

TM 9-4910-681-14&P

TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT
AND GENERAL SUPPORT MAINTENANCE
MANUAL INCLUDING REPAIR PARTS LIST

FOR

INDICATOR, WHEEL ALIGNMENT
MODEL AR-41
(BEAR MANUFACTURING CORPORATION)
NSN 4910-00-221-2472

H E A D Q U A R T E R S , D E P A R T M E N T O F T H E A R M Y

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REPORTING OF ERRORS

You can improve this manual by recommending improvements using DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2, located in the back of this manual. Mail your form direct to: Commander, US Army Armament Materiel Readiness Command, ATTN: DRSAR-MAS, Rock Island, IL 61299. A reply will be furnished direct to you.

NOTE

This manual is published for the purpose of identifying an authorized commercial manual for the use of the personnel to whom this indicator is issued.

Manufactured by: Bear Manufacturing Corp.
Rock Island, IL 61201

Procured under Contract No: DAAA09-77-C-6292

This technical manual is an authentication of the manufacturers' commercial literature and does not conform with the format and content specified in AR 3103, Military Publications. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

INSTRUCTIONS FOR REQUISITIONING PARTS

NOT IDENTIFIED BY NSN

When requisitioning parts not identified by National Stock Number, it is mandatory that the following information be furnished the supply officer.

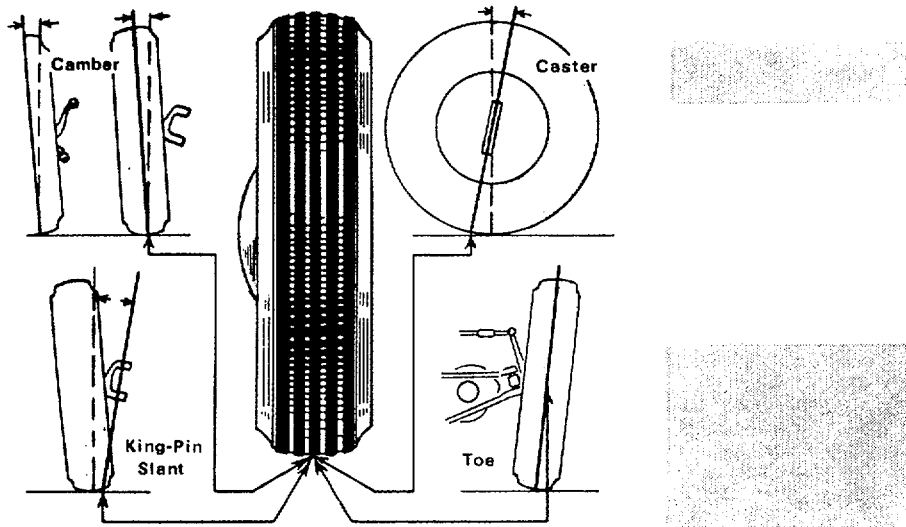
- 1 - Manufacturer's Federal Supply Code Number - 06365
- 2 - Manufacturer's Part Number exactly as listed herein.
- 3 - Nomenclature exactly as listed herein, including dimensions, if necessary.
- 4 - Manufacturer's Model Number - Model AR-41
- 5 - Manufacturer's Serial Number (End Item)
- 6 - Any other information such as Type, Frame Number, and Electrical Characteristics, if applicable.
- 7 - If DD Form 1348 is used, fill in all blocks except 4, 5, 6, and Remarks field in accordance with AR 725-50.

Complete Form as Follows:

- (a) In blocks 4, 5, 6, list manufacturer's Federal Supply Code Number - 06365 followed by a colon and manufacturer's Part Number for the repair part.
- (b) Complete Remarks field as follows:
Noun: (nomenclature of repair part)
For: NSN: 4910-00-221-2472
Manufacturer: Bear Manufacturing Corp.

Model: AR-41
Serial: (of end item)

Any other pertinent information such as Frame Number, Type, Dimensions, etc.



