Oct. 27, 1931. J. SNEED 1,829,306

TIE ROD

Filed July 16, 1928 3 Sheets-Sheet 1

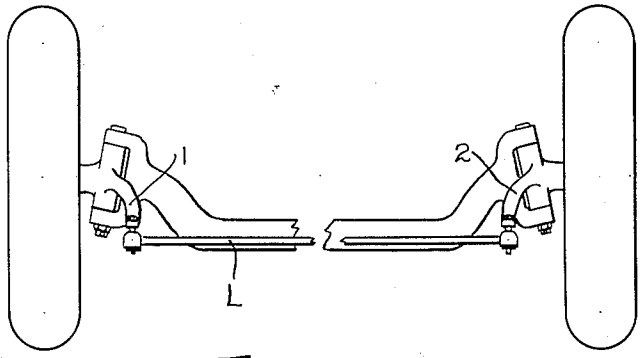


FIG. 1

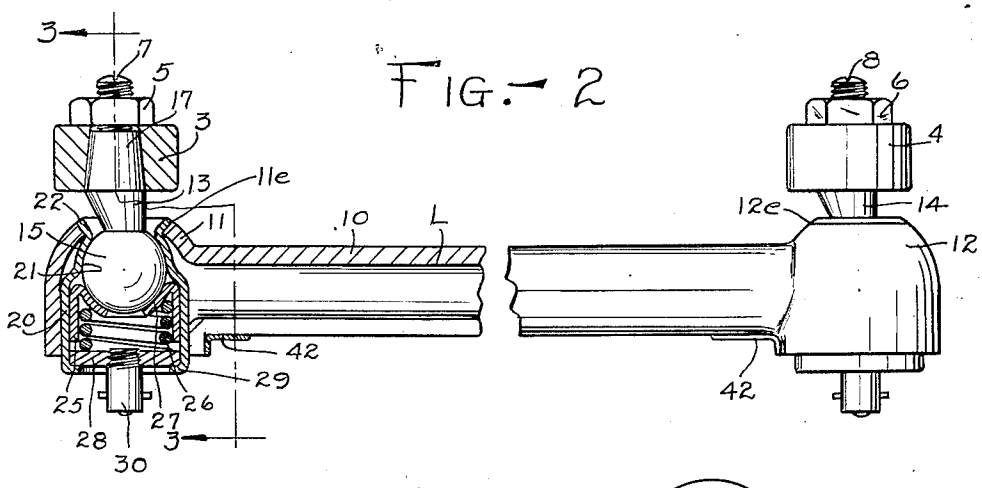


FIG. 2

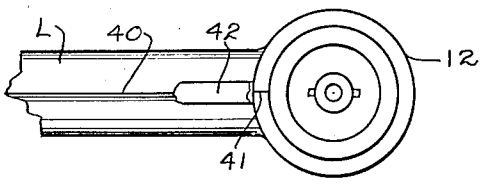


FIG. 4

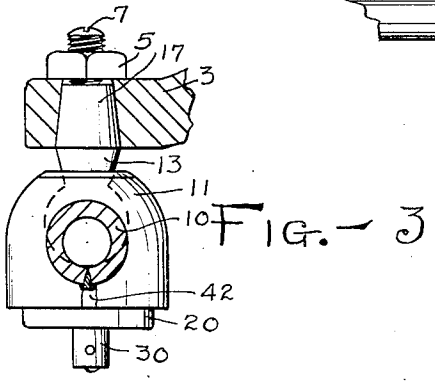


FIG. 3

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TIE ROD

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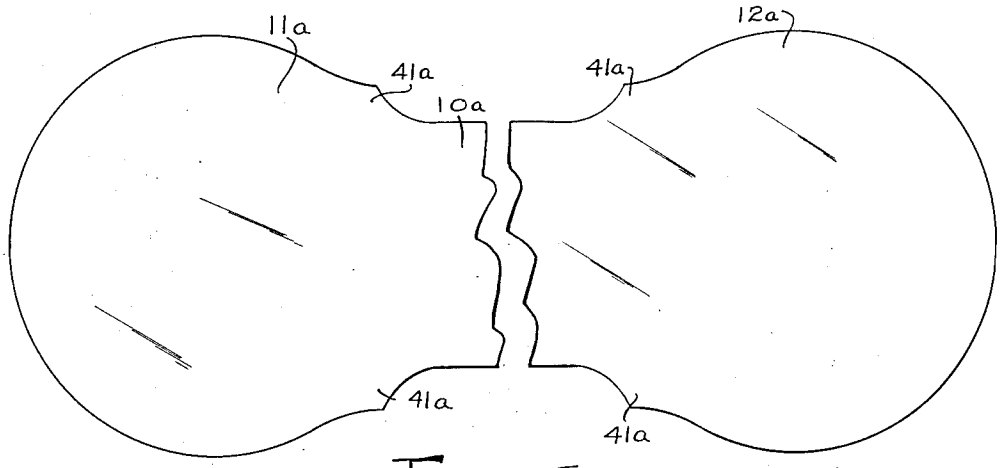


FIG.-5

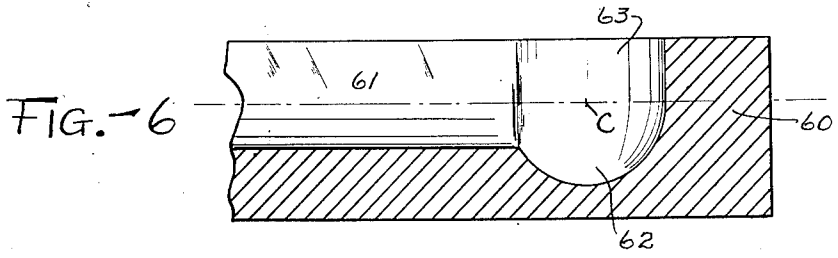


FIG.-6

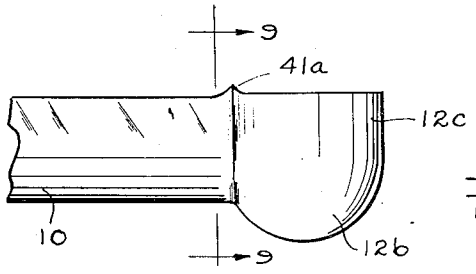


FIG.-7

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TIE ROD

