## UNIVERSAL JOINT AND DRIVE SHAFT NOMENCLATURE AND TERMINOLOGY—SAE J901a   SAE Recommended Practice

The definitions and illustrations in this report are intended to establish common nomenclature and terminology of an automotive drive shaft and of universal joints, both nonconstant and constant velocity types.

### DEFINITIONS FOR BASIC DRIVE SHAFT AND UNIVERSAL JOINT NOMENCLATURE AND TERMINOLOGY

*Drive Shaft*—A mechanical device which transmits torque or rotary motion from one shaft to another shaft (Fig. 1).

*Universal Joint*—A mechanical device which can transmit torque or rotary motion from one shaft to another shaft at varying intersecting shaft axes angles.

*Nonconstant Velocity Universal Joint*—A universal joint transmitting motion with varying instantaneous angular velocity ratios between output and input members when operating at joint angles greater than zero. The average angular velocity ratio is unity. (See Figs. 2 and 3.)

*Constant Velocity or CV Universal Joint*—A universal joint transmitting motion with an angular velocity ratio of unity between output and input members (Figs. 4-10).

*Self-Supporting Universal Joint*—A universal joint supported by internal means (Figs. 2-8 and 10).

*Nonself-Supporting Universal Joint*—A universal joint requiring external supporting means (Fig. 9).

*Joint Angle*—The acute angle described by the intersecting rotational axes of the input and output members of a universal joint (Fig. 1).

*Phase Angle*—The relative rotational position of the universal joints on a drive shaft (Fig. 1).

*Swing Diameter*—The maximum diameter described by a rotating universal joint (Fig. 1).

*Drive Shaft Length, Center to Center*—The distance between the outermost universal joint centers on a drive shaft (Fig. 1).

*Homokinetic Plane*—The plane of driving engagement of a universal joint producing an angular velocity ratio of unity between output and input members. This plane bisects the obtuse angle formed by the input and output member rotational axes and is normal to the plane containing these axes.

### NONCONSTANT VELOCITY UNIVERSAL JOINTS

*Cardan or Hooke's Universal Joint*—A nonconstant velocity universal joint consisting of two yokes with their forked ends joined by a cross (Fig. 2).

*Cross*—The intermediate drive member having four equally spaced trunnions (Figs. 2, 11, and 12).

*Yoke*—The basic torque or motion input and output member having drivable attaching means (Figs. 2, 11-13).

*Ball and Trunnion Universal Joint*—A nonconstant velocity universal joint, radially self-supporting, consisting of a housing, having diametrically opposed, partly cylindrical bores, drivably connected to a ball head through a pair of trunnion mounted balls and accommodating axial movement (Fig. 3).

*Housing*—A member having two partly cylindrical, diametrically opposed, axial bores and drivable attaching means (Fig. 3).

*Ball*—A pivoting spherical shaped member transmitting load from the housing to the ball head through needle rollers and the pin, and permitting axial movement (Fig. 3).

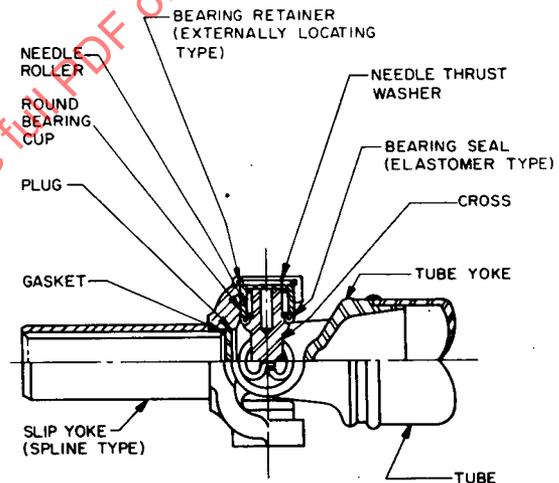*Button*—A thrust loaded member used to locate the ball head assembly during its various movements (Fig. 3).
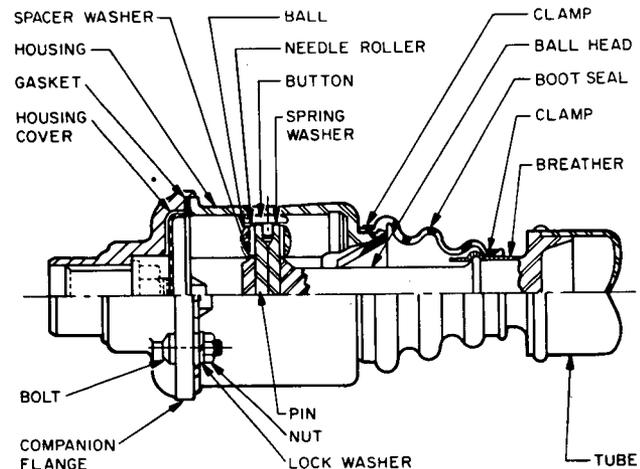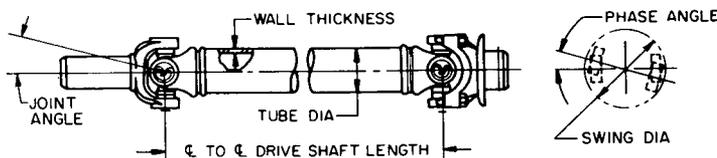


