It is well known that the connection of tie-rod ends to the steering knuckle arms of automobiles is one which tends toward heavy wear. Therefore there is always the risk of a serious accident caused by disconnection of a tie-rod end from the steering knuckle arm.

The main object of the present invention is to provide a device which eliminates this risk, and insures protection for the steering gear assembly.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel details of construction and combinations of parts, hereinafter more fully described and pointed out in the claims it being understood that changes may be made in the construction and arrangement of parts without departing from the spirit of the invention as claimed.

Referring to the drawings:

Fig. 1 is a vertical section of a safety shield formed in accordance with the invention, applied to a steering knuckle arm and tie-rod end.

Fig. 2 is a top plan view.

Fig. 3 is a perspective view of the shell on a reduced scale.

Fig. 4 is a side elevation view of a modified form of shield.

Fig. 5 is a view substantially on line 5—5 of Fig. 4.

Fig. 6 is a top plan view of said modified form.

Fig. 7 is a section taken substantially on line 7—7 of Fig. 5.

Referring to the drawing in detail, 1 is the steering knuckle arm and 2 the tie-rod end of a conventional steering assembly. It will be understood that in a conventional assembly such as that illustrated in Fig. 1, the steering knuckle arm is formed with a sleeve at one end, through which is vertically extended a connecting pin having at its lower end a ball received in a ball socket provided upon the member 2. In this connection, as used hereinafter, the term "steering knuckle arm" is intended to embrace the sleeve formed at the end of said arm, while the term "tie-rod end" is intended to embrace the ball socket provided upon the end of the member 2.

The invention includes a composite shell or sleeve comprising a pair of cooperating sleeve sections 3 and 4. This shell is formed open at both ends, and intermediate its ends is provided with an opening receiving the tie-rod end 2, said opening being defined by recesses 5, 5' opposite each other and formed in adjacent edges of the sleeve sections. The sleeve section 3 is also formed with a recess 6 in its opposite edge for the steering knuckle arm 1, the opening 6 being offset from the plane of the opening 5 and being spaced approximately 90 degrees from said opening 5.

The opposite ends of the sleeve sections have cooperating threads 7 and 8, and seated in the upper end of the assembled sleeve is a spacer 9. Overlying the spacer is a disc-like concavo-convex washer 10 and holding said sleeve sections, washer, and spacer assembled is a lock nut 11 threaded on the cooperating threads 7 and equipped with a locking set screw 12.

In the lower end of the assembled sleeve, there is positioned a washer 13 engaging the underside of the tie-rod end, and pressing upwardly against this washer is a coil spring 14, the other end of which is seated upon a rubber washer 15. The sleeve sections, washers 15, spring 14, and washer 13 are held assembled by a lock nut 16 equipped with locking set screw 17.

In use, the device is readily applied without necessity of disconnecting the steering knuckle arm 1 from the tie-rod end 2. The sleeve sections are simply placed around the connection in the positions seen in Fig. 1. The spacer 9 and washer 10 are then properly positioned and secured in place by lock nut 11. Parts 13, 14, and 15 are similarly held in place by lock nut 16.

In the form of the invention seen in Figs. 4 through 7, the safety shield is of sectional formation, and comprises a pair of transversely curved sections generally designated 18 and 19 which cooperate to provide the cylindrical sleeve of the invention.

The section 18 is formed with recesses 20 and 21 located in different planes and spaced approximately 180° from each other for the purpose of receiving the steering knuckle arm and tie-rod end. When the section 19 is positioned in opposition to the section 18, the edges of said section 19 cooperate with the recesses to define openings similar to the openings of the first form of the invention.

Considering the formation of the section 18, this is of multi-walled construction as seen in Fig. 7 and includes an outer portion 22 the ends of which are turned in as at 23 to provide flanges gripping the edges of the inner portion 24 so that in effect the section 18 is of laminated formation.

The section 19 is similarly formed and includes the outer portion 25 having the end flanges 26 gripping the inner portion 27.

I provide this arrangement so that each of the sections can be formed with spreadable ears at opposite ends. For example, the section 18 at opposite ends is provided with spreadable ears.
The ears 23 are formed from extensions of the outer portion 22. The ears 29 are formed from extensions of the inner portion 24. Similarly, the section 15 is formed with ears 30 and 31 at opposite ends. Said pairs of ears are extended through circumferentially spaced slots 32 formed in the dependingly flanged upper cap 33 having the central opening seen in Fig. 6, while the lower pairs of ears extend through similar slots formed in the lower cap 34 also centrally apertured.

