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(72) Parker, Eric G., US

(72) Rivard, Corey M., US

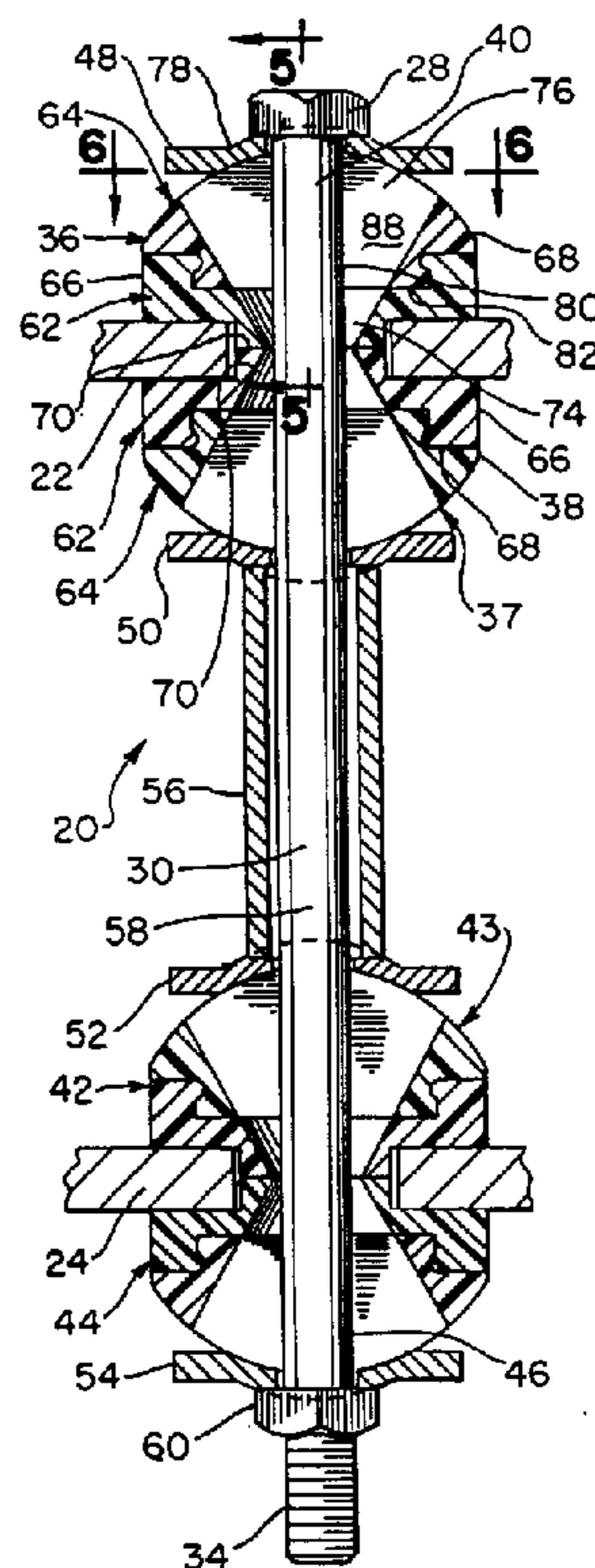
(73) ILLINOIS TOOL WORKS INC., US

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(54) **ORGANE DE RACCORD PIVOTANT A EMBOUT SPHERIQUE**

(54) **PIVOTAL BALL-END LINK**



(57) An end link for a stabilizer bar of a vehicle suspension system include an elongated connecting member or rod having a head at an end and a nut in threaded engagement with the rod at the other end, washers in engagement with the nut and head, a spacer which surrounds an intermediate portion of the rod, washers in engagement with the ends of the spacer, and pairs of grommets generally at each end of the rod. Each grommet includes a plastic bushing and washer which are interengaged and rotatable with respect to each other and combine to provide a ball member universal connection with the rod. Each grommet further includes a central passageway that which the rod is disposed within and permits pivotal movement of the rod only substantially in a single plane relative to said grommets and permit substantially universal pivotal movement of the rod around the center of the grommets.

