

[54] **BALL STUD REMOVER**

[75] Inventor: **Jacob Michelsen**, Aabenraa,
Denmark

[73] Assignee: **Kent-Moore Corporation**, Warren,
Mich.

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[51] Int. Cl. **B23p 19/02**

[58] Field of Search 29/256, 258, 259, 263,
29/265

[56] **References Cited**

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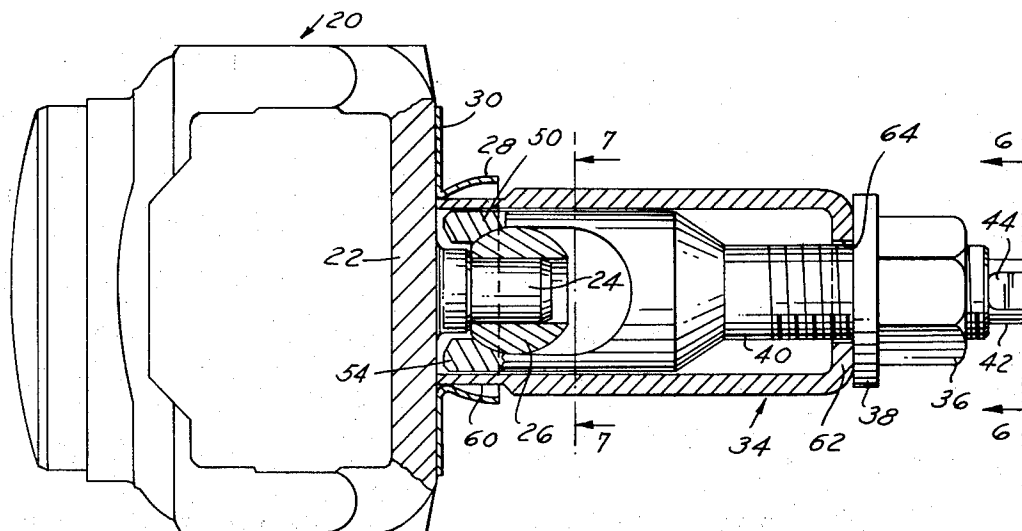
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Primary Examiner—Al Lawrence Smith
Assistant Examiner—Harold P. Smith, Jr.
Attorney, Agent, or Firm—Burton and Parker

[57] **ABSTRACT**

A ball stud removing tool for removing a ball from a stud on which it is press-fitted, wherein a cup-shaped shield surrounds the stud adjacent the ball; comprising a first member having an externally threaded upper end and a yoke-shaped lower end, the free ends of the yoke being dimensioned to embraceably engage the ball below its diameter so that it may be pulled from the stud. A second sleeve-like member is received over the first member after assembly of the latter on the ball, its threaded portion extending through an aperture in the upper sleeve end. An internally threaded nut is then threaded onto the first member, which is thereby retracted into the sleeve, drawing the ball from the stud.

