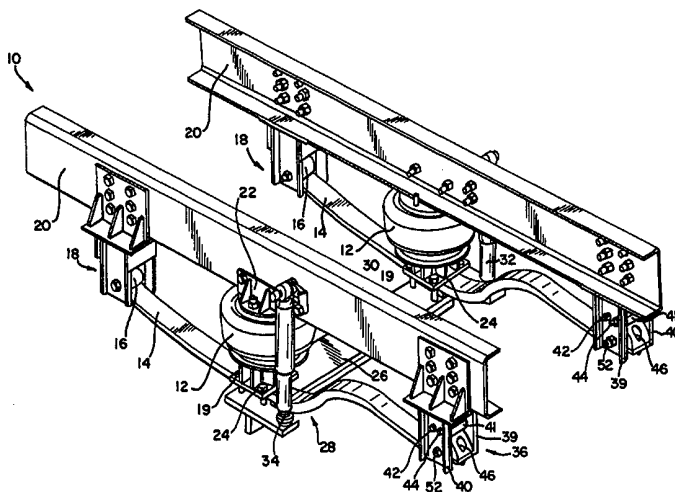




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<p>(21) International Application Number: PCT/US98/15557</p> <p>(22) International Filing Date: 28 July 1998 (28.07.98)</p> <p>(30) Priority Data: 08/909,244 11 August 1997 (11.08.97) US</p> <p>(71) Applicant: THE BOLER COMPANY [US/US]; Suite 1010, 500 Park Boulevard, Itasca, IL 60143 (US).</p> <p>(72) Inventor: HATCH, Allen; 7317 South Rockwell, Chicago, IL 60621 (US).</p> <p>(74) Agent: LOCKWOOD, Fred, S.; Lockwood, Alex, FitzGibbon & Cummings, Suite 1700, Three First National Plaza, Chicago, IL 60602 (US).</p>		<p>(81) Designated States: AU, CA, MX, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p>Published <i>With international search report.</i></p>

(54) Title: LEAF SPRING ATTACHMENT MEMBER



(57) Abstract

A suspension system (10) for supporting a frame member (20) on one side of a vehicle chassis on the adjacent end of an axle (26) comprises first and second frame brackets (18, 36), a single-leaf leaf spring (14), a leaf spring attachment member (46) and a wear plate (41). The first and second frame brackets (18, 36) are mounted to the frame member (20) on the outer sides thereof. The front end of the single-leaf leaf spring (14) is pivotally connected to the frame member (20) at the first frame bracket (18) and the rear end thereof is connected to the frame member (20) at the second frame bracket (36). The leaf spring attachment member (46) mounts to the rear end of the leaf spring (14) and connects the leaf spring (14) with the second frame bracket (36). The leaf spring attachment member (46) includes an arcuate upper surface (62) and a bottom surface. A rebound bolt (52) connects the rear end of the leaf spring (14) and the leaf spring attachment member (46) with the second frame bracket (36) and restricts the movement of the leaf spring (14) to a controlled range. The wear plate (41) is connected to the second frame bracket (36) and is associated with the leaf spring attachment member (46).

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LEAF SPRING ATTACHMENT MEMBER

Background of the Invention

This invention relates to innovations and improvements in axle suspensions for trucks and trailers and in certain components of such suspensions. More particularly, the invention relates to such suspensions wherein a single-
5 leaf leaf spring has an eye formation at one end by which it is pivotally connected to a mounting bracket on one side of a chassis side rail or frame member while the opposite end of the single-leaf leaf spring is connected to a mounting bracket on the frame member by a new and improved attachment part
10 which permits an acceptable amount of play or relative movement between that end of the spring and the frame mounting bracket while at the same time anchoring that end of the spring to the frame mounting bracket in the event the pivotal connection at the opposite end becomes broken or unattached.
15 Intermediate its opposite ends the single-leaf leaf spring is mounted on the adjacent end of the axle and supports an air cushion or air bag which provides a substantial portion of the support for the chassis.

