United States Patent

Obszarny

[15] **3,689,857**

[45] **Sept. 5, 1972**

[54] **SEQUENCE RELAY**

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

[73] Assignee: **Guardian Electric Manufacturing Company,**

[22] Filed: **Sept. 30, 1971**

[21] Appl. No.: **185,240**

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

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

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

[56] **References Cited**

UNITED STATES PATENTS

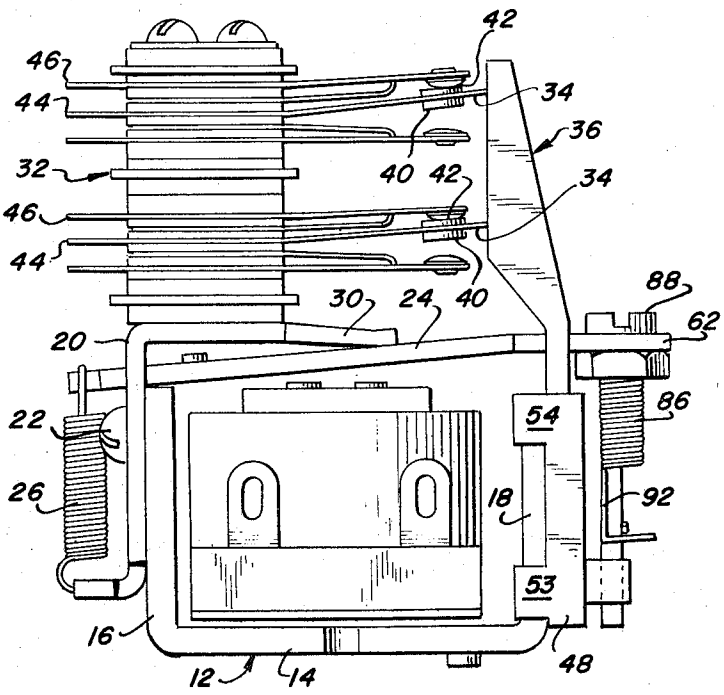
2,992,303	7/1961	Murphy	335/107
3,448,420	6/1969	Lotspeich et al.	335/123
3,244,836	4/1966	Myers	335/253

Primary Examiner—Harold Broome
Attorney—A. W. Molinare et al.

[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.