4 Claims, 8 Drawing Figures



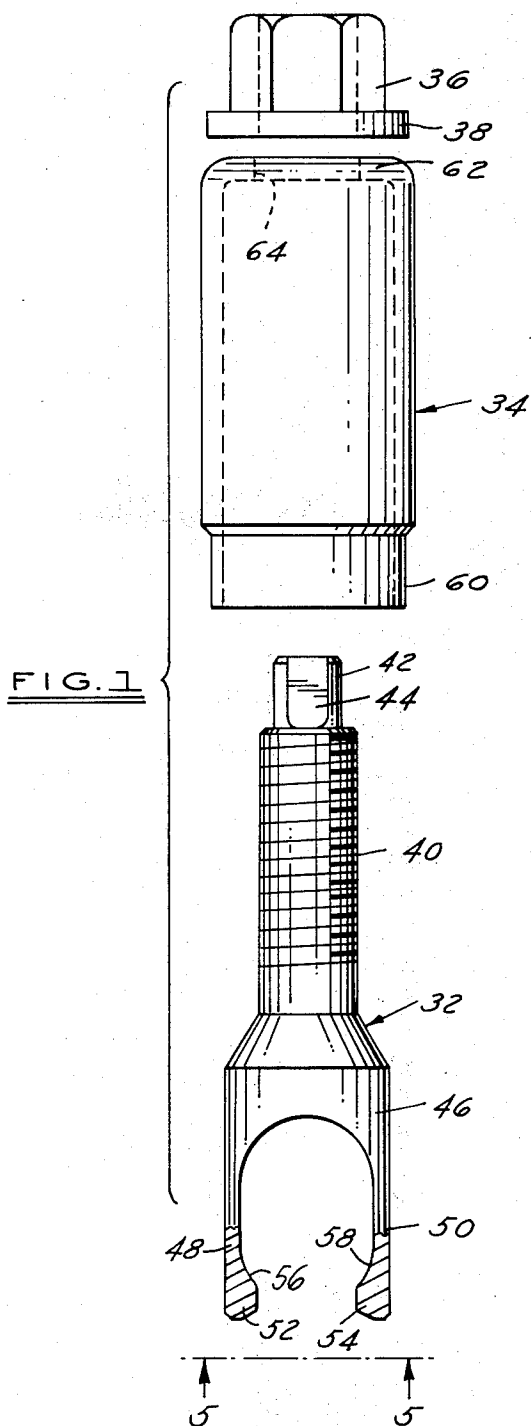
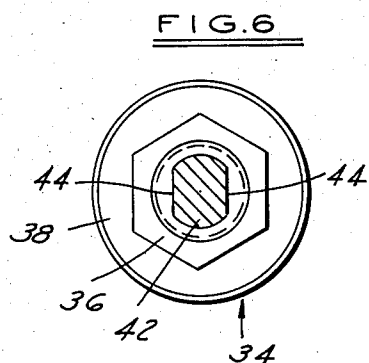
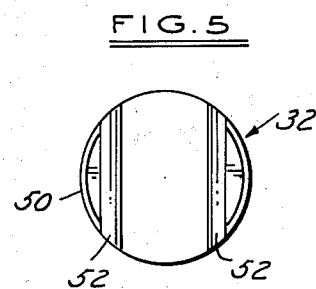
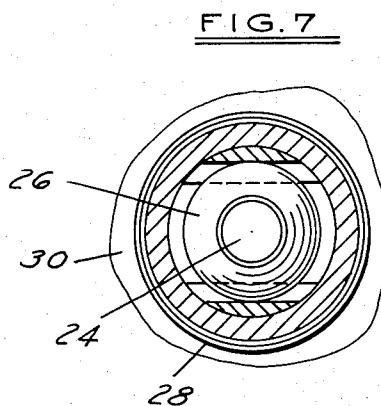
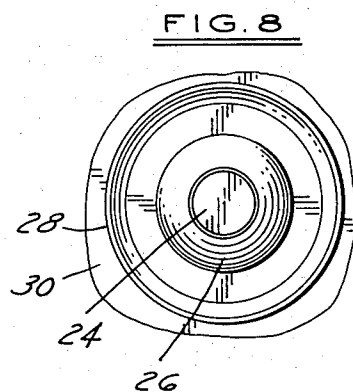


