STEERING

STEERING GEAR

An improved ball bearing worm and nut type of gear is used on all series. See Fig. 9-2.

Rotation of the worm causes the **ball nut** to move back and forth as in the conventional type of worm and nut gear. Instead of sliding contact between worm and nut, balls are used to reduce friction.

When the steering wheel is turned to the left, the **ball nut** moves downward. The balls roll between the **worm** and the **ball nut**. As balls reach top of **ball nut,** they enter the **ball return guide** and are again directed downward into the **ball nut.**

When a right turn is made, the **ball nut** moves upward and the balls circulate in the reverse direction.

The circuit through which the balls operate includes two complete loops around the worm when it is considered that the ball return guide is part of the circuit. See Fig. 9-1.

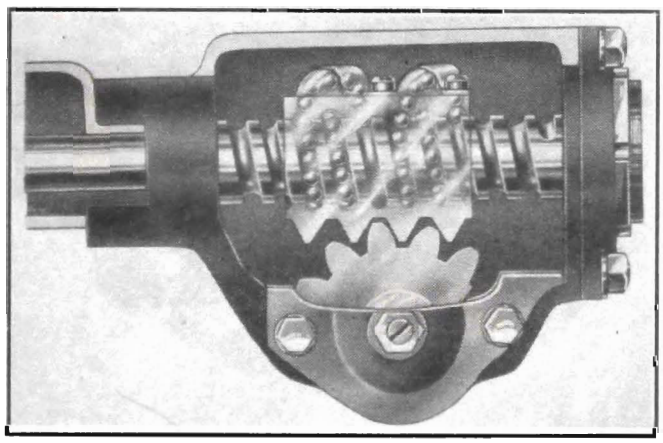


Fig. 9-1. Steering Gear Worm Showing Ball Circuit

The **ball nut** assembly contains two sets of balls and two **ball return guides.** Each set of balls operate independently of other set.

All series gears contain 33 balls in each set, or a total of 66 balls.

If in service balls are removed for any reason, re-installation will be simplified if **ball nut** and **worm** section of each circuit is first loaded and then **ball return guides.** Heavy lubricant should be used to hold balls in **ball return guides** during installation.

Under no circumstances should any balls be used other than those ordered as steering gear parts. These balls are special built and selected for steering gear use.

The end thrust of the **pitman arm shaft** is held in both directions by the **lash adjuster screw.** End-play in the **pitman arm shaft,** where the **lash adjuster screw** head locates, is governed by selecting lash adjuster shim which will slide freely in slot but not have more than .002″ end-play. **Lash adjuster shims** are available in various thicknesses used in production.

The teeth on **pitman shaft gear** are tapered so that when **pitman arm shaft** is moved in direction of **pitman arm** end, a tighter fit between teeth on **nut** and teeth on **pitman shaft gear** results.

The teeth on **ball nut** are made so that "high point," or tighter fit between the **pitman shaft gear** and **ball nut** occurs when front wheels are in straight-ahead position. For this reason it is important to have steering wheel turned in positions specified, when making steering gear adjustments.

STEERING GEAR ADJUSTMENTS

1. Tighten pitman arm **nut**, using 18″ wrench.
2. Disconnect **steering tie rod** from **pitman arm.** Note the adjustment and location of the springs in relation to the ball seats. See "Tie Rods" and Fig. 9-8.

   Turn steering wheel slowly as far as it will go in both directions. **Do not turn steering wheel hard against stop when tie rod is disconnected as damage to gear assembly may result.**

   Gear should be free except for possible 1¾ lb. load in center position.

   If stiffness occurs and is not found to be due to **pitman arm shaft** adjustment or **worm shaft** adjustment being too tight, loosen all bolts holding gear to frame bracket.

