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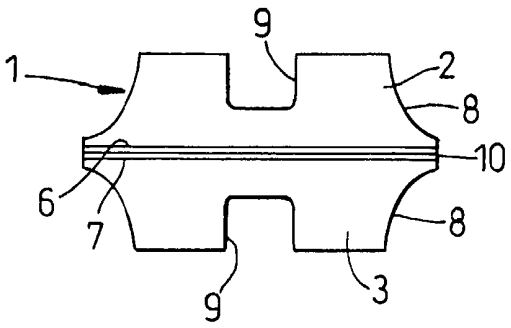
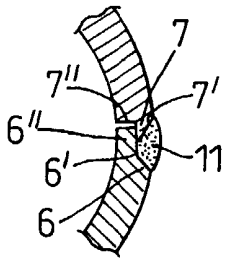
(54) Title: CONNECTION BETWEEN VEHICLE AXLE AND SUSPENSION ARM





(57) Abstract: A vehicle suspension axle wrap (1) is a composite tubular structure of cast or forged shells (2, 3) of part-tubular shape assembled into the tubular form and welded together at juxtaposed edges (6, 7). The shells (2, 3) can be cast or forged accurately to shape and profile to provide an improved quality of axle wrap. Wall thickness variations may be designed into the shells. The juxtaposed edges (6, 7) are shaped to space the welding at the edges from the interior of the assembled axle wrap. They may be bevelled adjacent the external circumferential surfaces of the shells to provide a V-shaped groove (10) at which the welded joint (11) is made. Preferably there is a stepped engagement at the edges between the V-shaped groove and the internal surface of the axle wrap to act as a barrier to weld extending to the internal surface. Each shell (6, 7) is formed with an aperture (9) at which a welded joint can be made between the axle wrap (1) and an axle.

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CONNECTION BETWEEN VEHICLE AXLE AND SUSPENSION ARM

This invention relates to a vehicle suspension axle wrap.

Axle wraps are used in the securing of axles to beams, for example in trailing arm suspensions. The axle wraps are welded to the beams.

Conventionally axle wraps have been made from metal plate which is formed to sleeve shape to receive the axles therein. A problem with forming an axle wrap from metal plate is that accuracy of its finished shape cannot be ensured. There may be variations in the wall thickness of the formed axle wrap and in profile shaping of the wrap which impair the effectiveness of securing the axle wrap to a beam and to the axle which it retains to the beam.

According to a first aspect of the present invention a vehicle suspension axle wrap is provided which is a composite tubular structure of cast or forged shells of part-tubular shape which are assembled into the tubular form and welded together at juxtaposed edges.

The shells can be cast or forged very accurately to shape and profile so that a better quality axle wrap can be provided by the present invention than has been possible with the known axle wraps formed from metal plate. Furthermore, variations in wall thicknesses may be designed into the shells if desired, for example by the inclusion of bead or rib formations.

Preferably the shells have their juxtaposed edges shaped to space the welding at the edges from the interior of the assembled axle wrap. The welding, therefore, does not intrude into the interior of the axle wrap, thereby avoiding a need for subsequent finishing treatment to remove

welding at the interior which might interfere with correct seating of the axle in the axle wrap. The edges of the shells may be bevelled adjacent the external circumferential surfaces of the shells to cause a V-shaped groove to be defined between juxtaposed edges at which the welded joint is made between the shells. The juxtaposed edges are preferably shaped so that between the V-shaped groove and the internal surface of the axle wrap they have a mating stepped engagement which acts as a barrier to prevent the weld from extending to the internal surface. For example, inwardly of the V-shaped groove one edge may have a projecting lip or flange and the other edge may have a complementally shaped recess with which the lip or flange engages. As an alternative the juxtaposed edges may be shaped to that inwardly of the V-shaped groove they meet at an angle inclined to the internal surface of the axle wrap. To provide this interengagement one edge may, for example, have a single chamfer and the other edge may have a double chamfer, an outer one of which defines the V-shaped groove with an outer part of the single chamfer and the other, inner, chamfer meets, and extends parallel to, an inner part of the single chamfer. These barrier arrangements effectively form an integral backing strip at the juxtaposed edges and so avoid the need for a separate backing strip to be applied inside the axle wrap at the edges while the shells are being welded or bonded together.

There may be just two of the shells. They may be of a common overall shape. They may meet on a central axial plane of the made-up axle wrap, or they may meet on a plane inclined to a central axial plane so that at one end of the axle wrap a shell may extend through more than 180° and at the opposite end through less than 180°. This latter arrangement enables some relative axial, and thereby diametral, adjustment between the shells to position them before they are secured together.

The interior of the axle wrap needs to be cylindrical but the shells may be shaped to give the exterior of the axle wrap a cylindrical or non-cylindrical form with uniform or varied wall thicknesses, as desired.

