April 26, 1966 K. C. ALLISON ETAL 3,248,490

SELECTOR SWITCH WITH MULTIPLE TIE ROD FASTENER AND MOUNTING BRACKET

Filed July 30, 1963

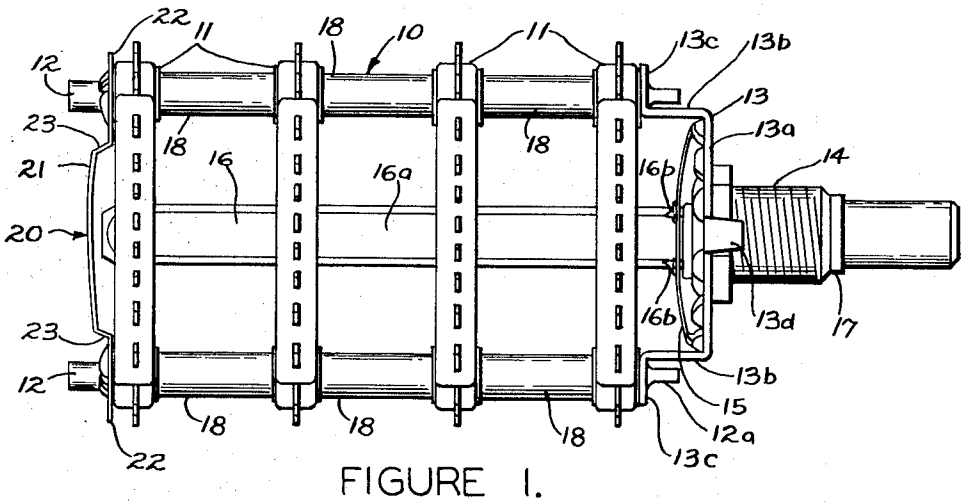

FIGURE 1.

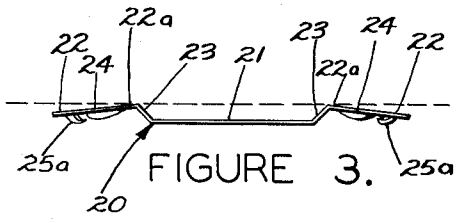

FIGURE 3.

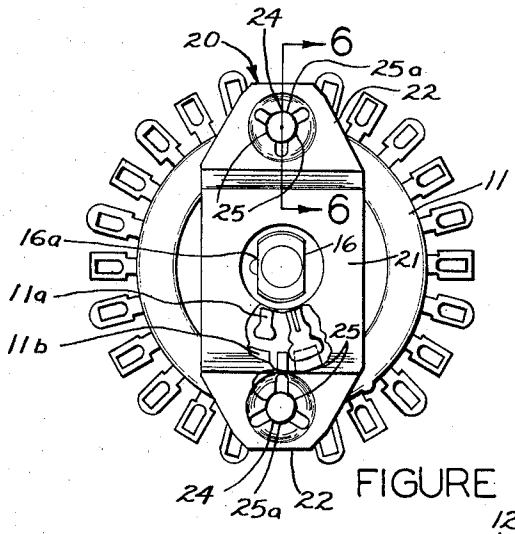

FIGURE 2.

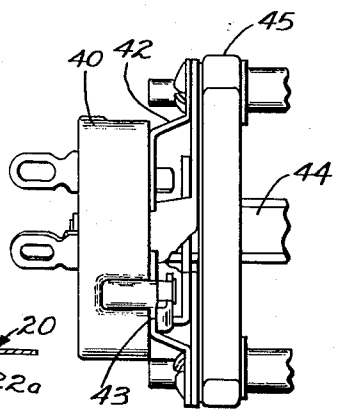

FIGURE 5.

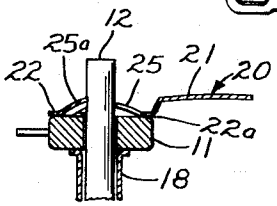

FIGURE 6.

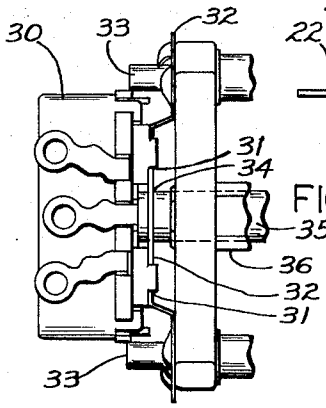

FIGURE 4.

