(12) UK Patent Application (19) GB (11) 2 244 114 (13) A

(43) Date of A publication 20.11.1991

(21) Application No 9110714.4

(22) Date of filing 17.05.1991

(30) Priority data
(31) 4015957 (32) 18.05.1990 (33) DE

(71) Applicant
GKN Automotive AG

(Incorporated in the Federal Republic of Germany)

Alte Lohmarer Strasse 59, D-5200 Sieburg,
Federal Republic of Germany

(72) Inventor
Norbert Heymann

(74) Agent and/or Address for Service
Forrester Ketley & Co
Chamberlain House, Paradise Place, Birmingham,
B3 3HP, United Kingdom

(51) INT CL[5]
F16D 3/22

(52) UK CL (Edition K)
F2U U534 U572

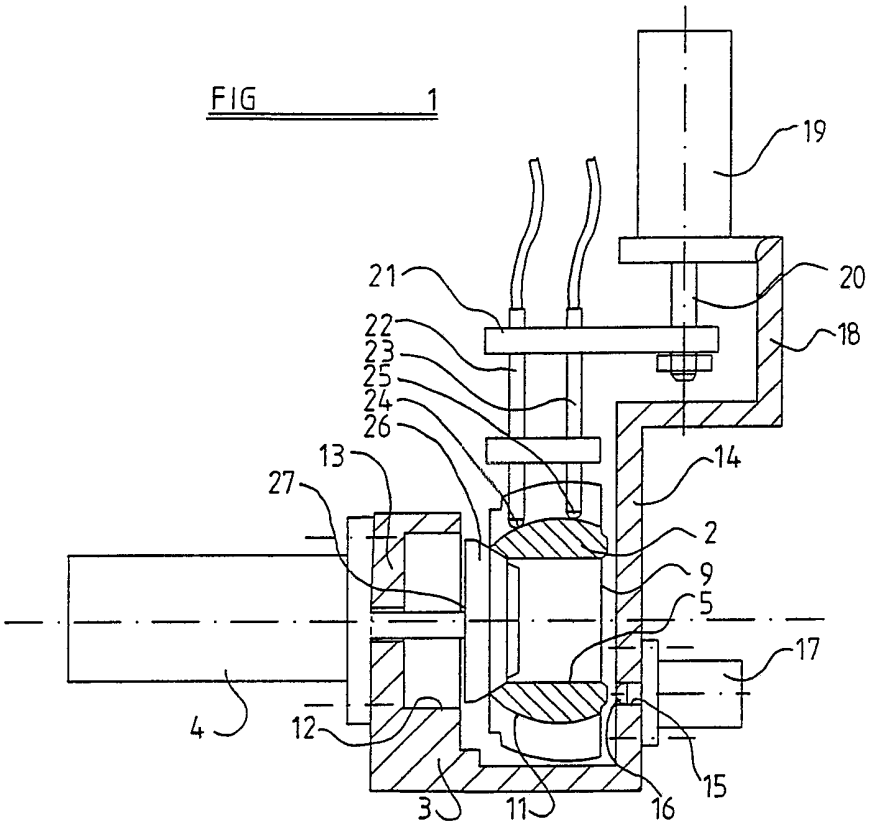
(56) Documents cited
GB 2112501 A US 4325125 A

(58) Field of search
UK CL (Edition K) F2U
INT CL[5] B23Q, B65B, F16D, G01B
On-line databases: WPI