FIG. 2—CARDAN UNIVERSAL JOINT



FIG. 1 — ONE-PIECE TUBULAR DRIVE SHAFT TERMINOLOGY



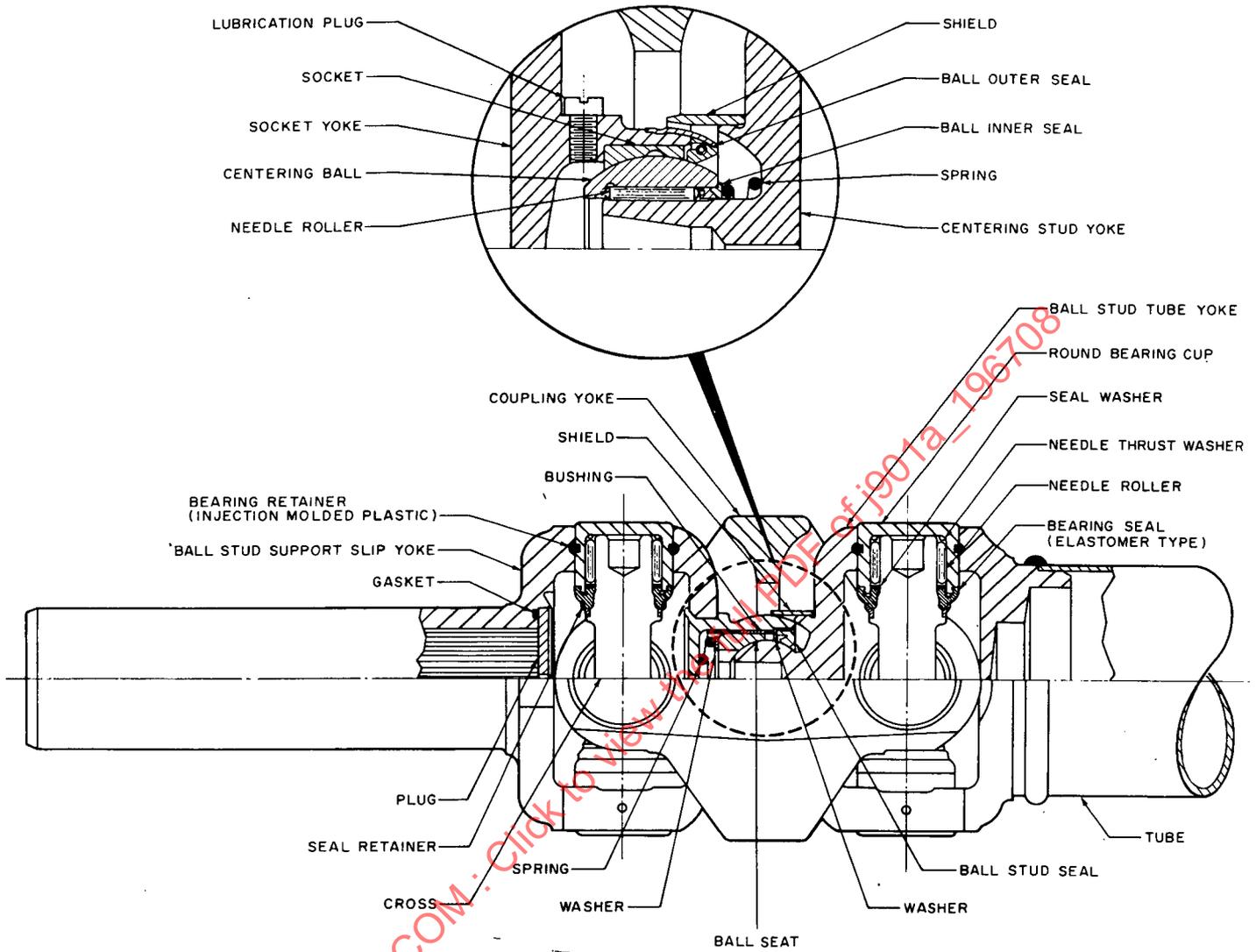FIG. 3—BALL AND TRUNNION UNIVERSAL JOINT

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FIG. 4—DOUBLE CARDAN UNIVERSAL JOINT (INTERNAL