FIG. 3

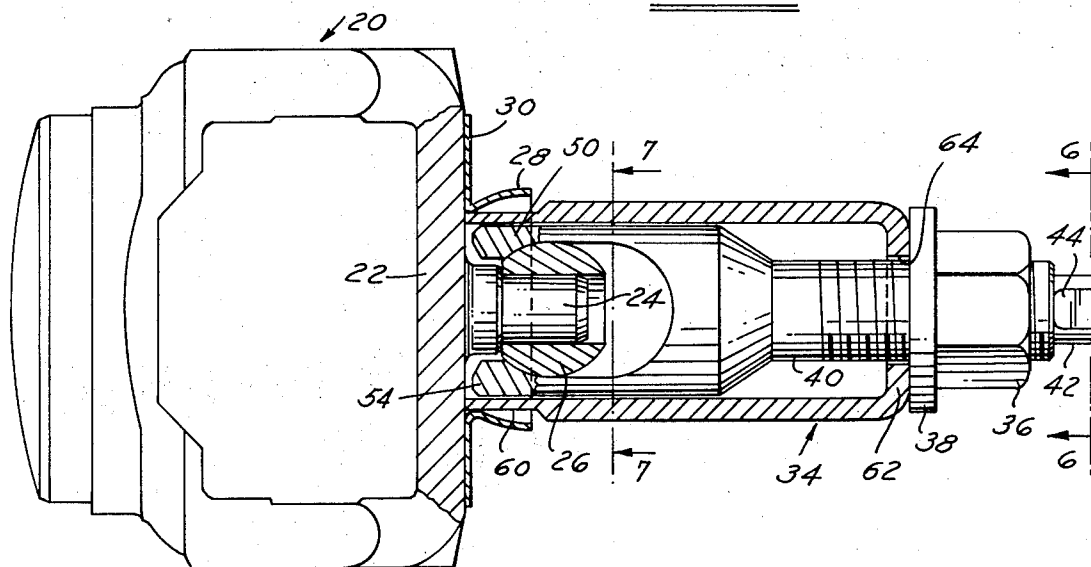


FIG. 2

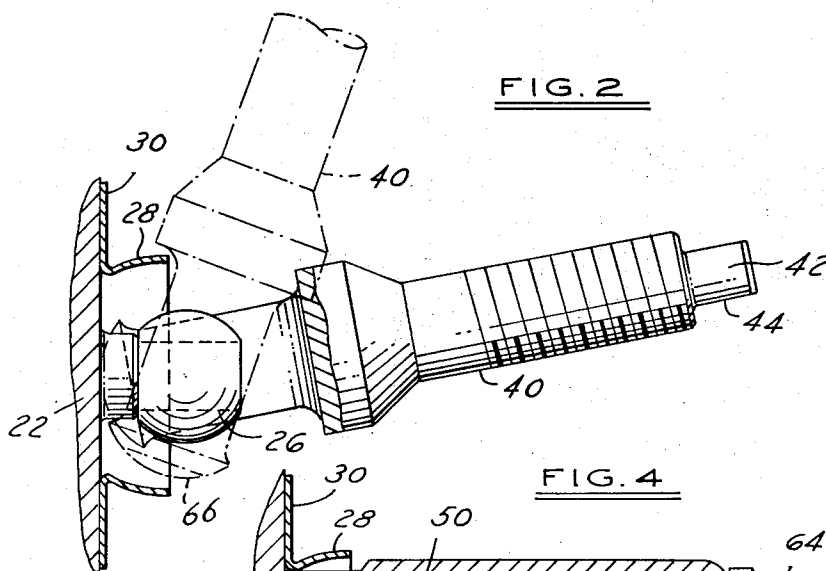
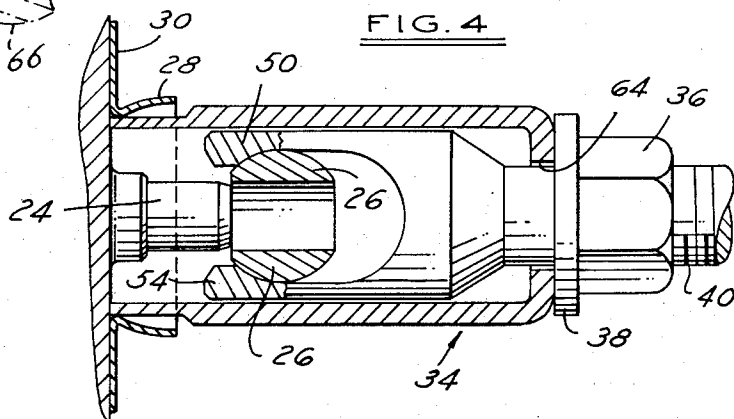


FIG. 4



BALL STUD REMOVER

BACKGROUND OF THE INVENTION

The invention lies generally in the field of pulling tools, i.e. tools for separating two parts, and more particularly relates to a tool for removing a ball from a stud on which it is press-fitted. The tool disclosed herein is specifically designed for removing the propeller shaft centering ball from the ball stud support yoke of an automobile drive shaft. Such ball is not removable by conventional pullers, as the stud upon which it is pressed projects from its support a short distance, and it is closely surrounded by a cup-shaped shield. The clearance between the ball and shield renders it impossible to insert a tool having movable jaws therebetween, at least without danger of damaging the shield.