22 Claims, 14 Drawing Figures



PATENTED SEP 5 1972

3,689,857

SHEET 1 OF 3

FIG. 1

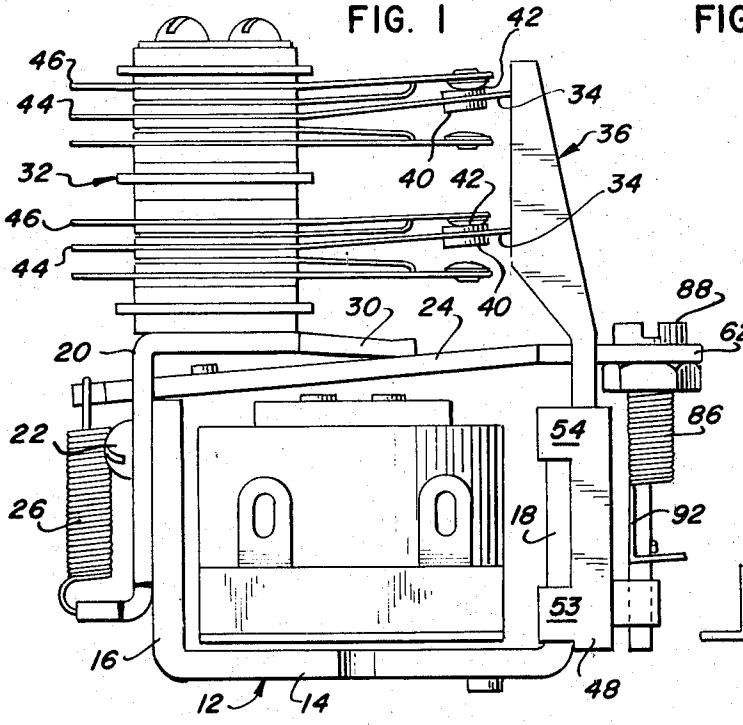


FIG. 2

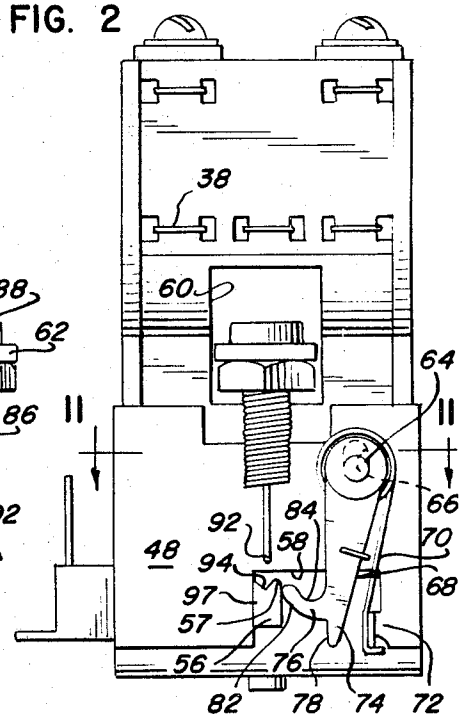


FIG. 3

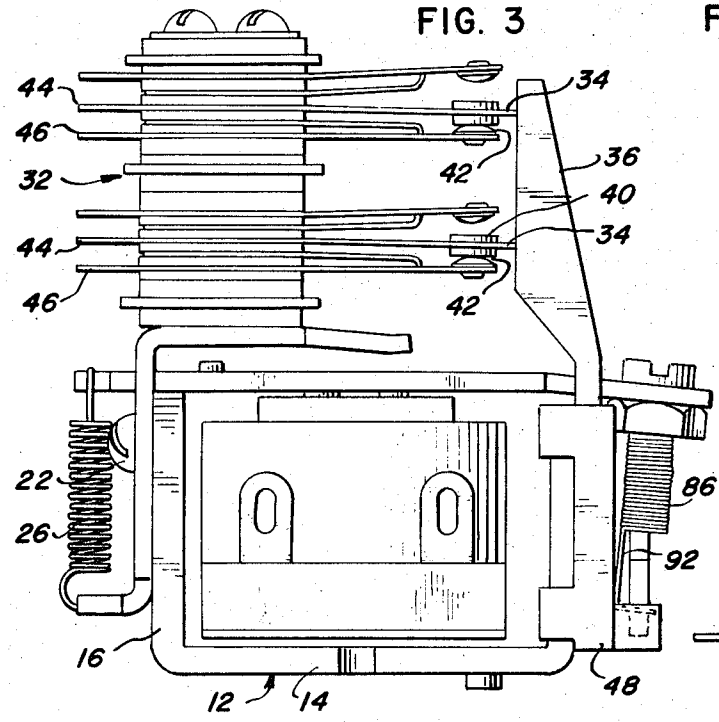
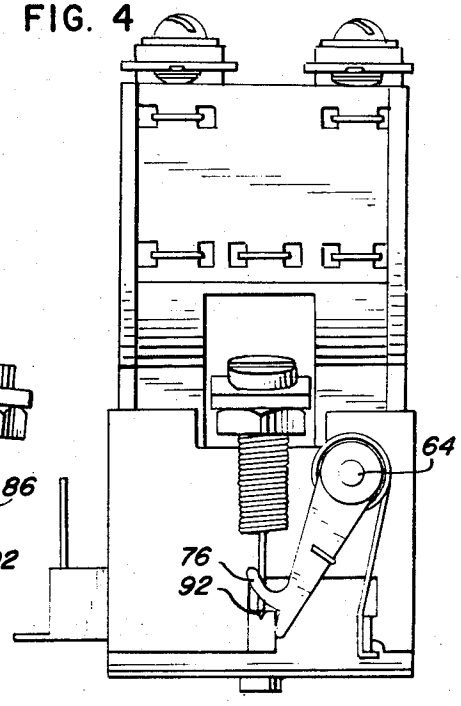