SUPPORTING AND CENTERING TYPE BALL STUD AND SEAT CONSTRUCTION)
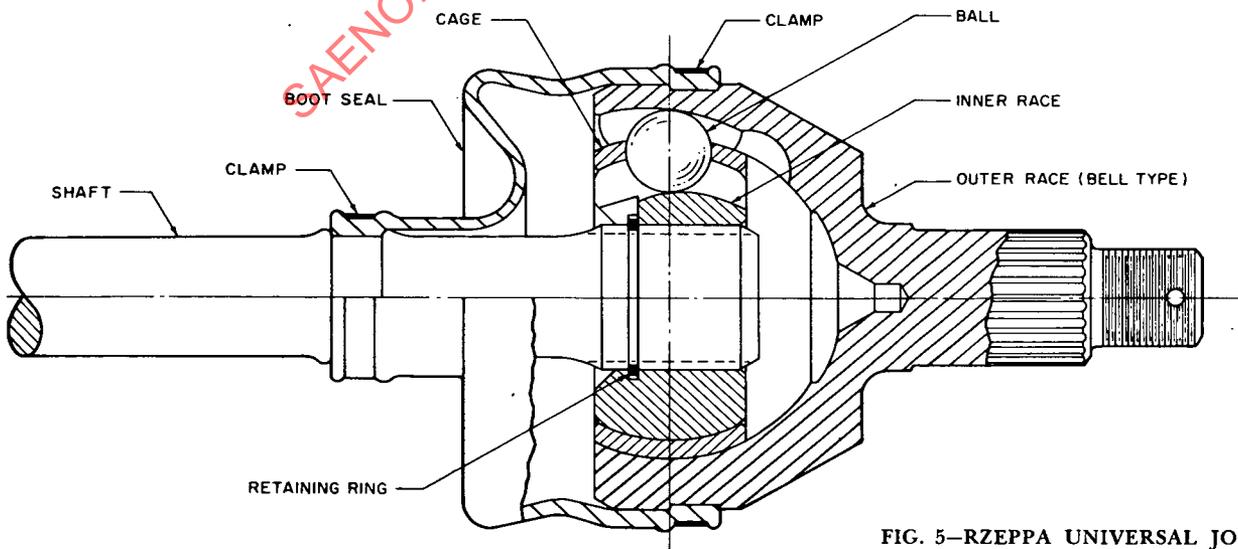


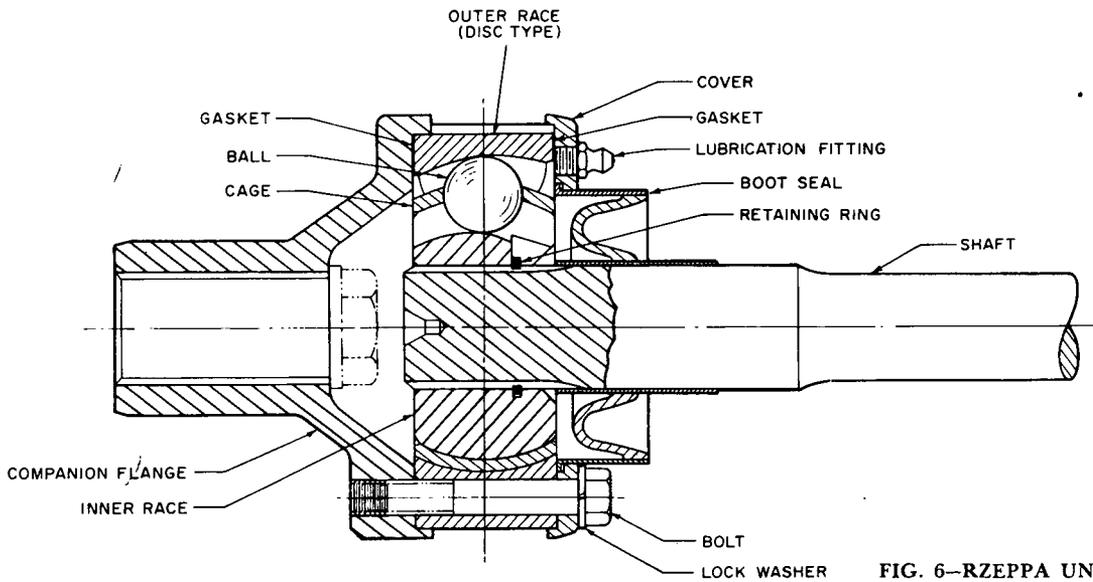FIG. 5—RZEPPA UNIVERSAL JOINT (BELL TYPE)
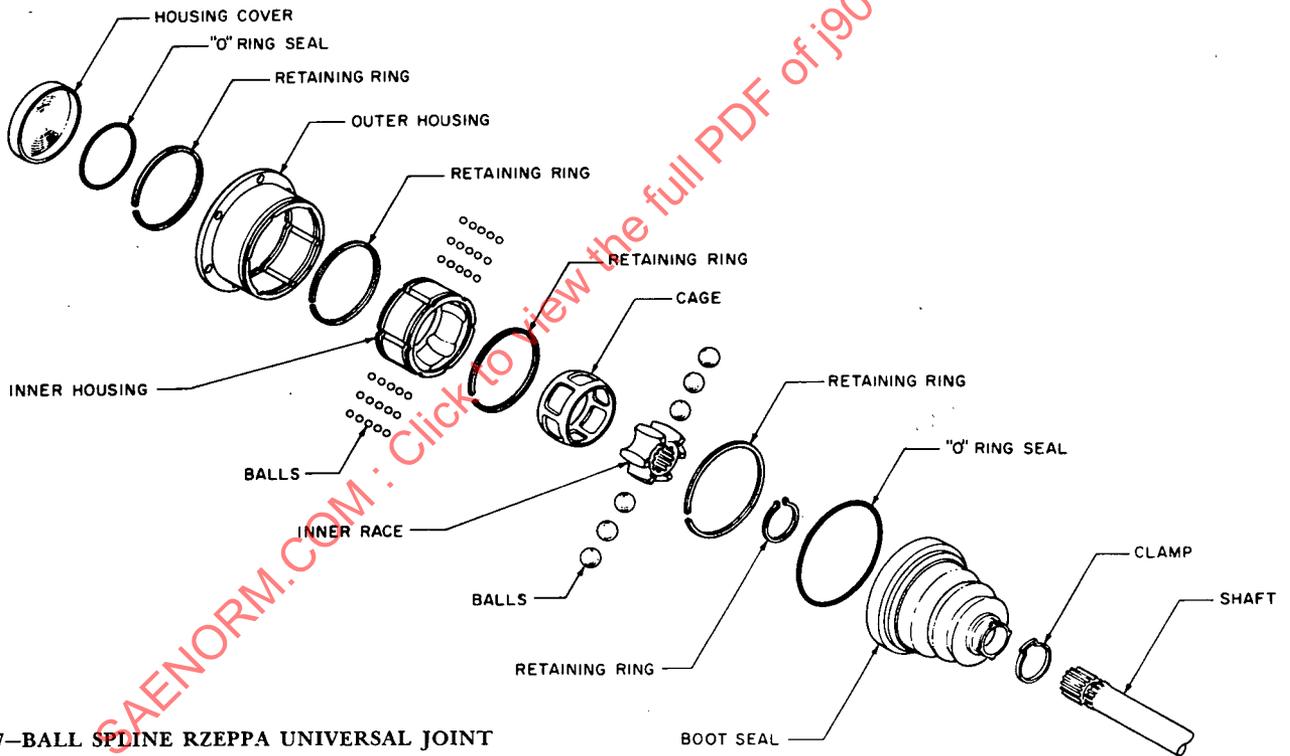
FIG. 6—RZEPPA UNIVERSAL JOINT (DISC TYPE)