Previously, the propeller shaft centering ball and stud were integral, making removal of the ball impossible and unnecessary. This construction mandated that the entire assembly of ball, stud and support yoke be replaced when the ball became worn, scored or otherwise damaged. Currently, at least one automobile manufacturer has made the ball separate, with the ball press-fitted on the stud so that it may be removed and replaced. While this construction has the definite advantage of more economical repair, it has also created the problem of how to remove the ball quickly and without damage to the shield.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded side elevation, partly in section, of a ball stud removal tool embodying the invention;

FIG. 2 is a side elevation of the ball engaging member of the tool showing the manner of assembling the member on the ball;

FIG. 3 is a side elevation, partly in section, showing the tool completely assembled on the ball for removal;

FIG. 4 is a view similar to FIG. 3 showing the ball being pulled from the stud;

FIG. 5 is an end elevation of the ball engaging member, taken along line 5—5 of FIG. 1;

FIGS. 6 and 7 are cross sections taken along the lines 6—6 and 7—7 respectively of FIG. 3; and

FIG. 8 is a top elevation of the assembled ball, stud and protective cup-shaped shield.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 3, there is shown a portion of an automobile drive shaft assembly, which includes a support yoke 20 having a support portion 22, from the outer surface of which projects a stud 24 with an apertured ball 26 press-fitted thereon. The ball 26 is commonly referred to in the trade as a propeller shaft centering ball. Surrounding the stud 24 and the lower portion of the ball 26 is a cup-shaped shield 28 having an integral base flange 30 fixed as by welding to the surface of the yoke support 22.

As can be seen most clearly from an examination of FIGS. 2 and 8, the shield 28 closely surrounds the base of the stud 24 and the portion of the ball 26 adjacent the support 22, so that there is insufficient clearance thereamong for insertion of any conventional puller tool having movable jaws, that is, those tools working on the principle of a pair of pliers or tongs. Thus, while

the ball 26 was made removable to provide more efficient, less expensive maintenance, the removal of the ball has presented problems to the repairman, which have now been alleviated by the provision of the instant tool.

Shown in exploded elevation in FIG. 1 is a ball removal tool embodying the invention, which is specifically designed to easily and quickly remove the ball 26 from the stud 24 without danger of damaging the shield 28 referred to above. The tool in general comprises a first ball engaging member 32, a second sleeve-like member 34, a conventional internally threaded nut 36, and a flat washer 38. Member 32 has an upper externally threaded portion 40 which is surmounted by an extremity 42 of a smaller cross section than the threaded length, the former having a pair of diametrically opposed flats 44 for engagement by a wrench or the like.

The lower portion 46 of member 32 is of bifurcated form, defined by a pair of parallel arms 48 and 50 which are spaced apart throughout most of their length a distance greater than the diameter of the ball 26. The lower extremities of arms 48 and 50 have inwardly extending protuberances 52 and 54, the distance between which is less than the ball diameter. The upper, inwardly facing surfaces 56 and 58 of the arm protuberances are arcuately shaped, and conform to the shape of the ball 26.

Sleeve member 34 is generally cylindrical in shape, and has an internal diameter sized to permit sliding reception of the member over member 32. The sleeve is of a length substantially exceeding the length of the lower portion 46 of member 32, as will become apparent from the description which follows, and its wall thickness is sufficiently great to prevent collapse under high compressive force in the longitudinal direction. The lower extremity 60 of sleeve 34 is of a slightly reduced outside diameter to permit reception within shield 28, thus permitting the sleeve to directly abut support 22 without touching the shield.