INVENTORS

KENNETH C. ALLISON

WILLIAM L. KELVER

BY John J. Gaydos

ATTORNEY

United States Patent Office 3,248,490 Patented Apr. 26, 1966

3,248,490

SELECTOR SWITCH WITH MULTIPLE TIE ROD FASTENER AND MOUNTING BRACKET

Kenneth C. Allison, Crystal Lake, Ill., and William L. Kelver, Cassopolis, Mich., assignors to CTS Corporation, Elkhart, Ind., a corporation of Indiana

Filed July 30, 1963, Ser. No. 298,742
4 Claims. (Cl. 200—14)

The present invention relates to selector switches and to multiple tie rod fasteners and, more particularly, to an improved selector switch and to a multiple tie rod fastener and mounting bracket for rigidly securing a component onto a pair of spaced tie rods.

In the production of electrical components, e.g., a selector switch, a pair of threaded screws extending from a bracket has been employed for stacking a plurality of wafer switch assemblies thereonto. The wafer switch assemblies may be spaced from each other by tubular spacers fitted over the threaded portion of the screw or the wafer switch assemblies may be stacked next to each other. After the proper number of wafer switch assemblies has been stacked onto the spaced pair of threaded screws, a bridge member may be employed for spacing properly the unsecured ends of the tie rods. A nut threadedly engaged onto each of the screws fixedly secures the bridge member and the wafer switch assemblies to the bracket. When the nuts are being threadingly engaged onto the screws, the torque applied to each of the nuts tends to rotate the bridge member of the switch with respect to the bracket and, consequently, the individual wafer switch assemblies become spiraled or twisted. Various complicated fixtures have been employed to avoid spiraling of the wafer switch assemblies, but much reliance is still placed upon human detection. However, as the size of the selector switch and the individual wafer switch assemblies decreases, the size of the bridge members and the tie rods also decreases proportionately. Therefore, the tendency for spiraling increases since the operator finds it more difficult to adjust to the assembly clearance to correct the twisting. Further, the angle generated by the decrease in size increases proportionally with a reduction in size of the selector switch. It would, therefore, be desirable to improve the design of certain electrical components, e.g., a selector switch, by employing means for fixedly securing one or more assemblies to the tie rods without causing twisting of the individual assemblies.

In the manufacture of selector switches, a large variety of screws generally is stocked in order that an adequate supply of the proper length screw is always available. By employing unthreaded rods instead of screws, the desired length may be easily obtained by quickly cutting the rod to the proper length and swaging one end thereof to form a head thereon. Moreover, it is well known that a screw or threaded rod has approximately 50 percent the tensile strength of an unthreaded rod of the same diameter. By using unthreaded rods or tie rods for assembling the wafer switch assemblies together, the diameter of the tie rods can be decreased. Such features have not been introduced heretofore since the present type of single or multiple sheet metal fastener available on the market generally is incapable of rigidly holding the wafer switch assemblies of a selector switch in stacked relationship. It would, therefore, also be desirable to provide an improved fastener for rigidly securing one or more assemblies onto a pair of tie rods.

Heretofore, the practice had been to secure a separate mounting bracket onto the ends of the threaded screws for mounting various electrical components, e.g., a variable resistor, onto the end of a selector switch. It would, therefore, also be desirable to provide a multiple tie rod fastener with mounting means, the electrical component being secured to the central portion of the multiple tie rod fastener. The shaft employed for rotating the rotors of the wafer switch assemblies may extend through an aperture in the fastener and into cooperation with the electrical component for controlling the same.

Various types of multiple sheet metal fasteners are currently available on the market. None of these fasteners, however, incorporates means for increasing the force for maintaining a component fixedly secured on a pair of tie rods. By utilizing the resiliency of a central member integrally joining a pair of fasteners together and by preforming the fasteners of a multiple tie rod fastener at an angle to the central member, the holding action of the fasteners against the component or assembly secured on the pair of tie rods is increased considerably. It would, therefore, also be desirable to provide such a multiple tie rod fastener wherein the fasteners are disposed at an angle to the central member and integrally secured thereto.

