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(54) APPARATUS FOR SECURING A ROTARY SHAFT AGAINST AXIAL DISPLACEMENT

(71) I, HUBERT LAURENZ NAIMER, of Schumanngasse 31–39, Vienna XVIII, Austria, an Austrian citizen, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:–

The present invention relates to apparatus for securing a rotary shaft, for example the shaft of a rotary switch, against axial displacement.

Two types of such apparatus are known.

In one known type, a slotted clamping bush engages the rotary shaft and a cammed locking ring is mounted on the bush. When the cammed locking ring is rotated, it presses the bush against the shaft to provide a friction coupling which holds the shaft against axial displacement. Such a friction coupling will not withstand heavy axial impacts which will permit axial displacement due to slippage of the coupling.

In the other conventional type of axial displacement locking devices, the shaft has grooves cooperating with shaft securing rings. These devices are expensive and have the further disadvantage that it is not possible for the user to adjust the axial position of the shaft steplessly after it has left the factory.

In accordance with the present invention there is provided apparatus for securing a rotary shaft against axial displacement comprising a securing element for fixing to the shaft and a first and second axially-spaced abutments between which the securing element is located wherein the shaft has at least one axially-extending groove in the surface thereof and the securing element has a central opening with at least one inwardly projecting tongue such that the shaft can be passed through the opening with the tongue within one of the grooves in the shaft, the tongue having a cutting edge capable of cutting the tongue into the circumference of the shaft adjacent the said groove upon relative rotation of the shaft and the securing element, whereby the securing element is fixed against axial displacement relative to the shaft.

The invention will be described in more detail with the aid of examples illustrated in the accompanying drawings in which:–

Figure 1 is a side elevational view, partly in section, showing one embodiment of the apparatus of this invention in connection with an otherwise conventional rotary switch;

Figure 2 is a perspective view showing the mounting of the securing element of this embodiment on the shaft;

Figure 3 is a view similar to that of Figure 1, illustrating another embodiment; and

Figure 4 is an exploded perspective view of the essential components of the apparatus of Figure 3.

Referring now to Figure 1, there is shown a generally conventional rotary switch 1 comprised of switching work 2 and indexing mechanism 3. The latter is covered in front by a detent plate 4 cooperating with an indexing plate 5. Since the switch is conventional, further details have not been shown because they are not pertinent to the apparatus of the invention.

Switch shaft 6 has a plurality of grooves 7 of wedge-shaped cross section about the circumference thereof, as is illustrated in Figure 2, and an abutment member 8 is mounted on the shaft, the abutment member having a central bore 27 conforming to the cross section of the switch shaft 6 so that the abutment member forms a friction fit with the shaft. An axially-extending portion of the abutment member 8 carries teeth 9 meshing with teeth 10 of the indexing plate 5 so that, when the shaft 6 is rotated, the indexing plate will be entrained by the abutment member 8. A securing element constituted by a platelet 13 is mounted in front of the abutment member 8, the platelet 13 having a central bore 14 shaped to fit the profile of the shaft 6. The platelet has a plurality of inwardly projecting tongues 15 which present cutting edges 17 capable of cutting the tongues into the circumference of the shaft adjacent an associated groove 7 (see Figure 2) upon relative rotation of the shaft and the

securing element. The annular platelet 13 also has two apertures 28 in diametrically opposite positions to enable a tool 29 with pins 32 to be engaged with the platelet 13 for turning the same relative to the shaft 6. Front plate 25 is mounted over the switch and presents a shoulder 30 forming an abutment for platelet 13, the platelet being held on the shaft between the abutment 8 and the abutment 30.

The switch is assembled by first putting together switching work 2 and indexing mechanism 3 in a conventional manner. The abutment member 8 is axially moved into a central recess 26 of the indexing plate 5 so that teeth 9 and 10 mesh and the abutment member 8 and indexing plate 5 are coupled together for common rotation. Platelet 13 is now placed into a central bore 31 of the front plate 25 in abutment with the shoulder 30 and the front plate is affixed, for instance by means of screws (not shown), on the rotary switch, whereby platelet 13 is held between abutments 8 and 30.

After the rotary switch has been installed, for instance on a switchboard, the switch shaft 6 is passed through the central bore 31 of the front plate, the bore 14 of the platelet 13 and the central bore of the abutment member 8 into the assembled switch. Wrench 29 is now applied with its pins 32 to apertures 28 of platelet 13 and turned through a predetermined angle to cause cutting edges 17 of tongues 15 to cut into the circumference of the shaft 6, as shown in Figure 2, thus wedging the securing platelet into firm association with the shaft. Since the platelet now forms an integral part of the shaft and is held between two axially spaced abutments, the shaft is firmly secured against axial displacement.

