **54** extending from the saddle **48.** The saddle **48** may thus be positioned precisely on the run **18** and locked into position therewith. The lifter **36** is thus translatable in the channel defined by the saddle **48** and run **18.**

The lifter **36** includes a stud **56** which extends outwardly and perpendicular to the lifter **36.** A window **58** is defined in the saddle **48.** Note also that the lifter **36** also includes a window **60** through which a forward extension **62** of the armature **24** projects.

A shaft or pin **64** is attached to and extends outwardly from the run **18** through a longitudinal slot **66** in lifter **36.** A pawl **68** is pivotally attached to the shaft **64** and is normally biased in the clockwise direction as seen in FIG. **2** by a biasing spring **70** passing about the shaft **64** and connected at one end against the pawl **68** and at its opposite ends against a lug **72** on saddle **48.** Pawl **68** includes a radially extending arm **74** with a projecting leg **76** from the arm. The arm **74** includes a stud engaging surface **78.** The leg **76** is arcuately shaped and includes a stud stop surface **80,** a guide surface **82** and engage surface **84.**

A pawl driving spring **86** is attached to the forward extension **62** of the armature **24** by a pan head screw **88.** As shown in FIG. **1,** the pan head screw **88** cooperates with the spring **86** and a locking palnut **90** to secure the spring **86** to the forward extension **62.** The spring **86** terminates at its lower end with an extension leg **92.** The spring **86** is flexible and is typically fashioned from music wire. The extension leg **92** is adapted to engage a channel **94** defined in the stud **56.**

Referring to FIG. **6,** the extension **92** is formed to a particular shape. That is, extension **92** has a first depending arcuate section **100** which terminates a distance *x* beyond the last coil of spring **86.** Section **100** engages the stud **56** to drive the lifter **36.**

Extension **92** includes a second section **102** which is for engagement with the surface **84** of leg **76** of pawl **68** when driving pawl **68** out of engagement with stud **56.** Section **102** is spaced a distance y beyond the last coil of spring **86.** Because the pawl **68** is spaced from the lifter **36,** and because the sections **100** and **102** of extension **92** are not equally spaced from the last coil of spring **86,** the effective length of spring **86** is varied for the pawl **68** vis-a-vis the lifter **36.**

Thus, if *x* is greater than y, it is possible to decrease spacing of the armature **24** from coil **10** and still maintain the maximum desired travel of lifter **36.** Switching can thus be more positive with greater reliability.

By this structure, it is possible to vary the relationship and the amount of travel imparted by the spring **86** to the pawl **68** and lifter **36** independently to thereby achieve the most desired switching characteristics. Thus, *x* may be less than, greater than or equal to *y* as desired and in an amount desired to control the switching characteristics of the relay.

The sequence of operation is illustrated in FIGS. **2–5.** Starting with the first step in the operation of the relay as illustrated in FIG. **2,** the relay is in the "first position." In this position, the stud **56** is positioned at the top of the window **58.** The window **58** thus defines the upper limit of travel of lifter **36** as biased by the spring action of blade **34.** The stud **56** includes a side surface **96** which engages the leg **76** and maintains the pawl **68** in the biased position illustrated in FIG. **2.** The stud **56** also includes an opposite surface **97** that engages the side of window **58** and maintains lifter **36** in a proper vertical orientation.

When current passes through the coil **10,** the armature **24** is attracted downward from engagement with the extension **30.** This drives the spring **86** with section **100** of its extension leg **92** into engagement with the channel **94** of stud **56.** The lifter **36** is thus driven down into a "second position" as illustrated in FIG. **3.** As this stud **56** is driven down, the spring **70** causes the pawl **68** to be biased in a clockwise direction, thereby engaging the stud **56** with the pawl **68.** The surface **78** thus engages the surface **96** and stops the rotation of the pawl **68.** The surface **80** engages the stud **56** at a locking nub **57** and prevents its movement upward from the second position.

When current to the coil ceases, the flexible spring **86** and, in particular, the extension leg **92** slides over the guide surface **82** as illustrated in FIG. **4.** The spring **86** thus bends permitting section **102** of the extension leg **92** to travel along the guide surface **82,** thereby permitting the armature to assume the upward position. The relay is thus locked in the "second position."

The next step in the sequence of operation is illustrated by FIG. **5.** The coil **10** has again been activated to cause the armature **24** to be driven downward. This time, section **102** of the extension leg **92** engages the engage surface **84,** thereby driving the pawl **68** in a counterclockwise direction. This disengages the pawl **68** from the nub **57** of stud **56** permitting the spring action of blades **34** to raise the lifter **36.**

While in the foregoing there has been described a preferred embodiment of the present invention, it is to be understood that the invention is to be limited only by the following claims and their equivalents.

What is claimed is:

1. An improved sequence relay of the type having an armature on a frame, means for driving said armature in response to a signal input to said relay, contact means operated in response to movement of said armature, and improved means for operating said contact means in response to movement of said armature, said improved means comprising, in combination:

lifter means mounted on said frame for driving said contact means, said lifter means translatable between a first position and a second position, drive means attached to said armature, said drive means engageable with said lifter means to translate said lifter means from said first position to said second position; means for locking said lifter means in said second position whenever said lifter means is driven by said drive means from said first position to said second position, said drive means also engageable with said means for locking whenever said lifter means is in said second position to disengage said means for locking from said lifter means; and means for translating said lifter means from said second position to said first position when said means for locking is disengaged, said drive means including means for providing a first amount of travel for said lifter means and a second amount of travel for said means for locking.

2. The improved relay of claim **1** wherein said drive means comprise means extending from said armature and having a first section for driving said lifter means and a second section for driving said means for locking.

3. The improved relay of claim **1** wherein said drive means comprise a first section spaced a first distance from said armature and a second section spaced a lesser distance from said armature.

* * * * *