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3,045,306

LOCKING DEVICE

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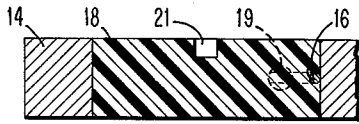


FIG. 5

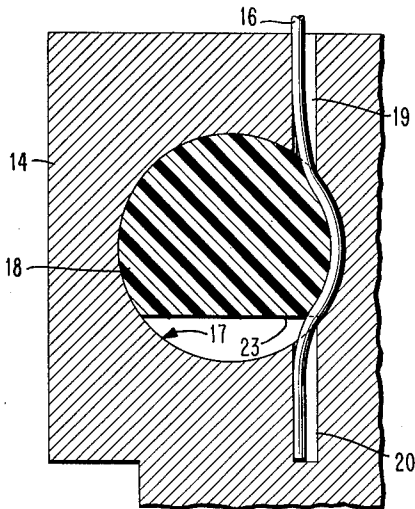


FIG. 4

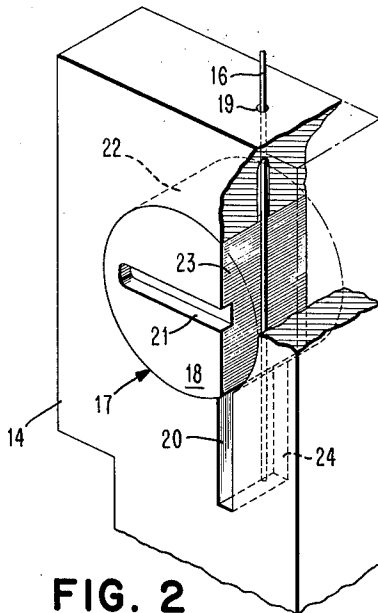


FIG. 2

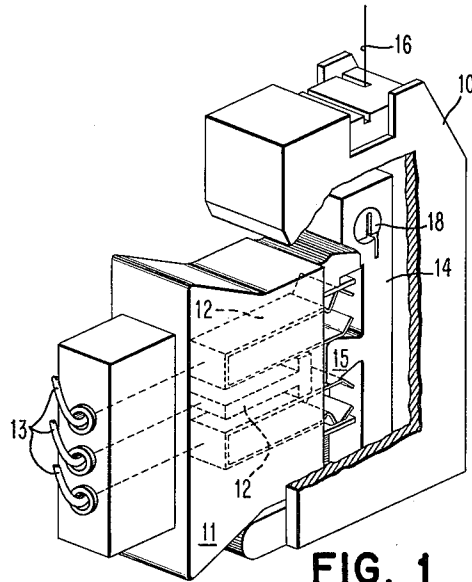


FIG. 1

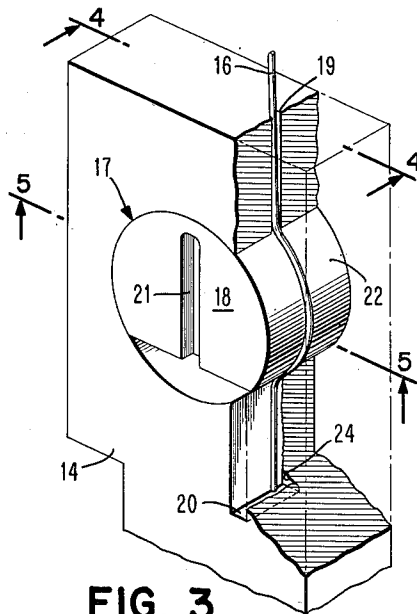


FIG. 3

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3,045,306

## LOCKING DEVICE

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This invention relates to a locking device and more particularly to an improved device for locking a wire element or the like to a mechanical element to be moved thereby.

It is a principal object of this invention to provide an improved locking device which is simple in construction so as to be adaptable to mass production techniques at improved cost economy.

It is also a prime object of this invention to provide an improved locking device whereby a firm fastening is obtainable but which also permits ease of locking and disassembly.

It is a further object to provide an improved locking device particularly suitable for use in miniaturized components.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a perspective view showing a device incorporating the invention.

FIGS. 2 and 3 are perspective views showing the element of FIG. 1 which contains the invention with portions cut away and phantomized to more clearly disclose the structural features of the elements coacting in accordance with the inventive principle.

FIG. 4 is a section view taken along line 4—4 of FIG. 3.

FIG. 5 is a section view taken along line 5—5 of FIG. 3.

Referring to FIG. 1, there is shown a switch device comprising a block member 10 and a plug-in member 11 having blade-like switch contact elements 12. External circuit leads 13 are connected to elements 12 in any well-known manner. Located within block member 10 is a switch operator 14 having an arm 15 designed to extend between contact elements 12. The opening and closing of the contact elements 12 are effected by the reciprocation of the switch operator. The details of switch operation and construction may be more fully understood by reference to application of B. J. Greenblott and M. J. Kelly, filed May 17, 1956, Serial No. 585,508, now U.S. Patent No. 2,919,326.

Reciprocating movement is imparted to the operator through a wire element 16 or the like connected thereto, which extends from a suitable external operator, such as an electromagnet, not shown. An adjustment mechanism, which forms no part of this invention, may be provided which is suitable connected to the wire in such a way as to effect fine vernier adjustments of the operator 14 to assure proper setting of arm 15 and contact elements 12.

In the first instance, it is apparent that in such a device, the continued successful operation of the switch depends upon the fixity of the wire 16 to the operator 14. In addition, the fixation of the parts and also the disconnection to facilitate replacement must be effectable with ease.