FIG. 4



INVENTOR
THEODORE J. OBSZARNY

BY Molinare, Allegretti, Newitt & Witcoff
ATTORNEYS

FIG. 5

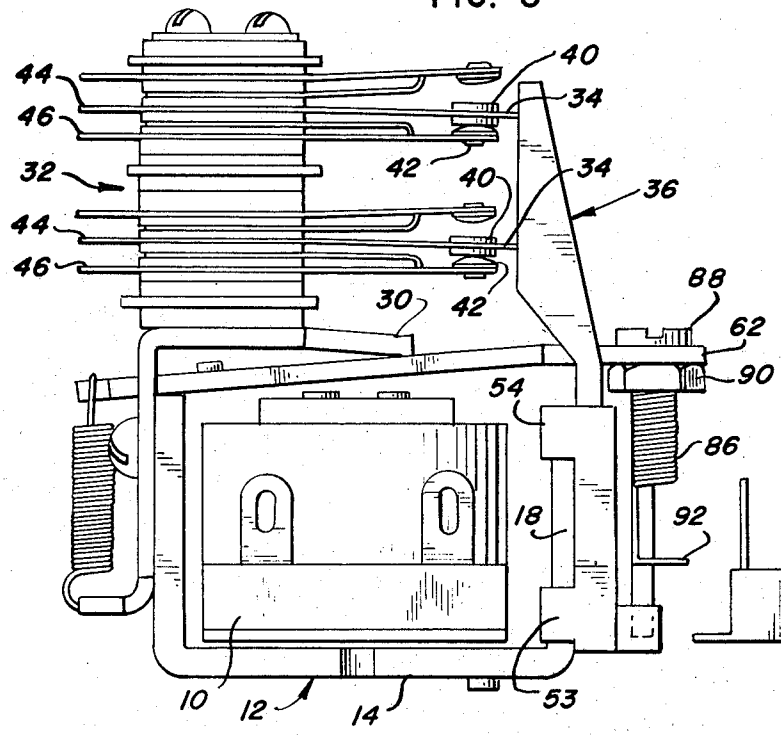


