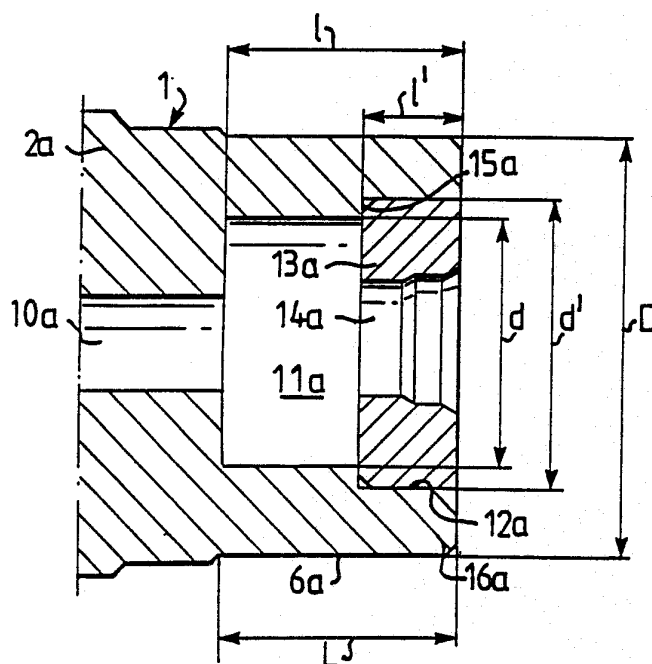




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(54) Title: CROSS FOR A UNIVERSAL JOINT



(57) Abstract

A cross (1) for a universal joint has axial recesses (11a) in the ends of the arms (2a). In the outer part of each of these recesses (11a) there is pressed-in a reinforcing plug (13a). By these means, each arm receives a modified elasticity which leads to a more uniform load on the bearing, with which the arm is intended to interact. This leads to improved bearing life.

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Cross for a universal joint

The present invention relates to a cross for a universal joint, in which each of the arms of the cross has at its outer end an external cylindrical bearing surface and, arranged coaxially with this, a recess which opens into the end of the arm.

5

Universal joints are used in transmissions in order to transfer torque, for example in a universal driving shaft for a lorry. The bearings, usually roller bearings, in which the ends of the arms of the cross forming part of the universal joint rest, are exposed to high stresses and wear relatively quickly.

10 These bearings, in particular the bearing boxes in them, therefore constitute a weak link in the transmission as a whole. It has emerged that the most common form of damage for the bearing boxes is constituted by surface fatigue damage, so-called pitting, on the axially outer end of the normally cylindrical bearing boxes. The loading on the bearing boxes is therefore
15 obviously greatest at this axially outer end.

Crosses are in this connection often solid, but it is also the case that they are provided with different types of holes and channels in the arms for different purposes. In one type of cross, for example according to SE-C-3 44 994 or US-
20 C-3 858 413, there are axial lubricant channels for the purpose of supplying lubricant to the bearings via the ends of the arms. These lubricant channels have in this connection a diameter which does not affect the rigidity of the ends of the arms to any significant extent in comparison with solid crosses. The bearing life is therefore equally problematic as in the case of solid
25 crosses, as described above.

In another known embodiment according to US-C-3 651 663, intended for steering gears, the arm ends of the cross are provided with recesses, into which rubber buffers are introduced in order to prevent play in the axial
30 direction of the arms. This type of cross is, however, usually intended for relatively small loads and the bearings are thus not exposed to any major loads. Moreover, these crosses also have a rigidity which is essentially identical to the rigidity of a solid cross.

The aim of the invention is to improve existing types of cross in order thus to achieve an increased life of the bearings in which the ends of the arms of the cross are intended to rest.

5 According to the invention, this is achieved in that there is pressed in, in the outer part of the recess, a reinforcing plug. By these means, the recess can be dimensioned with a diameter of such a size that there is achieved, in relation to a solid cross, a change in the flexural rigidity of the arms, which leads to a better load distribution in the bearings and thus an increased bearing life.

