June 28, 1966 D. J. KLEIN 3,258,763

THREE POSITION STATUS INDICATOR

Filed July 19, 1963 2 Sheets-Sheet 1

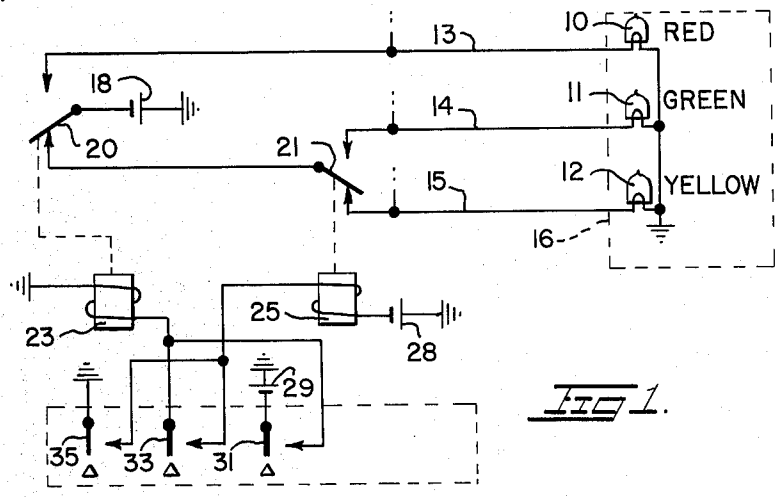


Fig 1.

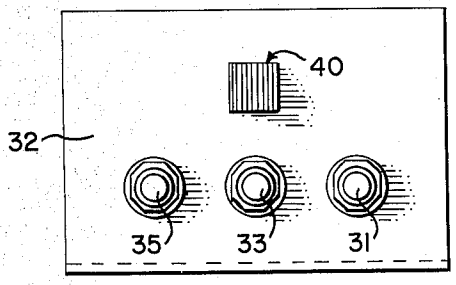


Fig 2.

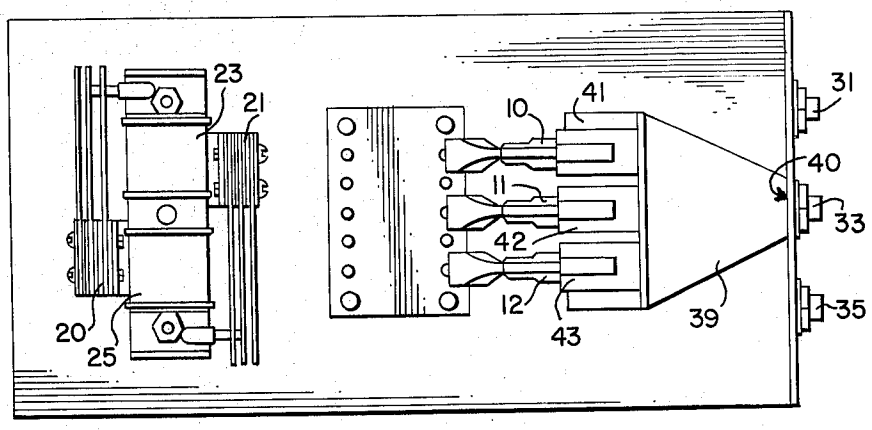


Fig 3.

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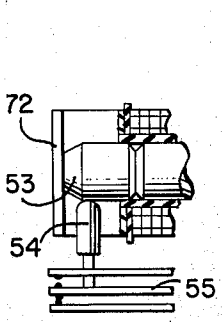


Fig 4A.

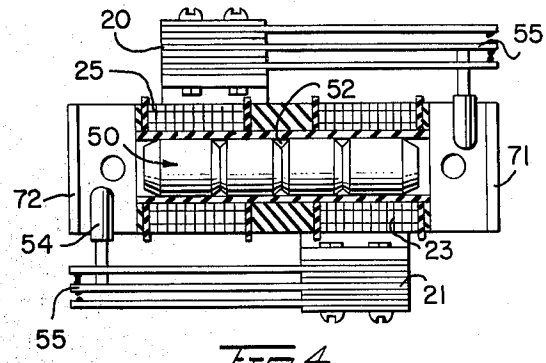


Fig 4.

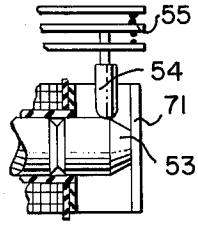


Fig 4B.