FIG. 6

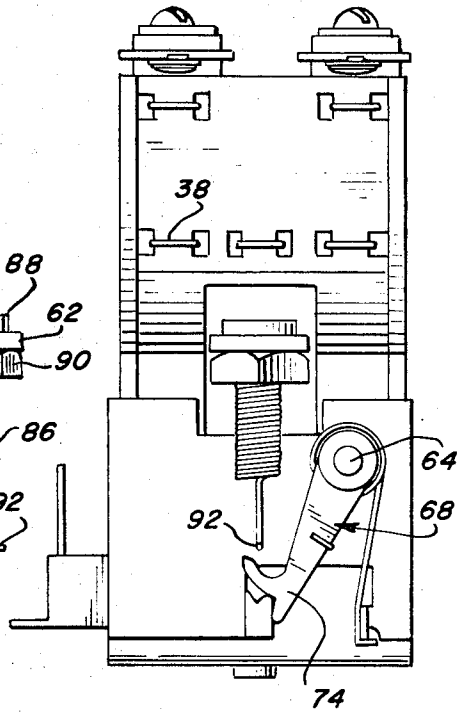


FIG. 7

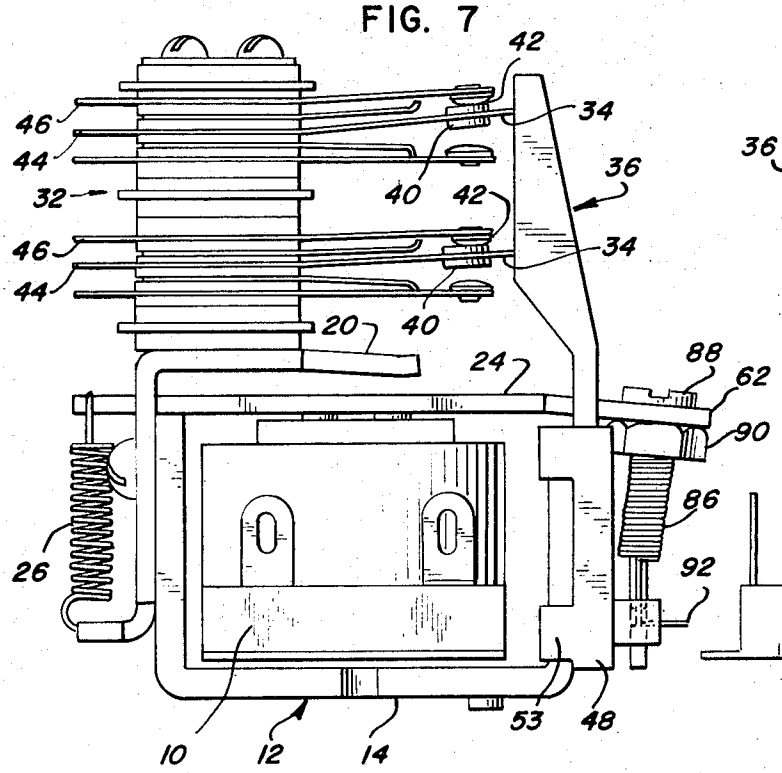
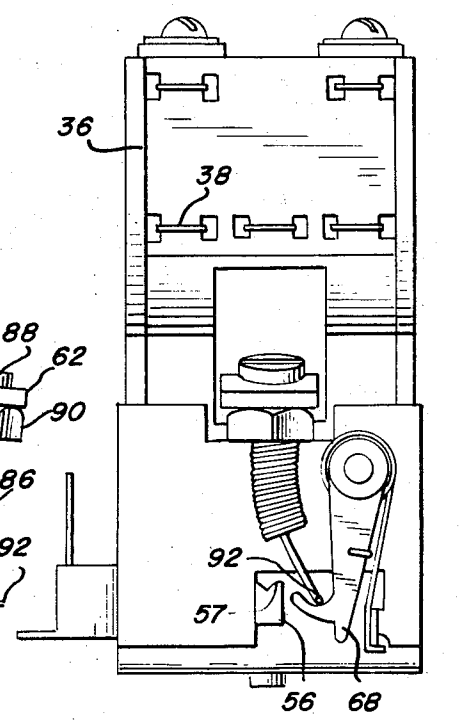