10

According to a particularly advantageous embodiment, the recess can be wider in its outer part which is intended for the plug, as a result of which an annular surface is formed, against which the plug bears in the axial direction. By these means, it is ensured in a simple manner that the plug assumes the correct position in the cross.

15

According to another advantageous embodiment of the cross, there can be in each of the arms an axial lubricant channel, the plug having an axial hole which is connected, via the recess, to the lubricant channel. By these means, lubrication of the bearings of the cross is ensured in a simple manner. The invention is explained in greater detail below with the aid of an exemplary embodiment shown in the attached drawing, in which Fig. 1 shows a view from above of a cross with associated bearings, Fig. 2 shows a side view, in partial cross-section, of the cross in Fig. 1, and Fig. 3 shows in cross-section the end of an arm of a cross.

20

25

According to Fig. 1, a cross 1, designed according to the invention, with four arms 2a-2d supports, at the outer ends of the arms, bearings 3a-3d which in known manner are to make possible mutual angular positioning between a first and a second part which the cross is to join. The bearings 3a and 3c are in this case each arranged in their holder 4a and 4c respectively, which are intended to be joined to one part, while the bearings 3b and 3d are intended to be joined to the other part.

30

35 The cross is intended to form part of a universal joint in a vehicle transmission, but can of course be also used in other transmissions.

As can be seen more clearly from Fig. 2, the bearing 3a, like the other bearings 3b-3d, is constituted by a roller bearing, in which a number of roller-shaped bearing boxes 5a are in contact on the one hand with an external cylindrical bearing surface 6a on the outer end of the arm 2a and on the other hand with an internal cylindrical surface on an outer race 7a. Between the arm 2a and the outer race 7a there is a packing 8a which has the function of protecting the bearing and retaining lubricant in the same.

For lubrication of the bearing 3a and other bearings, there is a lubrication nipple 9 which is centrally mounted on the cross and from which lubricant can be supplied to the bearings via channels, for example the channel 10a, which are arranged centrally in the arms and which run out in the ends of the arms. Size and design of the bearing boxes 5a can vary according to requirements. In the example shown here, there are two bearing boxes which are arranged axially one after another and which together extend along the whole length of the bearing surface 6a. Alternatively, it is possible to use instead a single bearing box, the length of which is identical to the length of the bearing surface 6a.

The special design, according to the invention, of the ends of the arms of the cross 1 can be seen from Fig. 3, in which the end of the arm 2a is shown. A cylindrical recess 11a opens into the free end of the arm 2a and is connected to the channel 10a. The purpose of the recess 11a is to bring about a deliberate reduction of the rigidity of the arm 2a of the cross 1 and thus increase its elasticity. This reduction of the rigidity is of such a size that it can generally be considered to result in the arm 2a receiving an abnormally great elasticity. The recess 11a has a length l and a diameter d . In its outer part, the recess 11a has a widened part 12a which has a length l' and a diameter d' which is greater than the diameter d . In the widened part 12a of the recess 11a, there is pressed-in a reinforcing plug 13a, in which there is a central continuous hole 14a. The race 6a has a length L and a diameter D . At the inner end of the widened part 12a of the recess 11a, there is an annular surface 15-a, against which the plug 13a bears.

The length l of the recess 11a is preferably essentially identical to the length L of the race 6a but can also be greater than the length L . The length l' of the plug 13a expediently amounts to at most half of the length L of the bearing

surface 6a, while the diameter d' expediently amounts to at least half of the diameter D of the bearing surface 6a.