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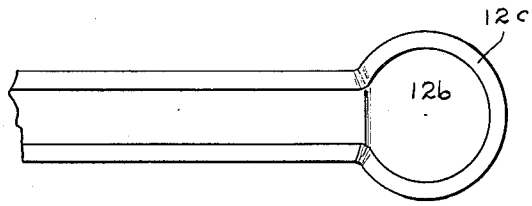


FIG.-8

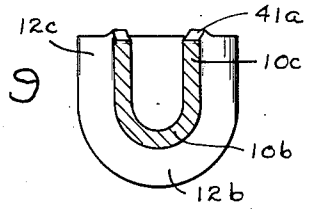
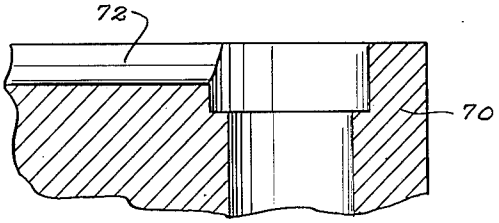


FIG.-9

FIG.-10



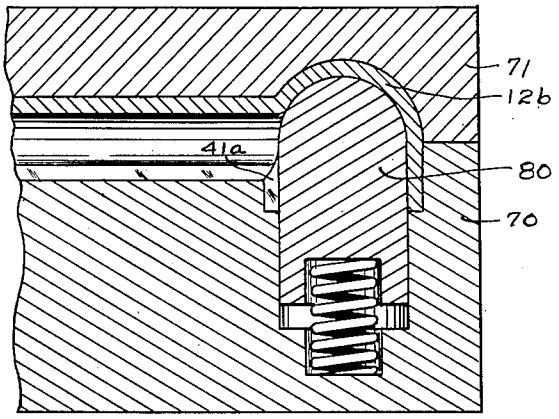


FIG.-11

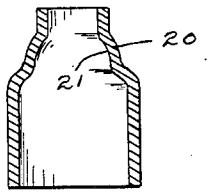


FIG.-12

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Patented Oct. 27, 1931

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UNITED STATES PATENT OFFICE

JOHN SNEED, OF FERNDALE, MICHIGAN

TIE ROD

Application filed July 16, 1928. Serial No. 293,107.