(54) Method and apparatus for identifying the orientation of a workpiece

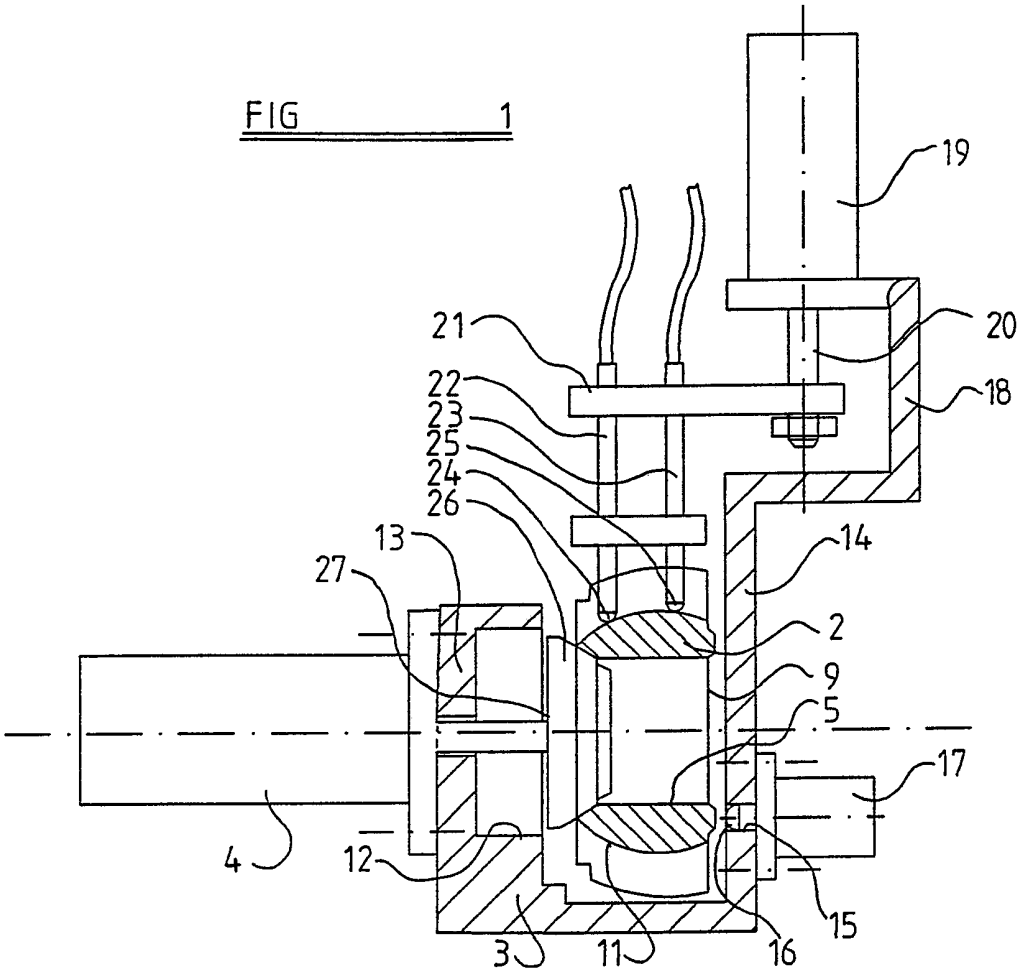
(57) The orientation of a workpiece, particularly an inner member (2) of a universal joint, is identified firstly by holding the workpiece at a holding station on a feed apparatus, and detecting its presence by the reaction of a stationary sensor (17), and subsequently scanning the contour of part of the surface of the workpiece by at least two spaced movable sensors (22, 23). The orientation of the workpiece is identified by determining the difference in outputs between the sensors (22, 23).

FIG 1



GB 2 244 114 A

FIG 1


19
21
20
22
18
23
25
24
26
13
14
27
2
9
5
17
4
12
15
3
11
16

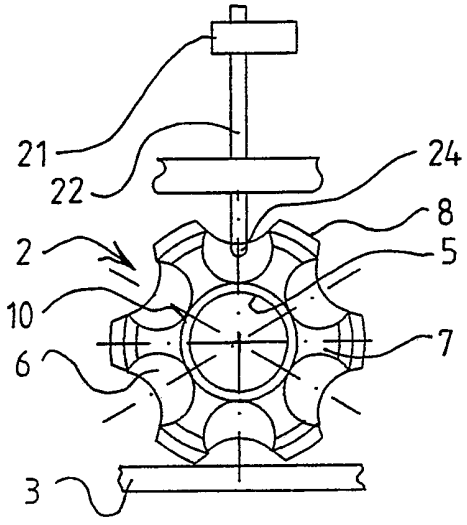

21
24
22
8
2
5
10
7
6
3

FIG 2

2244114

Title: Method and apparatus for identifying the orientation of a workpiece

Description of Invention

This invention relates to a method and apparatus for identifying the orientation of a workpiece having an outer configuration or contour which is asymmetrical, the workpiece being held at a holding station in a feed assembly. An example of such a workpiece is a hub or inner member of a universal joint, having tracks for engagement by torque-transmitting balls.

