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Hiltz et al.

[11] **3,761,911**

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[54] **SHAFT DISLOCATION DETECTOR**

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[52] **U.S. Cl.**..... **340/271,** 200/61.08, 200/61.41, 340/282

[51] **Int. Cl.** **G08b 21/00**

[58] **Field of Search**..... 340/271, 269, 282, 340/267 R, 52 A; 200/61.08, DIG. 13, 61.41, 61.42

[56] **References Cited**

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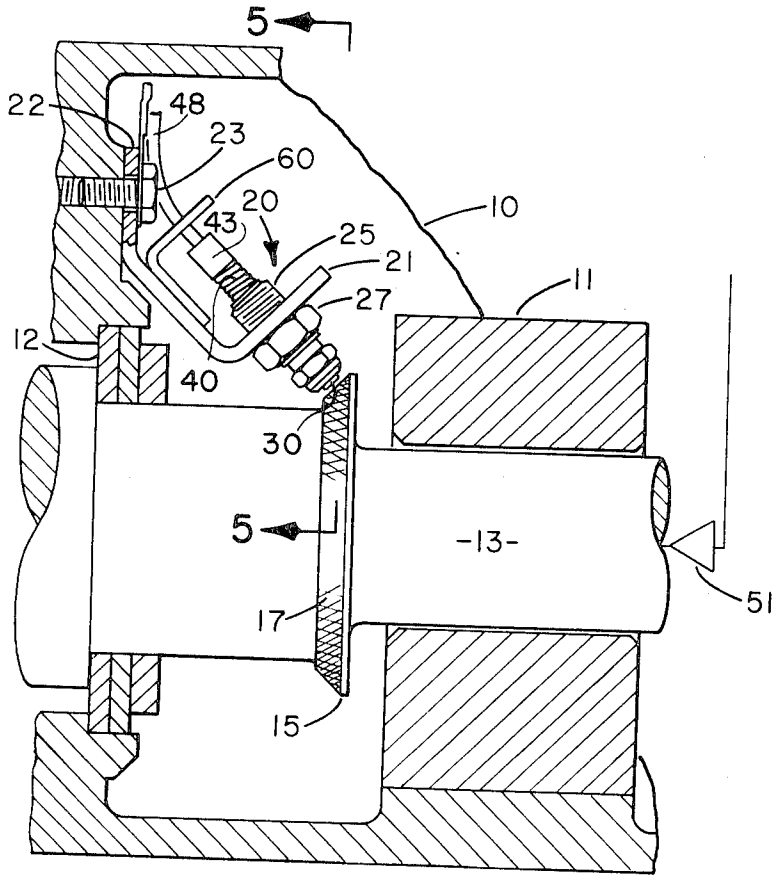
[57] **ABSTRACT**

A high speed rotating shaft is provided with an abrading collar. A contact assembly is mounted with the contacts thereof in juxtaposition to the collar. Upon displacement of the shaft from normal operating position, the collar abrades away one contact thus opening the detector circuit.