FIG. 7—BALL SPLINE RZEPPA UNIVERSAL JOINT

## CONSTANT VELOCITY UNIVERSAL JOINTS

*Double Cardan Universal Joint*—An approximate homokinetic constant velocity universal joint consisting of two Cardan universal joints, whose crosses are connected by a coupling yoke with either internal or external supporting and centering means and having intersecting shafts (Fig. 4).

*Rzeppa Universal Joint*—A self-supporting homokinetic constant velocity universal joint consisting of an outer and inner race drivably connected through balls located in meridionally curved grooves and positioned in the homokinetic plane by a cage located between the two races. All major rotating mass elements have constant velocity (Figs. 5 and 6).

**Outer Race (Bell Type)**—A bell-shaped member, integral with

driving means, having meridionally located ball grooves on the spherical inner bearing surface (Figs. 5 and 14).

**Inner Race**—An annular member having meridionally located ball grooves on the spherical outer bearing surface and internally splined attaching means (Figs. 5-7 and 14).

**Cage**—A ring-like member having outer and inner spherical bearing surfaces and a circumferential series of openings for receiving balls (Figs. 5-7 and 14).

*Ball Spline Rzeppa Universal Joint*—A disc type Rzeppa constant velocity universal joint accommodating axial motion by means of an integral ball spline (Fig. 7).