JOB ORD. 3105761

WHEEL ALIGNMENT

CHECKING PROCEDURES

FOR USE WITH AR-41

Issued especially for use by

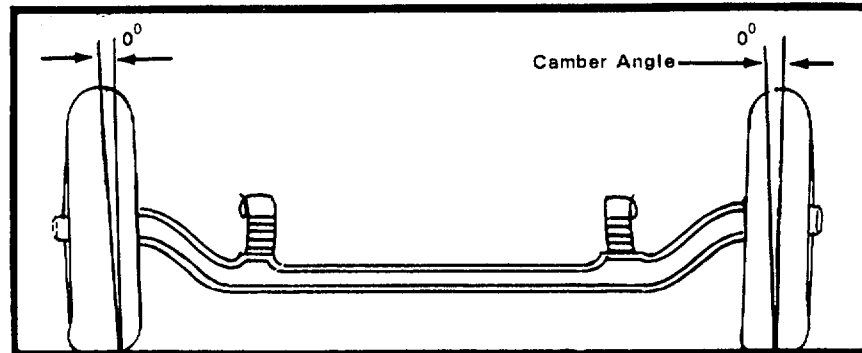
DEPARTMENT OF DEFENSE

Motorized Equipment Maintenance Personnel

What is WHEEL ALIGNMENT ?

Wheel Alignment is the correct positioning of the vehicle's front wheels and steering mechanism to give the greatest possible ease in steering and freedom from abnormal or excessive tire wear.

WHEEL ALIGNMENT ANGLES



WHAT IS CAMBER?

Camber is the term used to designate the inward or outward tilt of the wheel at the top. If the wheel is straight up and down, you have zero (0°) or no camber. Outward tilt of the wheel at the top from zero (0°), away from the engine, is known as positive camber. Inward tilt of the wheel at the top from zero (0°), toward the engine, is known as negative camber.

Camber is measured in degrees and may be corrected to the vehicle manufacturer's specifications. Its purposes are:

1. To bring the road contact of the tire more nearly under the point of load.
2. To provide easy steering by having the weight of the vehicle borne by the inner wheel bearing and spindle.
3. To prevent tire wear.

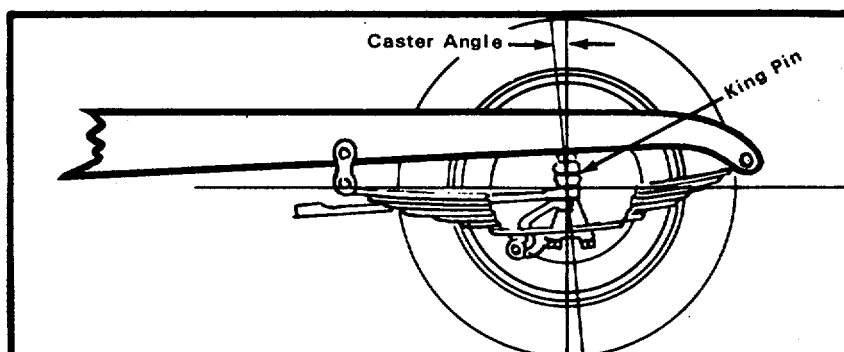
TOO MUCH CAMBER, negative or positive, causes

SMOOTH TIRE WEAR on one side of tire tread.

UNEQUAL CAMBER causes

PULLING TO ONE SIDE

WHEEL ALIGNMENT ANGLES



WHAT IS CASTER?

Caster is the backward or forward tilt of the king pin or spindle-support arm (ball joint) at the top. Backward tilt of the king pin at the top from straight up and down (zero) is positive caster, as illustrated above. Forward tilt of the king pin at the top is negative caster. Caster is measured in degrees and may be corrected to the vehicle manufacturer's specifications.

The caster of a vehicle is similar to the front fork of a bicycle.