In the embodiment of Figures 3 and 4, like parts functioning in a like manner are designated by like reference numerals to obviate redundancy in the description. In this embodiment, abutment and transmission member 8 has arcuate ribs 12 extending about a portion of the circumference of the member axially adjacent toothed section 9. Securing platelet 13 has a toothed circumference 16 and the central bore of front plate 25 carries closure element 18 comprising an annular end plate 19 constituting an abutment for platelet 13 and, axially adjacent thereto, a toothed section 20 meshing with toothed circumference 16 of the platelet. Annular end plate 19 also has radially inwardly projecting ribs 21 defining spaces 22 therebetween. The annular end plate also has an axially extending cylindrical body 23 with two flattened portions 24 for enabling the end plate to be grasped and turned. The stepped cylindrical body 23 is received and held by the front plate 25 in the manner shown in Figure 3.

The switch is assembled in substantially the same manner as described hereinabove in connection with Figures 1 and 2, securing element 13 being placed into closure element 18, with its teeth 16 meshing with teeth 20 and element 13 abutting closure wall 19. Thus assembled with platelet 13, the closure element is then moved axially into engagement with abutment and transmission member 8, ribs 12 of member 8 being positioned in spaces 22 between ribs 21 of element 18. Front plate 25 is then mounted on the closure element and screwed to the switch box. As in the first-described embodiment, shaft 6 is assembled only after the switch has been installed and closure element 18 is then angularly turned until ribs 21 abut faces 12a of ribs 12. During this turning movement, cutting edges 17 of tongues 15 cut into the circumference of the shaft (see Figure 4) to affix platelet 13 to shaft 6, the platelet being held on the shaft between end plate 19 and the front face of member 8 to prevent axial displacement of the shaft.

Abutment of ribs 12 and 21 will prevent an excessive angular movement of platelet 13 to a position wherein tongues 15 would be positioned again in grooves 7.

WHAT I CLAIM IS:—

1. Apparatus for securing a rotary shaft against axial displacement comprising a securing element for fixing to the shaft and first and second axially-spaced abutments between which the securing element is located wherein the shaft has at least one axially-extending groove in the surface thereof and the securing element has a central opening with at least one inwardly projecting tongue such that the shaft can be passed through the opening with the tongue within one of the grooves in the shaft, the tongue having a cutting edge capable of cutting the tongue into the circumference of the shaft adjacent the said groove upon relative rotation of the shaft and the securing element, whereby the securing element is fixed against axial displacement relative to the shaft.

2. Apparatus as claimed in claim 1 wherein the securing element is formed for engagement by a tool to effect the said relative rotation.

3. Apparatus as claimed in claim 2 in which the securing element has two diametrically opposite apertures for engagement by pins of a tool.

4. Apparatus as claimed in claim 1 in which the first abutment is coupled to the securing element to enable the said relative rotation to be effected by rotation of the said first abutment.

5. Apparatus as claimed in claim 4 in which the first abutment has an annular portion which surrounds the securing element, the annular portion and the securing element being formed with meshing teeth to couple the first abutment and the securing element.

6. Apparatus as claimed in claim 5 in which the first abutment has a radially inwardly projecting rib and the second abutment has a radially outwardly projecting rib, the ribs being arranged to engage to limit rotation of the securing element.

7. Apparatus as claimed in claim 6 in which

the second abutment is fixed to the shaft for rotation therewith.

8. Apparatus as claimed in any of claims 1 to 5 including means for limiting the said relative-rotation of the securing element and the shaft.

9. Apparatus as claimed in any of the preceding claims in which the shaft has a plurality of grooves and the securing element is a platelet with a central opening conforming to the profile of the grooved shaft.

10. A rotary switch including apparatus as claimed in any of the preceding claims securing the switch shaft against axial displacement.

11. A rotary switch as claimed in claim 9 in which the first abutment is a cover plate for the switch.

12. A rotary switch substantially as described with reference to Figures 1 and 2 or Figures 3 and 4 of the accompanying drawings.