One advantage of the suspension of this invention is
20 the omission of an additional leaf having a so-called "military wrap" formation that embraces the spring eye end of the single-leaf leaf spring. This omission is permissible since even with the spring eye freed or detached from its bracket, the opposite end of the single-leaf leaf spring is
25 connected to the frame mounting bracket in a sufficiently

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secure manner so that the end of the axle on which the single-
leaf leaf spring is mounted will not become loose and
uncontrolled while the vehicle is brought to a safe stop.

In view of the foregoing, it is a principal object
5 of the present invention to provide a novel component part of
a suspension system whereby the fore-and-aft movement of the
movable end of its attached leaf spring is reduced to a
controlled range.

It is a further object of the present invention to
10 provide a novel component part of a suspension system which
serves as a relatively consistent contact surface for its
attached leaf spring.

It is a further object of the present invention to
provide a novel component part of a suspension system which
15 mounts to a leaf spring and serves as a relatively consistent
contact surface therefor.

It is yet another object of the present invention to
provide a novel component part of a suspension system which
serves as an additional safety mechanism for a leaf spring.

It is still another object of the present invention
20 to provide a novel component part of a suspension system which
enables its attached leaf spring to be free of unnecessary
hardware components.

It is yet another object of the present invention to
25 provide a novel component part of a suspension system which
enables its attached leaf spring to be free of a military leaf
wrap.

It is still another object of the present invention

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to provide a novel component part of a suspension system which enables the system to include a single-leaf leaf spring on each side of the vehicle for supporting that side of the vehicle axle.

5 It is yet another object of the present invention to provide a novel component part of a suspension system which enables the suspension system to comprise a lighter-weight suspension system.

10 It is finally another object of the present invention to provide a novel component part of a suspension system which reduces the manufacturing costs of the system by eliminating the need for otherwise necessary parts thereof.

15 These and other objects of the invention will be apparent to those skilled in the art from the following detailed description of the preferred embodiment taken in conjunction with the accompanying drawings wherein:

Brief Description of the Drawings

20 Fig. 1 is an isometric view of a suspension system for a vehicle such as a light duty truck wherein the suspension system includes the leaf spring attachment member of the present invention;

25 Fig. 2 is a fragmentary side elevational view taken from the outside on one side of the suspension system of Fig. 1 showing the leaf spring attachment member of the present invention;

 Fig. 3 is an isometric view of the leaf spring attachment member forming a component part of the present

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invention; and

Fig. 4 is a top plan view of the novel leaf spring attachment member of the present invention.

Detailed Description of the Preferred Embodiment

5 Referring to the drawings, and in particular to Fig. 1, a suspension system is shown therein and is generally designated by reference number 10. It will be seen and understood that the construction of this suspension system on one side is duplicated on the opposite side of the vehicle. 10 The active or functional components of the suspension system 10 comprise two air springs 12-12 and two single-leaf leaf springs 14-14.

Each single-leaf leaf spring 14 is provided with an eye 16 located at the front end thereof. The eye 16 is 15 pivotally connected to a standard or existing frame mounting bracket indicated generally by reference numeral 18. As shown, the frame mounting brackets 18 are mounted on each fore-and-aft chassis frame member 20 of the suspension system 10.

20 An upper air spring support bracket 22 is mounted on each chassis frame member 20 at a location that is over one end of the vehicle axle (not shown) and over the mid-portion of the single-leaf leaf spring 14 on that side. The top portion of each air spring 12 is attached to its air spring 25 support bracket 22. The underside of each air spring 12 is mounted on an air spring support pad 24 which, in turn, is attached to an axle 26 extending from one side of suspension

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system 10 to the other side. As shown, the single-leaf leaf spring 14 extends between the air spring support pad 24 and the axle 26. Typically, the single-leaf leaf spring is attached to the vehicle axle by bolts 19-19.

5 A shock absorber generally designated at 28 is further included within suspension system 10. The shock absorber 28 is pivotally connected at its upper end to a bracket 30 mounted on frame member 20 and is attached at its bottom end to axle 26 by a fitting 34.