PIVOTAL BALL-END LINK

ABSTRACT OF THE DISCLOSURE

5 An end link for a stabilizer bar of a vehicle suspension
system include an elongated connecting member or rod having a
head at an end and a nut in threaded engagement with the rod
at the other end, washers in engagement with the nut and head,
a spacer which surrounds an intermediate portion of the rod,
washers in engagement with the ends of the spacer, and pairs
of grommets generally at each end of the rod. Each grommet
includes a plastic bushing and washer which are interengaged
10 and rotatable with respect to each other and combine to
provide a ball member universal connection with the rod. Each
grommet further includes a central passageway that which the
rod is disposed within and permits pivotal movement of the rod
only substantially in a single plane relative to said grommets
15 and permit substantially universal pivotal movement of the rod
around the center of the grommets.

PIVOTAL BALL-END LINKBACKGROUND OF THE INVENTION

This invention is generally directed to an end link for a stabilizer bar used in a suspension system for a vehicle, such as an automobile or a truck.

Suspension systems of the type contemplated herein usually include a stabilizer bar, a control element and an end link connecting an end of the stabilizer bar with the control element so as to transmit forces therebetween. These end links have included pairs of grommets which embrace the stabilizer bar and the control element, respectively, a connecting rod or bolt extending through the grommets and a spacer mounted on an intermediate portion of the bolt between the innermost grommets for spacing the stabilizer bar and the control element. The grommets include a generally straight axial passageway therethrough to allow the grommets to pivot around the rod. A suspension system and end link of the above-described type are disclosed in U.S. Patent No. 4,944,523.

While these types of end links are effective in many applications, under some conditions the rod must be able to pivot to a larger degree with respect to the grommets than what is provided by the prior art end links. The present invention is intended to overcome this problem as well as to present several other improvements over prior art end links.

OBJECTS AND SUMMARY OF THE INVENTION

The present invention seeks to provide a novel end link having a modified universal ball joint connection with elements of a vehicle suspension, which end link includes a ball structure which may be relatively economically produced.

Further the present invention seeks to provide an end link having grommets or ball members which are capable of pivotal movement with respect to a connecting member or rod.

Still further the present invention seeks to provide an end link that permits a lighter torsion bar to be used.

Further still the present invention seeks to provide an end link that includes grommets which allow loads to be transmitted directly through the grommets.

Moreover the present invention said to provide an end link having grommets which include a pivot promoting slot.

The invention in one broad aspect provides a link for accommodating adjustment between first and second elements comprising: an elongated connecting member for extending between the first and second elements and an end member on an end portion of the connecting member for embracing the first element. The end member has a central vertical axis therethrough and means for permitting universal pivotal movement of the connecting member around substantially a center of the end member and for permitting positive and negative pivotal movement of the connecting member relative to said central vertical axis of the end member only substantially in a single plane relative to the end member.

More particularly and in accordance with the foregoing, the present invention discloses an end link for a stabilizer bar of a vehicle suspension system which includes an elongated connecting member or rod having a head at an end and a nut in threaded engagement with the rod at the other end, washers in engagement with the nut and head, a spacer which surrounds an intermediate portion of the rod, washers in engagement with the ends of the spacer and pairs of grommets generally at each end of the rod.

Each grommet includes a plastic bushing and washer which are interengaged and rotatable with respect to each other and combine to provide a ball member universal connection with the rod. Each grommet further includes a central passageway that which the rod is
5 disposed within and permits pivotal movement of the rod only substantially in a single plane relative to said grommets and permit substantially universal pivotal movement of the rod around the center of the grommets.

BRIEF DESCRIPTION OF THE DRAWINGS

The organization and manner of the structure and operation of the invention, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawings, wherein like reference numerals identify like elements in which:

FIGURE 1 is an elevational view of an end link incorporating features of the present invention fully assembled and embracing portions of a stabilizer bar and a control element, portions of which are shown in cross-section.

FIGURE 2 is an exploded side elevational view of the end link shown in FIGURE 1.

FIGURE 3 is a cross-sectional view of the end link shown in a first position.

FIGURE 4 is a cross-sectional view of the end link shown in a second, pivoted position and taken generally along line 4 - 4 in FIGURE 7.

FIGURE 5 is a partial cross-sectional view taken along line 5 - 5 in FIGURE 3.

