AUSTRALIA 50931

Patents Act 1990

REQUEST FOR A STANDARD PATENT

AND NOTICE OF ENTITLEMENT

The Applicant identified below requests the grant of a patent to the nominated person identified below for an invention described in the accompanying standard complete patent specification.

[70,71]Applicant and Nominated Person: UNIDRIVE PTY. LTD.
(ACN 000 109 820)

of: 52 LISBON STREET,
FAIRFIELD, NEW SOUTH WALES 2165
AUSTRALIA.

[54]Invention Title: "PROPELLER SHAFT"

[72]Actual Inventor(s): Russell James BEAGLEY
John Alan SMALL

[74]Address for Service:

PHILLIPS ORMONDE & FITZPATRICK
367 Collins Street
Melbourne 3000 AUSTRALIA

Associated Provisional Application(s) Details
[60] Application Number(s) and Date(s): Australian Provisional Patent Application No. PL 5547 filed 28 October, 1992.

[31,33,32]

Applicant states the following:

The actual inventors created the invention in the course of their employment by UNIDRIVE PTY. LTD., and have acknowledged that company's right to the invention.

DATED: 27 October, 1993

UNIDRIVE PTY. LTD.
By: PHILLIPS ORMONDE & FITZPATRICK
Patent Attorneys
By:

David B Fitzpatrick

Our Ref : IRN 344819
TJC:KH

9624k

AU9350279

(12) PATENT ABRIDGMENT (11) Document No. AU-B-50279/93
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 669931

(54) Title
PROPELLER SHAFT

International Patent Classification(s)
(51)[5] **F16F 015/34** **F16C 003/02**

(21) Application No. : **50279/93** (22) Application Date : **27.10.93**

(30) Priority Data

(31) Number	(32) Date	(33) Country
PL5547	**28.10.92**	**AU AUSTRALIA**

(43) Publication Date : **12.05.94**

(44) Publication Date of Accepted Application : **27.06.96**

(71) Applicant(s)
UNIDRIVE PTY. LTD.

(72) Inventor(s)
RUSSELL JAMES BEAGLEY; JOHN ALAN SMITH

(74) Attorney or Agent
PHILLIPS ORMONDE & FITZPATRICK , 367 Collins Street, MELBOURNE VIC 3000

(56) Prior Art Documents
EP 520719
GB 1417266
GB 2147388

(57) Claim

1. A method of attaching a balance weight to a propeller shaft, including in order the steps of securing an anchoring element to a surface of the shaft so that said element projects from said surface, placing a balance weight which includes an opening on said element by locating said element within said opening and securing said balance weight to said element.

15. A propeller shaft including, a tubular body, a stud welded to a cylindrical outer surface of said body and projecting outwardly from that surface, a balance weight having a hole therethrough and located over said stud after said stud has been welded to said cylindrical outer surface so that said stud extends into said hole, and a terminal end portion of said stud coacting with said weight so as to thereby prevent separation of said weight from said stud.

AUSTRALIA

Patents Act

COMPLETE SPECIFICATION
(ORIGINAL)

Application Number: Class Int. Class
Lodged:

Complete Specification Lodged:
Accepted:
Published:

Priority

Related Art:

APPLICANT'S REF: COMPLETE-ASSOCIATED-WITH-PROVISIONAL PL 5547

Applicant(s):

UNIDRIVE PTY. LTD.,
52 LISBON STREET,
FAIRFIELD, NEW SOUTH WALES 2165,
AUSTRALIA

Actual Inventor(s): Russell James BEAGLEY
John Alan SMITH

Address for Service is:

PHILLIPS ORMONDE & FITZPATRICK
Patent and Trade Mark Attorneys
367 Collins Street
Melbourne 3000 AUSTRALIA

Complete Specification for the invention entitled:

"PROPELLER SHAFT"

Our Ref: IRN 344819

The following statement is a full description of this invention, including the best method of performing it known to applicant(s):

"PROPELLER SHAFT"

This invention relates to propeller shafts and is particularly although not exclusively concerned with such shafts as used to transmit drive from the engine of a vehicle to the road engaging wheels of that vehicle. It will be convenient to hereinafter describe the invention with particular reference to vehicle propeller shafts, but it is to be understood that the invention has other applications.