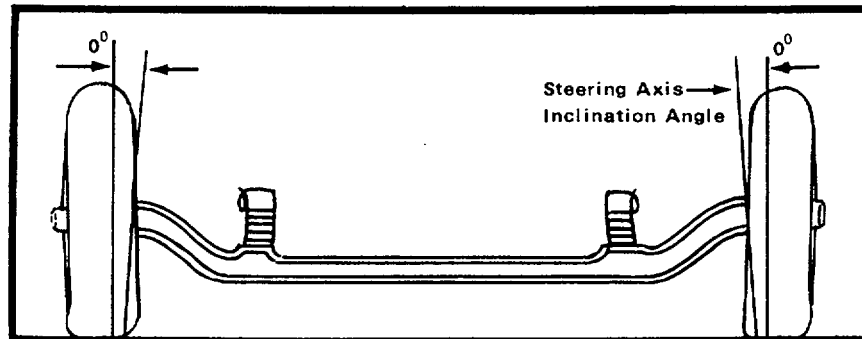
A line drawn through the king pin strikes the road just ahead of the road contact of the tire, thus holding to a straight ahead course.

NOT ENOUGH CASTER causes
WANDER OR WEAVE

TOO MUCH CASTER causes
SHIMMY at LOW SPEEDS and HARD STEERING

UNEQUAL CASTER causes
PULLING TO ONE SIDE

WHEEL ALIGNMENT ANGLES



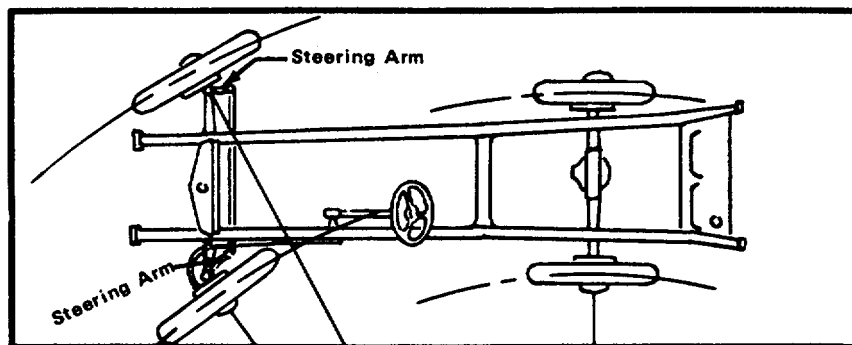
WHAT IS STEERING AXIS INCLINATION?

Steering Axis Inclination is the term used to designate the inward tilt of the king pin or spindle support arm (Ball Joint) at the top. It is a directional control angle and is non-adjustable as determined by the fixed relationship of the spindle, steering knuckle or spindle-support arm. Steering axis inclination does not change except when one or more of these parts become bent.

The purposes of Steering Axis Inclination are:

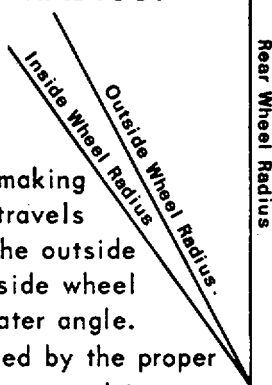
1. To reduce the need for excessive camber.
2. To distribute the weight of the vehicle more nearly under the road contact of the tire.
3. To provide a pivot point about which the wheel will turn producing easy steering.

WHEEL ALIGNMENT ANGLES



WHAT IS TURNING RADIUS?

Turning radius provides wheel alignment on turns. When a vehicle is making a turn, the inside wheel travels in a smaller circle than the outside wheel. Therefore, the inside wheel turns sharper, or at a greater angle. Turning radius is controlled by the proper position of the steering arms and is non-adjustable. Proper turning radius permits both inside and outside wheels to follow their correct alignment and roll freely, without scuff, on the turns.