FIG. 8



INVENTOR
THEODORE J. OBSZARNY

BY

ATTORNEY

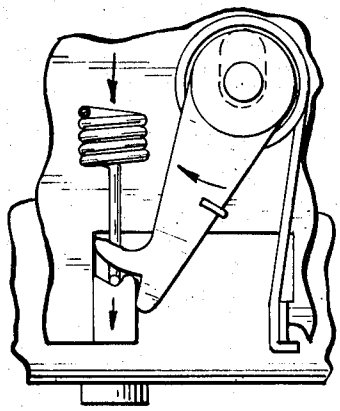


FIG. 9

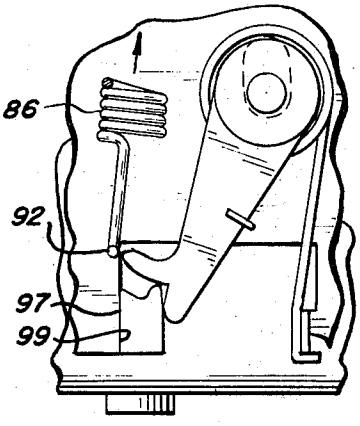


FIG. 9A

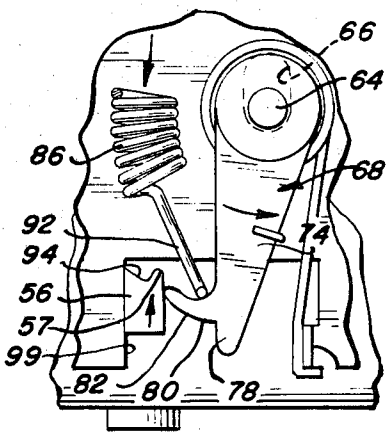


FIG. 9B

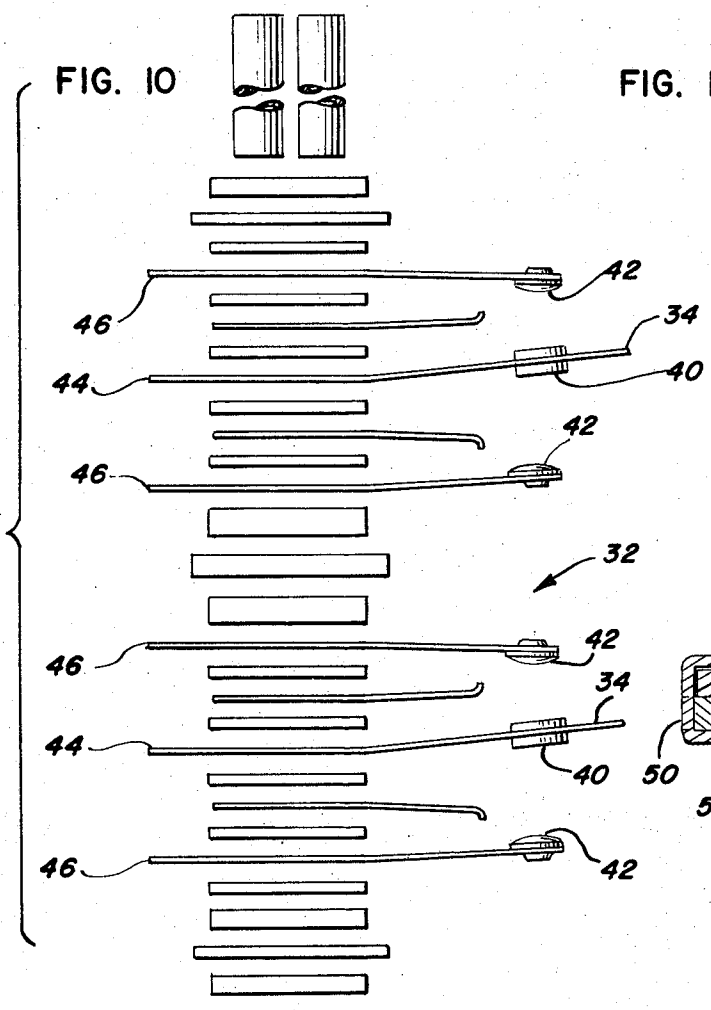


FIG. 10

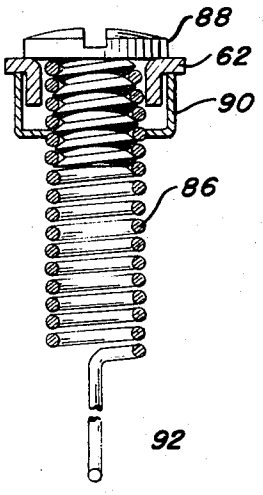


FIG. 11

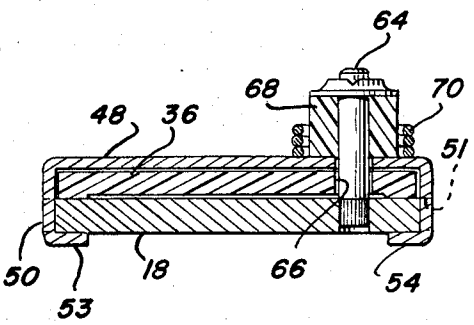


FIG. 12

INVENTOR
THEODORE J. OBSZARNY

BY

ATTORNEYS

SEQUENCE RELAY

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.