Vehicle propeller shafts need to be balanced in order to avoid development of annoying and possibly harmful vibration when the shaft is rotating. Attachment of balance weights is therefore a standard procedure in the manufacture of propeller shafts, and that procedure needs to be such as to meet both quality and manufacturing cost requirements. As to quality, the balance weights should be attached in a secure manner and also in a manner which does not disturb the integrity of the shaft. As to manufacturing cost, the attachment method should be relatively simple and accurate, and should not require excessive time to complete.

The problems associated with attachment of balance weights to propeller shafts have become exacerbated by the increasing popularity of shafts having a tubular body. Those problems are particularly pronounced in the case of such shafts which employ the use of an aluminium tube for the body. The invention will be hereinafter described with reference to aluminium tube propeller shafts, but it is to be understood that the invention is also applicable to shafts having a tubular body of steel or other appropriate metal.

It is generally preferred to use steel balance weights because of their favourable size to weight ratio. Attachment of such weights to aluminium tube is currently achieved in a number of ways, none of which is entirely satisfactory.

One current method involves the use of adhesive to secure the balance weight to the tube. That method requires the tube and the weight to be free of

contamination which might disturb the security of the attachment, and chemical cleaning is generally necessary for that purpose. Also, there is a significant time lapse (e.g., approximately 24 hours) after application of the adhesive before it achieves full strength. The process is therefore time consuming and requires adherence to high standards of cleanliness if effective results are to be achieved.

According to another prior method, the weights are attached to the tube by puddle welding. That method may be acceptable if the tube wall is relatively thick - e.g., 3mm or more - but many propeller shafts have a lesser wall thickness. Puddle welding can effect the structure of the tube wall to the extent that the risk of stress fatigue is significantly increased.

Another prior method involves spot or projection welding one or more weights to a steel sleeve which is secured around the outside of the propeller shaft tube, usually at the end of the tube which fits over the universal joint yoke. That method has the disadvantage of requiring an additional and relatively large component to be secured to the shaft. It also requires the application of suitable corrosion protection after completion of the securing operation.

It is an object of the present invention to provide an improved method for attaching a balance weight to a tube, and particularly the tubular body of a propeller shaft. It is a further object of the invention that such a method be convenient to carry out and is effective in providing a secure attachment. It is another object of the invention to provide a balance weight attached in an improved manner. It is still another object of the invention to provide an improved anchor for the balance weight of a propeller shaft.

In accordance with one aspect of the present invention, there is provided a method of attaching a balance weight to a propeller shaft, including in order the steps of securing an anchoring element to a surface of the shaft so that said element projects from said surface, placing a balance weight which includes an opening on said element by locating said element within said opening and securing said balance weight to said element.

The anchoring element can be secured to the shaft in any suitable fashion, but in a preferred method it is secured by a stud welding technique.

It is further preferred that attachment of a balance weight to the anchoring element may be effected by distorting the terminal outer end of the anchoring element after the

weight which includes an opening for receiving the anchoring element, has been located over that element in such a way that removal of the weight from anchoring element is resisted. Heat and pressure might be employed for that distortion oper ation.

In accordance with a further aspect of the present invention, there is provided a propeller shaft including a tubular body, a stud welded to a cylindrical outer surface of said body and projecting outwardly from that surface, a balance weight having a hole therethrough and located over said stud after said stud has been welded to said cylindrical outer surface so that said stud extends into said hole, and a terminal end portion of said stud coacting with said weight so as to thereby prevent separation of said weight from said stud.

In accordance with still another aspect of the present invention there is provided a propeller shaft balance weight anchor for attaching a balance weight having a hole therethrough, to the surface of a propeller shaft, said anchor including, a cylindrical body, a portion of which is adapted to extend into said hole for locating said balance weight relative to said anchor, and a welding pip projecting axially from an inner end of said body, said pip having a transverse cross-sectional size substantially less than the transverse cross-sectional size of said body.