5 Claims, 5 Drawing Figures



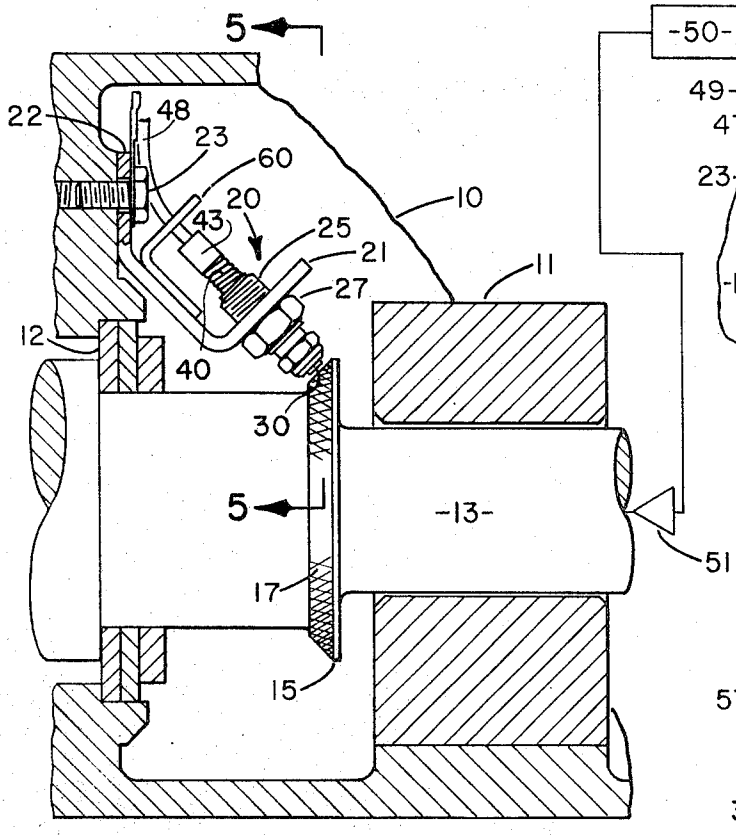


FIG. 1

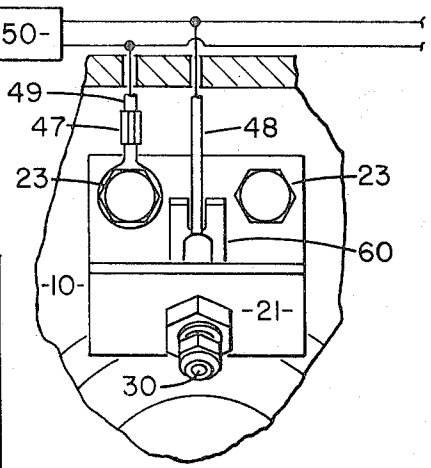


FIG. 5

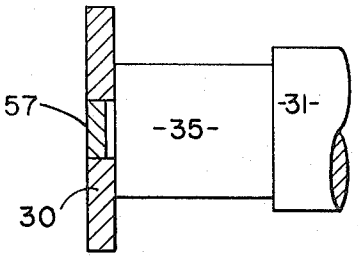


FIG. 4

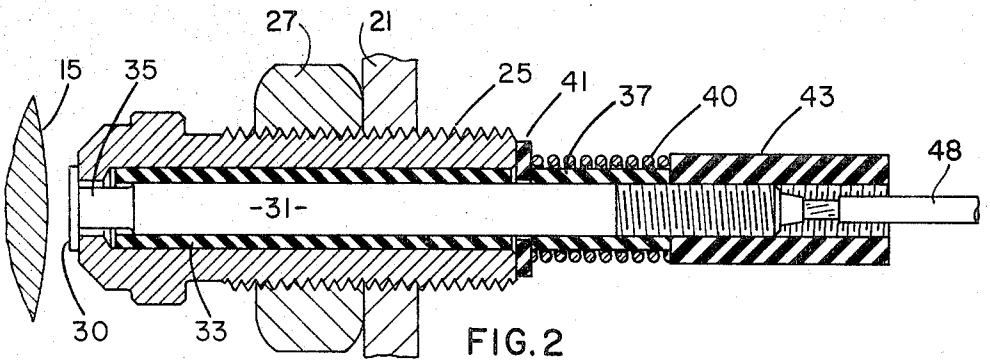


FIG. 2

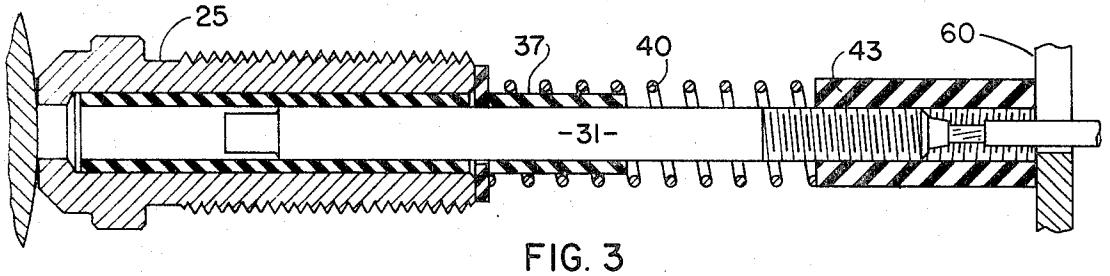


FIG. 3

SHAFT DISLOCATION DETECTOR

BACKGROUND OF THE INVENTION

A substantial number of devices have been designed and used for detecting displacement of a rotatable shaft or the like from normal operating position. Some such devices include a switch with the actuating member thereof positioned to be engaged and operated by some member attached to the shaft upon displacement thereof. In one such device, a closed pressurized tube has an end located to be abraded away upon displacement of the shaft permitting the fluid pressure to escape and actuate a pressure responsive switch.