10 The rear end of each single-leaf leaf spring 14 is operatively connected with a frame member 20. A mounting bracket 36 having depending inner and outer panels 39, 40 is mounted on frame member 20. A wear plate 41 (Fig. 2) is positioned between panels 39, 40 and is attached to the panels
15 by two nut and bolt arrangements 42, 44. Moreover, a novel leaf spring attachment member 46 is fixedly mounted to the single-leaf leaf spring 14. Two nut and bolt arrangements 48, 50 provide means for mounting the leaf spring attachment member 46 to the single-leaf leaf spring 14 (Fig. 2).

20 During assembly of the suspension system, the single-leaf leaf spring 14 is positioned between the panels 39, 40 of bracket 36 so that a rebound bolt 52 may be connected between the panels after it is inserted through the space defined at the bottom by the top surface of the single-
25 leaf leaf spring 14 and at the top 56 and sides 58, 60 by an interior recessed portion 54 (Fig. 2) of the leaf spring attachment member 46. Interior recessed portion 54, in turn, is defined by horizontally extending interior top wall 56 and

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two vertically extending interior sidewalls 58, 60 of the leaf spring attachment member 46.

In view of the above-described arrangement, those skilled in the suspension system art will appreciate that the leaf spring attachment member 46 provides advantages over the prior art systems since the attachment member permits the rear end of the single-leaf leaf spring 14 to move freely over a controlled range as fully described below. Thus, the combination of the attachment member 46 and the wear plate 41 eliminate a moving point contact on the single-leaf leaf spring and also create a bearing surface, providing a more constant spring rate for the single-leaf leaf spring 14 during operation of the suspension system 10.

Further, those skilled in the art will appreciate that use of the leaf spring attachment member 46 in a suspension system provides an additional safety feature and eliminates the practical necessity, based on safety concerns, of using a military leaf wrap. In particular, should the eye 16 of the single-leaf leaf spring 14 become detached from the mounting brackets 18, the attachment member 46 ensures that the vehicle axle will maintain a secure connection with frame member 20 through the suspension system 10.

Referring now to Fig. 2, the wear plate 41 is shown attached to the panels 39, 40 of bracket 36 by two nut and bolt arrangements 42, 44. In similar fashion, the leaf spring attachment member 46 is mounted to the rear portion of single-leaf leaf spring 14 by two nut and bolt arrangements 48, 50.

The leaf spring attachment member 46 restricts fore-

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and-aft, vertical and lateral movement of the single-leaf leaf spring 14 to a specific, controlled range. In particular, with respect to fore-and-aft movement, when the single-leaf leaf spring 14 moves in a forward direction, movement of the spring is restricted when the rear interior sidewall 58 of the leaf spring attachment member 46 makes contact with the rebound bolt 52. Likewise, when the single-leaf leaf spring 14 moves in a rearward direction, movement of the spring is restricted when the forward interior sidewall 60 of the leaf spring attachment member 41 makes contact with the rebound bolt 52.

With respect to vertical movement, when the single-leaf leaf spring 14 moves in an upward direction, movement of the spring is restricted when the arcuate upper surface 62 (i.e., wear surface) (Fig. 2) of the leaf spring attachment member 46 makes contact with the arcuate lower surface 64 of the wear plate 41. Similarly, when the single-leaf leaf spring 14 moves in a downward direction, movement of the spring is restricted when the interior top wall 56 of the leaf spring attachment member 46 makes contact with the rebound bolt 52.

Finally, with respect to lateral movement, movement of the leaf spring is restricted in each direction when the respective faces of the leaf spring attachment member 46 make contact with panels 39, 40.

As shown in Fig. 3, the leaf spring attachment member 46 preferably comprises a relatively thin metal or steel liner 65 which extends to form horizontally extending

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flange-like mounting surfaces 66, 68, arcuate surfaces 70, 72, the vertically extending interior sidewalls 58, 60, and the horizontally extending interior top wall 56 for the attachment member (Fig. 2).

5 A relatively thick plastic cap 74 is mounted atop the steel liner 65. The bottom surface of the plastic cap 74 is substantially identical in shape to the steel liner. However, the upper surface of the plastic cap 74 is substantially arcuate in shape in that it forms the upper
10 surface/wear surface 62 for the leaf spring attachment member 46.

Bolt-receiving recesses 76, 78 extend through cap 74 and liner 65 of the attachment member to accommodate the nut and bolt arrangements 48, 50 (Fig. 2), thereby allowing the
15 leaf spring attachment member 46 to be mounted to the single-leaf leaf spring 14.