Accordingly, it is an object of the present invention to provide an improved fastening means for a selector switch.

Another object of the present invention is to provide an improved selector switch wherein the wafer switch assemblies are properly aligned with respect to each other.

An additional object of the present invention is to provide an improved multiple tie rod fastener for firmly securing a component onto a pair of tie rods.

A further object of the present invention is to provide a combination multiple tie rod fastener and mounting bracket.

A still further object of the present invention is to provide a multiple tie rod fastener having the securing members thereof disposed at an angle to the central portion thereof, the securing members each being provided with a plurality of teeth for gripping a pair of tie rods wherein the teeth are urged into biting engagement with each of the tie rods by the central portion of the fastener bridging the tie rods together.

Yet another object of the present invention is to provide a multiple tie rod fastener for fixedly securing a plurality of wafer switch assemblies onto a pair of tie rods whereby rotation of the tie rods disassemblies the fastener from the tie rods by generating a spiral on the tie rods.

Further objects and advantages of the present invention will become apparent as the following description proceeds, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Briefly, the present invention is concerned with a selector switch, a multiple tie rod fastener, and a mounting bracket. The multiple tie rod fastener is employed for securing at least one and preferably a plurality of components, e.g., a plurality of wafer switch assemblies, onto a pair of tie rods extending from a wall or the like. In one instance, the multiple tie rod fastener is employed for securing a plurality of spaced wafer switch assemblies onto a pair of tie rods extending from a mounting bracket. The multiple tie rod fastener comprises a central portion of sheet metal and a pair of securing or end members integrally attached thereto. Each of the end members is provided with an aperture for receiving a tie rod. The end members are so orientated with respect to the central spring portion of the fastener that prior to assembling the multiple tie rod fastener onto a pair of tie rods each of the end members is disposed at an angle slightly less than 90° with respect to the axis of each of the tie rods. By forcing the end members of the multiple tie rod fastener onto the tie rods, the end members are biased into

a plane substantially normal to the axis of the tie rods. Upon releasing the force, the inner portions of the apertures of each of the end members bite into and grip the tie rods and, accordingly, firmly hold the wafer switch assemblies onto the tie rod.

When necessary, the central portion of the tie rod fastener is designed to accommodate an apparatus such as a variable resistor. Thus, it is merely necessary to secure the apparatus rigidly onto the central portion of the multiple tie rod fastener, and then assemble the multiple tie rod fastener onto the ends of the tie rods. In a preferred form of the invention, each of the apertures is provided with a plurality of inwardly extending teeth, the teeth in each of the end members being formed to generate a spiral whenever it is desirable to disassemble one of the tie rods from the multiple tie rod fastener by rotation of the former.

For a better understanding of the present invention, reference may be had to the accompanying drawings wherein the same reference numerals have been applied to like parts and wherein:

FIGURE 1 is a side view of a selector switch employing a multiple tie rod fastener;

FIGURE 2 is a rear view of the selector switch of FIGURE 1, a portion of the fastener being removed to show the contacts of the switch;

FIGURE 3 is a side view of a multiple tie rod fastener;

FIGURE 4 is a fragmentary view of the rear portion of a selector switch employing a multiple tie rod fastener having an electrical control fixedly secured to the central portions of the fastener;

FIGURE 5 is a fragmentary view of the rear portion of a selector switch assembly employing a tie rod fastener having an on-off switch fixedly secured to the fastener; and

FIGURE 6 is a fragmentary section taken along line 6—6 of FIGURE 2.

Referring now to the drawings and preferably to FIGURE 1 thereof, there is illustrated a multi-position or selector switch, generally indicated at **10**, comprising a plurality of wafer switch assemblies **11** fixedly secured in spaced relationship onto a pair of tie rods or studs **12** but a multiple tie rod fastener **20**. It is to be understood, however, that various other components, e.g., an on-off switch, may also be assembled onto a pair of tie rods and fixedly secured thereon by the multiple tie rod fastener.