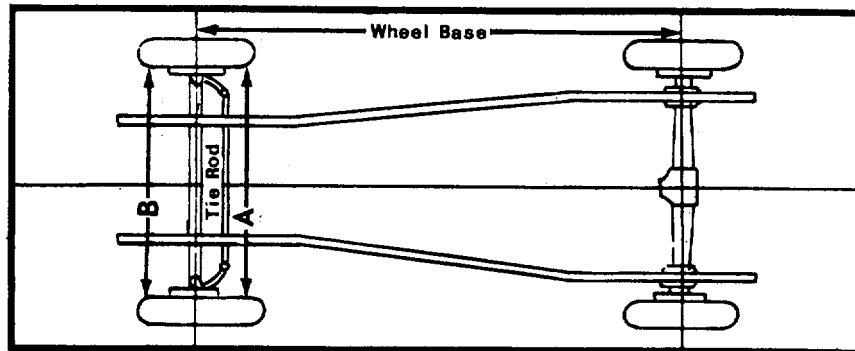


For this reason, turning radius will be correct when the other alignment angles are correct, except when a steering arm is bent.

EFFECTS OF INCORRECT TURNING RADIUS:

1. Excessive scuff wear of tires on turns.
2. Squealing of tires on turns, even at low speeds.

WHEEL ALIGNMENT ANGLES



WHAT IS TOE-IN?

Toe-in is the distance the front of the front wheels (line B) is closer together than the rear of the front wheels (line A). See above illustration. Toe-in is a necessary factor to correct against side friction or scuff of the tire.

Toe-out is the distance the front of the front wheels is farther apart than the rear of the front wheels.

The toe-in angle is the last of the alignment angles to be adjusted in any wheel alignment operation. It is adjusted by turning the tie rod adjusting sleeve(s) until the measurement taken at the front of the wheels complies with vehicle manufacturer's specifications.

INCORRECT TOE-IN causes

1. EXCESSIVE SCUFF TIRE WEAR
2. WANDER OR WEAVE

PRELIMINARY PROCEDURE

To obtain satisfactory results, the following steps should be taken before attempting to check Camber, Caster, Steering Axis Inclination, Turning Radius or Toe-in.

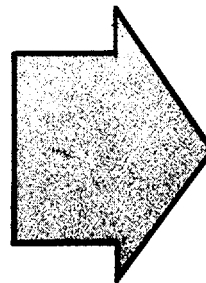
1. Inflate all tires to correct air pressure. Also check condition of tires at this time.
2. Visually check for sagged or broken springs. Check operation of shock absorbers.
3. Jack front end of vehicle and check for loose front wheel bearings, ball joints or king pin bushings.
4. Check tie rod ends, steering linkages and steering gear for looseness.
5. Check front spring U-bolts. Tighten if necessary.
6. Check for loose spring shackles.
7. Check to be sure steering gear is on hi-point position when front wheels are in straight-ahead position.

Note: All loose or worn suspension and steering parts, including wheel bearings, should be adjusted or replaced before checking or setting wheel alignment angles.