5 The plug 13a is expediently mounted in the widened part 12a of the recess 11a by means of a drive fit and thus reinforces the outside wall 16a of the arm 2a. It is in this connection important that the fit between plug and recess is suitably firm, since the end of the arm becomes too weak if the fit is too loose, but has undesirable internal stresses if the fit is too tight. A drive fit or light drive fit has proved to be most advantageous in the tests which have
10 been carried out. The plug thus partially compensates the earlier deliberate reduction of the rigidity of the arm of the cross and causes the end of the arm to be reinforced while the race around the remaining part of the recess continues to be elastic.

15 Mounting the plug 13a can advantageously be carried out relatively early in the manufacture of the cross after the recess has been bored, and, by means of expedient design of the hole 14a, the plug can subsequently be used for clamping the cross during continued working. After mounting the plug, the end surface of the arm can further be ground and hardening can take place.
20

Tests with an embodiment according to the invention have resulted in more than a doubling of the bearing life compared with that in the case of a conventional embodiment.

25 In the embodiment shown here, the hole 14a in the plug 13a is utilised, as has been made clear, both for clamping of the cross and for supplying lubricant to the bearing. It is of course also possible to make the cross without channels for lubricant and to dispense with the possibility of being able to clamp the cross via the plug. The plug 13a can then be made solid,
30 but it continues to be essential that the recess 11a is sufficiently great in order to impart to the end of the arm the desired elasticity.

Patent Claims

1. Cross for universal joint, in which each of the arms (2a) of the cross (1) has at its outer end an external cylindrical bearing surface (6a) and, arranged coaxially with this, a recess (11a) which opens into the end of the arm, characterised in that there is pressed-in, in the outer part of the recess (11a),
5 a reinforcing plug (13a).
2. Cross according to Claim 1, characterised in that the length (l') of the plug (13a) amounts to at most half of the length (L) of the bearing surface (6a).
- 10 3. Cross according to Claim 1 or 2, characterised in that the diameter (d') of the plug (13a) amounts to at least half of the diameter (D) of the bearing surface (6a).
- 15 4. Cross according to any one of Claims 1-3, in which, in each of the arms (2a), there is an axial channel (10a) for lubricant, characterised in that the plug (13a) has an axial hole (14a) which is connected, via the recess (11a), to the channel (10a) for lubricant.
- 20 5. Cross according to any one of the Claims 1-4, characterised in that the recess (11a) is widened in its outer part (12a) which is intended for the plug (13a), as a result of which an annular surface (15a) is formed, against which the plug bears in the axial direction.
- 25 6. Cross according to any one of Claims 1-5, characterised in that the length (l) of the recess (11a) is essentially identical to the length (L) of the bearing surface (6a).
- 30 7. Cross according to any one of Claims 1-6, characterised in that the plug (13a) is designed for clamping the cross in a working machine.