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Agents for the Applicants

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Sheet 1

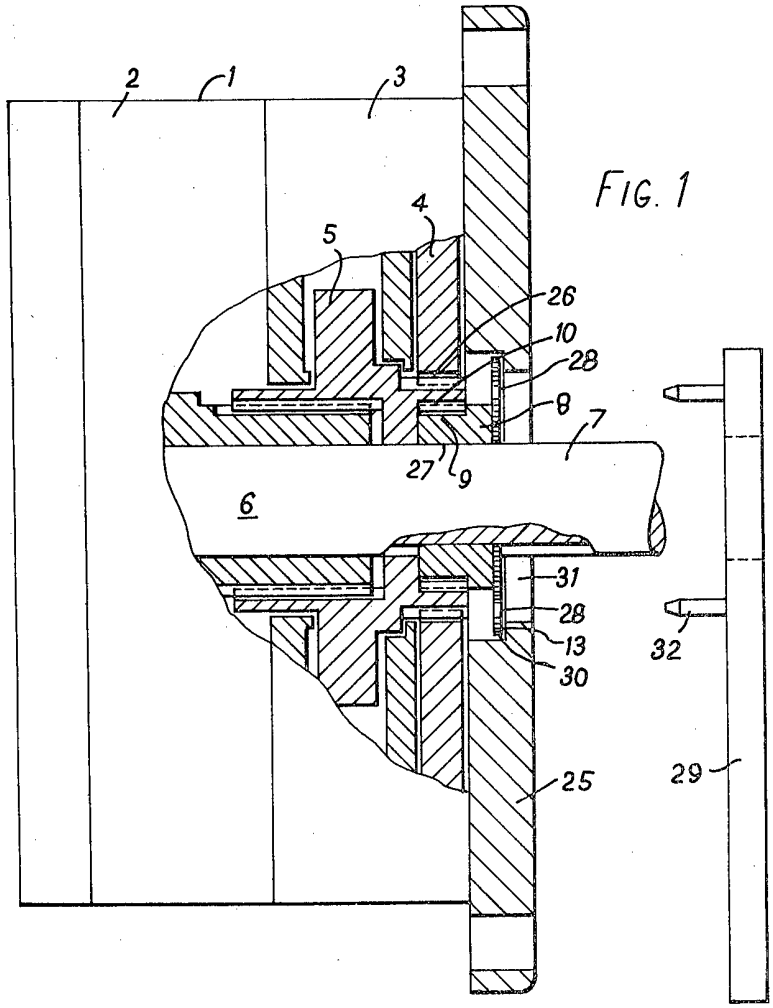


FIG. 1

FIG. 2

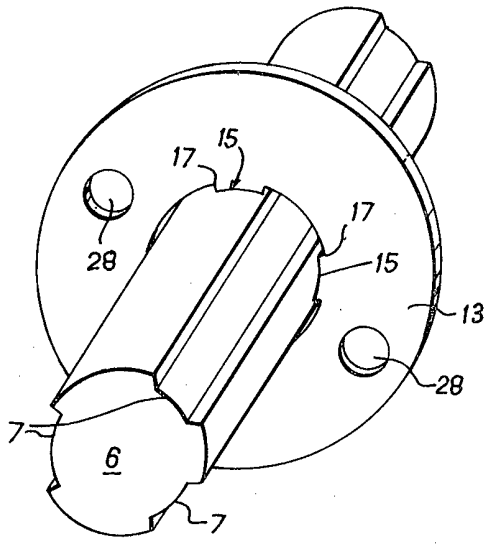
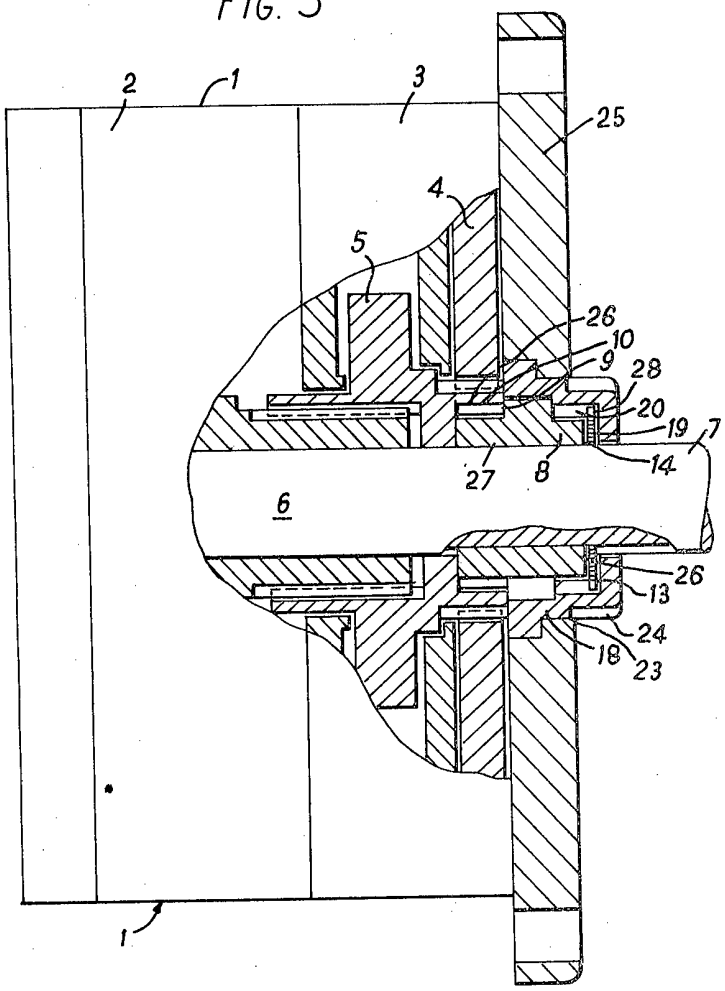


FIG. 3



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Sheet 4

FIG. 4