All such known devices embody an expensive structural arrangement and are difficult to mount accurately in position.

SUMMARY OF THE INVENTION

A tubular contact member is fixedly mounted with its inner end positioned in proximity to an abrading collar carried by the rotating shaft. A second contact overlies the inner end of the tubular contact and is maintained in conductive relation thereto by spring pressure. The second contact is mounted on the inner end of a supporting member slidably mounted in the tubular contact. Upon displacement of the shaft axially or radially, the collar abrades the second contact away and the supporting member, which is insulated from the tubular contact, is moved outwardly to assure complete opening of the detector circuit.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view showing the orientation of the shaft and detector mechanism;

FIG. 2 is a lengthwise sectional view of the contact assembly prior to the separation of the contacts thereof by abrading action of the shaft collar;

FIG. 3 is a view similar to FIG. 2 showing one of the contacts abraded away as a result of shaft displacement;

FIG. 4 is an enlarged view of the second contact of the pair wherein the contact disc is attached to its supporting member by a fusable joint; and

FIG. 5 is a view taken on line 5—5, FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, 10 designates a portion of a housing containing a journal bearing 11 and a thrust bearing 12 in which the shaft 13 is journaled. The shaft is provided with a radially extending collar 15, the peripheral surface 17 of which is roughened as by being knurled. This surface, as shown in FIG. 1, extends in angular relation to the axis of the shaft 13, preferably at an angle of 45°.

A contact assembly 20 is fixedly mounted in the flange 21 of a bracket formed with a second flange portion 22 fixed to the housing 10 as by cap screws 23. The contact assembly includes a first contact structure consisting of a tubular contact member 25 threaded externally for threaded engagement with the flange 21 of the bracket, and a lock nut 27 is provided to secure the member 25 in adjusted position with the inner end thereof in proximity to the peripheral abrading surface 17 of the collar 15.

A second contact structure consists of a disc-like portion 30 of conductive material secured to the end of a

supporting member in the form of stem 31 which is slidably mounted for axial movement in the tubular member 25. The supporting stem 31 is formed of conductive material and is insulated from the tubular member 25 by an insulating sleeve 33. The inner end portion 35 of the supporting member 31 is of reduced diameter as shown in FIG. 2.

The axial length of the supporting stem 31 exceeds the axial length of the tubular member 25, whereby the outer end portion of the supporting member extends outwardly beyond the outer end of the tubular member 25. This extending portion is encircled by an insulating sleeve 37, which in turn is encircled by a helical compression spring 40. A washer 41 of insulating material is positioned between the outer end of the tubular member 25 and the inner end of the spring 40. A cap 43 of insulating material is affixed to the outer end of the support member 31, as by threaded connection, and is engaged by the outer end of the spring 40.

In FIG. 2 it will be apparent that the spring 40 yieldingly urges the support member 31 outwardly and, accordingly, yieldingly holds the contact disc 30 in overlying conductive engagement with the inner end of the tubular member 25.

The tubular contact member 25 is mounted in conductive relation to the metal bracket 21, to which a terminal 47 is attached by one of the cap screws 23. A conductor 48 is attached to the outer end of the support member 31. A conductor 49 is connected to the terminal 47. The conductors 48, 49 extend to the controller 50 energizing the driver 51, effecting rotation of the shaft 13. The conductors 48, 49 may also form part of a circuit including an indicator lamp.

When the shaft 13 is rotating in normal operative position, the peripheral abrading surface 17 of the collar 15 is spaced slightly from the contact disc 30. Upon radial or axial displacement of the shaft, the roughened surface 17 of the collar is moved into engagement with the disc 30 whereby the same is abraded away and is, therefore, separated from the support member 31, and from engagement with the tubular contact 25, whereupon, the spring 40 effects outward axial movement of the support member 31 as indicated in FIG. 3. This operation effects a complete opening of the control circuit.

