PATENT SPECIFICATION (11) 1 577 804

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(21) Application No. 33090/77 (22) Filed 8 Aug. 1977 (19)

(31) Convention Application No. 51/105 747U

(32) Filed 6 Aug. 1976 in

(33) Japan (JP)

(44) Complete Specification published 29 Oct. 1980

(51) INT. CL.³ F16D 1/02

(52) Index at acceptance

F2U 230 376 392

(54) COUPLING

(71) We, YOSHIDA KOGYO K.K., a Japanese corporation of No. 1, Kanda Izumi-cho, Chiyoda-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, 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 a coupling for joining a pair of shafts end to end.

Various types of shaft couplings capable of transmitting torque and axial shift have long been developed by prior workers in the art. All presently available couplings are relatively complicated in structure, and the joining and unjoining of the shafts with such couplings are tedious and time-consuming. This has often retarded assembling and disassembling such as for installation and repair of machines in which the couplings are used.

The present invention seeks to provide a coupling which can be used to connect and disconnect two shafts easily and speedily, and which is relatively simple in structure.

According to the invention, there is provided a coupling comprising: first and second shafts; the first shaft having a tongue, and a rod coaxial with the shaft, said rod having an annular groove; the second shaft having a pair of spaced jaws which are adapted for meshing engagement with the tongue, a coaxial bore for receiving said rod, and a plurality of apertures disposed around and communicating with the bore, there being a plurality of locking means fitted loosely in the apertures and capable of partly projecting into and retracting from the bore; and a sleeve disposed around and slidable axially on the second shaft, the sleeve having means for holding the locking means partly in the apertures and partly in the groove when the rod is fully inserted in the bore.

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

Figure 1 is a perspective view of a coupling constructed in accordance with the present invention, the coupling being separated;

Figure 2 is a longitudinal sectional view of the coupling before its connection; and

Figure 3 is a longitudinal sectional view of the coupling upon being put together.

Figures 1 and 2 show a coupling generally indicated by 10 for joining a pair of first and second shafts 11, 12 end to end. The coupling 10 comprises a first male member 13 mounted on the end portion of the first shaft 11 and a second female member 14 mounted on the end portion of the second shaft 12.

The first member 13 has a mounting cylinder 15 fitted in a bore 16 provided coaxially in the end portion of the shaft 11 and fixed to the shaft 11 by means of a pin 17 extending diametrically through the shaft 11 and the cylinder 15 for rotation with the shaft 11 and resistance against axial shift relative to the shaft 11. A central cylindrical block 18 is provided on an exposed end of the mounting cylinder 15, the cylindrical block 18 having substantially the same diameter as that of the shaft 11. The cylindrical block 18 has a pair of diametrically opposed segmental recesses 19, 20 which provide therebetween an axial tongue 21 projecting away from the shaft 11.

The tongue 21 supports thereon a rod 22 disposed coaxially with the cylindrical block 18 and extending away from the shaft 11. The rod 22 has in its circumference an annular groove 23 with its bottom cross-sectional arcuately. The rod 22 has a distal end 24 chamferred at is circumferential edge.

The second member 14 comprises a pair of segmental jaws 25, 26 provided on and projecting axially from the end portion of the shaft 12, the jaws 25, 26 being disposed in diametrically opposed relation to provide a slot 27 therebetween. The jaws 25, 26 are complementary in shape to the recesses 19, 20, respectively. Thus, when the coupling 10 is assembled, the jaws 25, 26 are received in the recesses 19, 20 respectively, with the tongue 21 fitted snugly in the slot 27. An elongate bore 28 is provided coaxially in the end portion of the shaft 12, the hole 28 being longer than the rod 22. The bore 28 has substantially the same diameter as that of the rod 22, so that when the rod 22 is inserted in the bore 28, there will be no substantial radial backlash within the bore 28.

A plurality of radially through apertures 29

are provided in an annular wall 30 around the bore 28 and are circumferentially spaced apart from each other. Fitted loosely in the apertures 29 are a plurality of locking members such as steel balls 31 having a diameter larger than the thickness of the annular wall 30. The apertures 28 are progressively tapered or narrower toward the bore 28 so that the balls 30 can partly project into the bore 28, but be held in the apertures 29 from falling into the bore 28. The locking members may instead be retractable tapered pins with their narrower end projecting into the bore 28.

A sleeve 32 is disposed around the end portion of the shaft 12 and is axially slidable back and forth thereon. The sleeve 32 has an inner annular recess 33 at an end remote from the jaws 25, 26 of the shaft 12, the recess 33 receiving therein a compression coil spring 34 which surrounds the shaft 12. Another inner annular recess 35 is provided at an end of the sleeve 32 which is located closer to the jaws 25, 26. The recess 35 acts as a space for partly receiving the balls 31.

Between the annular recesses 33 and 35, there is an annular land 36 held in sliding contact with the shaft 12, the land 36 being bounded partly by a shoulder 37 and an inclined surface 38. The spring 34 extends between the shoulder 37 and a retainer ring 29 fixed to the shaft 12. Thus, the sleeve 32 is normally urged toward the jaws 25, 26.

A stop ring 40 secured to the shaft 12 is located between the jaws 25, 26 and the apertures 29.

Instead of the spring 34, the sleeve 32 may be internally threaded and the shaft 12 externally threaded, in which case the sleeve 32 can threadedly engage the shaft 12 when advanced toward the jaws 25, 26. Alternatively suitable detent means such as spring-biased balls may be provided between the sleeve 32 and the shaft 12 to located the sleeve 32 in an advanced and a retracted position on the shaft 12.