It is preferred, that when the body is being secured to a shaft tube, the pip is engaged against the outer surface of the propeller shaft and an electrical current is passed through the body so that the pip melts and fuses with the surface of the propeller shaft. Capacitance discharge stud welding or any other suitable resistance welding technique may be used for that purpose.

Embodiments of the invention are described in detail in the following passages of the specification which refer to the accompanying drawings. The drawings, however, are

merely illustrative of how the invention might be put into effect, so that the specific form and arrangement of the various features as shown is not to be understood as limiting on the invention.

In the drawings:

Figure 1 is a semi-diagrammatic view of a propeller shaft having a balance weight attached.

Figure 2 shows a preferred form of an anchoring element according to the invention.

Figure 3 shows an intermediate step in securing an anchoring element to a propeller shaft.

Figure 4 shows a balance weight secured to a propeller shaft.

Figure 5 is a diagrammatic view of a propeller shaft having a balance weight attached.

Figure 1 illustrates in semi-diagrammatic form an end portion 2 of a tubular propeller shaft 1 attached to the yoke 3 of a typical universal joint. An anchoring element in the form of a small stud 4 is adapted to be secured to the end portion 2 as hereinafter described, and that stud 4 is adapted to receive and hold a balance weight 5 in a manner also hereinafter described.

The anchoring element can be of any suitable form and composed of any suitable material according to the circumstances of use. It is generally preferred however, that the anchoring element be arranged so that it projects outwardly from the outer surface of the shaft 1 when secured to that shaft, so as to be thereby cooperable with a balance weight. In the particular example shown in Figures 2 to 4 of the drawings, the anchoring element is a small cylindrical stud 4, which is initially formed to have a small pip 6 projecting axially from one end as shown in Figure 2. Assuming the tubular body of the shaft 1 is of aluminium or an aluminium alloy, the stud 4 may be also composed of aluminium or an aluminium alloy, but that is not essential.

Known techniques can be adopted to select a position on the shaft 1 at which a balance weight is required. The stud 4 is then located at that position with the pip 6

engaging the outer surface of the shaft 1 as shown in Figure 2. A known stud welding technique can be then employed to cause passage of an electric current through the stud 4. The pip 6 is thereby caused to melt and is fused into the body of the shaft 1 as shown diagrammatically by the zone 7 in Figures 3 and 4. An axial force F may be applied to the stud 4 during the welding process, but that need not be high. It will be appreciated that other suitable methods may be adopted for securing the stud 4 to the shaft 1.

Any appropriate method may be used to attach the weight 5 to the stud 4 and thereby effect attachment of the weight to the shaft 1. In the particular example shown, the weight 5 is provided with a hole 8 which is able to receive the stud 4 as shown in Figures 3 to 5. The stud 4 may be a loose or an interference fit within the hole 8, although it is preferred to provide a neat sliding fit. The stud 4 may also be provided with a flange 9 against which the weight 5 may be located.

It is usually preferred to positively retain the weight 5 against separation from the stud 4, and any suitable means can be used for that purpose. In one arrangement as illustrated diagrammatically in Figure 4 of the drawings, the outer terminal end of the stud is distorted so as to spread and create an enlargement 10 which cannot pass through the hole 8. The weight 5 is thereby held against separation from the stud 4.

Distortion of the stud end can be achieved in any suitable fashion. According to the arrangement shown diagrammatically in Figure 5, such distortion is achieved by passing electric current through the stud 4 so as to heat it to a plastic state, and simultaneously applying endwise pressure to the stud 4. A resistance welding technique can be used for that purpose. In the arrangement shown in Figure 5, contacts 11 and 12 are connected into an electric circuit 13 which includes a suitable energy source 14, and the circuit is completed when the contact 11 engages the stud 4. The stud 4 is thereby heated to a plastic state, and pressure applied

through the contact 11 causes the end of the stud 4 to spread as shown in Figure 4.

An advantage of the method described in relation to Figure 5 is that the pressure applied to the stud 4 need not be great, and consequently distortion of the tubular body of the shaft 1 is unlikely.