FIGURE 6 is a plan view of the end link taken along line 6 - 6 in FIGURE 3.

FIGURE 7 is a plan view of the end link partially broken away taken along line 7 - 7 in FIGURE 4 and without the head or washer at the top of the end link.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

While the invention may be susceptible to embodiment in different forms, there is shown in the drawings and herein will be described in detail, a specific embodiment with the understanding
5 that the present disclosure is to be considered an exemplification of the principles of the invention and is not intended to limit the invention to that as illustrated and described herein.

An end link 20 incorporating features of the present invention is shown in the drawings. The end link 20 is adapted to be
10 assembled with first and second elements, for example, a torsion or stabilizer bar 22 and a control arm or element 24 of a vehicle suspension of known construction. The first and second elements 22 and 24 are preferably made of metal.

In the embodiment shown, the end link 20 includes an elongated
15 connecting member or bar 26, which may be in the form of a bolt having an abutment or a head 28 at one end thereof or a stud having opposite threaded ends for receiving nuts (not shown). An elongated rod or shank 30 extends axially from the head 28 and includes an unthreaded portion 32 having a predetermined diameter
20 and a threaded end portion 34.

As shown in FIGURE 1, a first pair of grommets 36, 38, or first and second portions, which will be described in detail herein, is assembled generally at a first end 40 of the bolt 26, in a manner described in detail herein. The grommets 36, 38 combine
25 to provide a first ball member 37 which embraces the suspension element 22. A second pair of grommets 42, 44, or first and second portions, is assembled generally at a second end 46 of the bolt 26. The grommets 42, 44 combine to provide a second ball member 43 which embraces the suspension element 24.

30 Washers 48, 50, 52, 54 engage the outermost extents of the grommets 36, 38, 42, 44 as described more fully in detail herein. A spool or spacer 56 is mounted on an intermediate portion 58 of the bolt 26 between the innermost grommets 38, 42 and engages the innermost washers 50, 52. The spacer 56 supports the innermost

grommets 38, 52 thereby maintaining the desired spacing between the first element or stabilizer bar 22 and the second element or control element 24. A nut 60 is applied to the threaded end portion 34 of the bolt 26 for maintaining the parts in assembled relationship. Outermost washer 54 is disposed between the nut 60 and the outermost grommet 44. Outermost washer 48 is disposed between the head 28 and the outermost grommet 36.

The pairs of grommets 36, 38 and 42, 44 will be described in detail with respect to the first pair of grommets 36, 38 which combine to form the first ball member 37, with the understanding that the second pair of grommets 42, 44 which combine to form the second ball member 43, is identical in construction except that the second pair of grommets 42, 44 engages the control element 24.

Referring now to FIGURE 2, it is seen that each grommet 36, 38 is comprised of first and second sections, a washer 62 and a bushing 64. The washer 62 and bushing 64 are interengaged with each other and are relatively rotatable with respect to each other in response to universal movement between the rod 30 and the ball members 37, 43 as described more in detail hereinbelow. The washer 62 and bushing 64 are made of suitable materials, preferably hard plastic, for reasons described herein.

Each washer 62 has an annular body portion 66 which defines a first end 68 and a protruding generally cylindrically shaped shoulder 70 which defines a second end 72. Each end 68, 72 has a circular aperture formed therein and the washer 62 has a central passageway 74 therethrough which is generally conically shaped such that the passageway 74 generally tapers from the first end 68 to the second end 72. The aperture at the second end 72 of the washer 62 is of a predetermined diameter which is larger than the diameter of the rod 30 so as to allow the rod 30 to pivot with respect to the washer 62.

Each bushing 64 includes an arcuate or partially spherical body portion 76 which defines a first end 78 and a protruding portion 80 extending therefrom which defines a second end 82. The

bushing 64 may include ribs 84 to reinforce and strengthen the arcuate body portion 76.

5 A straight, elongated slot 86, as best shown in FIGURES 6 and 7, is formed in the first end 78 of the bushing 64 and promotes the pivoting of the rod 30 with respect to the ball members 37, 43 as described hereinbelow. The slot 86 extends generally along the entire arc of the arcuate portion 76.