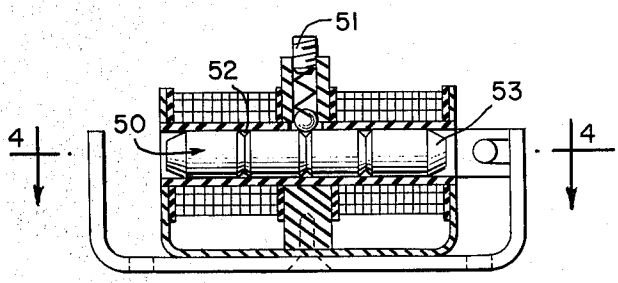


Fig 5.

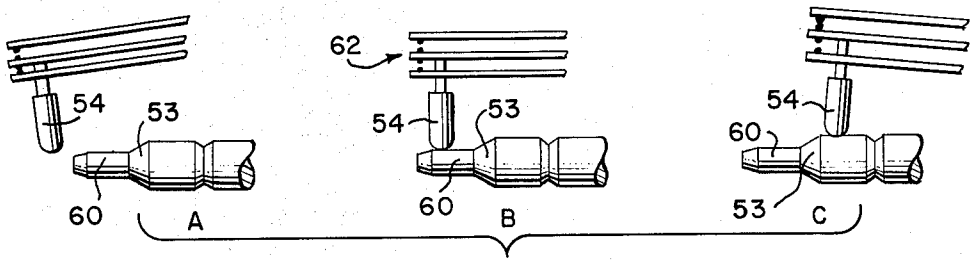


Fig 6.

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3,258,763

THREE POSITION STATUS INDICATOR

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Filed July 19, 1963, Ser. No. 296,169
3 Claims. (Cl. 340—332)

This invention relates to multiple position relays having at least three separate stable switching positions and more specifically, it relates to status indicators for visually displaying multiple-position signals.

Simple bistable memory devices, such as latching relays and flip flop circuits, are well known in the art, but tristable or multistable status devices have been significantly complex. An even greater disadvantage is the requirement for continuous power in many of the prior art multi-state devices used as memory devices to maintain the selected status.

A memory device for general application or for use in status indicators must be capable of performing outside work by operation of switching devices. Non-destructive readout characteristics are also desirable, so that multiple readouts of the same condition or continuous readout may be provided without restoring the status in the memory device.

One example of a tristable visual display device is a room status indicator for a hotel, which can signal that a room is occupied, free or in need of maid services. Such an indication should be capable of remote as well as local display. Thus, it can be monitored at the room door or at the hotel desk, and possibly also in the maids' quarters. If such a display device requires continuous power to store the status it generates excessive heat, is more subject to failure and is expensive since more rugged components must be used in construction for continuous rather than momentary operation.

A further requirement of a status indicator is the lack of confusion in identification. Display systems become confusing when mental decisions must be made to interpret the positions of a large number of lamps where information is contained relative to the particular display position.

Accordingly, it is an object of this invention to provide improved multistable state memory means.

Another object of the invention is to provide reliable and simplified means for visually indicating a multiple-position status.

Thus, in accordance with an embodiment of the invention, a tristable state status indicator is provided employing a simplified memory relay. The status indicator may be operated manually by closing one of three momentary contact switches, which accordingly operate the memory relay to a corresponding stable static (non-energized) storage position. The relay has accompanying switch blades so that a corresponding annunciator lamp of a distinctive color is energized in each storage position. The lamp signals are concentrated at a single panel position to provide a fool-proof status indication of the selected relay state.

Simplified relay construction is afforded by providing a detented movable magnetic core with a plurality of actuating solenoids arranged along the core axis to influence the movement of the core to a detented position determined by the combination of solenoids energized momentarily. The core is shaped to operate as a cam for one or more sets of movable switching springs provided with a corresponding cam-rider extension.

Further features and objects of the invention will be found throughout the following detailed description of the invention as displayed in the accompanying drawing, wherein:

FIGURE 1 is a schematic circuit diagram of a tri-position status indicator embodiment of the invention;

FIGURE 2 is a front panel view of an assembled status indicator;

FIGURE 3 is a top plan view of an assembled status indicator;

FIGURE 4 is a plain view, partly in section, of a memory relay afforded in accordance with the invention;

FIGURES 4A and 4B are fragmentary views of the relay of FIGURE 4 in different operating positions;

FIGURE 5 is an elevation view, partly in section, of a portion of the relay of FIGURE 4; and

FIGURES 6A, B and C are fragmentary sketches of a modified relay switching embodiment in various operating positions.

The status indicator of FIGURES 1–3 is of the type useful in providing signals for the status of a room in a hotel. Thus, colored lamps **10**, **11**, **12** respectively, for example, red, green and yellow, may indicate "maid service required," "room free for occupancy," and "room occupied." The circuit leads **13**, **14**, **15** for the lamps and the lamp panel portion **16** may be located at several positions, such as with the room clerk, at the room door and in the maids' quarters. Annunciator lamps **10**, **11** and **12** may be low powered neon lamps, for example operated by a voltage source such as battery **18** or an equivalent 110 volt A.C. line with suitable current limiting resistors.