Although the present invention has been described by reference to a certain preferred embodiment, it should be understood that this preferred embodiment is merely
20 illustrative of the principles of the present invention. Therefore, modifications and/or changes may be made by those skilled in the art without departing from the true spirit and scope of the invention as defined by the appended claims.

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I CLAIM:

1. A suspension system for supporting a frame member on one side of a vehicle chassis on the adjacent end of an axle comprising:

5 a first frame bracket mounted to said frame member;

a second frame bracket mounted to said frame member;

10 a fore-and-aft extending single-leaf leaf spring having a front end and a rear end, the front end of said leaf spring being operatively connected to said first frame bracket and the rear end of said leaf spring being operatively connected to said second frame bracket;

a rebound bolt extending transversely through said second bracket;

15 a leaf spring attachment member mounted to said leaf spring and operatively connected with said second frame bracket, said leaf spring attachment member having an interior recessed portion providing a space of sufficient size to accommodate said rebound bolt with fore-and-aft and vertical play therebetween; and

20 a wear plate associated with said leaf spring attachment member which is operatively connected to said second frame bracket.

2. The suspension system as defined by claim 1 wherein said leaf spring attachment member includes an arcuate

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upper surface and a bottom surface.

3. The suspension system as defined by claim 2 wherein said bottom surface includes a first horizontally extending flange-like mounting surface, a second horizontally extending flange-like mounting surface, a first vertically extending interior sidewall, a second vertically extending interior sidewall and a horizontally extending interior top wall.

4. The suspension system as defined by claim 3 wherein said interior top wall extends between said first interior sidewall and said second interior sidewall and is offset from said mounting surfaces.

5. The suspension system as defined by claim 3 wherein said interior top wall and said interior sidewalls define said interior recessed portion of said leaf spring attachment member.

6. The suspension system as defined by claim 1 wherein said leaf spring attachment member comprises a metal liner and a plastic cap.

7. The suspension system as defined by claim 1 wherein said leaf spring attachment member comprises a steel liner and a plastic cap.

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8. The suspension system of claim 1 wherein said leaf spring attachment member is mounted to said leaf spring.

9. The suspension system of claim 8 wherein said leaf spring attachment member is mounted to said rear end of said leaf spring.

10. The suspension system of claim 1 wherein said wear plate includes an arcuate lower surface.

11. A suspension system for supporting a frame member on one side of a vehicle chassis on the adjacent end of an axle comprising:

a first frame bracket mounted to said frame member;

a second frame bracket mounted to said frame member;

a fore-and-aft extending single-leaf leaf spring having a front end and a rear end, said front end being operatively connected to said first frame bracket and said rear end being operatively connected to said second frame bracket;

a leaf spring attachment member mounted to said leaf spring and operatively connected with said second frame bracket, said leaf spring attachment member having an arcuate upper surface and a bottom surface, the bottom surface including a first horizontally extending flange-like mounting surface, a second horizontally extending flange-like mounting

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20 surface, a first vertically extending interior sidewall, a
second vertically extending interior sidewall and a
horizontally extending interior top wall, said interior top
wall extending between said first interior sidewall and said
second interior sidewall and being offset from said mounting
surfaces;

25 said interior top wall and said interior
sidewalls defining an interior recessed portion of said leaf
spring attachment member which provides a space of sufficient
size to receive a rebound bolt when said leaf spring
attachment member is mounted to said leaf spring; and

30 a wear plate associated with said leaf spring
attachment member, said wear plate being operatively connected
to said second frame bracket.

12. The suspension system of claim 11 wherein said
leaf spring attachment member includes a metal liner and a
plastic cap.

13. The suspension system of claim 12 wherein said
mounting surfaces and said interior recessed portion are
formed by said metal liner.

14. The suspension system of claim 11 wherein said
leaf spring attachment member includes a steel liner and a
plastic cap.

15. The suspension system of claim 14 wherein said

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mounting surfaces and said interior recessed portion are formed by said steel liner.

16. The suspension system of claim 11 wherein said wear plate includes an arcuate lower surface.

17. The suspension system of claim 11 wherein said leaf spring attachment member is designed to restrict movement of said leaf spring.