**Outer Housing**—An annular member having axial ball spline ball grooves on its bore and drivable attaching means (Fig. 7).
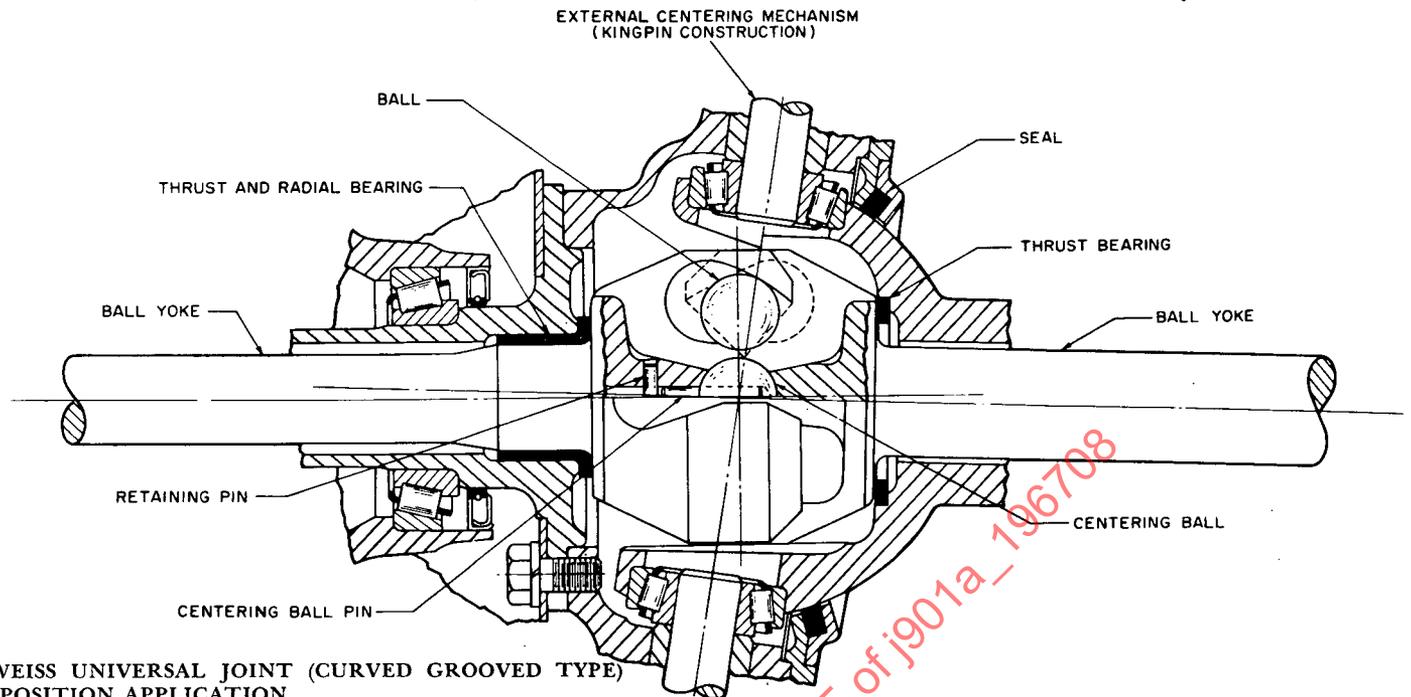
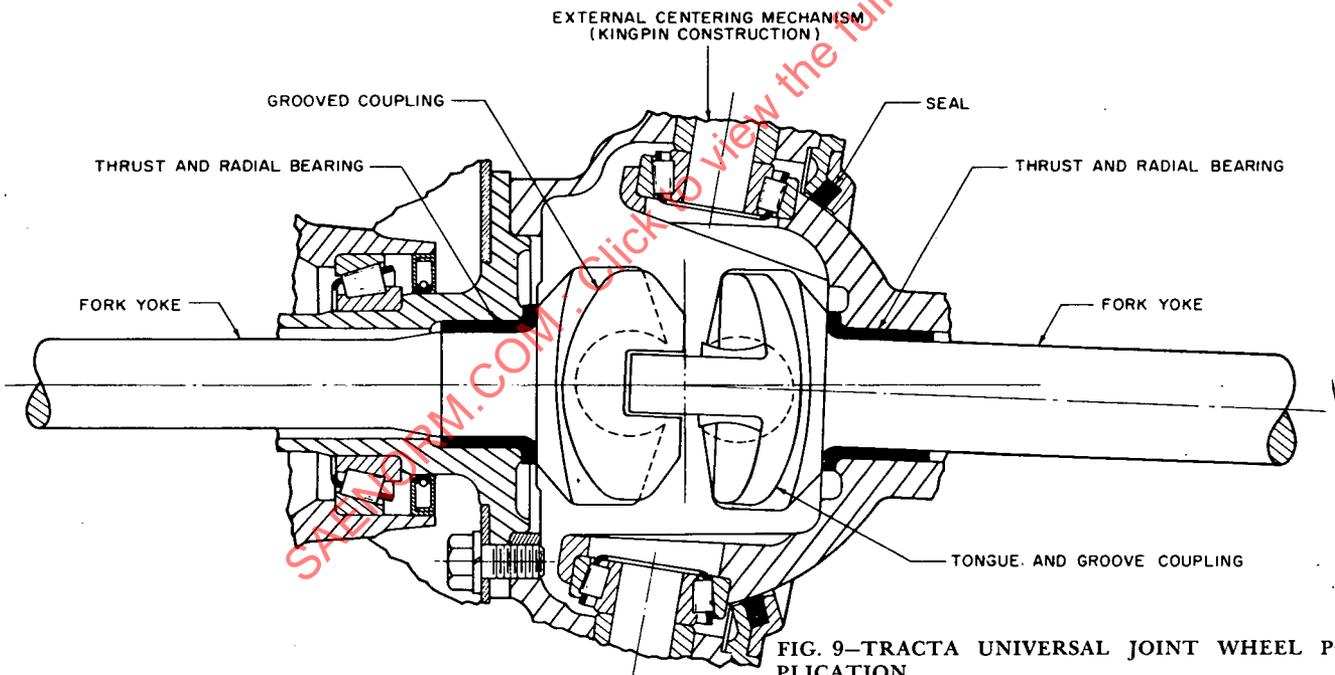FIG. 8—WEISS UNIVERSAL JOINT (CURVED GROOVED TYPE)
WHEEL POSITION APPLICATION



FIG. 9—TRACTA UNIVERSAL JOINT WHEEL POSITION APPLICATION

Inner Housing—A disc type Rzeppa outer race having axial ball spline ball grooves on its cylindrical outer surface (Fig. 7).