**COMPLETE CHECKING PROCEDURE OF
WHEEL ALIGNMENT FACTORS WITH**

**WHEEL ALIGNMENT KIT
AR-41 (Fig. 1)**

APPEAR ON THE FOLLOWING PAGES



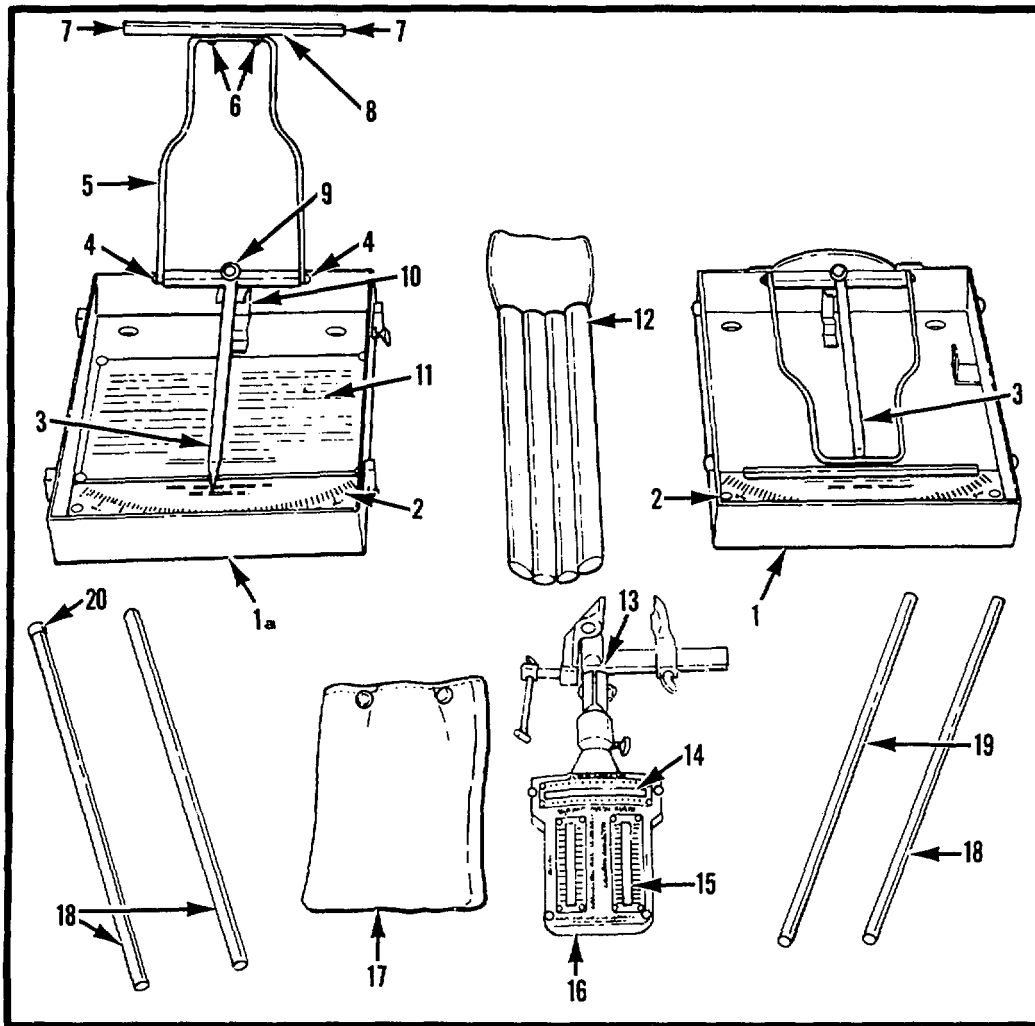


Figure 1.

IMPORTANT Order replacement parts, when needed, by name and number shown below. If levels become broken in camber-caster-king pin gauge (No. 15), return complete gauge to manufacturer for repair.

Ref.	Part		
No.	No.	Part Name	Qty.
1.	50695	Turning Radius Gauge Box (Bottom)	1
1a.	50696	Turning Radius Gauge Box (top)	1
2.	3399	Turning Radius Dial	2
3.	M-961	Turning Radius Pointer Ass'y	2
4.	M-958	Turning Radius Pointer Screw	4
5.	M-962	Turning Radius Yoke	2
6.	9989	Turning Radius Rod Screws	5
7.	9988	Turning Radius Rod Set Screws	4
8.	M-963	Turning Radius Yoke Rod	2
9.	9820	Turning Radius Pointer Acorn Nut	2
10.	M-957	Turning Radius Pivot Stud	2
11.	50697	Instruction Plate	2
12.	M-982	Turning Radius Rod Holder	1
13.	18341	Camber-Caster-King Pin Gauge Clamp Ass'y	1
14.	18171	Camber-Caster Steering Axis Cover Plate	1
15.	18169	Camber-Caster-King Pin Gauge Body Ass'y	1
16.	18170	Camber-Caster-King Pin Gauge Body Casting	1
17.	50702	Camber-Caster-King Pin Gauge Protective Bag	1
18.	M-964	Turning Radius Rod Extension (Plain)	3
19.	M-965	Turning Radius Rod Extension (Grooved)	1
20.	M-966	Toe-in Pointer Clip	1