This invention relates to links or tie rods and a method of making them. The invention also relates to the arrangement of parts used in conjunction with the link by means of which its effective operative length may be adjusted.

It is among the objects of my invention to form a link essentially of one piece of sheet stock. Another object is to form a link with integral portions at its ends which are adapted to retain parts through which the link may be connected to external agencies. A further object is to provide parts associated with the link which are universally movable with relation to the end of the link and which have parts for engaging external agencies whose effective centers may be changed without changing the relation of the parts engaged by the link. A further and more specific object is to provide a link which may be used as a tie rod between the swiveling wheels of a vehicle. Another object is to connect the tie rod and the steering arms to permit universal movement and to permit adjustment between the steering arms and without changing the actual length of the tie rod per se. Another object is to provide a method for forming the link by a simple and economical process. A further object is to arrange bearing surfaces and a chamber for retaining lubricant for the connecting members at the ends of the link. My most comprehensive object is to provide a link and method of making same which had the attributes of strength, durability, economy and neatness of appearance.

Other objects will appear from the following description of a preferred form of my invention in which the article and the steps of a preferred method are described in detail. The precepts of my invention are equally applicable to such devices as drag links in the steering mechanism and connecting links in shock absorbers etc. The essential characteristics are summarized in the claims.

In the drawings, Fig. 1 illustrates the embodiment of my link as a tie rod between the steering arms of the swiveling wheels of a motor vehicle; Fig. 2 is a partially broken longitudinal section of the link and the assembled parts at the end; Fig. 3 is a section taken along the line 3—3 of Fig. 2; Fig. 4 is a bottom plan view of one end of the link; Fig. 5 illustrates the blank of sheet stock from which the body of the link may be formed; Fig. 6 is a partial longitudinal section of the female die used in the first step of the forming operation of the link; Fig. 7 is a partial side elevation of one end of the link after the first forming step; Fig. 8 is a top plan view of the piece in the same stage; Fig. 9 is a section taken along the line 9—9 of Fig. 7; Fig. 10 is a section taken through the end of the female die used in the second forming step; Fig. 11 is a section intended to illustrate the relation of the piece and the several dies at the end of the second step showing an injecting and centering die or mandrel; and Fig. 12 illustrates in cross-section a tubular bearing or bushing prior to its insertion in the end of the link.

Referring to Fig. 1, I show the link or tie rod L joining steering arms 1 and 2. As is the usual practice the steering arms are carried by swiveling stub axles which pivot about inclined axes. As the wheels swivel the end of the one of the steering arms falls while the end of the other steering arm rises so that universal connections are desirable between the ends of the link and the steering arms. In the embodiment of my link as a tie rod for the front wheels of a motor vehicle, it is also desirable that the ends of the steering arms be moved toward or away from each other to align the wheels.

Referring to Figs. 2 and 3, the link member L comprises a longitudinally extending cylindrical portion 10 with integrally formed cupped ends 11 and 12. As illustrated in Fig. 2, the upper parts of the cupped ends 11 and 12 are hemispherically formed and merge into depending cylindrical parts of like radius. Generally speaking the end portions 11 and 12 comprise sockets for holding and permitting universal movement of connecting and adjusting members 13 and 14. The axes of the cylindrical parts of the cupped ends preferably extend at right angles to the longitudinal axis of the link. The intersections of the axes determine the

centers of the hemi-spherical parts of the cups. Each of the cupped ends has a central aperture 11*e* and 12*e* punched in the hemi-spherical part through which the shank of one of the members 13 and 14 extends.

The connecting members 13 and 14 may be similar. The member 13 comprises a substantially spherical ball portion shown at 15 which is held in a socket in the end portion of the link. Opposite the ball end is a tapered shank 17 the axis of which is offset from the center of the ball. The ends of the steering arms 3 and 4 have conically formed seats into which the tapered shanks of the members 13 and 14 are secured by nuts 5 and 6 threaded on extensions of the members. The ends of the threaded extensions may be slotted as at 7 and 8 to be held against rotation. I prefer that the ball parts of the connecting members 13 and 14 be carried by the link. The principle of this phase of my invention being that the offset shanks facilitate adjustment while the ball parts permit universal movement between the link and the members between which it serves.