10 The bushing 64 further includes a central passageway 88 therethrough which commences at the straight slot 86 at the first end 78 of the bushing 64 and terminates at the second end 82 of the bushing 64. The passageway 88 includes four surfaces or walls 90, 92, 94, 96 with the side surfaces or walls 90, 92 being generally vertical and the end surfaces or walls 94, 96 tapering from the first end 78 of the bushing 64 to the second end 82 at an angle
15 similar to that of the conical passage 74. The slot 86 and associated passageway 88 have a width which is approximately equal to the diameter of the rod 30. When the washer 62 and bushing 64 are interengaged as described below, the washer passageway 74 and the bushing passageway 88 are aligned to form a passageway 74, 88,
20 which has a cross-section, as best shown in FIGURES 3 and 4, that tapers from the bushing first end 78 to the washer second end 72.

To interengage the washer 62 and the bushing 64, the protruding portion 80 of the bushing 64 is snapped into and is held securely within a complementarily shaped recess 98 generally at the
25 first end 68 of the washer 62. The washer 62 includes a shoulder or annular rib 100 interengageable with a complementary shoulder 80 on the bushing 64 whereby the washer 62 and bushing 64 are securely held together. With this configuration, the washer 62 and bushing 64 simply snap together to form the completed grommet 36 or 38
30 while permitting the washer 62 and bushing 64 to freely rotate relative to each other. It is to be understood that other interengaging structures are within the scope of the invention so long as the washer 62 and bushing 64 are able to freely rotate relative to each other. For example, a hook shaped boss may be

formed on the bushing with a complementarily shaped recess in the washer.

The bottom surface 102 of the bushing 64 and the top surface 104 of the washer 62 provide bearing surfaces along which the washer 62 and bushing 64 may rotate with respect to each other. These bearing surfaces 102, 104 are generally smooth and so as to allow the parts to rotate easily relative to each other. Since the washer 62 and bushing 64 are preferably made of plastic, a desired ease of rotation between these parts can be achieved by modifying the coefficient of friction of the plastic material used. For example, nylon may be used to produce the washer 62 and the bushing 64 may be made of acetal copolymer or acetal homopolymer.

To form the grommets 36, 38 and 42, 44 which are disposed on each end 40, 46, respectively, of the bolt 26, the washer 62 and the bushing 64 are interengaged, as described above, to form a completed grommet 36, 38 and 42, 44. The second ends 72 of each of the washers 62 are placed in an abutting relationship to form the ball members 37 and 43. The stabilizer bar 22 or control element 24 is held between the washers 62. It is to be understood that the coefficient of friction of the plastic washer 62 is sufficiently related to the coefficient of friction of the metal stabilizer bar 22 or the metal control element 24 such that the ball members 37 and 43 generally do not rotate relative to the elements 22, 24 which prevents undue wear of the washers 62. The rod 30 is disposed within the aligned passageways 74, 88 of each grommet 36, 38 and 42, 44.

The washers 48, 50, 52, 54 which engage the outermost extents of each grommet 36, 38 and 42, 44, respectively, include a seat 106 that is complementarily shaped to the arcuate portion 76 of the bushing 64. The washers 48, 50, 52, 54 are formed from a suitable material, preferably metal, such as steel and the seat 106 may be formed by any suitable known method, such as stamping or coining. When a washer 48, 50, 52 or 54 is disposed on the arcuate portion 76 of the bushing 64, the washer 48, 50, 52 or 54 is free to travel

along the arc of the arcuate portion 76 when there is relative movement between the stabilizer bar 22 and the control element 24. Each washer 48, 50, 52, 54 also includes a circular aperture 108 generally in the center thereof to allow the rod 30 to pass through the washer 48, 50, 52, 54.

Now that the specifics of the end link 20 have been described, a general description of how the end link 20 operates will be explained. Initially, the bolt 26 extends generally perpendicularly between the first element or stabilizer bar 22 and the second element or control element 24, as shown in FIGURE 3 and as shown in FIGURE 6, sits generally in the center of the ball member 37.

When an input load is incurred, the rod 30 begins to move or pivot along a single plane in the straight slot 86. When the rod 30 pivots, the seat 106 of each washer 48, 50, 52, 54 slides along the arc of the arcuate portion 76. Since the aligned passageway 74, 88 is tapered, the rod 30 is free to pivot plus or minus 30° from the vertical position or some lesser or greater angle determined by the slope of the passage 74, 88 surface.