Sequence relays have many applications. For example, a sequence relay may be utilized in garage door openers where a switch is operated to momentarily close a circuit. Closing the switch causes relay contacts to close and lock thereby allowing the garage door to be opened by operation of a motor. The subsequent momentary operation of the switch will unlock the relay contacts and will close certain previously open contacts thereby effecting switching which closes the garage door by operation of a motor.

Typically, sequence relays provide for an armature which drives a counter mechanism. The counter mechanism includes a rotatable cam which, in turn, engages contacts and drives those contacts to a desired position, dependent upon the shape of the cam.

Such a sequence relay operates quite well and has been utilized for some time in the art. However, it is desirable to reduce the size of such relays to eliminate parts and to reduce the cost of manufacture of sequence relays. These are just a few of the considerations accomplished by the present invention.

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.

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 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.

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

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 FIGURES:

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 a side elevation of the relay of the invention wherein the armature has been operated to drive the relay from the "first position" to the "second position;"

FIG. 4 is an end elevation of the relay as shown in FIG. 3;

FIG. 5 is a side elevation of the relay after the armature has been released from the position shown in FIG. 3;

FIG. 6 is an end elevation of the relay as shown in FIG. 5;

FIG. 7 is a side elevation wherein the armature has again been translated by passage of current through the coil to thereby permit movement of the relay from the second position back to the first position;

FIG. 8 is an end elevation of the relay as shown in FIG. 7;

FIG. 9 is an enlarged view of the drive and pawl mechanism incorporated as a part of the sequence relay of the invention;

FIG. 9A illustrates the sequential operation of the drive and pawl mechanism shown in FIG. 9;

FIG. 9B illustrates the further sequential operation of the drive and pawl mechanism illustrated in FIG. 8;

FIG. 10 is an exploded view of the contact blade assembly of the preferred embodiment of the present invention;

FIG. 11 is an enlarged cross-sectional view of the drive spring which is attached to the armature of the relay of the present invention; and

FIG. 12 is a cross-sectional view of the pawl mechanism of the present invention taken substantially along the line 11—11 in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The Figures are arranged in pairs to illustrate the sequential operation of the relay of the present invention. 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.

In a similar fashion, FIGS. 3 and 4, FIGS. 5 and 6 and FIGS. 7 and 8 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. FIG. 10 illustrates, in an exploded view, the construction of the contact sets 32. 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 thus 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 parallel to the movement of armature 24 about its pivotal axis. 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 as at 50 and 51 in FIG. 1 and FIG. 12. The notches 50 and 51 are engageable by tabs 53 and 54 respectively 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 so at the stud 56 may move freely from the "first position" illustrated in FIG. 2 to the "second position" illustrated in FIG. 4.

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. This attachment is illustrated in detail in FIG. 11. As shown in FIG. 11, the pan head screw cooperates with the spring 86 and 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 which is an L-shaped wire. The spring 86 is flexible and is typically fashioned from music wire. The extension is adapted to engage a channel 94 defined in the stud 56.

As stated above, the sequence of operation is illustrated by the separate pairs of FIGURES. Starting with the first step in the operation of the relay as illustrated in FIGS. 1 and 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 its extension leg 92 into engagement with the channel 94 of stud 56. Note that extension 62 is inclined slightly to thereby place leg 92 in a plane which forms an arcuate angle with the plane of lifter 36. This insures positive engagement of leg 92 with channel 94.

The lifter 36 is thus driven down into a "second position" as illustrated in FIG. 3 and FIG. 4. As this stud 56 is driven down, the spring 70 causes the pawl 68 to be biased in a clockwise direction, thereby engaging the pawl 68 with the stud 56. 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. 9A. The spring 86 this bends permitting the extension leg 92 to travel along the guide surface 82, thereby permitting the armature to assume the upward position illustrated in FIG. 5. The relay is thus locked in the "second position."

The next step in the sequence of operation is illustrated by FIGS. 7 and 8. The coil has again been activated to cause the armature 24 to be driven downward. This time, 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 as illustrated in FIG. 8.