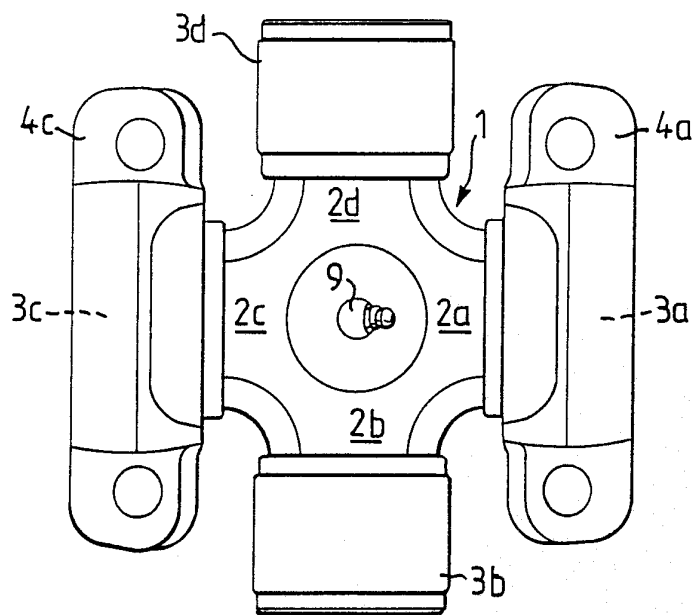


FIG. 1

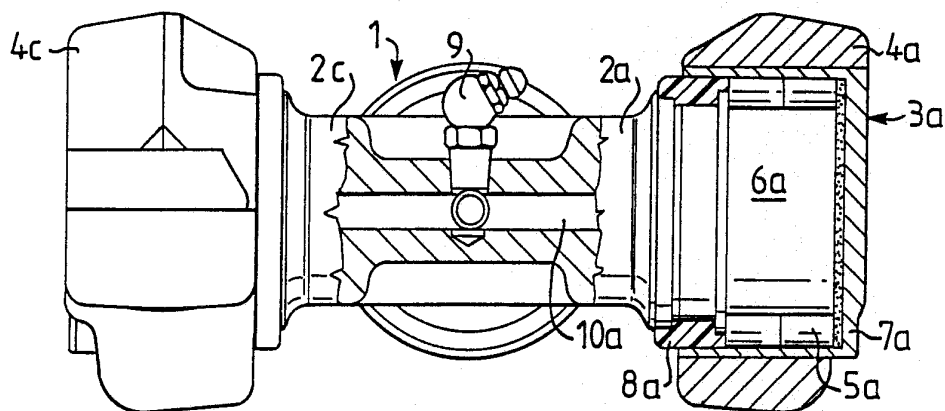


FIG. 2

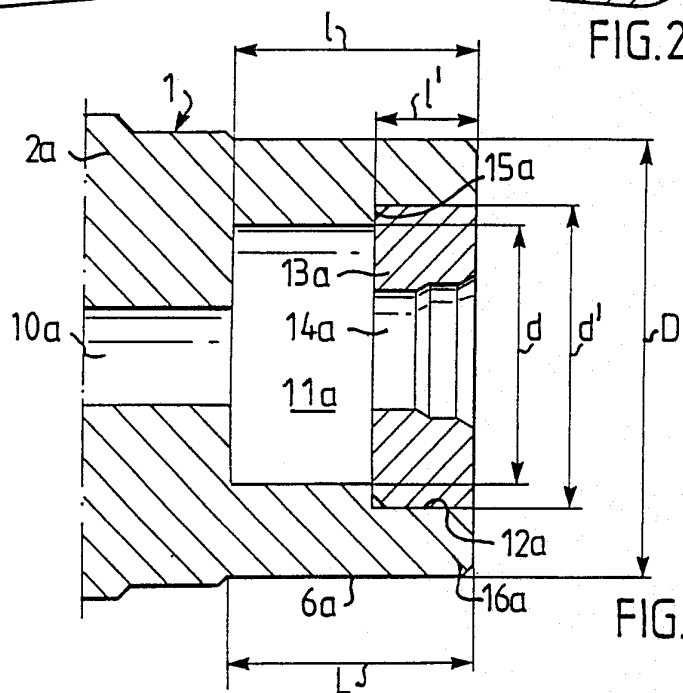
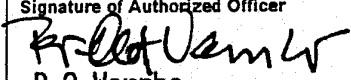


FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 90/00711

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁸ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: F 16 D 3/40		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC5	F 16 D	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched ⁸		
SE,DK,FI,NO classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	SE, B, 432294 (ROCKWELL INTERNATIONAL CORPORATION) 26 March 1984, see page 5, line 16 - page 6, line 9 --	1-6
A	US, A, 3651663 (LANGE ET AL) 28 March 1972, see abstract; figures 2,3 --	1-6
A	US, A, 3858413 (NEMTSOV ET AL) 7 January 1975, see column 2, line 47 - line 51; figure 3 --	1
A	DE, C2, 2933505 (UNI-CARDAN AG) 10 November 1983, see claim 1 -- -----	1
* Special categories of cited documents: ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
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ANNEX TO THE INTERNATIONAL SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
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