Only one lamp is energized in accordance with the positions of relay contacts **20** and **21**. Thus, in the status position shown lamp **12** is energized, but if contact **21** is moved, lamp **11** is energized and if contact **20** is moved, lamp **10** is energized. Solenoid winding **23** serves to move contact **20** from its rest position to its "latching" position energizing lamp **10**, when energized by momentary contact **31** in key panel **32**, as provided from a power source represented by battery **29**. Similarly, solenoid **25** is energized by operation of momentary contact **35** from power source represented by battery **28**. Batteries **28** and **29** may be one and the same if so desired.

When the remaining key **33** is momentarily closed it serves to operate both solenoids **23** and **25** from power source **28** to return both contacts to the rest position shown. Thus, the respective momentary contacts **31**, **33** and **35** could be labeled red, yellow and green to correspond with the lamp designation, or such other designation as desired to indicate the choice of status.

To provide a single status indication on the front panel, a light pipe such as plastic prism **39** is employed with a front panel viewing window **40**. Since each lamp has a distinctive color filter **41**, **42** or **43**, and is energized alone, the front panel window will display a single color at a single position, so that reading of numbers or mental interpretation of the position will not be required.

The solenoid arrangement as shown in FIGURES 4–6 employs a soft magnetic core **50**, which is held in three stable positions by detent mechanism **51** which engages notches **52** in the core. The core is shaped to have a cam surface **53**, which operates on cam rider **54** to move the switch springs **55**.

Solenoids **23** and **25** are arranged along the axis of core **50** so that they tend to center the core whenever energized in series. Thus, as solenoid core **25** is energized, the core is moved to its leftmost latching or detented position as sketched in FIGURE 4A. Conversely, when solenoid coil **23** is energized the core is moved to its rightmost latching position as shown in FIGURE 4B. When both solenoid coils **23** and **25** are energized in series, the core **50** is centered and contact assemblies **20**, **21** are in their rest position.

End stops **71** and **72** are provided to limit the move-

ment of the core. Accordingly, the amount of energization of the solenoid windings need not be critical since an overshoot will not occur.

It is to be noted that because of the constructional features described, the relay can be quite inexpensive. For example, the solenoids may be designed for momentary operation rather than continuous duty because of the static storage feature incorporated.

In FIGURE 6, the cam-core action is shown with three switching steps on a single switch assembly, accomplished by providing an intermediate cam surface **60**, which actuates the cam rider **54** in position B to provide open switch contacts **62**. The principles of this invention are thus extendable to include switching variations generally useful in obtaining a status indication over a plurality of memorized positions, requiring no stand-by power except for lamp excitation.

Having therefore described the nature of this invention, features of novelty are set forth in detail in the following claims.

I claim:

1. A three position electromagnetic relay switching circuit comprising in combination, two actuating solenoids arranged side by side along a common axis, a soft magnetic core member longer than either solenoid and freely movable along said axis to a centered position within either solenoid under the influence of the magnetic field produced by either solenoid when energized, detent structure mounted between said solenoids comprising a spring biased cam rider and three cammed surface indentations in said core member to receive the cam rider and thereby frictionally hold the core in three stable positions without energization of the solenoid, said cam rider and cammed surface being fashioned to permit said core to attain a different stable position by frictional displacement of the cam rider as said solenoids are energized to center the core in a different position, and three temporary energization circuits for establishing said three stable positions respectively comprising a momentary switch coupling an energizing source independently to each solenoid to center the core therein at the two stable end positions, and a third momentary switch coupling an energizing source to both solenoids simultaneously to center the core within both solenoids at the center stable position.

2. Annunciator means as defined in claim **1** including switching contacts having a spring with a cam rider extension disposed to ride the cammed surface of said core

to provide distinctive switching circuits for each rest position, three lamps of different colors, a plastic prism displaying the light from each of the three lamps at a single viewing panel position, and connections through said switching circuits to light lamps of different colors for each stable position.

3. A tri-stable memory device comprising two adjacent solenoid windings with a magnetic core having a cammed surface movable within the windings to center in three stable positions respectively within the two solenoids at end positions and intermediate the two solenoids at a center position, a spring biased frictional detent mechanism comprising a cam rider and a mating cammed surface on said core to hold the core removably in each of said positions without energization of said solenoids, spring biased switch contacts having a cam rider engaging said cammed surface of the core to provide three distinctive switching circuits for the respective stable positions, and circuit means connecting said two solenoid windings for moving said core to one of the stable positions against the detent friction respectively to an energizing source singly to establish the two end core positions and together to establish the intermediate core position.

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