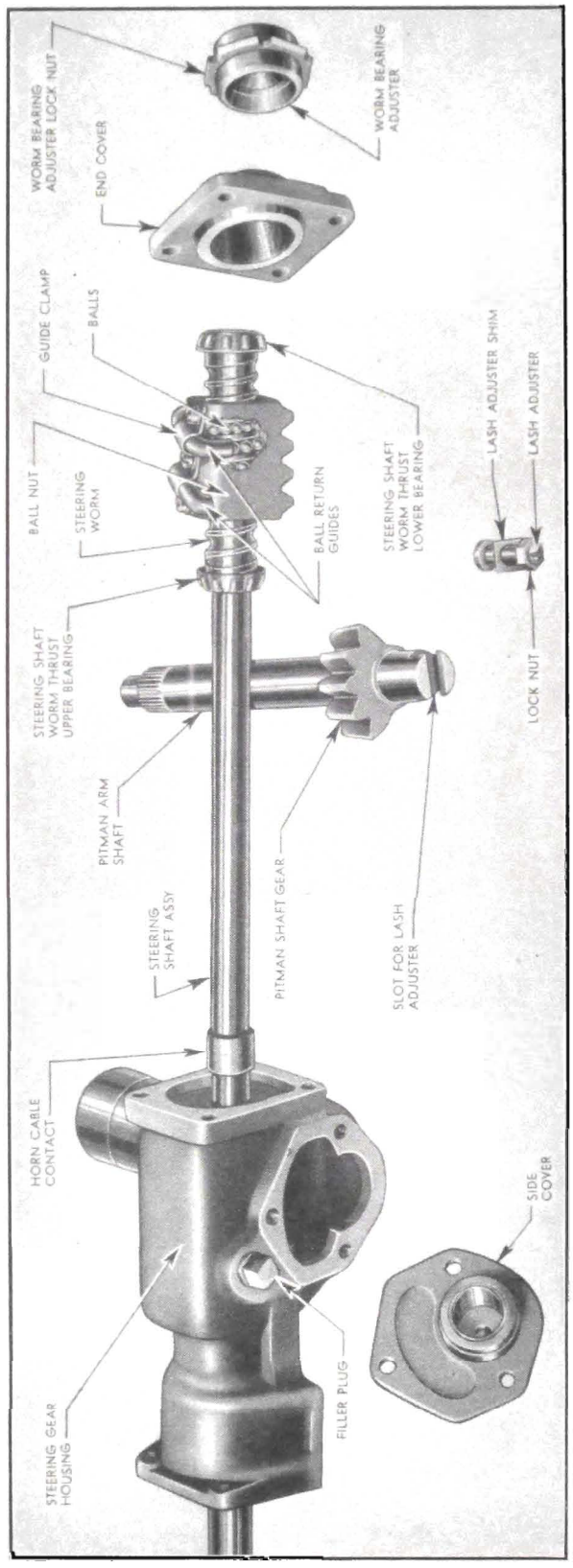


Fig. 9-2. Steering Gear Assembly—Exploded View

If binding is overcome by loosening gear to frame bracket it will be necessary to realign the gear so that same is free when all frame bracket bolts are tight.

One pivot hole and three slotted holes provide for vertical alignment of steering gear to frame. Sidewise alignment is obtained by rotating the steering gear housing in the trunnion type mounting. No shims are required for proper alignment of steering gear to frame.

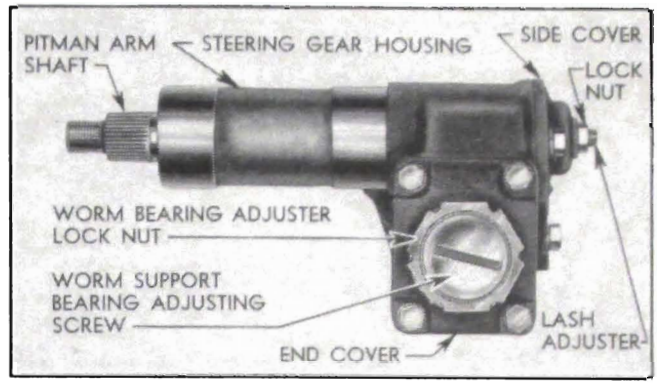


Fig. 9-3. Steering Gear Adjustment

3. **Remove worm shaft end-play.**

(a) Tighten four hex. head screws that hold **end cover** to **housing.** See Fig. 9-3.

(b) Loosen **worm adjuster lock nut.** Use wrench J-1592.

(c) Tighten **worm bearing adjuster,** using tool J-1593, until a slight load is felt on steering wheel when turning steering wheel near extreme positions. Use care when making this adjustment, to see that the **worm bearing adjuster** is not backed out far enough to permit bearings at end of the **steering worm** to get out of alignment with bearing race.

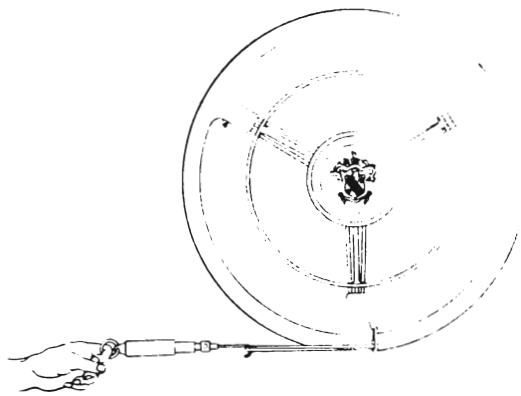
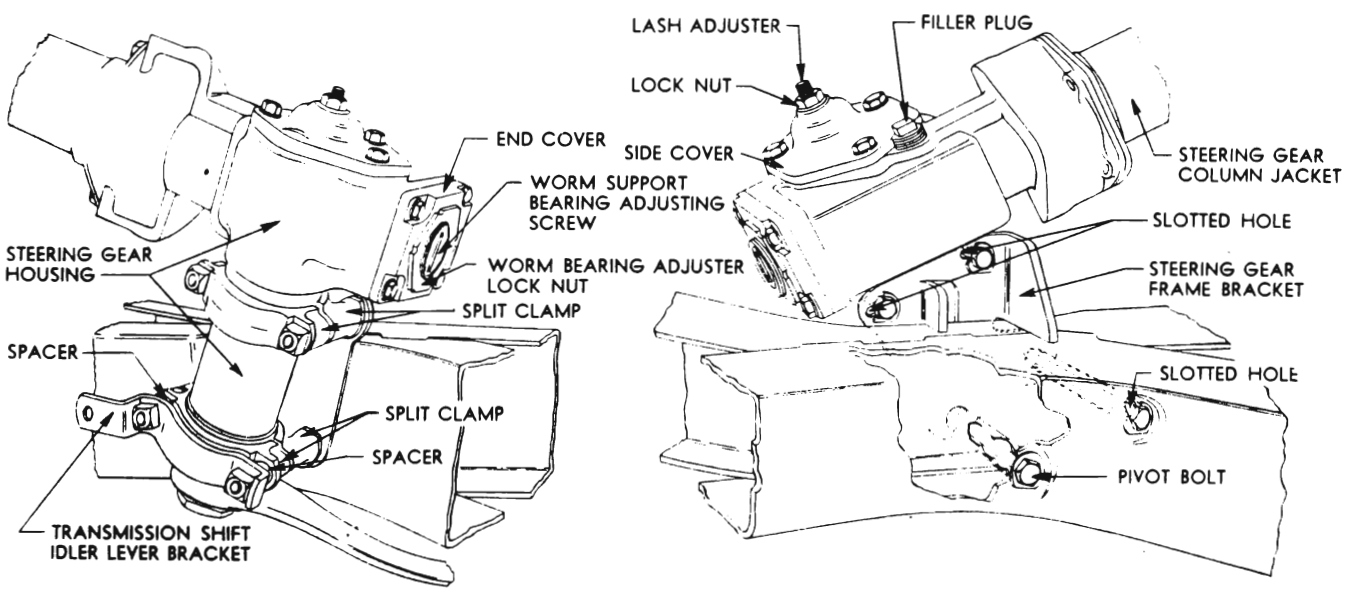