Adoption of attaching means according to the invention has several benefits. By way of example, the balance weight can be supplied with a suitable corrosion resistant coating, and that can be very important if the weight is made of a metal different to that of the anchoring stud and/or the tubular body of the shaft. The integrity of the corrosion resistant coating is unlikely to be damaged by the relatively mild method utilised for attaching the weight to the anchoring stud. A further benefit is that the attaching means can be conveniently adopted in a machine controlled manufacturing process. Still further, the integrity and strength of the tubular body of the propeller shaft are not significantly disturbed by the method whereby the anchoring stud is secured to the shaft.

Various alterations, modifications and/or additions may be introduced into the constructions and arrangements of parts previously described without departing from the spirit or ambit of the invention as defined by the appended claims.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of attaching a balance weight to a propeller shaft, including in order the steps of securing an anchoring element to a surface of the shaft so that said element projects from said surface, placing a balance weight which includes an opening on said element by locating said element within said opening and securing said balance weight to said element.

2. A method according to claim 1, wherein said anchoring element is secured to the shaft by welding.

3. A method according to claim 2, wherein said welding is effected by a resistance welding operation.

4. A method according to claim 2, wherein said welding is effected by capacitor discharge stud welding.

5. A method according to any preceding claim, wherein said anchoring element is a neat sliding fit within said opening.

6. A method according to any preceding claim, wherein said opening is a hole which extends completely through said weight.

7. A method according to claim 6, wherein said anchoring element is extended through said hole so that a terminal outer end thereof projects beyond an outer surface of said weight, and said weight is secured to said element by distorting said terminal outer end.

8. A method according to claim 7, wherein heat and pressure are employed to cause said distortion of said terminal outer end.

9. A method according to claim 8, wherein said heat is generated by passing an electric current through said anchoring element.

10. A method according to any preceding claim, wherein said weight is coated with a corrosion resistant coating.

11. A method according to any preceding claim, wherein said anchoring element is in the form of a cylindrical stud.

12. A propeller shaft having a balance weight secured thereto in accordance with the method of any preceding claim.

13. A propeller shaft according to claim 12, wherein said shaft has a tubular body and said shaft surface is an outer cylindrical surface of that body.

14. A propeller shaft according to claim 13, wherein said body is formed of aluminium or an aluminium alloy.

15. A propeller shaft including, a tubular body, a stud welded to a cylindrical outer surface of said body and projecting outwardly from that surface, a balance weight having a hole therethrough and located over said stud after said stud has been welded to said cylindrical outer surface so that said stud extends into said hole, and a terminal end portion of said stud coacting with said weight so as to thereby prevent separation of said weight from said stud.

16. A propeller shaft balance weight anchor which attaches a balance weight having a hole therethrough to the surface of a propeller shaft, said anchor including a cylindrical body having a portion which is adapted to extend into said hole and which locates and secures said balance weight relative to said anchor and a welding pip projecting axially from an inner end of said body and being used to weld said anchor, to said propeller shaft prior to attachment of said balance weight to said anchor, said pip having a transverse cross-sectional size substantially less than the transverse cross-sectional size of said body.

17. An anchor according to claim 16, wherein a laterally projecting flange is provided at said inner end for engagement with a balance weight mounted on said anchor.

18. An anchoring element substantially as herein particularly described with reference to what is shown in the accompanying drawings.

19. A method of attaching a balance weight to a propeller shaft, substantially as herein particularly described with reference to what is shown in the accompanying drawings.

20. A propeller shaft substantially as herein particularly described with reference to what is shown in the accompanying drawings.

DATED: 4 April 1996
PHILLIPS ORMONDE & FITZPATRICK
Attorneys for:
UNIDRIVE PTY. LTD.

ABSTRACT

A propeller shaft is provided including, a tubular body (1) and a balance weight (5) attached to the body (1). The propeller shaft is characterised in that a stud (4) is welded to a cylindrical outer surface of the body (1) so as to project outwardly from that surface. The weight (5) has a hole (8) therethrough and located over the stud (4) so that the stud (4) extends into the hole (8). A terminal end portion (10) of the stud (4) coacts with the weight (5) so as to thereby prevent separation of the weight (5) from the stud (4). A method for attaching a balance weight to a propeller shaft is also provided.