FIG. 9B illustrates in detail how the spring 86 flexes and the manner in which the extension leg 92 engages the surface 84 to drive the pawl 64 out of engagement with the stud 56.

Now again referring to FIG. 7 and FIG. 8, when the coil 10 is deactivated, the armature assumes the position illustrated in FIG. 1.

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. It should be noted for example, that the spring 86 and various other mechanical arrangement for operating the lifter 36 can be placed in the region intermediate the coil 10 and the run 18 without departing from the scope of the invention. Also, a spring may be substituted for the spring action of blades 34.

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.

2. The improved relay of claim 1 wherein said means for locking comprises pawl means biased to engage said lifter means and hold said lifter means in said second position whenever said lifter means is driven to said second position by said drive means.

3. The relay of claim 1 wherein said lifter means is mounted on said frame for translatable movement substantially parallel to the direction of pivotal movement of said armature.

4. The relay of claim 1 wherein said lifter means include stud means and wherein said drive means is comprised of pawl means adapted to engage said stud means and thereby lock said lifter means in said second position.

5. The improved relay of claim 1 wherein said locking means comprises pawl means rotatable about an axis perpendicular to the direction of translation of said lifter means, said pawl means adapted to engage stud means on said lifter means whenever said lifter means is in said second position.

6. The relay of claim 1 wherein said drive means is attached to said armature and is moved by said armature in a direction substantially parallel to the direction of pivotal movement of said armature.

7. The relay of claim 1 wherein drive means comprises flexible means for engaging said lifter means to drive said lifter means to said second position and for alternatively engaging said means for locking to disengage said means for locking upon flexion of said drive means.

8. The relay of claim 1 wherein said drive means comprises flexible means fixed to said armature, said drive means also including an extension to engage said lifter means and, alternatively, said means for locking.

9. The relay of claim 1 wherein said means for locking comprises a pawl, said pawl including a radial arm extending from an axis of rotation for said pawl, a leg extending from said radial arm and adapted to engage said drive means whenever said pawl is being translated to the unlocked position, and means on said radial arm for engaging said lifter means to normally hold said lifter means in said second position.

10. The improved relay of claim 9 wherein said leg is arcuately shaped to facilitate engagement with said drive means.

11. The relay of claim 9 wherein said radial arm is normally biased about an axis into engagement with said lifter means and said radial arm includes an engaging surface driving said radial arm into engagement with said lifter means thereby limiting the travel of said radial arm, said radial arm also including a surface adapted to engage said lifter means and hold said lifter means in said second position, said radial arm also including a drive means guide surface for guiding said drive means from engagement with said lifter means subsequent to positioning of said lifter means in said second position by said drive means and subsequent to removal of a signal input to said relay.

12. The relay of claim 1 wherein said lifter means includes stud means extending therefrom and positioned for engagement with said drive means.

13. The relay of claim 12 wherein said stud means includes channel means for engagement with said drive means to hold said drive means in a fixed position relative to said stud means.

14. The relay of claim 1 wherein said drive means comprises a flexible spring positioned for movement substantially parallel with said lifter means, said spring having one end attached to said armature and having its opposite end positioned for engagement with said lifter means.

15. The relay of claim 1 wherein said means for translating said lifter means from said second position to said first position comprises biasing means.

16. The relay of claim 1 wherein said means for translating said lifter means from said second position to said first position comprises portions of said contact means engaging said lifter means to continuously bias said lifter means in the direction of movement from said second position to said first position.

17. The relay of claim 1 wherein said lifter means is engaged with a plurality of contact means for switching thereof.

18. The relay of claim 1 wherein said drive means is positioned for movement in a plane at an arcuate angle to a plane defined by the movement of said lifter means.