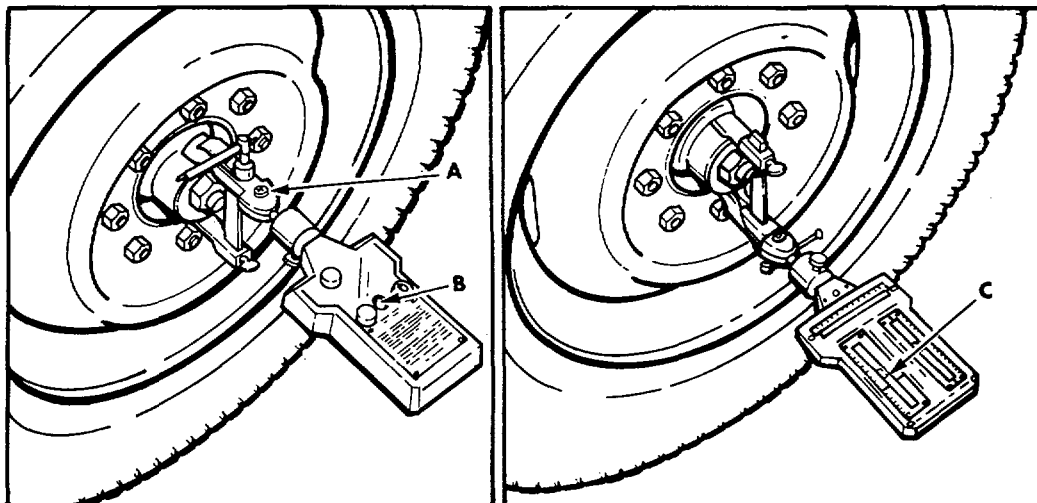


Figure 2.

Figure 3.

CAMBER CHECKING PROCEDURES

- Step 1. Place vehicle in level position if possible.
- Step 2. Roll vehicle forward at least three feet to force wheels into normal driving position.
- Step 3. Attach Camber-Caster-King-Pin gauge to wheel (either a lug nut or hub). Dial face down, with clamp in vertical position. See Fig. 2
- Step 4. Adjust gauge by means of ball joint, A, Fig. 2 until square with wheel and until level, B, Fig. 2 is centered.
- Step 5. Roll vehicle forward to rotate wheel 180° to bring Dial face up.
- Step 6. Read Camber on Camber scale located to the right of spirit level bubble inner scale, C, Fig. 3. Positive camber is indicated when bubble rests toward the vehicle, "+" sign on dial. Negative camber is indicated when bubble rests away from the vehicle, "-" sign on dial. Each graduation mark is 1/2 degree. 1/4 and 1/8 degree may be easily determined.
- Step 7. Repeat same procedure for opposite wheel. Refer to vehicle manufacturer's specifications for correct settings.