To move the ends of the steering arms 3 and 4 toward or away from each other, one or both of the shanks of the members 13 and 14 may be turned with relation to the ends of the steering arms and the arms will be moved by reason of the eccentricity of the axes of the shanks with relation to the centers of the balls. Thus if the offsets be an eighth of an inch per member, a gross over-all adjustment of one-half inch may be obtained between the ends of the steering arms.

In the preferred form of my invention I desire to support the ball parts of the connecting members in an assembled socket between which is incorporated a lubricating device and chamber. In Figs. 2 and 12 there is illustrated a tubular bushing or bearing member 20 which has a concave spherical surface 21 forming the upper part of the socket. The member 20 extends through the cylindrical part of the end portion of the link with shoulders resting against the periphery of the aperture 11*e*. The upper edge of the member is peaned over as at 22 and is thereby permanently secured in the end of the link. The cylindrical walls of the cupped end closely fit and support the member. When the member 20 is secured in the end of the link, the lower longitudinal seam 40, see Fig. 4, and the joint 41 in the cylindrical part of the cupped end are welded, as at 42, see also Figs. 2 and 3.

After the members 20 are secured in the cupped ends, the ball stud connecting members 13 and 14 are inserted so that the ball portions rest upon the surfaces 21. Then a member 25 is inserted in the member 20 to engage the ball portion along the surface 26 to complete the socket, see Fig. 2. A short coil spring 27 is compressed between the member 25 and a closure member 28. The closure member 28 may be permanently secured by inturning the lower edge of the member 20 as at 29. Lubricant fittings 30 of any well known type may be threaded into the member 29 so that lubricant may be forced into the chamber defined by the member 20. The member 25 has a central aperture in its bearing surface both for the admission of lubricant and for the admission of such means as a drift pin for driving the shank of the ball stud into the conical seat in the end of the steering arm.

Referring particularly to Figs. 5 to 11, I will briefly describe a preferred method of forming the link. The blank from which the link may be formed is illustrated in Fig. 5 and comprises a longitudinally extending rectangular part 10*a* with substantially disc-like ends 11*a* and 12*a*. The junction between the disc-like ends and the middle rectangular portion may be cut as at 41*a* to provide an excess of metal to close the joint at 41, see Fig. 4.

Referring to Figs. 6 to 9 inclusive, the blank is forced into a female die 60 partially illustrated in Fig. 6 which comprises primarily a longitudinally extending channel part 61 the bottom of which is semi-cylindrical so that the mid portion 10 of the link is drawn to a semi-cylindrical section 10*b*, see Fig. 9. The die 60 has at both ends a substantially hemispherical bottom 62 struck from a sphere whose center C lies coincident with the axis of the semi-cylindrical part 61 of the die. The whole die may have an adjustable insert not shown so that the distance between centers C determines the distance between which the center of the balls 15 will be spaced apart in the finished link. The parts of the die 60 directly above the hemispherical part 62 are substantially cylindrical as at 63. The piece is drawn by a complementary male die not shown and is thus formed with cupped ends partially spherical in form as at 12*b* and partially cylindrical in form as at 12*c*.

Referring to Figs. 10 and 11 the piece having been formed to the shape shown in Figs. 7 to 9 is inverted with its open edge facing the die 70 and with the cupped end portions carried by retractable dies or mandrels 80. The dies 80 may be resiliently or otherwise retractably supported and serve to space the end portions and hold the walls thereof during the last forming operation. A downwardly moving die 71 having a contour similar to the die 60 urges the piece downward into the die 70. In this operation the edges of the channel 10*c*, see Fig. 9, are moved toward each other along the surface 72 of the die 70 into a cylindrical form illustrated at 10 in Figs. 2 and 3. During the same motion of the die, the parts 41*a*, see Figs. 5, 7, 9 and 11 are moved and drawn

toward each other until they meet as at 41, see Fig. 4. There remains the operation which is not shown of punching out openings 11*e* and 12*e* in the spherical domed part of the end portions. As mentioned above and as shown in Figs. 2, 3 and 4, the joints 40 and 41 are welded as at 42 both for the purpose of filling the joint and of securing the edges together adjacent the ends of the link.