*Weiss Universal Joint (Curved Groove Type)*—A homokinetic constant velocity universal joint consisting of two yokes drivably connected through balls located in nonconcentric intersecting grooves symmetrically positioned in radial planes and retained as an assembly by a piloted centering ball. External sealing and axial supporting means are required. All major rotating mass elements have constant velocity (Fig. 8).

**Ball Yoke**—A yoke-shaped member having curved ball grooves located in radial planes and integral attaching means (Figs. 8 and 15).

**Centering Ball**—A ball with a pilot hole, providing for universal joint centering, absorption of end thrust and retention of the universal joint components as an assembly (Figs. 8 and 15).

*Tracta Universal Joint*—A homokinetic constant velocity universal joint consisting of two yokes drivably connected through plane surfaces to two intermediate couplings similarly engaged and requiring external supporting, centering, and sealing means (Fig. 9).

**Fork Yoke**—A fork-shaped member having plane surfaces used for engaging the mating groove of an intermediate coupling and integral attaching means (Figs. 9 and 16).

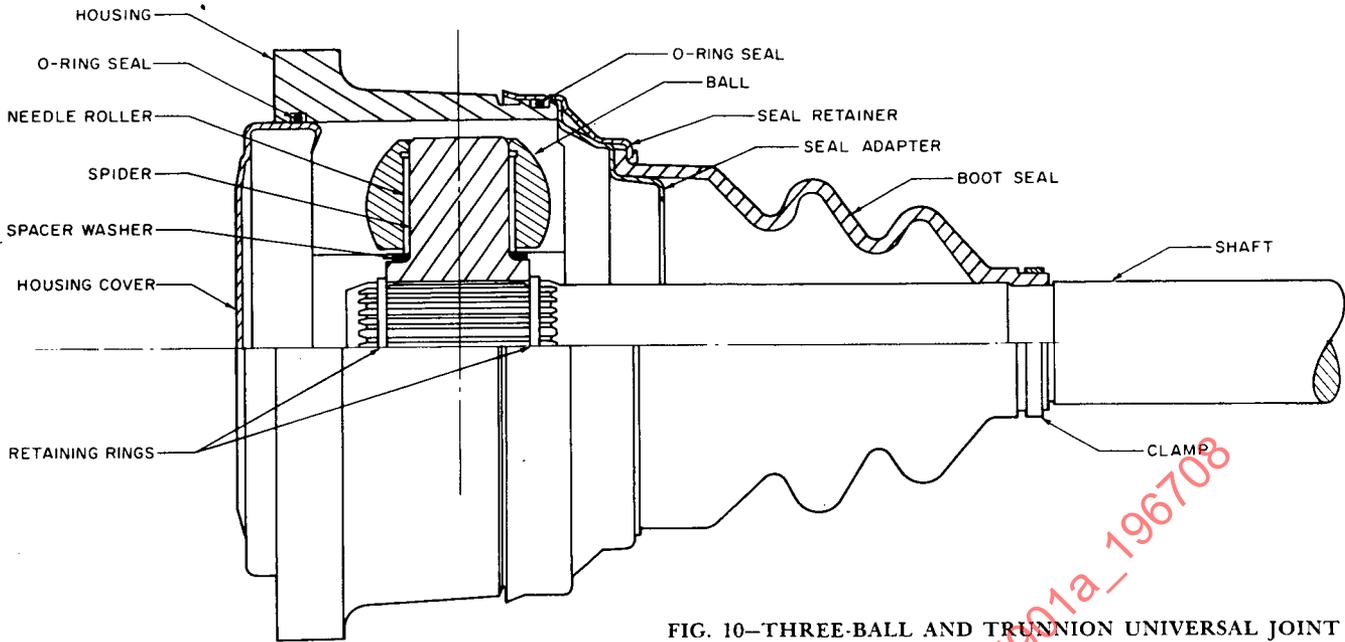**Tongue and Groove Coupling**—A hemispherically shaped inter-