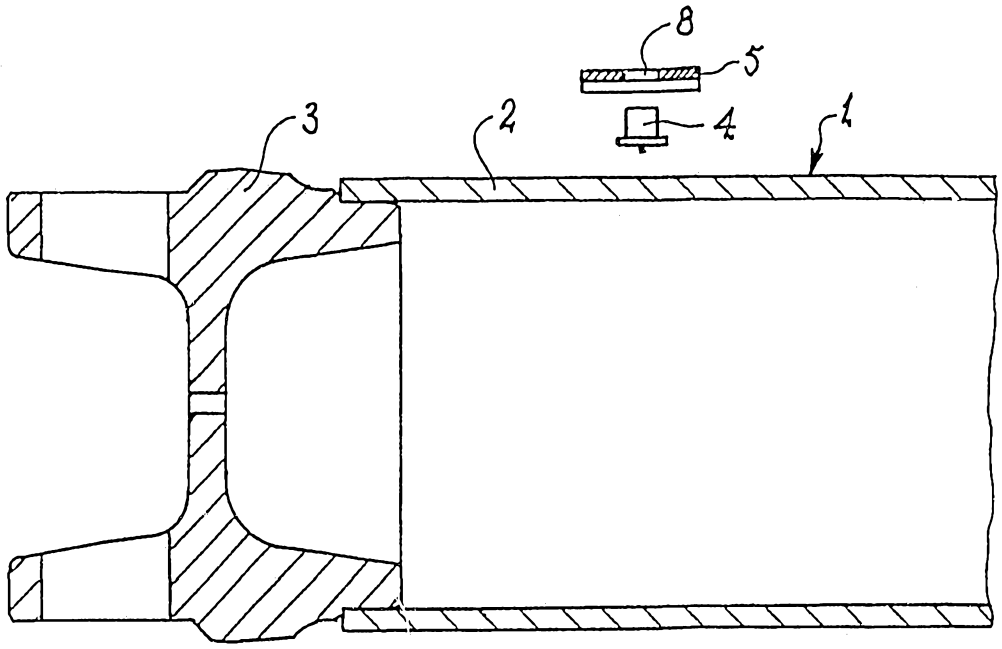

FIG 1

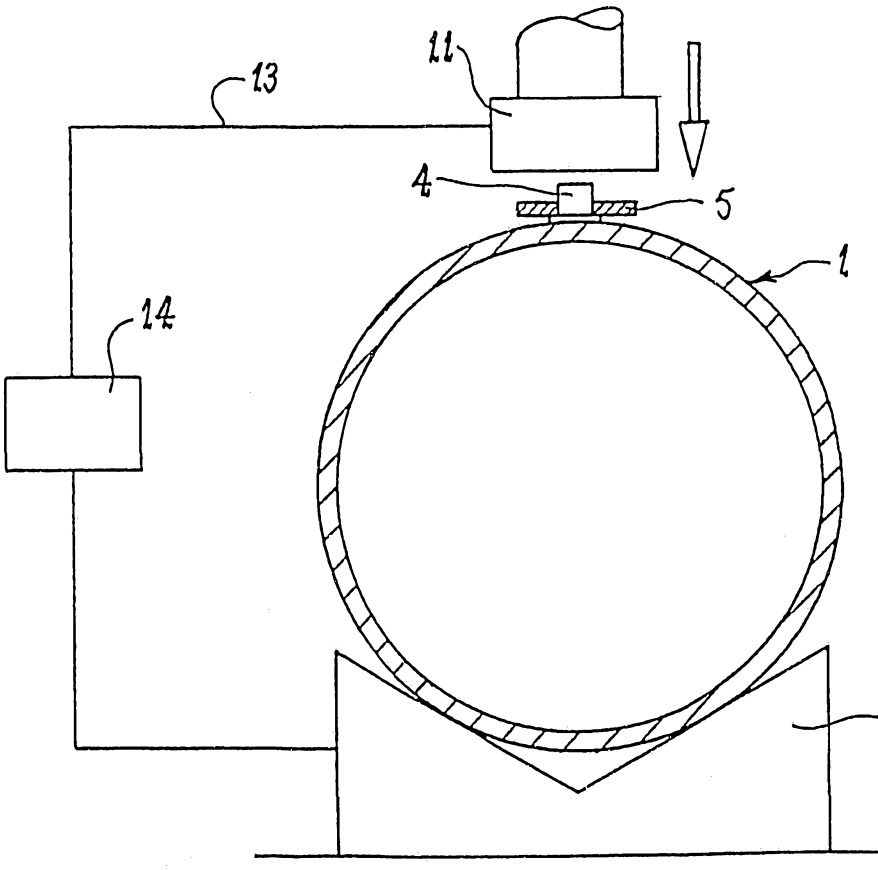

FIG 5

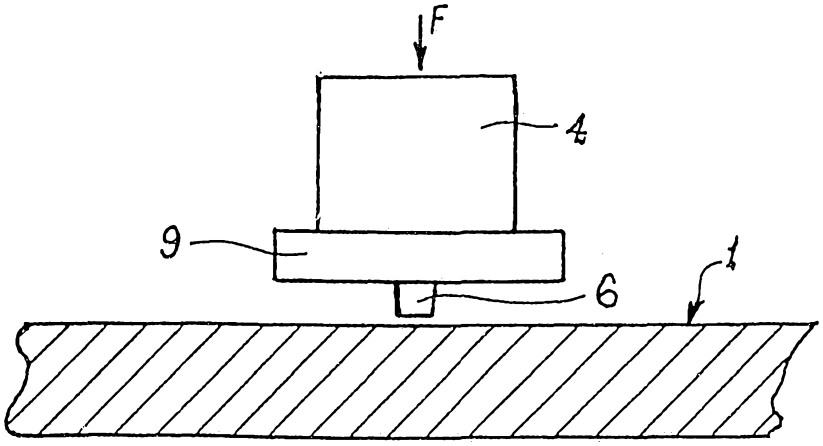