Considering first the selector switch **10**, it comprises a front end bracket **13** of general configuration. The end bracket **13** comprises a central portion **13***a* provided with a centrally located aperture for receiving a bushing **14**. Preferably, the bushing **14** is provided with an external thread for fixedly securing the selector switch **10** to a not shown panel with a suitable threaded nut. The front end bracket **13** generally is referred to as a detent bracket inasmuch as it supports a detent assembly **15** for selectively positioning the rotor contacts **11***a* (see FIGURE 2) of each of the wafer switch assemblies **11** with respect to the stator contacts **11***b* thereof. In order to space the detent assembly **15** from the wafer switch assembly **11** immediately adjacent thereto, the detent bracket **13** is provided with a pair of lateral extensions or legs **13***b* having a pair of feet **13***c* extending outwardly of the lateral extensions **13***b* to provide a supporting surface for the wafer switch assemblies **11**. Each of the feet **13***c* is provided with an aperture for receiving one end of each of the tie rods **12**, the end of the tie rod **12** adjacent to the aperture in each of the feet **13***b* of the detent bracket **13** being swaged in order to limit in one direction the axial movement of the tie rod with respect to the detent bracket. An ear **13***d* extending normal to the central portion **13***a* of the detent bracket **13** engages a slot in a not shown panel and fixedly secures the angular position of the switch **10** with respect to the panel.

As best shown in FIGURE 2 of the drawings, an elongated shaft **16** provided with a pair of flats **16***a* inwardly of the detent bracket is employed for rotating the rotors of each of the wafer switch assemblies **11**. One end of the shaft **16** is journaled in the bushing **14**, and a C washer **17** fitted into a circumferential groove of the shaft **16** prevents the shaft from shifting inwardly or to the left as shown in FIGURE 1 of the drawings. To prevent the shaft from shifting outwardly of the bushing **14**, portions **16***b* of the shaft **16** adjacent to the detent bracket **13** are crimped. Thus, with this arrangement, the longitudinal movement of the shaft is restricted with respect to the bushing **14** and the detent bracket **13**.

Inasmuch as the novel features of the invention do not reside in the wafer switch assemblies **11**, additional details thereof are not being included herein. For further details, reference may be had to a selector switch shown in United States patent of Allison No. 2,988,606, dated June 13, 1961 and in my copending application, Serial No. 5686, now Patent No. 3,219,785, filed February 1, 1960, both the patent and the application being assigned to the same assignee as the present invention.

As shown in FIGURE 1 of the drawings, one or more wafer switch assemblies **11** are assembled onto the tie rods in spaced parallel relationship, the spacing being obtained by assembling tubular spacers **18** between adjacent wafer switch assemblies. If preferable, the tubular spacers **18** may be deleted and the wafer switch assemblies **11** may be stacked on the tie rods **12** in side by side relationship.

After the last wafer switch assembly **11** is assembled onto the tie rods **12**, means must be employed for fixedly securing the wafer switch assemblies **11** thereonto. In accord with the present invention, the multiple tie rod fastener **20** is assembled onto the ends of the tie rods in a simple and facile manner without spiraling the individual wafer switch assemblies as is usually done when a threaded nut is employed for fixedly securing the wafer switch assemblies onto a pair of threaded screws extending from the detent bracket.

As best seen in FIGURES 1, 2, and 3 of the drawings, the multiple tie rod fastener **20** comprises a sheet metal central or main portion **21** having a pair of sheet metal end members **22** integrally secured thereto. It is to be understood, however, that the number of end members integrally secured to the central portion may be increased or decreased. If only one end member is employed, then one end of the central portion is merely fixedly secured so as to be the equivalent of a second end member. If three end members are employed, then the end members are equally spaced around the central portion. In a preferred form of the invention, the end members **22** lie in a plane in spaced relationship to the major plane of the central portion **21** to prevent the use of spacers or washers intermediate the multiple tie rod fastener **20** and the adjacent wafer switch assembly **11**. Thus, the number of parts for assembling the selector switch **10** is reduced and the major plane of the central portion **21** of the multiple tie rod fastener **20** is properly spaced from the rotor contacts **11***a* so as not to interfere with the rotation of the rotor in the last wafer switch assembly. As illustrated in FIGURES 1 and 3 of the drawings, the central portion **21** is provided with a short substantially lateral extension **23** for integrally securing each of the end members **22** to the central portion **21**.