In other words, connecting member 32 extends between first element 22 and second element 24 with end member of grommets 36 on the end of member 32 embracing first element 22. The end member 36 has a central vertical axis therethrough and its construction provides means for permitting universal pivotal movement of the end member 36 and for permitting positive and negative movement of the connecting member 32 relative to the central vertical axis of the end member only substantially in a single plane relative to the end member.

As the rod 30 leaves the center of the slot 86 and as any amount of side load is incurred, the rod 30 begins to push against the vertical side wall 90 or 92 of the slot 86. This force results in a moment about the center of the bushing 64 causing it to rotate relative to the washer 62 as shown in FIGURES 4 and 7. The rod 30 can universally pivot generally around the center of each ball

member 37, 43, that is, move 360° conically by this pivoting on each end of the end link 20.

5 Since the rod 30 passes directly through ball members 37 and 43 which are respectively provided by the grommets 36, 38 and 42, 44, loads are directly transmitted through the grommets 36, 38 and 42, 44. This allows a lighter torsion bar to be used. Furthermore, since the end link 20 is comprised of few parts and is easily assembled, the end link 20 may be economically produced.

10 While a preferred embodiment of the present invention is shown and described, it is envisioned that those skilled in the art may devise various modifications of the present invention without departing from the spirit and scope of the appended claims. The invention is not intended to be limited by the foregoing disclosure.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A link for accommodating adjustment between first and second elements comprising:

an elongated connecting member for extending between the first and second elements and an end member on an end portion of said connecting member for embracing the first element, said end member having a central vertical axis therethrough and means for permitting universal pivotal movement of said connecting member around substantially a center of said end member and for permitting positive and negative pivotal movement of said connecting member relative to said central vertical axis of said end member only substantially in a single plane relative to said end member.

2. A link as defined in claim 15, further including an opposite end member on an opposite end portion of said connecting member for embracing the second element; said opposite end member having means for permitting universal pivotal movement of said connecting member around substantially a center of said opposite end member and for permitting pivotal movement of said connecting member only substantially in a single plane relative to said opposite end member.

3. A link as defined in claim 2, further including at least one spacer member between said end member and said opposite end member.

4. A link for accommodating adjustment between first and second elements comprising:

an elongated connecting member for extending between the first and second elements and an end member on an end portion of said connecting member for embracing the first element, said end member having means for permitting universal pivotal movement of said connecting member around substantially a center of said end member and for permitting positive or negative pivotal movement of said connecting member only substantially in a single plane

relative to said end member, said end member including first and second portions for embracing the first element, each of said first and second portions including first and second relatively rotatable sections having a central passageway therethrough defining said means, the means of said passageway in said first sections for permitting said universal pivotal movement of said connecting member generally around said center of said end member and the means of said passageway in said second sections for permitting said positive or negative pivotal movement of said connecting member only substantially in said single plane relative to said second sections, whereby said second sections will rotate relative to said first sections in response to universal relative movement between said connecting member and said end member.

5. A link as defined in claim 4, wherein each of said first sections having a conical central passageway therethrough defining said means in said first sections and each of said second sections having a passageway slot defined in part by opposite side walls defining said means in the second sections.

6. A link as defined in claim 4, wherein said connecting member has a predetermined diameter and said side walls of said passageway slot comprises opposite tapered side walls and opposite straight side walls connecting said tapered side walls together, said straight side walls being spaced apart from each other a distance which is slightly greater than the diameter of said connecting member.

7. A link as defined in claim 5, wherein each of said second sections has an arcuate outer end, said link further including means at opposite ends of said connecting member for slidably engaging said arcuate outer ends.

8. A link as defined in claim 4, further including an opposite end member on an opposite end portion of said connecting member for embracing the second element; said opposite end member having means for permitting universal pivotal movement of said connecting member around substantially a center of said opposite

end member and for permitting positive or negative pivotal movement of said connecting member only substantially in a single plane relative to said opposite end member.

9. A link as defined in claim 8, further including a spacer on said connecting member between said end member and said opposite end member.