18. The suspension system of claim 11 wherein said second frame bracket includes at least two panel members.

19. A suspension system for supporting a frame member on one side of a vehicle chassis on the adjacent end of an axle comprising:

5 a shock absorber connected between said frame member and said axle;

a first frame bracket mounted to said frame member;

a second frame bracket mounted to said frame member having first and second depending panels;

10 a single-leaf leaf spring having a front end and a rear end, said front end including an eye of said leaf spring, said leaf spring being connected to said first frame bracket at said eye, said rear end being operatively connected to said second frame bracket;

15 a leaf spring attachment member mounted to said

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rear end of said leaf spring, said leaf spring attachment member being operatively connected with said second frame bracket, said leaf spring attachment member having a liner and a plastic cap, said leaf spring attachment member further
20 having an arcuate upper surface and a bottom surface, said liner of said attachment member forming said bottom surface thereof, the bottom surface including a first horizontally extending flange-like mounting surface, a second horizontally extending flange-like mounting surface, a first vertically
25 extending interior sidewall, a second vertically extending interior sidewall and a horizontally extending interior top wall, said interior top wall extending between said first interior sidewall and said second interior sidewall and being offset from said mounting surfaces;

30 said interior top wall and said interior sidewalls defining an interior recessed portion of said leaf spring attachment member;

 a rebound bolt connected between said first and second panels of said second frame bracket, said rebound bolt
35 being inserted into said interior recessed portion; and

 a wear plate associated with said leaf spring attachment member which is connected to said second frame bracket.

20. The suspension system as defined by claim 19 wherein said liner is substantially thinner than said plastic cap.

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21. The suspension system as defined by claim 19 wherein said liner is metal.

22. The suspension system as defined by claim 19 wherein said liner is steel.

23. The suspension system of claim 19 wherein said attachment member includes bolt-receiving recesses which receive means for mounting said attachment member to said leaf spring.