In operation, the sleeve 32 is retracted away from the jaws 25, 26 against the force from the spring 34 until the space 35 surrounds the balls 31 in the apertures 29. Then, the rod 22 is inserted into the bore 28. While the rod 22 is being inserted, the chamferred edge on the rod end 24 abuts against the balls 29 that project partly into the bore 28 and starts displacing them radially toward the space 35. As the rod 22 advances further, the balls 31 are shifted sideways and partly accommodated in the space 35. When the tongue 21 is fully received between the jaws 25, 26, the annular groove 23 in the inserted rod 22 is held in registration with the apertures 29.

With the shafts 11, 12 thus put together, the sleeve 32 is allowed to move forward under the bias of the spring 34. Advancing movement of the sleeve 32 causes the inclined surface 38 to push the balls 31 out of the space 35 radially toward the rod 22. As the land 36 slides over the apertures 29, the balls 31 are shifted radially inwardly with their surfaces that project out of the apertures 29 being snugly received in the arcuately cross-sectioned groove 23 (Figure 3). Further spring-biased movement of the sleeve 32 is arrested when the inclined surface 38 becomes engaged by the retainer ring 40.

The shafts 11 and 12 are thus joined end to end by the coupling 10. Torque can be transmitted from shaft to shaft by the tongue 21 and jaws 25, 26 meshing together. Further, axial force transmission is possible since the balls 31 are received partly in the apertures 29 and partly in the groove 23, the balls 31 being trapped in position under the land 36 against radially outward movement.

When it is required to unjoin the shafts 11 and 12, the sleeve 32 is retracted again to move the land 36 away from the balls 31 which are then free to back off toward the relief space 35. Then, the rod 22 is pulled out of the hole 28. As the groove 23 is retracted out of registration with the apertures 29, the balls 31 are radially outwardly displaced smoothly without substantial resistance until they are shifted back out of the bore 28 and are received partly in the apertures 29 and partly in the space 35.

WHAT WE CLAIM IS:—

1. A coupling comprising: first and second shafts; the first shaft having a tongue, and a rod coaxial with the shaft, said rod having an annular groove; the second shaft having a pair of spaced jaws which are adapted for meshing engagement with the tongue, a coaxial bore for receiving said rod, and a plurality of apertures disposed around and communicating with the bore, there being a plurality of locking means fitted loosely in the apertures and capable of partly projecting into and retracting from the bore; and a sleeve disposed around and slidable axially on the second shaft, the sleeve having means for holding the locking means partly in the apertures and partly in the groove when the rod is fully inserted in the bore.

2. A coupling according to Claim 1, wherein the locking means comprise steel balls having a diameter larger than the length of the apertures, the apertures being progressively narrower toward the bore to hold the balls in the apertures from falling into the bore, and the sleeve having an annular space for partly receiving the balls.

3. A coupling according to Claim 1 or 2, wherein the rod has a free end with is circumferential edge chamferred.

4. A coupling according to Claim 1, 2 or 3, wherein the groove has a bottom of arcuate cross-section.

5. A coupling according to any one of Claims 1 to 4, wherein a compression coil

spring is disposed around the second shaft and biases the sleeve to a position where it enables the locking means to be held partly in the apertures and partly in the groove.

6. A coupling according to Claim 5, wherein the sleeve has an annular recess, and the spring is received in the recess and acts between a shoulder partly defining the annular recess and a retainer ring fixed to the second shaft.

7. A coupling according to any one of Claims 1 to 6, wherein a stop ring is fixed to the second shaft, the holding means comprises an annular land on the sleeve held in sliding contact with the second shaft, and the land is engageable with the stop ring.

8. A coupling according to any one of Claims 1 to 7, wherein the first shaft has a coaxial bore, and a male member has a mounting cylinder disposed in the bore of the first shaft and fixed to said first shaft, the male member including the tongue and supporting the rod thereon.

9. A coupling according to any one of Claims 1 to 8, wherein the jaws are segmental in cross-section to provide a slot therebetween, and the tongue is complementary in shape to the slot.

10. A coupling substantially as herein described with reference to and as illustrated in the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1980
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY
from which copies may be obtained.

1577804 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

FIG. 1

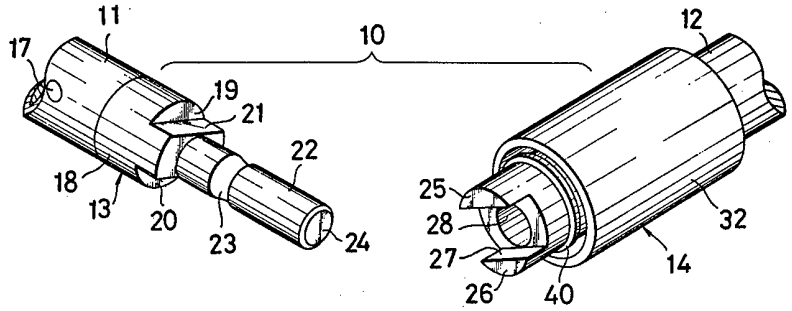

FIG. 2

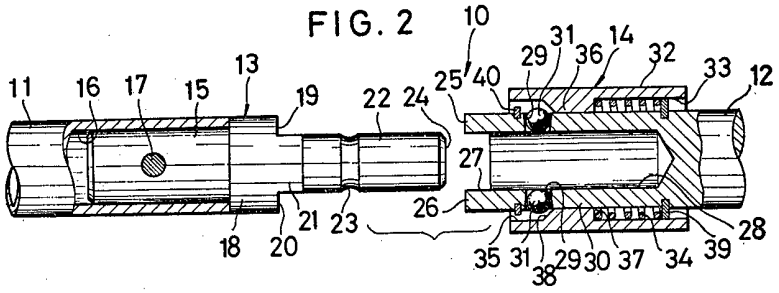

FIG. 3