Fig. 9-4. Weighing Steering Adjustment



ROTATE HOUSING INSIDE SPLIT CLAMPS FOR SIDEWAYS ALIGNMENT

PIVOT BOLT AND 3 SLOTTED HOLES FOR VERTICAL ALIGNMENT

Fig. 9-5. Steering Gear Mounting

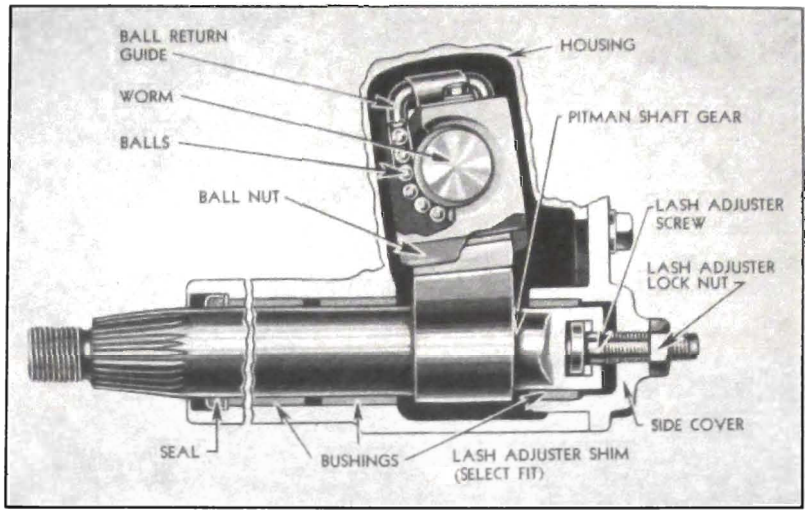


Fig. 9-6. Cross Section of Ball Nut and Pitman Arm Shaft

When this adjustment is completed and the **lock nut** tightened, the load on the **worm bearings** should be between 7/8 and 1 1/8 lbs., measured at the rim of the steering wheel with a spring scale. See Fig. 9-4. This check must be made with the gear turned to extreme ends just free of the stops.

4. **Remove backlash between ball nut and pitman shaft gear.**

(a) Tighten three hex. head screws holding **side cover** to **housing.**

(b) Center steering gear so that indented steering wheel spoke (small dent on underside near hub) is straight down and there is approximately same number of steering wheel turns to the right and left of this position.

(c) Loosen lash adjuster **lock nut.** See Figs. 9-3 and 9-6.

(d) Turn **lash adjuster** clockwise to reduce backlash or counter-clockwise to increase backlash.

(e) Rotate steering wheel to right and left to see if there are any tight spots. If so, it will be necessary to increase lash only enough to allow wheel to be turned through any spots without binding.

(f) Tighten **lock nut** securely. With gear properly adjusted, the load required to turn the gear through center position should be between 2 and 2 1/4 lbs., when measured at steering wheel rim. See Fig. 9-4.

(g) Check backlash with gear in center (or straight-ahead position) by feeling the pitman arm.

There should be no movement of pitman arm in this position.

If lash cannot be removed from center position, or if gear load varies greatly and feels rough, the gear should be removed and inspected for wear.

To remove pitman arm from the pitman arm shaft use puller J-1596. **Damage will result if pitman arm is driven or pried off shaft.**

Lubrication

The steering gears are filled at the factory with a special all-season steering gear lubricant. This lubricant is a light non-flowing lubricant that has a temperature range from extreme summer conditions to below zero without affecting the efficiency of the steering gear.

The steering gear should be checked twice each year and kept filled at all times with above lubricant. **Do not use a pressure fitting in filler plug hole when filling gears.**

Lubricant capacity of gears: See specifications.

Steering Wheel Removal

Remove horn button as outlined under "Horn Button" in Electrical Section. Back off steering wheel nut until top of nut is flush with top of steering tube. Use puller J-1120.

Steering wheel is located on steering tube with marks lined up as shown in Fig. 9-7.

CAUTION

Always have directional signal switch in *"off"* position whenever removing or replacing steering wheel.

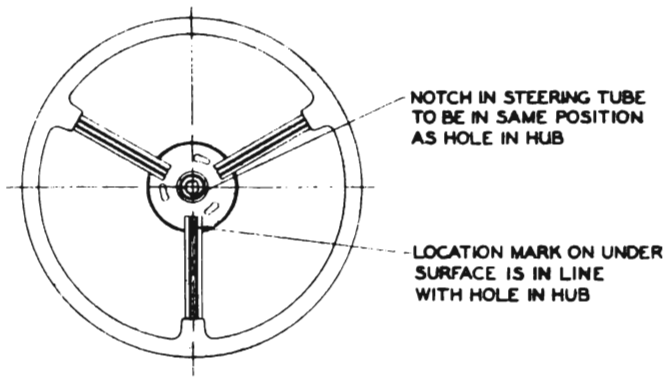


Fig. 9-7. Locating Steering Wheel Spoke

STEERING COLUMN BRACKET

Adjustment

All cars are built with steering column set to the highest position. Steering column may be lowered by loosening mounting bolts at frame bracket and instrument panel and shims added at instrument panel as shown in chart. New longer bolts are required when adding spacers. See Figs. 9-9 and 9-10. Tighten mounting bolts at frame bracket.