Also, in many applications, it is essential that the switch device of FIG. 1 be as small as possible. Thus miniaturization becomes a necessity. It is readily apparent that such being required, the connection of the wire element 16 to the switch operator 14 becomes further complicated.

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With this background, the details of the invention may be further appreciated by reference to FIGS. 2-5. In FIG. 2, it will be seen that the body portion of the switch operator 14 is provided with a cylindrical recess 17 within which a cylindrical locking member 18 is placed. The recess may be formed in any suitable manner but is preferably formed when the operator is molded. The recess 17 preferably extends completely through the operator 14, thereby permitting the insertion of the locking member 18 from either side. A channel 19, having an opening on the external upper surface of the operator 14 and in the side wall of the recess 17, provides access for wire element 16 to the recess. A cavity 20 is provided in the side wall on the side of the recess 17 opposite channel 19 to permit wire element 16 to extend completely across the recess. In the preferred version of the invention, channel 19 is a drilled cylindrical hole to provide some limitation to possible lateral displacement of the wire 16 while cavity 20 is a rectangular recess having an opening to one side surface of operator 14 as well as to recess 17 to thereby facilitate fabrication by molding. The enlargement of cavity 20 also facilitates location of the wire 16 therein during assembly. The interior surface 24 of cavity 20 is located to the one side of the line of entry of wire 16 and thereby serves to support the portion of wire 16 in the cavity to prevent buckling in one direction. The channel 19 and cavity 20, of course, are in alignment and are preferably located along a segment line to one side of the center axis of the recess.

Located within recess 17 is a cylindrical locking member 18 having a segment portion removed and a turning groove 21 in one face thereof. In accordance with this invention, the peripheral surface 22 of locking member 18 is in frictional engagement with the side wall of recess 17 and serves as a locking surface whereby wire 16 is fixed to the operator 14. The segment surface 23 coacts with the side wall of recess 17 to form a receptacle and is located between the segment line of channel 19 and cavity 20 and the center axis of recess 17 when in the position shown in FIG. 2. Also, in accordance with this invention, the locking member 18 is an elastic material. A preferred elastic material for the purpose of the present invention is a synthetic linear superpolymer of which nylon is a commercial example, such as is disclosed in U.S. Patent No. 2,130,948 issued on September 30, 1938. Where nylon is the material used, the locking member 18 may be molded in any well-known device to take the form of a cylinder having a segment portion removed. Or alternatively, the locking member 18 may be molded as a solid cylinder and then machined to remove the segment portion. Other methods of making the locking member may be followed which will readily occur to persons skilled in the fabricating arts. At the time the locking member is molded, the groove 21 may also be formed.

When the locking member 18 has been formed, it is readily insertable into recess 17. Depending on the dimensioning and making allowances for manufacturing variations, the locking member 18 is inserted with some pressure brought to bear on the end surface.

The manner of connecting wire element 16 to operator 14 is best shown by reference to FIGS. 2 and 3. In FIG. 2, the locking member 18 is rotated within the recess 17 so that the surface 23 is parallel to the line of channel 19 and cavity 20. With locking member 18 in this position, wire 16 is inserted through channel 19, the recess 17, and into the cavity 20 to the bottom thereof. Thus the cavity 20 serves as a locating means for the end of wire 16. Using a suitable tool, such as a screwdriver inserted into groove 21, the locking member 18 is turned to cause locking surface 22 to bend wire element 16 along the side wall of the recess between channel 19 and cavity 20. At the same time, the locking member 18 is compressed along

the line of contact with the wire element 16. The locking member 18 being elastic, the compression produces a displacement of material along locking surface 22 which thereby produces a reactive force effective to compressively lock the wire element 16 to the operator 14. Thus wire element 16 is compressively locked between the side wall and locking surface 22. In the case of nylon, a particularly firm locking takes place. While ordinarily nylon has low coefficient of friction and has many applications where low frictional effects are desired, in the present invention, nylon was found to be particularly effective to fix the wire element 16 to operator 14 without slipping even under high frequency reciprocations of the operator. The compression of the locking member 18 as well as the bending of the wire element 16 into contact with the side wall between channel 19 and cavity 20 is seen more clearly by reference to FIGS. 4 and 5. It will be seen that the engagement of the wire element 16 is effected by surface contacts only along the bent portion of the wire. While, as illustrated, the only displacement occurs in the locking member 18, it is possible within the scope of the present invention to provide for partial or entire displacement, to effect the compressive locking, in the side wall of recess 17.

In the event it becomes necessary to replace wire element 16, the disconnection is easily effected by turning locking member either clockwise or counterclockwise to position shown in FIG. 2. The locking member 18, being elastic, particularly when made of nylon, restores itself to fully expanded condition and is usable when a reconnection is desired.

Thus it can be appreciated that a locking device has been provided which is simple in construction and which, by virtue of simplicity, is readily adaptable to mass production techniques which afford economic results. It is also apparent that a locking device has been provided which makes it possible to obtain a fixed connection which permits motion without slipping while also permitting

quick disconnection and reconnection. It is further apparent that a locking device has been provided which is suitable for miniaturized devices.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by persons skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In combination, a body portion having a cylindrical recess therein, said body portion having a channel for receiving a wire element or the like to be removably connected to said body portion, said channel having openings in the exterior of said body portion and the side wall of said recess, and a cylindrical locking member within said recess and having an elastically compressible locking surface frictionally engaging said side wall, said locking member having a segment removed so as to form a receptacle with said side wall, said locking member being rotatable within said recess to a first position to permit insertion of a wire element or the like through said channel into said recess and to a second position to effect an elastic compression of said locking member to compressively lock said wire element between said side wall and said locking surface.

2. A combination in accordance with claim 1 in which said locking member is made of nylon.

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