An aperture may be formed in at least one of the shells, opening from the exterior of the shell to the interior, for a welded joint between the axle wrap and the axle it receives in use to be made at the periphery of the aperture. The aperture may be circular or non-circular.

The axle wrap may be secured in a complementary seating in a suspension beam. It may be welded, preferably continuously, around its external circumference to the beam. In a beam of hollow box or comparable section having opposed side walls, the seating for the axle wrap may be defined by recesses in the side walls of the beam. Preferably, in accordance with our co-pending GB patent application No. 0021718.2, the axle wrap is secured to the beam by welded jointing internally and externally of the beam.

According to a second aspect of the present invention a suspension beam is provided which includes an axle wrap in accordance with the first aspect of the present invention herein set forth.

An embodiment of the invention will now be described by way of example only with the reference to the accompanying drawings, in which:

Figure 1 is a plan view of a vehicle suspension axle wrap in accordance with the present invention;

Figure 2 is an end view of the axle wrap;

Figure 3 is a perspective view of a shell of the axle wrap,

Figure 4 is an enlarged fragmentary section through juxtaposed edges of shells of the axle wrap, and

Figure 5 is a side view of a suspension beam including the axle wrap.

In this embodiment a cylindrical axle wrap 1 comprises two similar semi-circular shells 2, 3 which are assembled and welded together to form the tubular axle wrap.

Each shell 2, 3 is accurately formed to shape as a steel casting or forging having a smooth semi-cylindrical internal surface 4 and external surface 5. As best seen in Figure 4, each shell has one longitudinal edge 6 formed with a chamfer 6' and a projecting lip 6'' of rectangular cross-section and the opposite longitudinal edge 7 is formed with a chamfer 7' and a recess 7'' of complementary rectangular shape to the lip 6''. End edges 8 of each shell 2, 3 are square but are concavely arced circumferentially of the shell so that the longitudinal edges 6,7 are longer than the shell is at the crest of its semi-cylindrical shape. Formed through the wall of each shell, centrally of the length of the shell, is an elongated, generally rectangular, aperture 9 which has rounded corners and has its length extending circumferentially of the shell.

The two shells 2, 3 are assembled together so that each shell has the chamfer 6' and lip 6'' of its one longitudinal edge juxtaposed with the chamfer 7' and recess 7'' of the opposite longitudinal edge of the other shell. Where each pair of juxtaposed longitudinal edges meet a V-shaped, external, groove 10 is defined between their chamfers 6', 7'. The lip 6'' of the one edge locates closely in the recess 7'' of the other edge. A step is therefore formed by the mating edges between the groove 10 and the

internal surface of the formed axle wrap. The two diametrically opposed, external grooves 10 thus formed extend along the length of the formed fully tubular axle wrap. The shells are welded together, as at 11, at these grooves 10 continuously along the lengths of the juxtaposed longitudinal edges 6. The welds 11, therefore, are contained at the exterior of the finished axle wrap 1. The stepped engagement of the juxtaposed edges inwardly of the groove 10 provides a barrier to the welds extending into the interior of the axle wrap, leaving the internal surface of the axle wrap smooth and unimpaired throughout its circumference.

The axle wrap can be made to any desired length and diameter to suit the axle and suspension beam with which it is to be used. The shapes and profiles of the shells can be readily changed in the casting and forging process to suit the requirements of the axle wrap to be produced.

In a suspension beam assembly, as shown for example in Figure 5, the axle wrap 1 is located in a complementary seating 12 in a beam 13 and fixed by continuous welding, 14, of its external circumferential surface to the periphery of the seating. The beam 13, in the example shown, is of a hollow construction comprising two, forward and rearward, components 15, 16 of a generally U-shaped section butt-welded together end-to-end. Each component 15, 16 is made from metal plate cut to the required outline and formed to the generally U-shaped section. The components 15, 16 are welded together such that their opposite side limbs form side walls 17 of the beam and the web 15' of the forward component 15 is at the top of the beam whilst the web 16' of the rearward components 16 is at the bottom of the beam. The seating 12 for the axle wrap is defined by co-axial, almost circular, recesses 18 formed in the side walls 17 by part-circular hollows in the butting end edges of the forward and rearward components 15, 16. The axle wrap is welded to the side walls 17 of the beam around the recesses 18, on both the outside and inside of the side

walls, in accordance with our co-pending GB patent application No. 0021718.2. The inside welding is made possible by the access available through the mouths of the U-shaped sections of the forward and rearward components.

An axle 19 is fixed in the axle wrap 1 by welding the axle wrap to the axle around the peripheries of the apertures 9. A galling agent, in the form of a paste, may be applied between the axle wrap and the axle to increase frictional purchase between them, and thereby assist in evening out load distribution between the two parts.