If steering column has been lowered, before replacing dash mat retainer, pack opening which remains with piece of jute filler to prevent under hood fumes from entering body.

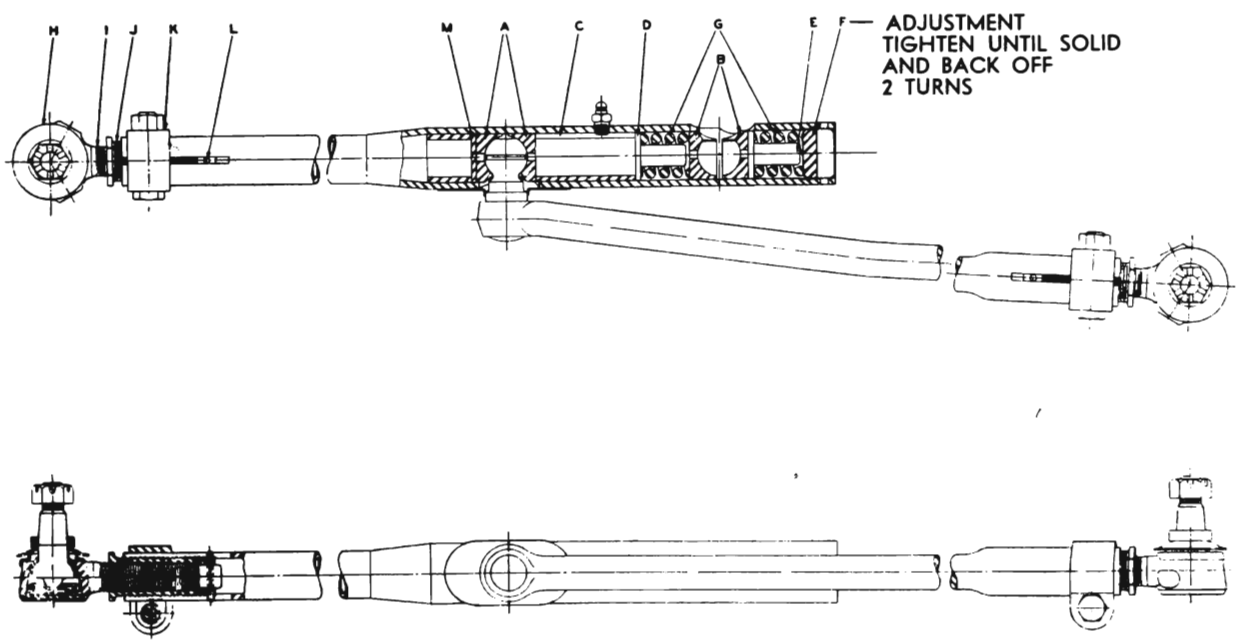


Fig. 9-8. Tie Rod and Steering Hook-Up—Series 60-70

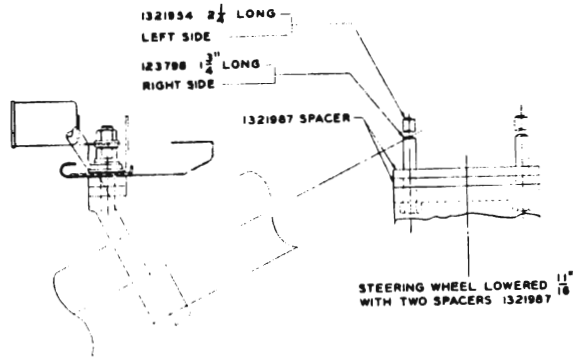


Fig. 9-9. Steering Column Bracket Adjustment—Series 40A

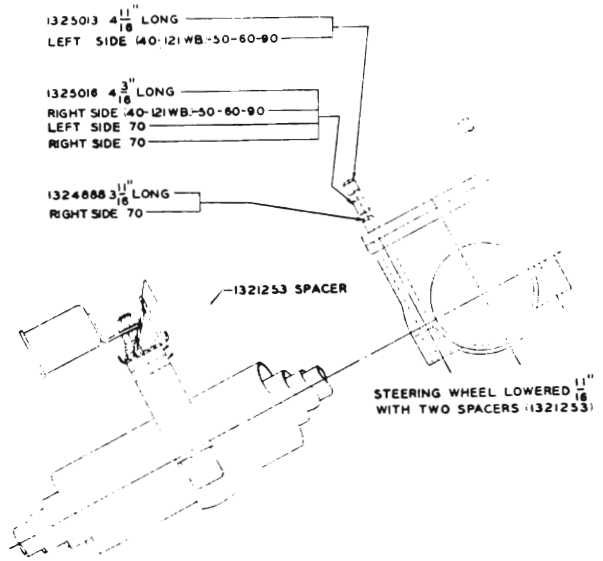


Fig. 9-10. Steering Column Bracket Adjustment—Series 40B-50-60-70-90

STEERING GEAR MAST JACKET

The lower end of steering gear mast jacket, where it mounts to the steering gear housing, is provided with a flat felt seal riveted to mast jacket to prevent air fumes and sound from engine being transmitted to driving compartment of body. See Fig. 7-8, "Transmission" Section.

TIE RODS

All Series

The tie rods are direct center point steering type. See Fig. 9-8.

Points "A" and "B" show the ball socket bearings. Bearing "A" carries intermediate point ball. One side of bearing is located against the washer "M." This washer prevents lubricant from filling up the entire tie rod tube.