FIG 2

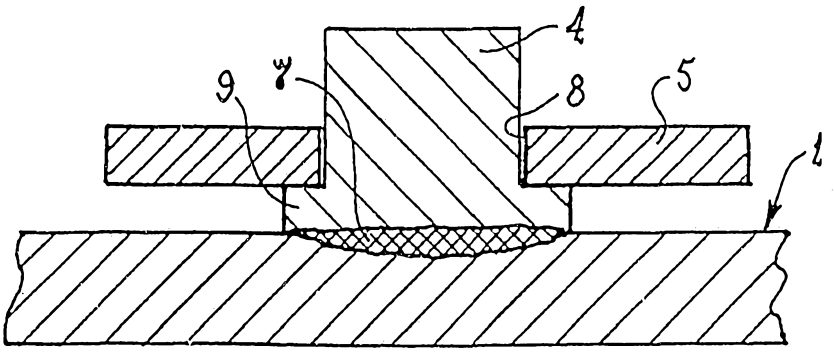

FIG 3

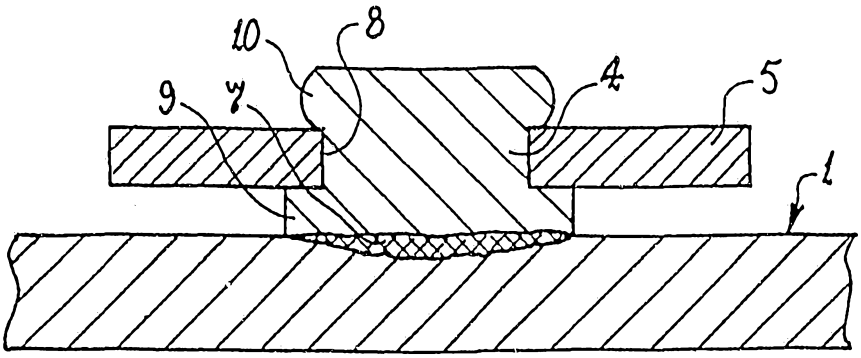

FIG 4