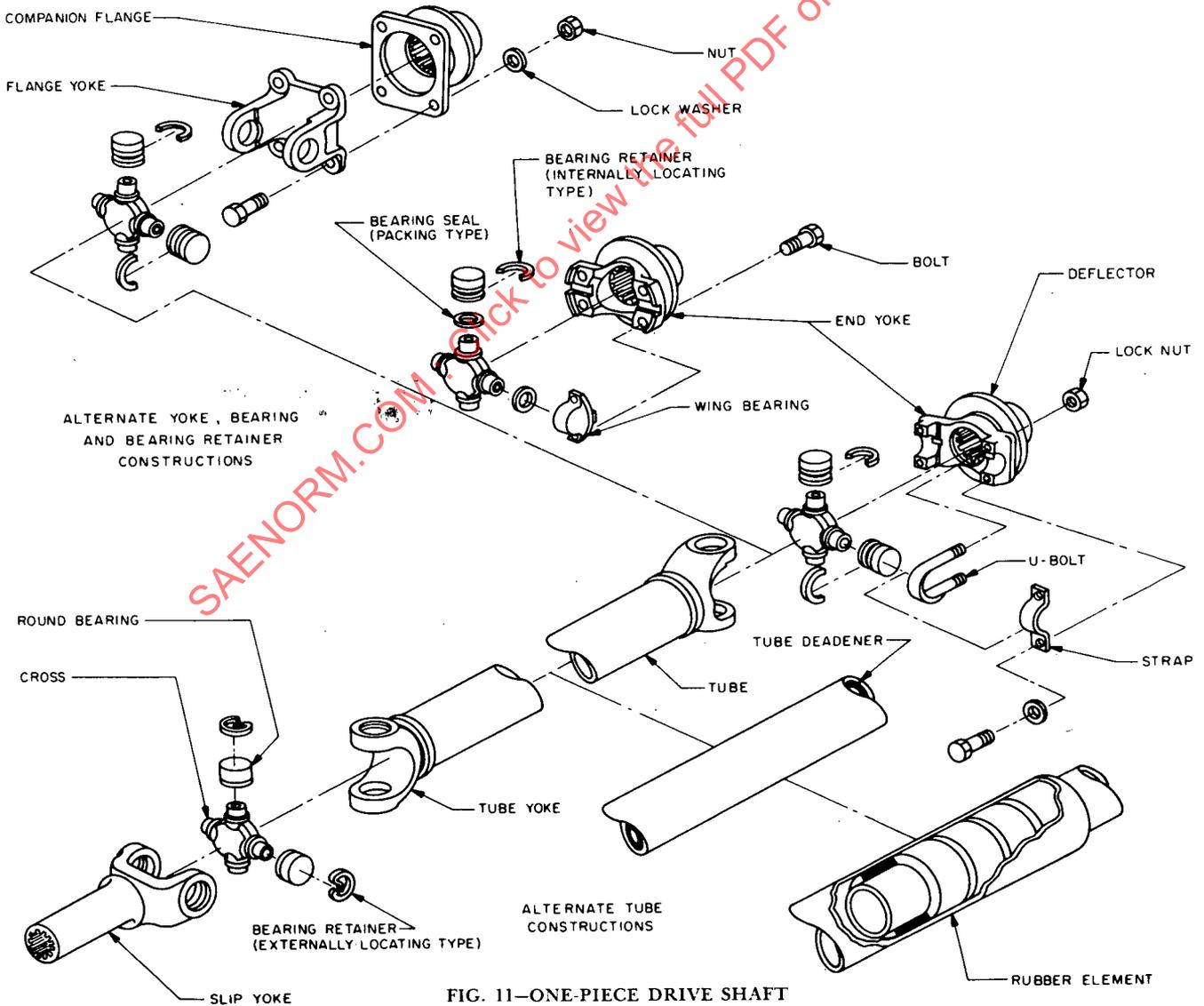FIG. 10—THREE-BALL AND TRUNNION UNIVERSAL JOINT
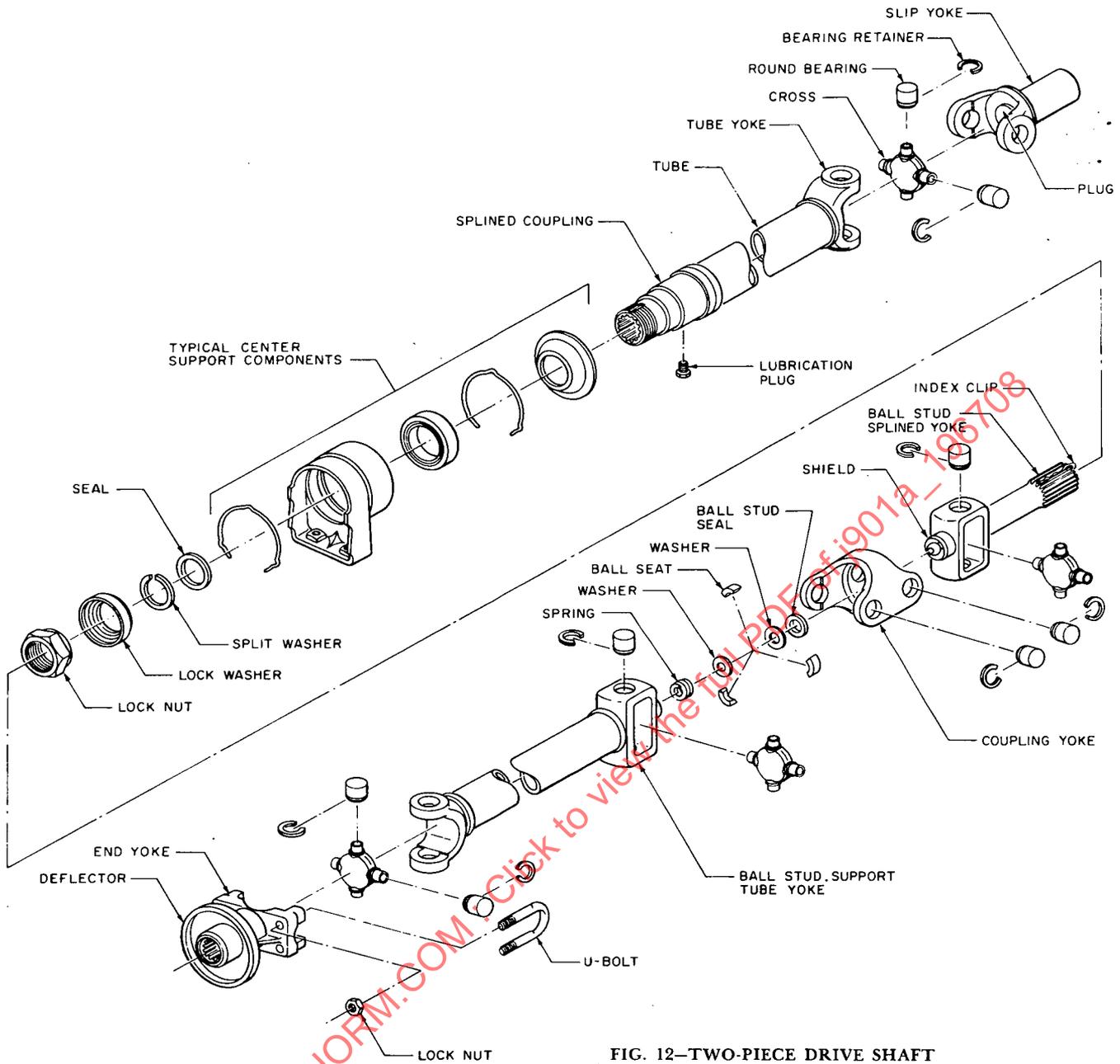