A forward cover plate 20 is welded in the mouth of the forward component to close the bottom of the beam between its front end and the axle wrap. In addition, a rearward cover plate 21 is welded over the mouth of the beam between its rear end and the web 15' of the forward component 15. The rearward cover plate 21 also provides a seating 22 for an air spring, not shown.

Front ends 23, 24 of the web 15' of the forward component 15 and of the forward cover plate 20, and front edges of the side limbs of the component, are so shaped as to form in combination a seating 25 for a pivot bush 26 of the beam 13.

CLAIMS

1. A vehicle suspension axle wrap characterised in that it is a composite tubular structure of cast or forged shells (2, 3) of part-tubular shape which are assembled into the tubular form and welded together at juxtaposed edges (6, 7).

2. A vehicle suspension axle wrap according to claim 1 characterised in that the shells (2, 3) have variations in wall thicknesses.

3. A vehicle suspension axle wrap according to claim 2 characterised in that the shells (2, 3) include bead or rib formations.

4. A vehicle suspension axle wrap according to any preceding claim characterised in that the shells (2, 3) have their juxtaposed edges (6, 7) shaped to space the welding (11) at the edges from the interior of the assembled axle wrap (1).

5. A vehicle suspension axle wrap according to claim 4 characterised in that the juxtaposed edges (6, 7) are bevelled adjacent the external circumferential surfaces of the shells (2, 3) to cause a V-shaped groove (10) to be defined between the edges at which the welded joint is made between the shells.

6. A vehicle suspension axle wrap according to claim 5 characterised in that the juxtaposed edges (6, 7) are shaped between the V-shaped groove (10) and the internal surface of the axle wrap (1) to have a mating stepped engagement which acts as a barrier to prevent the weld (11) from extending to the internal surface.

7. A vehicle suspension axle wrap according to claim 6 characterised in that inwardly of the V-shaped groove (10) one (6) of the juxtaposed edges has a projecting lip (6'') or flange and the other (7) of the juxtaposed edges has a complementary shaped recess (7'') with which the lip (6'') or flange engages.

8. A vehicle suspension axle wrap according to claim 6 characterised in that the juxtaposed edges (6, 7) are shaped to meet inwardly of the V-shaped groove (10) at an angle inclined to the internal surface of the axle wrap (1).

9. A vehicle suspension axle wrap according to claim 8 characterised in that one of the juxtaposed edges has a single chamfer and the other of the juxtaposed edges has a double chamfer one, outer, chamfer of which defines the V-shaped groove (10) with an outer part of the single chamfer and the other, inner, chamfer of which meets, and extends parallel to, an inner part of the single chamfer.

10. A vehicle suspension axle wrap according to any preceding claim characterised in that there are two of the shells.

11. A vehicle suspension axle wrap characterised in that the two shells (2, 3) are of a common overall shape.

12. A vehicle suspension axle wrap according to claim 11 characterised in that the two shells (2, 3) meet on a central axial plane of the made-up axle wrap (1).

13. A vehicle suspension axle wrap according to claim 11 characterised in that the two shells (2, 3) meet on a plane inclined to a central axial plane of the made-up axle wrap (1).

14. A vehicle suspension axle wrap according to any preceding claim characterised in that the shells (2, 3) are shaped to give the exterior of the assembled axle wrap (1) a cylindrical form.

15. A vehicle suspension axle wrap according to any of claims 1 to 13 characterised in that the shells (2, 3) are shaped to give the exterior of the assembled axle wrap (1) a non-cylindrical form.

16. A vehicle suspension axle wrap according to any preceding claim characterised in that an aperture (9) is formed in at least one of the shells (2, 3), opening from the exterior of the shell to the interior, whereat a welded joint can be made at the periphery of the aperture between the axle wrap (1) and the axle it receives in use.

17. A suspension beam characterised in that it includes an axle wrap (1) as claimed in any preceding claim.

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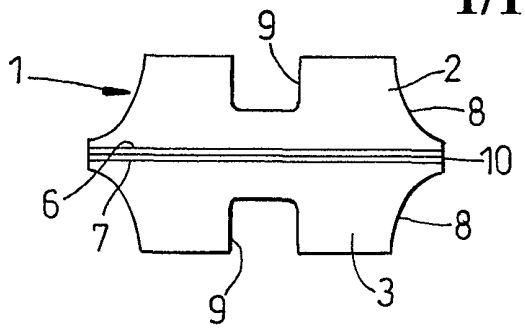