19. 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:

a lifter attached to said frame and translatable in a plane substantially parallel to the direction of pivotal movement of said armature, said lifter being translatable from a first position to a second position by drive means, said lifter being normally biased toward said first position by biasing means, said lifter having a portion thereof in engagement with contact means to effect switching of said contact means whenever said lifter is translated from one position to another; said drive means being attached to said armature and positioned for movement by said armature into engagement with said lifter whenever said lifter is in said first position; a

biased pawl member biased to pivot about an axis perpendicular to the direction of translation of said lifter, said pawl member including a surface for engagement with said lifter whenever said lifter is in said second position to hold said lifter in said second position, said pawl member also including a drive means engaging surface positioned for engagement with said drive means whenever said pawl member is positioned to maintain said lifter in said second position.

20. The improved relay of claim **19** wherein said drive means comprises a flexible spring member attached to said armature and having a longitudinal extension from the one end for engagement with said lifter.

21. The improved relay of claim **19** wherein said pawl member comprises a leg radially extending from said pivotal axis and biased into engagement with a stud projecting from said lifter.

22. The improved relay of claim **19** including a saddle member for attachment to said frame to thereby define a channel in which said lifter is positioned for translatable movement.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,689,857 Dated September 5, 1972

Inventor(s) THEODORE J. OBSZARNY

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the drawings, cancel Figures 1 and 9a and substitute Figures 1 and 9a on the attached sheet.

Signed and sealed this 18th day of December 1973.

(SEAL)
Attest:

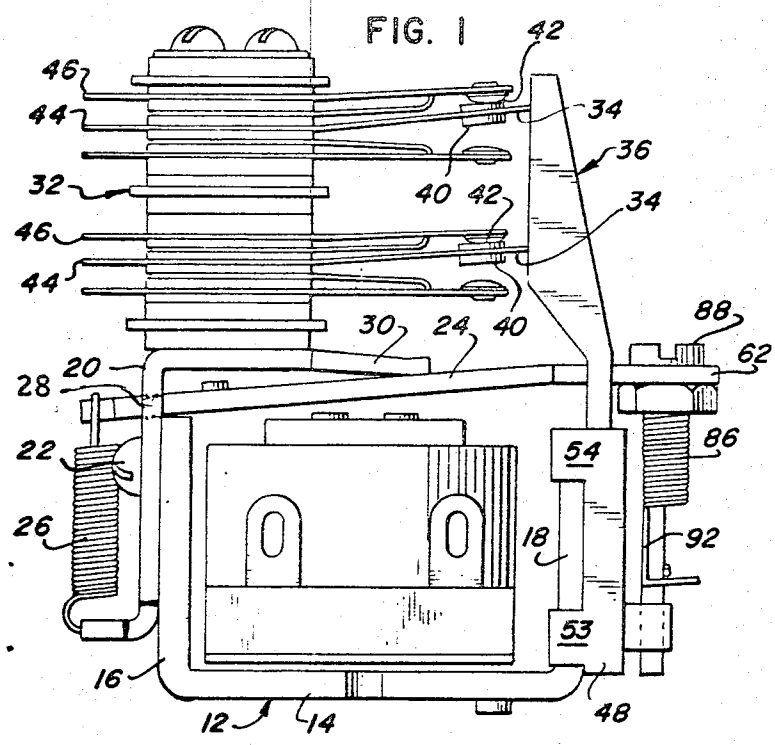
EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
☆ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

FIG. 1


42
46
44
34
36
32
40
42
34
46
44
88
30
24
40
62
20
28
86
22
54
92
26
18
53
16
48
12
14

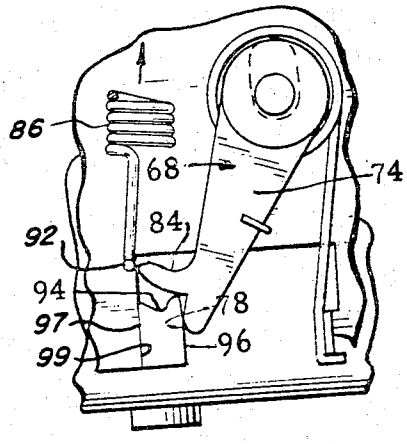

86
68
74
84
92
94
78
97
96
99

FIG. 9A