In the automated production of such universal joints, the ball hubs are lifted individually by an elevator from a bulk quantity thereof. While standing on part of their circumferential surface, they are positioned in a suitable feed assembly to be prepared for subsequent production operations. The feed assembly ensures the required angular position of the hubs about their axes, by virtue of the fact that the part of its circumferential surface on which each hub stands is two webs between which one of the ball-receiving grooves is provided, but this does not ensure that the hubs are in the correct end to end orientation with the smaller diameter end correctly positioned.

It is the object of the present invention to provide a method and apparatus for identifying the orientation of a workpiece, particularly in respect of the end to end orientation of a ball hub member as above referred to.

According to one aspect of the invention, we provide a method of identifying the orientation of a workpiece having an outer contour which is asymmetrical, comprising detecting the presence of the workpiece at a holding station by means of a stationary sensor, and subsequently detecting the contour of part of the workpiece by means of two spaced movable sensors, the orientation of the workpiece being identified from the difference between the outputs of the two movable sensors.

By selecting a suitable part of the external surface of the workpiece and by moving the two spaced movable sensors against it, it is possible, by virtue

of the difference in outputs of the two sensors, to find a specific criterion which represents the true orientation of the workpiece in the required sense. The decisive factor is the comparison between the outputs of the two sensors.

According to a further aspect of the invention, we provide apparatus for carrying out the method according to the first aspect of the invention as above set forth, comprising a feed assembly including a workpiece holding station; a workpiece holding member arranged transversely of the feed assembly and movable in the direction of an axis of the workpiece; and means for identifying the orientation of the workpiece comprising a stationary sensor operable by the workpiece held by the holding member, and at least one movable member provided with at least two sensors for detecting the contour of a surface part of the workpiece at the holding station.

In apparatus according to the invention, the stationary sensor detects that the workpiece is located in the required position at the holding station. After this has been detected, the sensors on the movable member are able to detect the contour of the workpiece.

The movable member having the at least two sensors may be the movable part of lifting cylinder unit, having its axis lying at right angles relative to the axis of the workpiece at the holding station and/or the direction of feeding of the workpieces. If the lifting cylinder is arranged at an angle relative to the moving member or for feeding purposes, it is possible for the lifting cylinder to be aligned horizontally, perpendicularly or at an angle relative to a radial plane of the workpiece or relative to the direction of movement of the holding member, thereby permitting individual adaptation to the workpiece and allowing the contour which presents the greatest changes in shape to be selected for detection to indicate the orientation of the workpiece. With a hub member as above referred to, the base of each of the tracks in which the respective torque transmitting balls engage has, at its front end face pointing in the direction of the holding member, a smaller diameter than at its rear end face.

To permit adaptation of the sensors to the surface of different workpieces, the sensors provided on the movable member of the lifting cylinder unit may be adjustable relative to each other in the direction of their movement and/or transversely thereto. The sensors may be spring loaded in the direction of their movement, and comprise tactile sensors in order to prevent the workpiece from being damaged.

To permit data recording, the sensors, at their ends facing towards the workpiece, may comprise displacement transducers with parts which have point or substantially point contact with the workpiece. The stationary sensor, arranged at the workpiece holding station, may be engaged by the workpiece when it is held by the holding member, to permit the presence of the workpiece to be detected. When thus held, the sensors of the lifting cylinder permit the orientation of the workpiece to be identified. If a particular workpiece is not disposed in the correct orientation at the holding station, a suitable device for turning the workpiece may be provided in association with the feed apparatus.

The invention will now be described by way of example with reference to the accompanying drawings, of which:-

Figure 1 is a lateral view of apparatus according to the invention, partly in section; and

Figure 2 is an end view of the workpiece in the apparatus, showing the disposition of sensors.

Referring firstly to Figure 1 of the drawings, the apparatus indicated generally at 1 is used for identifying the orientation of a workpiece which is indicated at 2. The workpiece 2 is a hub or inner member of a universal joint of the kind wherein torque is transmitted by balls engaging in respective ball tracks in the inner joint member and in an outer joint member, the workpiece 2 comprising ball tracks 6 with webs 7 therebetween. The workpiece has a central bore 5, and the tracks 6 and webs 7 are disposed symmetrically circumferentially about the axis of the bore 5.

In the longitudinal section through the workpiece 2 which appears in Figure 1 of the drawings, it will be noted that the workpiece is asymmetrical in that the base 10 of each of the ball tracks 6 (indicated at 11) is at a smaller distance from the axis of the workpiece adjacent the front end face 27 of the workpiece, compared with the distance adjacent the rear end face 9 thereof. The diameters of the outer surface of the webs 7 between the grooves vary in like manner. It is important that the workpieces are fed in the correct orientation as shown in Figure 1.