It must be appreciated that the multiple tie rod fastener **20** fixedly securing the wafer switch assemblies onto the tie rods **12** also is provided with means for applying sufficient force against the wafer switch assemblies to prevent spiraling of the assemblies during operation of the selector switch in order to avoid misalignment of the contacts of one of the wafer switch assemblies with respect to the other. To this end, the major plane of each of the end members **22** of the multiple tie rod fastener **20**, while unassembled, forms a small angle with respect to a plane normal to the axis of the tie rods. In other words, as best illustrated in FIGURE 3 of the drawings, each of the

end members **22** forms an angle of approximately 4° with respect to a plane in spaced parallel relationship to the major plane of the unbowed central portion **21**. It is to be understood, however, that the end members **22** may form a positive or negative angle with respect to the plane, i.e., the end members may be angled upwardly or downwardly as well as inwardly or outwardly of the central portion **21** of the multiple tie rod fastener **20**. When the end members extend inwardly of the central portion, then corresponding openings are usually provided in the central member for receiving the tie rods.

In order to assemble the multiple tie rod fastener **20** onto the pair of tie rods **12**, each of the end members **22** is provided with an aperture **24**. As best illustrated in FIGURE 2 of the drawings, a plurality of teeth **25** extends inwardly of each of the apertures **24**. Preferably each of the teeth **25** associated with one aperture is disposed in different planes and is formed at an angle so as to generate the path of a spiral. Thus, after the multiple tie rod fastener **20** is assembled onto the ends of the tie rods **12**, the selector switch **10** may be disassembled by rotating the swaged heads of the tie rods, the effect thereof generating a spiral into the distal end of the tie rod. It is to be understood, however, that other types of aperture designs may be employed for receiving the tie rods **12**. For example, the aperture may be elliptical and receivable by a circular tie rod or vice versa.

Upon assembling the tie rod fastener onto the tie rods, it is merely necessary to apply a force substantially normal to the end members **22** with a suitable tool thus forcing the end members **22** into a plane normal to the longitudinal axis of the tie rods **12**. As best shown in FIGURES 1 and 6 of the drawings, the application of the force onto the end members **22** causes the central member **21** to bow slightly. In effect, the force flattens the end members **22** against the surface of the stator **11** of the wafer switch assembly, each of the end members pivoting about an axis formed at the junction of the end member and the lateral extension. When the tool forcing the multiple tie rod fastener is removed, the bowed central portion **21** biases the outer ends of the end members **22** toward the free ends of the tie rods causing the teeth **25** of the end members **22** to grip each of the tie rods **12**. As soon as the teeth **25** grip each of the tie rods **12**, the outer tooth **25***a* becomes fixed with respect to the associated tie rod **12** (see FIGURE 6) urging the end members **22** to pivot at a point or between the distal end of the outer tooth **25***a* and the tie rod, the point becoming a fulcrum. Thus, the pivoting action of the end members **22** about the fulcrum substantially increases the force at the inner end **22***a* of each of the end members **22** and, accordingly, maintains the wafer switch assemblies fixedly secured on the tie rods **12** after the force assembling the fastener thereonto is released.

For certain applications, it is desirable to mount an electronic control onto the end of a selector switch. For example, the electronic control may comprise a variable resistor **30** as shown in FIGURE 4 of the drawings. By providing suitable notches **31** in the outer edges of the central portion of a multiple tie rod fastener **32** employed for fixedly securing a plurality of wafer switch assemblies onto a pair of tie rods **33**, the variable resistor **30** may be mounted onto the fastener in a simple and facile manner before or after the fastener **32** is assembled onto the tie rods. With this arrangement, it is possible to select the proper angular positions of the rotors of the individual wafer switch assemblies by selectively rotating a tubular shaft **36** and simultaneously vary the resistance of the variable resistor **30** by rotating an inner shaft **35** disposed within the tubular shaft **36**. When the multiple tie rod fastener **32**, generally referred to as a multiple tie rod fastener and mounting bracket, is employed for supporting an electronic control, e.g., a variable resistor, the central portion of the multiple tie rod fastener and mounting bracket **32** is provided with an aperture **34** slightly larger than the diameter of the shaft **35**. Thus, the shaft can rotate freely in the aperture **34** of the multiple tie rod fastener and mounting bracket **32** and engage a suitable not shown driver or the like carrying a contact finger in the variable resistor **30**.