A spacer "C" made of rolled stock, and located in position by the lubrication fitting, provides the correct spacing between the bearing "A" and pitman arm bearing spring stop "D." This rolled tube also serves as a lubrication reservoir. The stops "D" and "E" are of the conventional drag link type and act as guides for the springs "G," permitting the pitman arm ball to move through a restricted area and prevents bearing sockets "B" from falling off the pitman arm ball in the event of a spring breakage. The clearance between stops, "D" and "E," and bearings "B," is adjustment by tightening adjustment nut "F" in a clockwise direction until the nut stops, then **backing off the adjustment screw 2 complete turns.**

STEERING WHEEL SPOKE LOCATION AND TIE ROD ADJUSTMENT

All Series

Before adjusting tie rods or toe-in, set centering spoke of steering wheel in center downward position as shown in Fig. 9-7.

The adjustment mechanism for toe-in and centering the steering wheel third spoke is provided by the adjusting sleeve "J" at the outer end of each tie rod, and a locking clamp "K." This sleeve "J" is provided with an inside and outside thread, right-hand and left-hand, so that one turn of the adjusting sleeve is equal to two turns of a single screw. There is ¾" total adjustment provided at each end of the tie rod. The location of the ball sockets "H" in relationship to the pitman arm ball and intermediate point ball position is maintained by the pin "L," which is free to move in an inward and outward direction as governed by the slotted portion of the tie rod ends.

When adjustment is completed, centering spoke of steering wheel should be in downward position, wheels set straight ahead, and toe set correctly.

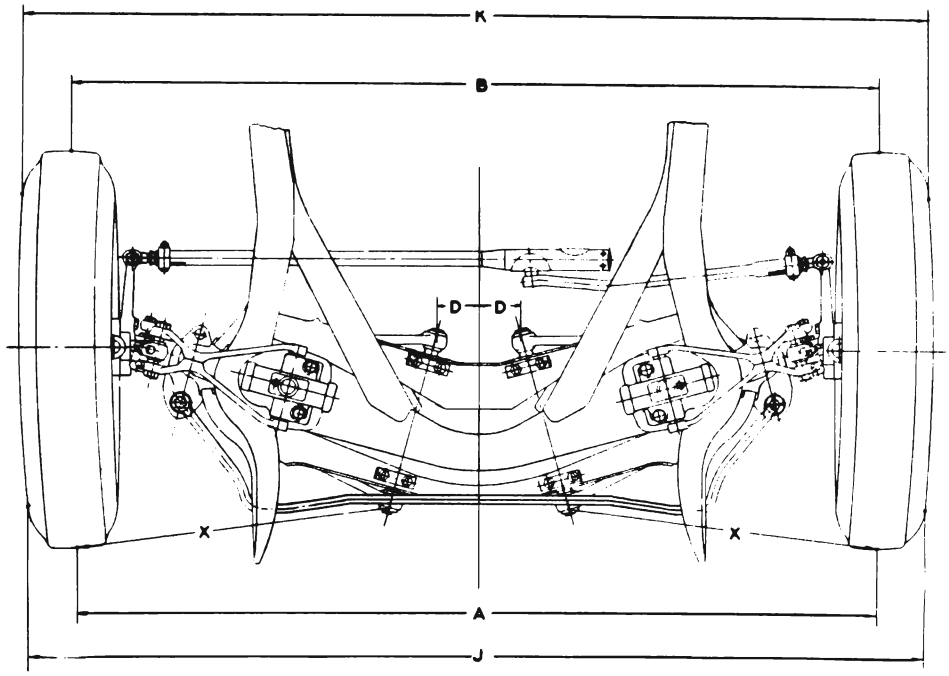


Fig. 9-11. Front Wheel Alignment

FRONT WHEEL ALIGNMENT

With the type of front suspension used, the toe-in adjustment is much more important than caster and camber setting, in so far as tire wear is concerned. **Close limits on caster and camber are beneficial to car handling but only require reasonable accuracy to provide normal tire life.**

Maintaining toe-in adjustment (see Fig. 9-11), proper tire pressures, and interchanging wheels and tires as outlined in "Wheel and Tire" section, will afford the maximum in tire wear.

Cars which are checked on front end machines because of tire wear will not be benefited materially by adjusting caster and camber. Caster and camber need not be changed unless visual inspection shows these settings to be out or unless the customer is experiencing poor car handling on the road.

Front suspension checks consisting of setting toe correctly, balancing all wheels and tires, interchanging wheels and tires, and inflating to proper pressures, will provide more improvement in car operation than will the usual caster, camber, and toe check as usually made on front end equipment.

• Toe, caster and camber should be checked
• individually and not collectively.

Rear Tires

1. Jack up rear wheels and rotate to check run-out of wheel and tire at side of tire. This should not exceed ⅛".
2. Check rear axle housing for straightness, by checking toe-in or toe-out and camber of rear wheels. Limits not to exceed ⅛" toe-in or ⅛" toe-out, or ⅛" camber and ⅛" reverse camber when measured at tire tread. To correct, it will be necessary to straighten or replace axle housing. Use rear axle housing alignment gauge J-1105. See "Rear Axle" section.

WHEEL AND TIRE BALANCE

See "Wheel and Tire" section.

DIMENSIONAL DRAWINGS

Drawings showing correct dimension of various steering parts which may be bent through accident, are incorporated in "Dimensional Drawings."