10. A link for accommodating adjustment between first and second elements comprising:

an elongated connecting member for extending between said first and second elements, an end member on an end portion of said connecting member for embracing said first element;

said end member having a central vertical axis therethrough and including first and second portions for embracing said first element; said second portion being rotatable relative to said first portion, said first portion having means for permitting universal pivotal movement of the connecting member around substantially a center of the end member and said second portion having means for permitting positive and negative pivotal movement of the connecting member relative to said central vertical axis of the end member and only substantially in a single plane relative to said end member, whereby said second portion will rotate relative to said first portion in response to relative movement between the connecting member and the end member.

11. A link as defined in claim 10, wherein said second portion has a passageway slot defined in part by opposite side walls providing said means in the second portion and said first portion comprises a washer having a substantially hemispherical recess therein and a universal ball member engaged in said hemispherical recess providing said means in said first portion.

12. A link as defined in claim 11, wherein said universal ball member encircles a portion of said connecting member.

13. A link as defined in claim 12, wherein said washer is adapted to be substantially fixed relative to said first element.

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14. A link as defined in claim 12, wherein said second portion has an arcuate outer end and further including means for slidably engaging said arcuate outer end.

15. A link as defined in claim 14, wherein said means for slidably engaging said arcuate outer ends is a complementarily shaped washer.