24. The suspension system of claim 19 wherein said wear plate includes an arcuate lower surface.

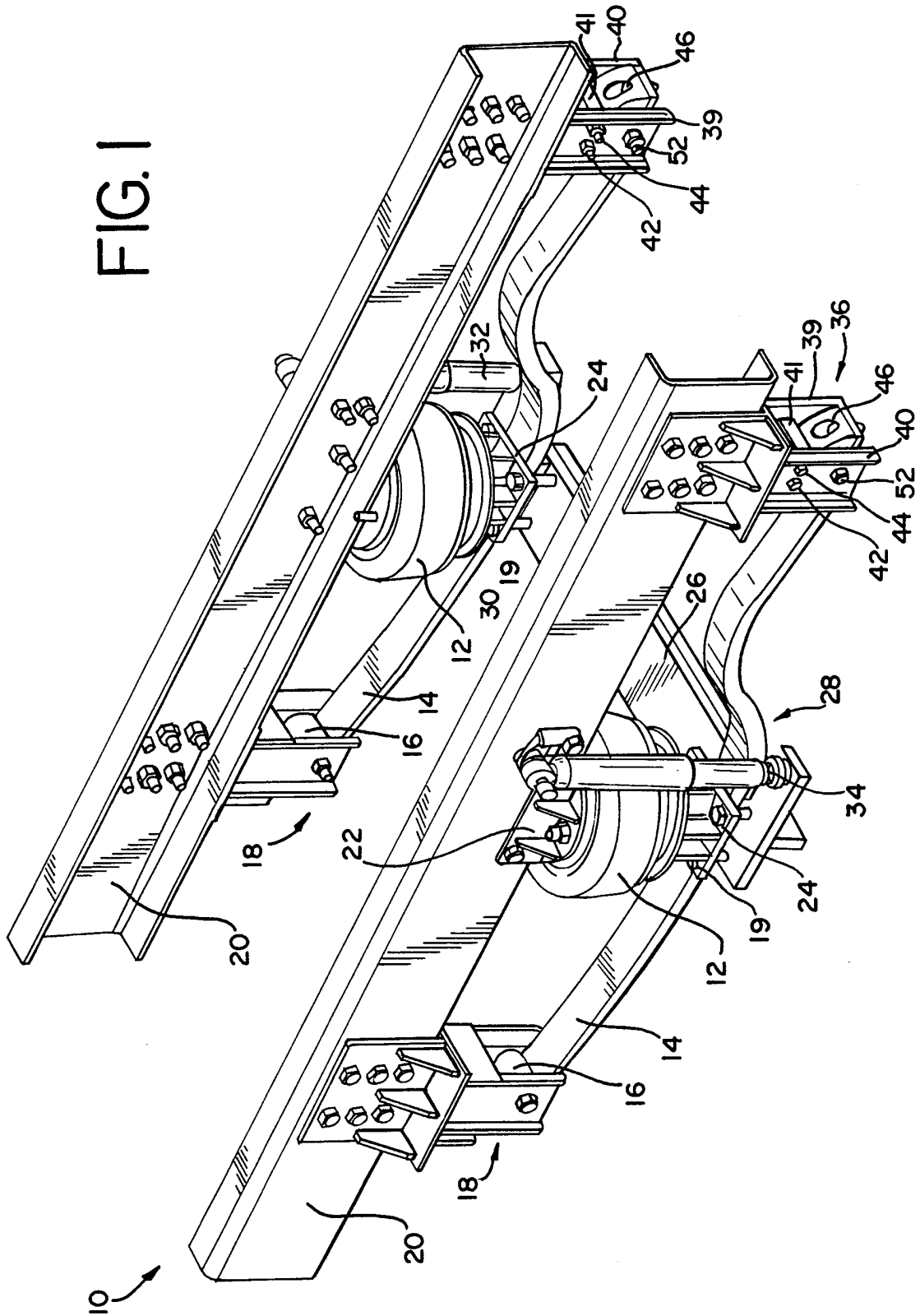


FIG. 2

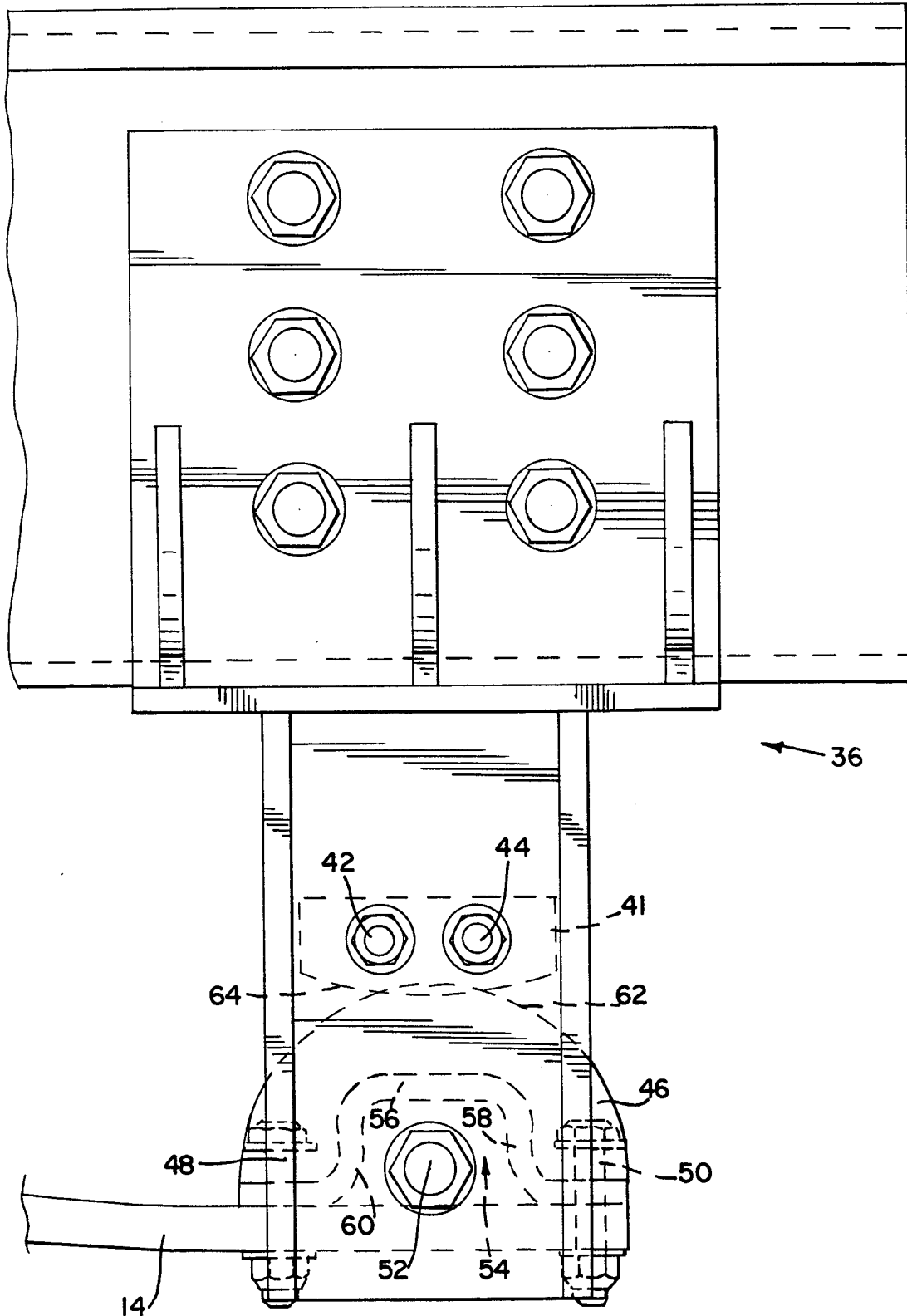


FIG. 3

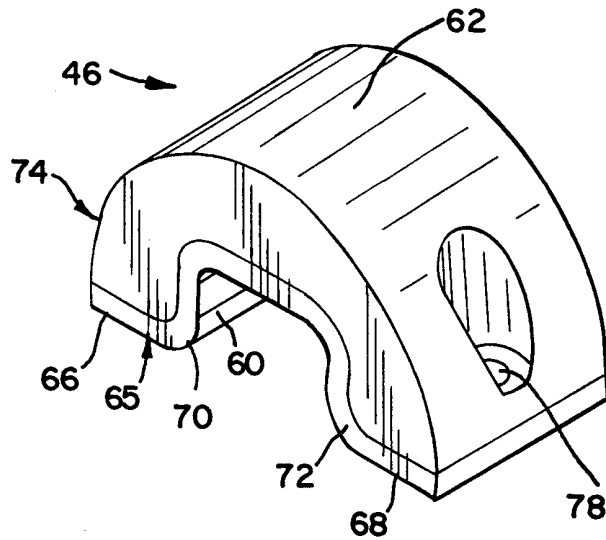
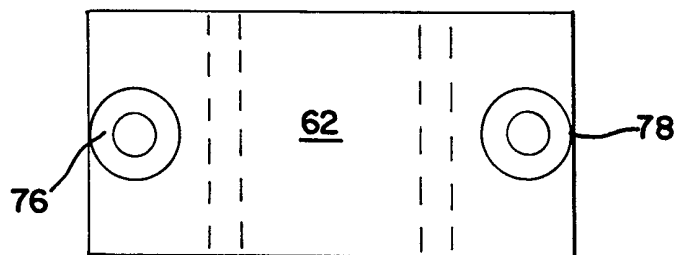


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/15557

A. CLASSIFICATION OF SUBJECT MATTER
 IPC(6) :B62D 21/11
 US CL :280/124.175
 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)
 U.S. : 280/124.175, 124.162, 124.157, 124.163, 124.164, 124.165, 124.17, 124.177; 267/260, 262, 269; 403/220, 291

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 practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 256,284 A (BUCKLAND) 11 April 1882 (11.04.82), lines 43-48.	1-10
A	US 2,126,086 A (BANKS) 09 August 1938 (09.08.38), col. 1, lines 32-40.	1-24
A	JP 60-45409 A (MISUMI) 11 March 1985 (11.03.85), Constitution of English Abstract.	1-24

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	"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
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Date of the actual completion of the international search 21 SEPTEMBER 1998	Date of mailing of the international search report 19 OCT 1998
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