CURB WEIGHT

All checks for toe-in, caster angle, camber angle, king pin inclination and steering geometry should be made at curb height (no passengers, no load in car, extra tires in place,

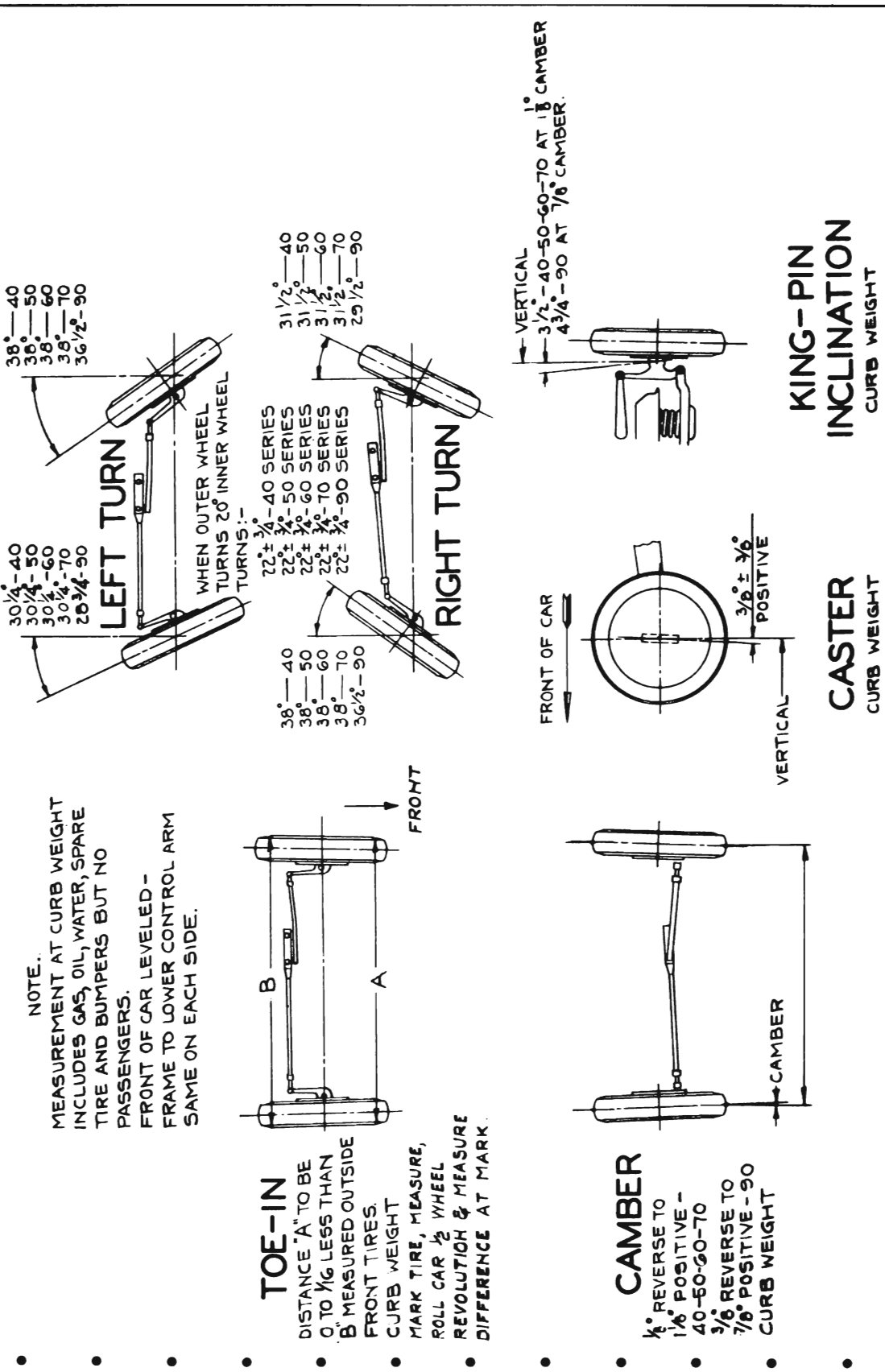


Fig. 9-12. Wheel Alignment and Specification Chart—All Series

and full of water, oil, and gas). The front tires should have approximately same wear and all tires inflated to correct operating pressures.

See "Tire Pressures" in Wheel and Tire Section.

Both front springs will be equally and correctly extended if car is curb weight, but may be checked according to the following curb height dimensions: (See Fig. 3-10, "Chassis Suspension")

		Dimension "A"
• Series 40-50-60-70:	Regular springs	3⅞"
•	Optional high springs	4⅛"
Series 90		4"

If the car leans to one side it may be caused by a spring, a stabilizer, or a frame condition.

When springs are not of the same free height add service shim washer to the low spring to make springs of equal height. These washers are ⅛" thick.

Shim washers should be placed above the top coil of spring.

Caster Angle Adjustment

Car must be on level surface and "curb weight."

There are machined "V" notches on each end of the steering knuckle bosses on all series. These notches provide means for measuring caster and camber when using tool J-1521. See Fig. 9-13. Lines on glass represent degrees.

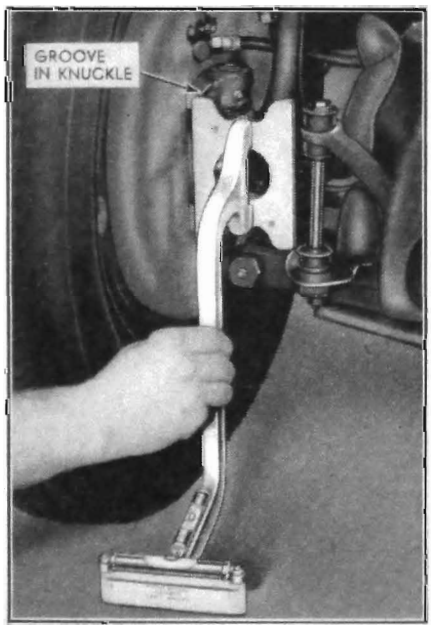


Fig. 9-13. Tool J-1521

All Series

(See Fig. 9-12)

Caster adjustment is at rear side of left shock absorber arm and front side of right shock absorber arm. This is result of front shock absorbers being interchangeable between the two sides. See Fig. 9-14.