The top of sleeve 34 has a partial end wall 62, which is apertured as shown at 64 for reception of threaded portion 40 of member 32 therethrough. End wall 62 also serves as an abutment against which washer 38 bears upon assembly of the tool. The threaded portion 40 of member 32 is receivable through the end wall aperture 64, and is threadably engageable with nut 36. Washer 38 serves as a bearing member, being interposed between nut 36 and sleeve 34.

In order to remove ball 26 from stud 24, member 32 is first positioned embracing the ball in the manner shown in FIG. 2. Preferably, the extremities of arms 48 and 50 terminate in arcuately shaped surfaces, one of which is shown at 66 in FIG. 2. Member 32 is tipped at an obtuse angle with respect to the axis of the stud and ball, as shown in phantom outline in FIG. 2, with the arms 48 and 50 embracing the ball 26, and the inner surfaces 56 and 58 thereof in substantial contact with the ball surface. The member 32 is then swung to a position in alignment with the stud and ball axes, the member being shown rotated almost to said position in solid outline in FIG. 2.

Once member 32 is positioned as above described, the arms 48 and 50 thereof embrace ball 26, with the arcuate surfaces 56 and 58 engaging the ball 26 as shown in FIG. 3. Sleeve member 34 is then slid over member 32 until its inner end 60 abuts the surface of

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support 22. As pointed out above, the end 60 is dimensioned so as to closely surround and embrace arms 48 and 50, while at the same time passing interiorly of cup-shaped shield 28 to abut support 22 without deforming the shield. The sleeve is also of a length substantially exceeding the length of the lower portion 46 of member 32, so that the latter is capable of substantial longitudinal movement within the sleeve to completely separate the ball 26 from the stud 24. Washer 38 is then slipped over threaded end 40 of member 32, and nut 36 is threadably engaged on the threaded end and tightened until washer 38 abuts the end 62 of sleeve 34. The parts are then in the relationship shown in FIG. 3.

As can be seen from an examination of FIGS. 3 and 4, the ball 26 is withdrawn from the stud 24 by the retraction of member 32 within sleeve 34. This is accomplished by threadably engaging nut 36 onto threaded length 40 of member 32 while holding the latter stationary. A wrench or other suitable tool may be engaged on portion 42 bridging the flats 44 (FIGS. 1 and 6), to hold the member 32 stationary while a second wrench is used to rotate the nut 36, thereby retracting member 32 and withdrawing the ball 26 from the stud 24. When the ball is shifted to the position shown in FIG. 4, the entire removing tool and ball may be manually removed, leaving the stud 24 in place for reception of a new ball.

What is claimed is:

1. A tool for removing a ball from a stud upon which the ball is press-fitted, wherein a cup-shaped shield surrounds the stud in the area adjacent the ball, comprising a first member having a threaded upper end and a bifurcated lower end defining a pair of rigid parallel arms spaced throughout a major portion of their length

a distance greater than the ball diameter, the free ends of said arms having inwardly extending protuberances defining arcuately shaped surface portions conforming to the curvature of said ball and adapted to embraceably support the ball therebetween, a second sleeve-like member slidably receivable over said first member and insertable within said cup-shaped shield, said second member having a partially closed upper end apertured to receive said threaded end of the first member, and nut means threadably engageable with said first member threaded end, said first member being tiltably receivable within said shield with said arms thereof embracing said ball and thereafter rotatable into alignment with the stud axis for reception of said second member, whereby the ball may be withdrawn from the stud by threaded engagement of said nut with said first member threaded length.

2. A tool as defined in claim 1 characterized in that said first member has an upper extremity surmounting said threaded length having a cross-sectional area less than said threaded length for reception of said nut means thereover, said extremity defining opposed flats engageable by a wrench or the like.

3. A tool as defined in claim 1 characterized in that said stud and cup-shaped shield are fixed to a support, said sleeve-like member having a lower end portion receivable through the shield into abutment with said support.

4. A tool as defined in claim 1 characterized in that said free ends of said arms of said first member terminate in arcuately shaped extremities extending transverse the longitudinal axis of the member and within the plane of said arms.

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