Another embodiment illustrated in FIGURE 5 of the drawings is substantially identical to the embodiment shown in FIGURE 4. The only exception is that instead of mounting an electronic control onto the central portion of a multiple tie rod fastener and mounting bracket, an on-off switch **40** is mounted onto the central portion of the bracket **42**, and a section of the central portion of the fastener is removed to provide adequate space for a bell crank **43** operatively connected to the switch **40** and to the end of a shaft **44**. Thus, by rotating the shaft **44** of the selector switch **45** from an initial position, not only are the rotors of the wafer switch assembly repositioned to alter the circuit, but a switch **40** is employed to energize or de-energize the equipment incorporating the selector switch **45**.

From the above description, it is apparent that an improved selector switch and a very simple and inexpensive multiple tie rod fastener and/or mounting bracket has been provided for fixedly securing a plurality of wafer switch assemblies onto a pair of tie rods extending from a detent bracket. Moreover, various types of electronic controls, e.g., a variable resistor, a potentiometer and the like as well as a switch such as a single or double pole on-off switch, may be mounted onto the central portion of the tie rod fastener and mounting bracket.

The operation of the present invention will readily be understood, in view of the detailed description included above, and no further discussion is included herewith. It will be appreciated that by employing a multiple tie rod fastener, the stability of a selector switch is increased and, by employing tie rods or unthreaded studs, the diameter of the supporting rods may be decreased thus increasing the electrical clearance between each of the tie rods and the adjacent contacts of the selector switch.

While there has been illustrated and described what is at present considered to be a preferred embodiment of the present invention and various modifications thereof, it will be appreciated that numerous changes and modifications are likely to occur to those skilled in the art, and it is intended in the appended claims to cover all those changes and modifications falling within the true spirit and scope of the present invention.

The invention claimed is:

1. In a multi-position electric switch having a supporting bracket, a pair of tie rods extending from the supporting bracket, at least one stator mounted onto the pair of tie rods, a shaft journaled in a bearing carried by the supporting bracket, and a rotor operatively associated with the stator and constrained to rotate with the shaft whereby upon rotation of the shaft a contact on the stator is selectively engaged by a contact on the rotor, the improvement comprising a multiple tie rod fastener of resilient material fixedly securing the stator onto the tie rods, the fastener comprising a central portion, and a pair of end members disposed at an angle to the central portion of the fastener and integral therewith, each of the angles defining a thrust bearing biased against the stator and exerting a force substantially parallel to the axis of the tie rods, each of the end members being provided with an aperture receiving the tie rods, an edge portion surrounding each of the apertures biting into the tie rod associated therewith and defining a fulcrum, the central portion being bowed during assembly of the fastener onto the tie rods thereby pivotally biasing the thrust bearings of the fastener forceably against the stator after the force assembling the fastener onto the tie rods is released.

2. The selector switch of claim **1** wherein the end members are integrally connected to the central portion with a double bend before the force assembling the fast-

ener onto the tie rods is applied to the fastener, one of the double bends defining the thrust bearing.

3. The selector switch of claim 1 wherein the central portion of the fastener is provided with means for mounting a component directly thereonto.

4. In a selector switch, the combination of a shaft, an end bracket supporting one end of the shaft, a pair of spaced tie rods carried by the end bracket, a rotor mounted on the shaft, a stator supported by the tie rods in operable relationship with the rotor, and a multiple tie rod fastener fixedly securing the stator onto the tie rods, the tie rod fastener comprising a central portion, a pair of end members integrally connected to the central portion, each of the end members being provided with an aperture received by the tie rods, and a plurality of teeth integrally secured to the peripheral edge of the apertures and extending inwardly thereof, each of the end members being preformed at an angle to the major plane of the central portion for fixedly securing the stator on the tie rods, each of the angles defining a thrust bearing biased against the stator and exerting a force substantially parallel to the axis of the tie rods, the central portion being bowed during assembly of the fastener onto the tie rods thereby pivotally biasing the thrust bearings of the fastener forceably against the stator after the force assembling the fastener onto the tie rods is released.

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KATHLEEN H. CLAFFY, *Primary Examiner.*

ROBERT K. SCHAEFER, *Examiner.*

JAMES R. SCOTT, *Assistant Examiner.*