The assembly of the several parts has been described above and while I have described a preferred form of my invention, I do not care to be limited in its application particularly to a tie rod. Neither do I care to be limited particularly to the particular form of link described. For instance, I may use the link illustrated in Figs. 7, 8 and 9 and while such a link would lack the neatness of appearance and might lack strength for a given thickness of stock that my preferred link has, still such a link is within the broad teaching of my invention and has its utility. In describing a preferred form of the article and method of making it, I do not care to be limited by the particular description or in any manner other than by the claims appended hereto.

I claim:—

1. A link comprising a stamping pressed from one piece of sheet stock having cupped ends whose axes are parallel and an integrally formed longitudinally extending part joining said ends and extending at right angles to said axes.

2. A link pressed from a flat piece of sheet stock having a middle connecting part formed at least semi-cylindrical in cross section and having at least one integrally formed cupped end disposed with its axis at right angles to said middle connecting part.

3. A link pressed from sheet stock having a generally cylindrical body and integrally formed cup shaped ends, the cup shaped ends each comprising a substantially spherical part whose center lies in the axis of the cylindrical body of the link and also comprising a substantially cylindrical part having the same radius as the radius of the spherical part with its axis including the center of the spherical part.

4. A link having integrally formed cupped ends having apertures in the base portions of the cups and sleeves having restricted neck portions disposed within and closely fitting said apertures.

5. A link pressed from sheet stock having a central tubular body portion with a longitudinally extending seam and having cupped end portions with the brims of the cups comprising coextensive parts of the stock adjacent said seam, the parts of the stock adjacent the seam being welded together at least near the brims of said cupped portions.

6. A link pressed from a strip of sheet stock having a tubular body portion and integral cupped end portions whose axes extend at an angle to the axis of the body portion, wherein the edges of the body portion of the strip abut along a longitudinal seam throughout the body portion of the link and the edges of the end parts of the strip comprise the brims of the cupped ends of the link, the abutting edges of stock being welded together at least near the ends of the said body portion.

7. A link pressed from a strip of sheet stock having a body portion and integral cupped end portions whose axes extend at an angle to the axis of the body portion, wherein the edges of the end parts of the strip comprise the brims of the cupped ends of the link and abut below and adjacent the said brims, the abutting edges of stock being welded together at least adjacent the brims of the cupped ends.

8. A link pressed from a strip of sheet stock having a tubular body portion and integral cupped end portions whose axes extend at an angle to the axis of the body portion, wherein the edges of the body portion of the strip abut along a longitudinal seam throughout the body portion of the link and the edges of the parts of the strips comprise the brims of the cupped ends of the link, the abutting edges of stock being welded together at least adjacent the brims of the cupped ends.

9. A link comprising a hollow tubular body portion and integrally formed cup shaped ends whose axes extend at an angle to the axes of the body portion and whose bases lie beyond the longitudinal zone of the body portion and whose brims lie beyond the body portion, the edges of the stock abutting throughout the body portion of the link to form a longitudinal seam and abutting adjacent the brims of the cupped ends and forming a continuation of said longitudinal seam, the said edges being welded together at least at the seam in the cupped end portions.

10. A link comprising at least a semi-cylindrical body portion and integrally formed cup shaped ends whose axes extend at an angle to the axes of the body portion and whose bases lie beyond the longitudinal zone of the body portion, the edges of the stock abutting adjacent the brims of the cupped ends to form a seam and being welded together at the seam in the cupped end portions.

11. A link comprising a hollow tubular body portion and integrally formed cup shaped ends whose axes extend at an angle to the axes of the body portion and whose bases lie beyond the longitudinal zone of the body portion and whose brims lie opposite and beyond the body portion, the edges of the stock abutting throughout the body portion of the link to form a longitudinal seam and the edges of the stock also abutting adjacent the brims of the cupped ends and forming a continuation of said longitudinal seam, the said

edges being welded together at least at the ends of the body portion and at the seam in the cupped end portions.

12. A link comprising a hollow tubular body portion and integrally formed cup shaped ends whose axes extend at an angle to the axes of the body portion and whose bases lie beyond the longitudinal zone of the body portion and whose brims lie beyond the body portion and define planes parallel to the axis thereof, the edges of the stock abutting throughout the body portion of the link to form a longitudinal seam and the edges of the stock also abutting adjacent the brims of the cupped ends and forming a continuation of said longitudinal seam, the said edges being welded together at least at the ends of the body portion and at the seam in the cupped end portions.

In testimony whereof, I hereunto affix my signature.

JOHN SNEED.