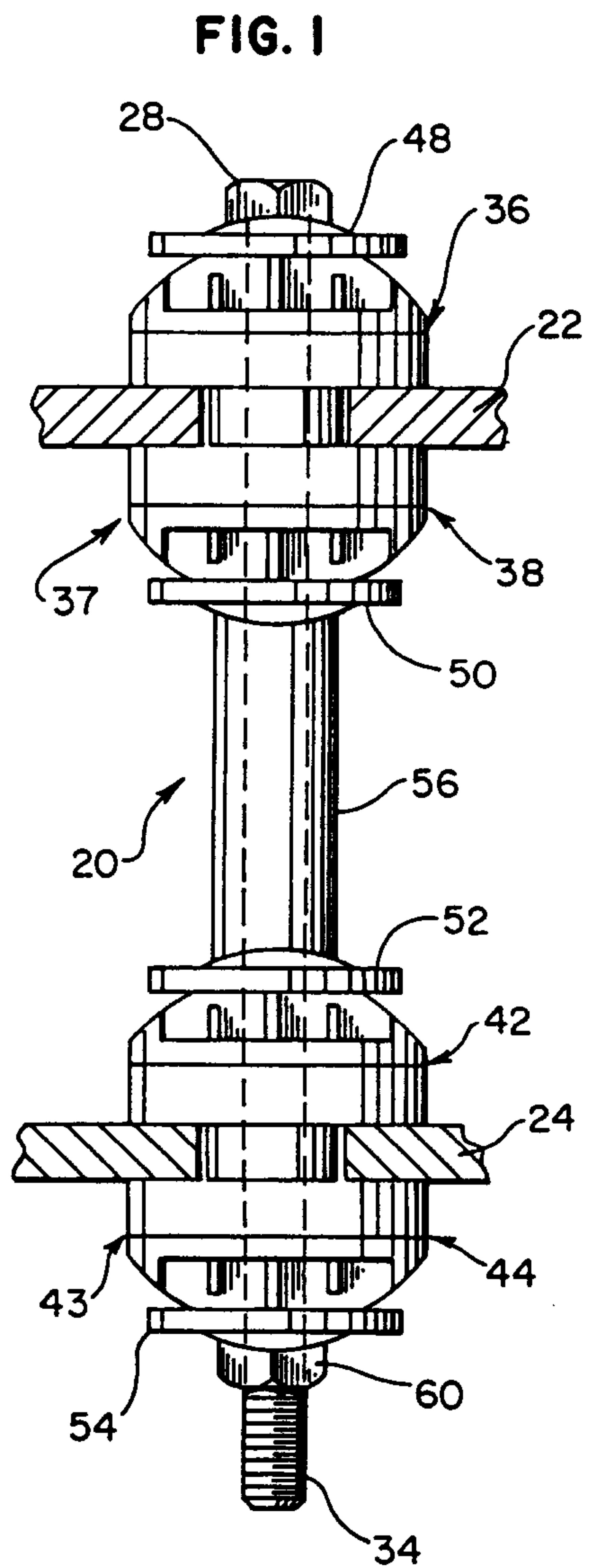
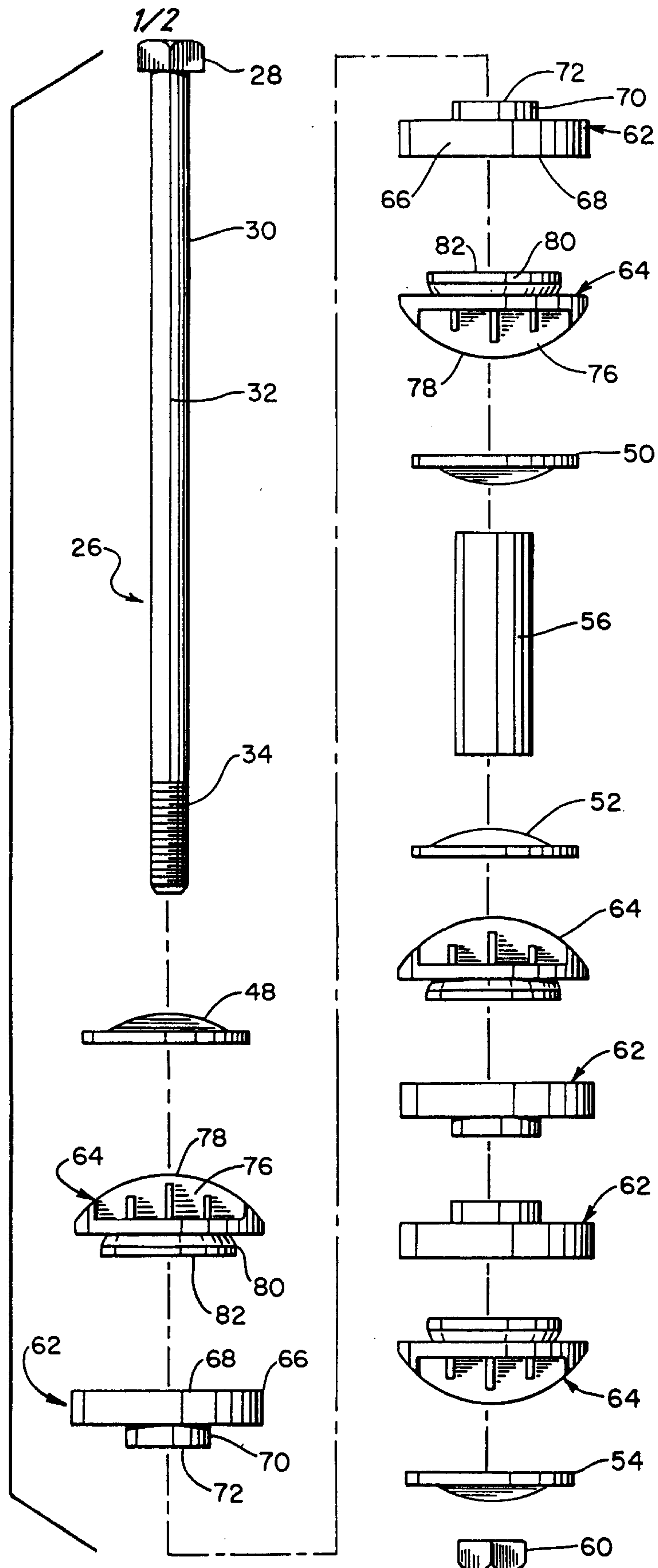
16. A link as defined in claim 10, further including an opposite end member on an opposite end portion of said connecting member for embracing said second element;

said opposite end member having means for permitting universal pivotal movement of the connecting member around substantially a center of the opposite end member and for permitting pivotal movement of the connecting member only substantially in a single plane relative to said opposite end member.

17. A link as defined in claim 16, further including at least one spacer member between said end member and said opposite end member.

18. A link as defined in claim 17, wherein two spacer members are provided and further including a shock absorber member between said spacer members.

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**FIG. 2**

Fuller & Singlehurst
PATENT AGENTS