I believe it will be apparent from the description of the second form of the invention that this form of the device can be applied to a steering knuckle arm and tie-rod end without the necessity of disconnecting these parts. In other words, the sections 18 and 19 initially will be separated and are simply positioned in opposition to each other around the connected steering knuckle arm and tie-rod end. At this stage of the mounting of the device, the ears described above will not be bent back. Rather, the ears will be extending straight upwardly and downwardly and it is necessary only to position the caps 33 and 34 thereover and bend the ears back as seen in Figs. 4 to 7, after which the sleeve sections 15 and 19, caps 33 and 34, will all be held properly assembled in protective relation to a connected steering knuckle arm and tie-rod end.

The advantages of the device may be readily noted. The risk of accidents is eliminated, since any tendency of the arm and tie-rod end to disconnect is overcome entirely by the safety shield. Additionally, the tie-rod ends when equipped with safety shields formed as illustrated and described cannot disconnect from the car and wear three to four times longer, I believe, and are entirely free from danger of breakage.

What is claimed is:

1. A safety shield for connected, superposed ends of a steering knuckle arm and a tie-rod of a steering gear assembly comprising a cylindrical sleeve formed open at opposite ends and proportioned to surround and extend above and below said arm end and tie-rod end respectively, said sleeve being completely formed of a pair of sleeve sections of semi-circular cross sectional configuration, said sections contacting along their side edges, the side edges of at least one of the sections being recessed to receive the arm end and tie-rod end respectively, means at opposite ends of the sleeve engaging the respective sections to hold them assembled with one another, said means extending inwardly of the sleeve to form abutments at opposite ends of the sleeve, and stops extending from said abutments adapted for engagement with the arm end and tie-rod end respectively to prevent disconnection thereof.

2. A safety shield for the connected ends of a steering knuckle arm and tie-rod of a steering gear assembly comprising a cylindrical sleeve proportioned to surround said ends and extending above and below the knuckle arm end and tie-rod end respectively, said sleeve being completely formed of a pair of sleeve sections of semi-circular cross sectional configuration, said sections contacting one another from end to end thereof, along their respective side edges, one of said sections having a transversely extended recess formed in one of its side edges through which the steering knuckle arm may be extended, said section having a recess formed in its other side edge, the other section having a recess formed in one side edge thereof and communicating with the second-named recess, the second and third named recesses being adapted for extension therethrough of the tie-rod end, there being threads formed upon the opposite ends of the respective sleeve sections, lock nuts threaded upon the opposite ends of the sleeve, each lock nut engaging the threads of both sections to hold said sections assembled with one another, the lock nuts extending inwardly of the sleeve to provide end abutments thereupon, and stops adapted to be interposed between said abutments and the arm and tie-rod ends respectively to prevent disconnection of said ends.

3. A safety shield for the connected ends of a steering knuckle arm and tie-rod of a steering gear assembly comprising a cylindrical sleeve proportioned to surround said ends and extending above and below the knuckle arm end and tie-rod end respectively, said sleeve being completely formed of a pair of sleeve sections of semi-circular cross sectional configuration, said sections contacting one another from end to end thereof, along their respective side edges, one of said sections having a transversely extended recess formed in one of its side edges through which the steering knuckle arm may be extended, said section having a recess formed in its other side edge, the other section having a recess formed in one side edge thereof and communicating with the second-named recess, the second and third named recesses being adapted for extension therethrough of the tie-rod end, there being threads formed upon the opposite ends of the respective sleeve sections, lock nuts threaded upon the opposite ends of the sleeve, each lock nut engaging the threads of both sections to hold said sections assembled with one another, the lock nuts extending inwardly of the sleeve to provide end abutments thereupon, a spacer adapted to extend between one of said abutments and the steering knuckle arm end, and a spring adapted to extend between the other end abutment and the tie-rod end, said spacer and spring constituting means operative to prevent disconnection of said ends of the steering knuckle arm and tie-rod.

4. A safety shield for the connected, superposed ends of a steering knuckle arm and tie-rod of a steering gear assembly comprising a cylindrical sleeve proportioned to surround and extend above and below said ends, said sleeve being completely formed of a pair of sleeve sections of semi-circular cross sectional configuration contacting along their respective side edges, one of said sleeves being formed with recesses extending inwardly from its respective side edge, said recesses being adapted to receive the steering knuckle arm end and tie-rod end respectively, flanged caps fitted over opposite ends of the sleeve to hold the sleeve sections assembled with one another, said caps being formed with circumferentially spaced slots, ears on the respective sleeve sections extending through the slots to prevent disconnection of the caps from the sleeve sections, and stops adapted to extend between the respective caps and the upper arm and tie-rod ends, said stops constituting means for preventing disconnection of said arm and tie-rod ends from one another.

FRED R. BRITT.

References Cited in the file of this patent

<table>
<thead>
<tr>
<th>FOREIGN PATENTS</th>
<th>Number</th>
<th>Country</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>204,402</td>
<td>Italy</td>
<td>Apr. 26, 1929</td>
<td></td>
</tr>
</tbody>
</table>