Figure 1 shows a member 3 which defines a groove or channel along which successive workpieces are fed (by means not shown) in the direction which extends perpendicular to the plane of the drawing. The apparatus provides a holding station at which there is disposed a fluid pressure operable cylinder 4 mounted in one wall 13 of the member 3 which defines the feed groove. The piston rod of the pressure cylinder 4 is provided with a workpiece holding member 26 which is generally of frusto-conical configuration to engage the end of the bore 5 in the workpiece. Thus the workpiece can be held at a fixed position in the feed groove with the axis of its bore 5 in line with the axis of the pressure cylinder 4. The workpiece holding member 26 is retractable into an opening 12 in the wall 13. The opposite wall 14 of the member 3 is provided with a bore 15 through which the movable part 16 of a sensor 17 protrudes, to be engaged by the workpiece when the latter is pressed by the pressure cylinder 4 by way of the holding member 26.

The wall 14 is extended upwardly as indicated at 18 and supports a lifting cylinder unit 19 whose piston rod 20 is connected to a bracket 21 which in turn carries two spring loaded tactile sensors 22, 23. The two sensors 22, 23 are aligned in such a way that their operative parts 24, 25 are engageable with the base 10 of the ball track 6 which is aligned therewith. The operative parts preferably have point or substantially point contact with the workpiece. The distance between the displacements of the parts 24, 25 of the sensors gives an indication of the orientation of the workpiece.

In use of the apparatus, operation of the lifting cylinder unit 19 to cause the sensors 22, 23 to be lowered to engage the workpiece is initiated in response to the indication from the stationary sensor 17 that a workpiece is correctly held at the holding station.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS

1. A method of identifying the orientation of a workpiece having an outer contour which is asymmetrical, comprising detecting the presence of the workpiece at a holding station by means of a stationary sensor, and subsequently detecting the contour of part of the workpiece by means of two spaced movable sensors, the orientation of the workpiece being identified from the difference between the outputs of the two movable sensors.

2. Apparatus for carrying out the method according to claim 1, comprising a feed assembly including a workpiece holding station; a workpiece holding member arranged transversely of the feed assembly and movable in the direction of an axis of the workpiece; and means for identifying the orientation of the workpiece comprising a stationary sensor operable by the workpiece held by the holding member, and at least one movable member provided with at least two sensors for detecting the contour of a surface part of the workpiece at the holding station.

3. Apparatus according to claim 2 wherein said movable member is movable by a lifting cylinder unit.

4. Apparatus according to claim 2 or claim 3 wherein said movable member is movable along an axis extending at a right angle relative to the axis of the workpiece and/or the direction of workpiece feeding.

5. Apparatus according to any one of claims 2 to 4 wherein the sensors on the movable member are adjustable mounted relative to each other in the direction of their movement and/or transversely relative thereto.

6. Apparatus according to any one of claims 2 to 5 wherein the sensors on the movable member are spring loaded in the direction of their movement.

7. Apparatus according to any one of claims 2 to 6 wherein the movable sensors comprise tactile sensors.

8. Apparatus according to any one of claims 2 to 7 wherein the movable sensors comprise parts for point contact or substantially point contact with the workpiece.

9. Apparatus according to any one of claims 2 to 8 wherein the stationary sensor is disposed opposite the workpiece holding means.

10. Apparatus according to any one of claims 2 to 9 wherein the holding member is movable by a fluid pressure operable cylinder.

11. Apparatus according to any one of claims 2 to 10 wherein the feed assembly comprises a channel or groove along which the workpieces are fed.

12. A method of identifying the orientation of a workpiece, substantially as hereinbefore described.

13. Apparatus for identifying the orientation of a workpiece substantially as hereinbefore described with reference to the accompanying drawings.

14. Any novel feature or novel combination of features described herein and/or in the accompanying drawings.

Published 1991 at The Patent Office, Concept House, Cardiff Road, Newport, Gwent NP9 1RH. Further copies may be obtained from Sales Branch, Unit 6, Nine Mile Point, Cwmfelinfach, Cross Keys, Newport, NP1 7HZ. Printed by Multiplex techniques ltd, St Mary Cray, Kent.