(a) Jack up front wheels so that tires clear floor.

(b) Loosen clamp bolt on upper end of knuckle support.

(c) Remove lubrication fitting and with Allen wrench, tool J-720, adjust caster by turning threaded pin, moving the top of the knuckle support to the rear, increasing the caster angle. One-quarter turn of the threaded pin changes the caster angle one-quarter degree. Care must be used not to turn pin beyond threads and bind knuckle support against the side of the shock absorber assembly.

(d) Tighten knuckle support clamp bolt.

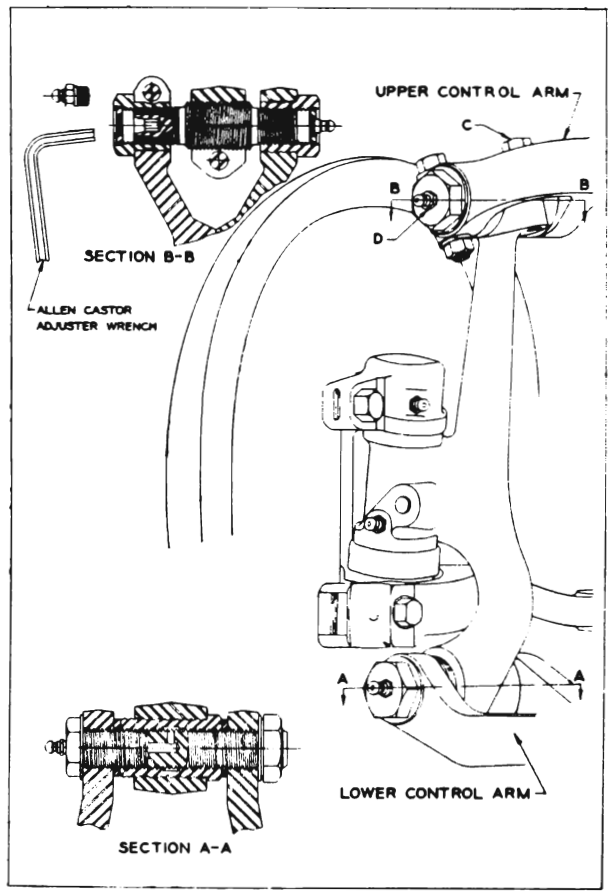


Fig. 9-14. Adjusting Caster Angle

(e) **Remove jack from front wheels before rechecking caster.** Any change greater than ¼ degree in caster will require checking of toe-in, because a change in caster will to some extent change toe-in.

Camber

Car must be on level surface and "curb weight."

If the frame dimensions check as given in "Frame" section, and Front Suspension parts check according to limits in "Dimensional Drawing" section, camber setting will automatically come within the limits given below. Therefore, no camber adjustment is provided. See Fig. 9-12.

A special upper control arm eccentric pivot pin is available for use on all series under **Group 6.178, Part No. 231760,** to be used where camber corrections are desired. This eccentric pin should be used only to correct slight errors.

When checking camber angles, it is very important that the car be leveled sidewise, that tires are of the same diameter, with wear approximately equal, and *springs equally and correctly extended.*

Machined "V" notches on steering knuckles on all series are for the purpose of measuring caster and camber. Clean dirt from these surfaces and hold tool J-1521 in "V" notches to make readings. Lines on glass represent degrees. See Fig. 9-13.

Camber is proportional to the height of the front springs.

Series 40-50-60-70 Regular springs should check ⅛° Reverse to 1⅛° Positive.

Series 40-50-60-70 Optional high springs should check ⅛° Positive to 1⅜° Positive.

Series 90 Regular springs, ⅜° Reverse to ⅞° Positive.

Other reliable methods of checking camber angle can be used. When equipment is used which checks camber against the tire or wheel felloe, it is of course essential that the tires and wheels be checked for "run-out" and two points selected which have no run-out or which lay in the same plane.

Regardless of what equipment is used, *all looseness* must be removed from the *front wheel bearings* before checking.

Knuckle—Check for Straightness

Place car on level surface.

Use tool J-1521 to measure camber in regular way using "V" notches in knuckle to take measurement. See Fig. 9-13.

Remove dust cap and bearing cap from front wheel bearing hub.

Using above tool place same against machined surface of bearing hub. See Fig. 9-15.

Read camber on caster gauge part of tool. If both readings taken are not the same it indicates that knuckle is bent.

King Pin Inclination

This is the in-and-out inclination of the axis of the king pin with respect to the longitudinal vertical plane.

When checking this angle, it is very important that the car be leveled sidewise, that the tires are of the same diameter, with wear approximately equal, and the springs correctly extended.

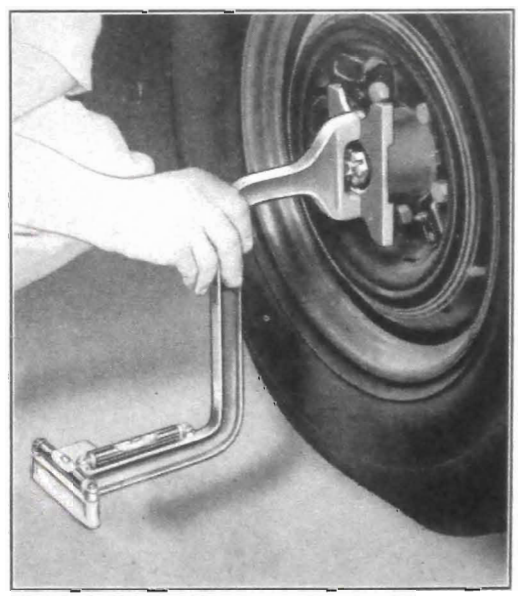


Fig. 9-15. Tool J-1521

Toe-In Adjustment

Check toe-in at curb weight dimensions. Before checking toe-in of front wheels roll car

ahead at least one full revolution of wheel with normal load on tires. Check rear dimension first, mark tire at dimension point. Roll car ahead one-half revolution or until same mark may be used for checking the front dimension.