The mounting bracket for the contact structure 20 is formed, in the portion thereof intermediate the flanges 21, 22, with a stop tab 60 extending in parallel spaced relation to the flange 21. The tab 60 is formed with an aperture for the free passage of the conductor 48. The tab serves as a stop to limit outward movement of the support stem 31 and the cap member 43 carried thereby upon the portion 30 of the second contact being abraded away.

The disc 30 may be formed integrally with the conductive support stem 31, or it may be attached thereto by a fusable connection indicated at 57, FIG. 4. The material at 57 may be of a form of a solder which will not fuse at the operating ambient temperature, but will quickly melt by the heat generated by abrading action of the collar 15, resulting in separation of the disc from the support member 31.

This detector mechanism embodies, as will be apparent, a very simple construction which may be fabricated at low cost. The various parts of the mechanism do not require precision machining. Upon the disc portion 30 of the second contact structure being abraded

away, the circuit **48, 49** is positively opened. The reduced inner end portion **35** of the stem **31** serves to prevent the stem from sticking in the tubular member **25** of the first contact structure, upon the disc **30** being abraded away. During the abrading operation, it might happen that the inner end of the stem **31** would be formed with a radial burr which, if the inner end portion of the stem **31** was dimensioned close to the bore in the inner end of the member **25,** or to the internal diameter of the insulating sleeve **33,** the stem **31,** with the burr thereon, might remain in contact with the member **25** with the result that the circuit **48, 49** would not be opened. The bore in the insulating sleeve **33** is slightly larger than the opening in the inner end of the member **25.**

While a preferred embodiment of this invention has been described for purposes of illustration, it will be appreciated that this invention may be otherwise embodied within the scope of the following claims.

We claim:

1. Detector mechanism for detecting displacement of a rotating shaft from the normal operating position, said mechanism comprising a detector circuit, first and second normally closed contact structures connected in said circuit, a radially extending collar fixed to said shaft, said first contact structure including a tubular contact member of conductive material fixedly mounted with the inner end thereof positioned in proximity to said collar, said second contact structure including a contact portion formed of conductive material, spring means operable to yieldingly maintain said portion in overlying conductive engagement with the inner end of said tubular contact, said collar being movable into abrading engagement with said overlying portion of said second contact structure upon displacement of said shaft from normal operating position, said overlying portion of said second contact structure being severable from said tubular contact member upon such abrading engagement by said collar.

2. Detector mechanism as set forth in claim **1** wherein said contact portion of said second contact structure is fixed to a supporting member mounted in said tubular contact for axial movement therein, said spring means acting on said supporting member and

yieldingly urging the same in a direction from the inner end of said tubular contact.

3. Detector mechanism as set forth in claim **2** wherein said supporting member is formed of conductive material and means insulating said supporting member from said tubular contact member.

4. Detector mechanism for detecting displacement of a rotating shaft from normal operating position, said mechanism comprising a detector circuit, first and second normally closed contact structures connected in said circuit, a radially extending collar fixed to said shaft, said first contact structure including a tubular member of conductive material fixedly mounted with the inner end thereof positioned in proximity to said collar, a second contact structure including a supporting member of conductive material mounted in said tubular member for axial movement therein, a contact portion of conductive material fixed to the inner end of said supporting member and overlying the inner end of said tubular member in confronting relation to said collar, said supporting member extending outwardly from the outer end of said tubular member, a cap member fixed to the outer end of said supporting member in axially spaced relation to the outer end of said tubular member, a spring encircling the outer end portion of said supporting member and being disposed intermediate the outer end of said tubular member and said cap, said spring being operable to yieldingly urge said supporting member outwardly of said tubular member to maintain said contact portion of said second contact structure in overlying conductive engagement with the inner end of said tubular member, and means insulating said supporting member and said spring from said tubular member, said contact portion of said second contact structure being severable from said supporting member upon said collar moving into abrading engagement with said contact portion.

5. Detector mechanism as set forth in claim **4** wherein said spring is operable upon severance of said contact portion to move said supporting member outwardly in said tubular member and stop means to limit the outward movement of said support.

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