Fig. 1

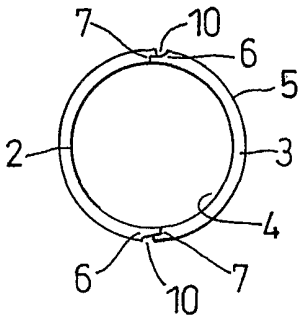

Fig. 2

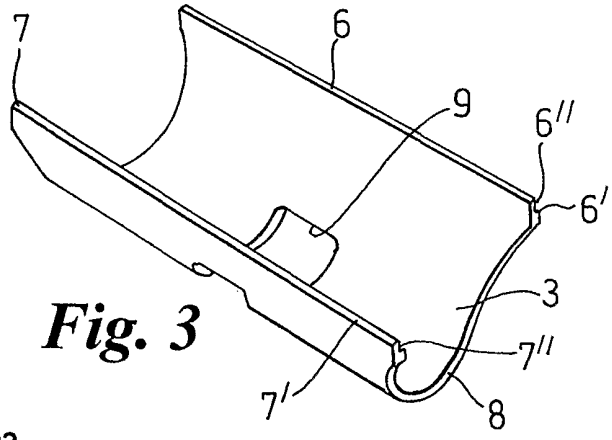

Fig. 3

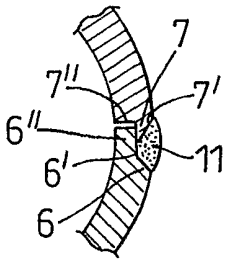

Fig. 4

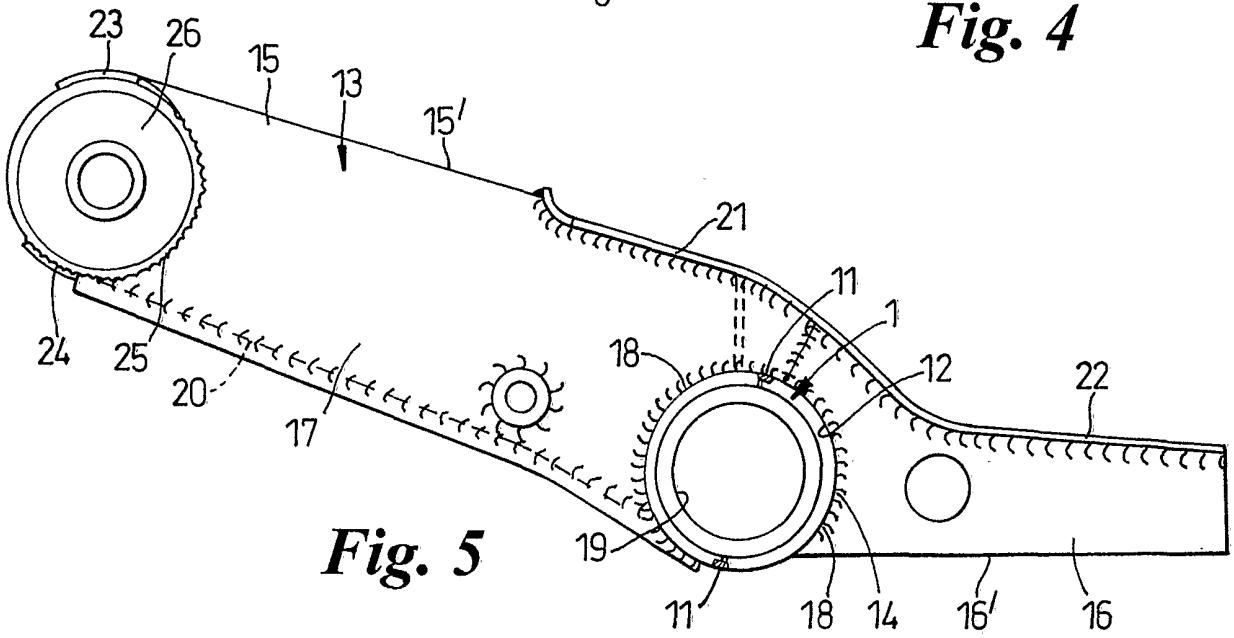

Fig. 5

INTERNATIONAL SEARCH REPORT

tional Application No
PCT/GB 01/03894

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B60G9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B60G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	WO 97 06022 A (NAI NEWAY INC ;SMITH JOHN P (US); PIERCE WILLIAM C (US)) 20 February 1997 (1997-02-20) page 15, line 1 - line 11 page 32, line 8 - line 20 figures 2,4,7,9,17,39	1-6, 10-12, 14-17 7,8,13
X	US 5 366 237 A (DILLING SCOTT ET AL) 22 November 1994 (1994-11-22) column 9, line 1 - line 44 figures 12-15	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"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

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search	Date of mailing of the international search report
30 November 2001	06/12/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Savelon, O

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