An accurate check can be made by jacking up the wheels, rotating and scribing a fine line near the center of the tread. With the tires on the floor, and the front springs correctly extended, the distance from line to line can be measured with a steel tape and the difference of "A" from "B" will be the amount of toe. See Fig. 9-12.

To increase toe-in: Lengthen the rods. Turn the wrench toward the rear on both rods.

All Series

⅛ turn on adjusting sleeve on each side changes toe $\frac{1}{32}$"
¼ turn on adjusting sleeve on each side changes toe $\frac{5}{64}$"
⅜ turn on adjusting sleeve on each side changes toe ⅛"
½ turn on adjusting sleeve on each side changes toe $\frac{5}{32}$"

IMPORTANT

Both rods should be adjusted same amount when changing toe in order to maintain proper relation between front wheels and proper steering wheel spoke location. See "Tie Rod Adjustment."

Steering Geometry on Turns

Correctness of steering geometry depends on location of the steering arm balls and location of pitman arm balls.

When the outside wheel is turned to an angle of 20 degrees, the inside wheel should set at the following angles:

Series	Inside Wheel Angle	Allowable Error
40	22°	¾°
50	...	...
60	22°	¾°
70	...	...
90	22°	¾°

Front Wheel Stops

All series wheel stops are not adjustable.

STEERING SPECIFICATIONS

ITEMS	SERIES 40-A	SERIES 40-B	SERIES 50	SERIES 60	SERIES 70	SERIES 90
STEERING GEAR						
Make	Saginaw	Saginaw	Saginaw	Saginaw	Saginaw	Saginaw
Type	←Ball Bearing Worm and Nut→		←Ball Bearing Worm and Nut→		←Ball Bearing Worm and Nut→	
Ratio—Actual	19.8 to 1	19.8 to 1	19.8 to 1	19.8 to 1	19.8 to 1	23.6 to 1
Lubrication	←——Grease Through Plug——→		←——Grease Through Plug——→		←——Grease Through Plug——→	
Oil Capacity	15 oz.	15 oz.	15 oz.	15 oz.	15 oz.	15 oz.
Center of Gear to Top of Wh. Rim	50"	50"	50"	54 5/16"	54 5/16"	54 5/16"
Diameter of Sector Shaft Bearing	1 1/8"	1 1/8"	1 1/8"	1 1/8"	1 1/8"	1 1/4"
Distance between Centers of Worm and Roller Shaft	2 1/4"	2 1/4"	2 1/4"	2 1/4"	2 1/4"	2 1/2"
Steering Shaft Diameter	13/16"	13/16"	13/16"	13/16"	13/16"	13/16"
Steering Jacket Diameter	2 3/8"	2 3/8"	2 3/8"	2 3/8"	2 3/8"	2 3/8"
Steering Wheel Make	←———Inland Mfg. Co.———→		←———Inland Mfg. Co.———→		←———Inland Mfg. Co.———→	
Steering Wheel Diameter	18"	18"	18"	18"	18"	18"
Steering Wheel Type	Rubber with steel core on Series 40; banjo type with steel spokes on Series 50-60-70-90.					
Optional Steering Wheel	Banjo type with steel spokes on Series 40.					
Steering Post Bracket Adjustment	Down	Down	Down	Down	Down	Down
Turning Radius—						
Outer Wheel (Left Turn)	30 1/4 Deg.	30 1/4 Deg.	30 1/4 Deg.	30 1/4 Deg.	30 1/4 Deg.	28 3/4 Deg.
Inner Wheel (Left Turn)	38 Deg.	38 Deg.	38 Deg.	38 Deg.	38 Deg.	36 1/2 Deg.
Outer Wheel (Right Turn)	31 1/2 Deg.	31 1/2 Deg.	31 1/2 Deg.	31 1/2 Deg.	31 1/2 Deg.	29 1/2 Deg.
Inner Wheel (Right Turn)	38 Deg.	38 Deg.	38 Deg.	38 Deg.	38 Deg.	36 1/2 Deg.
Turning Circle Diameter—Ft. Rt.	——	——	——	——	——	——
Turning Circle Diameter—Ft. Lt.	——	——	——	——	——	——
No. of Turns of Wheel—Lt. to Rt.	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	——
Toe-in at Outside of Tire (in.)	0 to 1/16	0 to 1/16	0 to 1/16	0 to 1/16	0 to 1/16	0 to 1/16
Toe-in at Inner Edge of Tire (in.)	0 to 1/16	0 to 1/16	0 to 1/16	0 to 1/16	0 to 1/16	0 to 1/16
Caster—Degrees	Pos. 3/8±3/8	Pos. 3/8±3/8	Pos. 3/8±3/8	Pos. 3/8±3/8	Pos. 3/8±3/8	Pos. 3/8±3/8
Crosswise Inclination of King Pin	Series 40-50-60-70—3 1/2° at 1 1/8° Camber; Series 90—4 3/4° at 7/8° Camber.					
Camber—Degrees	Series 40-50-60-70—1/8 Reverse to 1 1/8 Positive; Series 90—3/8 Reverse to 7/8 Positive.					