FIG. 11—ONE-PIECE DRIVE SHAFT

FIG. 12—TWO-PIECE DRIVE SHAFT

Labels (Fig. 12): SLIP YOKE, BEARING RETAINER, ROUND BEARING, CROSS, TUBE YOKE, TUBE, SPLINED COUPLING, PLUG, TYPICAL CENTER SUPPORT COMPONENTS, LUBRICATION PLUG, INDEX CLIP, BALL STUD SPLINED YOKE, SHIELD, SEAL, BALL STUD SEAL, WASHER, BALL SEAT, WASHER, SPRING, SPLIT WASHER, LOCK WASHER, LOCK NUT, COUPLING YOKE, END YOKE, DEFLECTOR, BALL STUD SUPPORT TUBE YOKE, U-BOLT, LOCK NUT
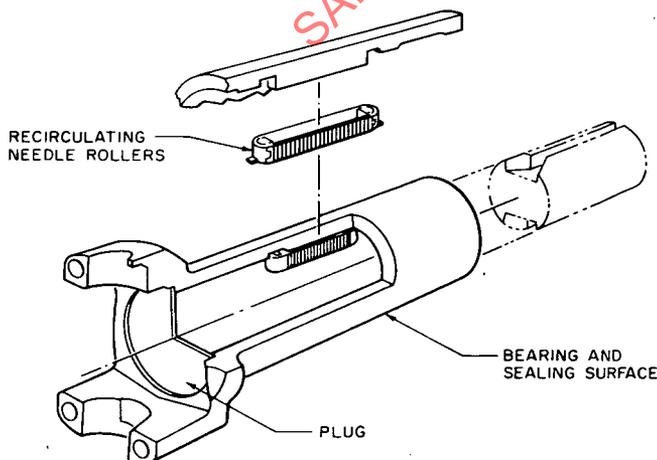


FIG. 13—SLIP YOKE (RECIRCULATING NEEDLE ROLLER TYPE)

Labels (Fig. 13): RECIRCULATING NEEDLE ROLLERS, BEARING AND SEALING SURFACE, PLUG

mediate member having tongue and groove located normal to each other (Figs. 9 and 16).

Grooved Coupling—A hemispherically shaped intermediate member having two grooves located normal to each other (Figs. 9 and 16).

*Three-Ball and Trunnion Universal Joint*—A self-supporting, non-homokinetic constant velocity universal joint, accommodating axial movement, consisting of a housing drivably connected to a shaft through three equally space trunnion mounted balls (Fig. 10).

Housing—A member having three partly cylindrical, equally spaced axial bores and drivable attaching means (Figs. 10 and 17).

Spider—A member having three equally spaced trunnions and internally splined attaching means (Figs. 10 and 17).