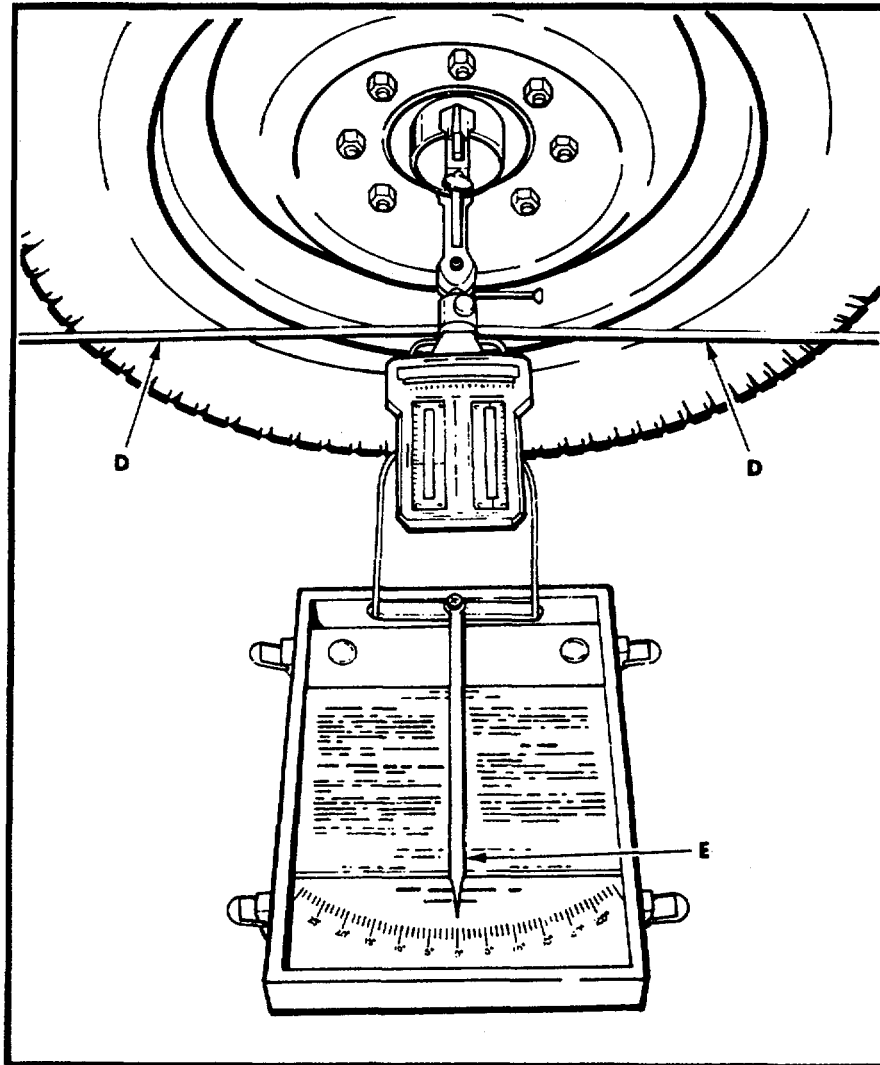


Figure 4.

**CHECKING PROCEDURES FOR CASTER, STEERING
AXIS AND TURNING RADIUS ANGLES
(These checks may be made simultaneously)**

- Step 1. Place front wheels in straight ahead position. Attach Camber-Caster-King Pin gauge firmly to Wheel Spindle or hub, face up.
- Step 2. Place Turning Radius Gauge Boxes one against each front wheel as shown in Fig. 4 Be sure Turning Radius Yoke Rods, D, Fig. 4 are leaning firmly against tires.

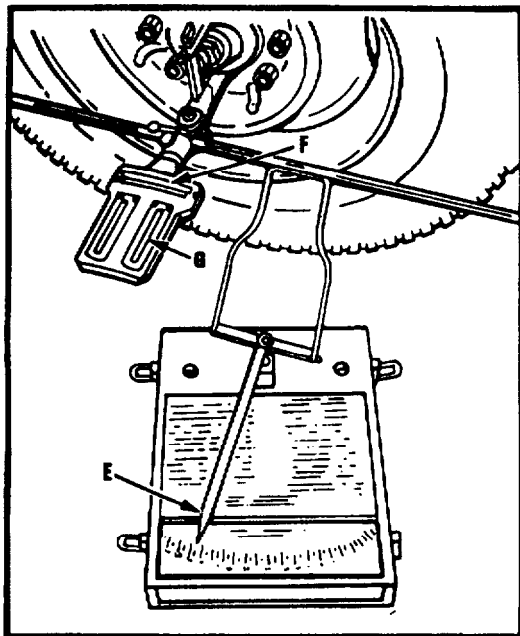


Figure 5.

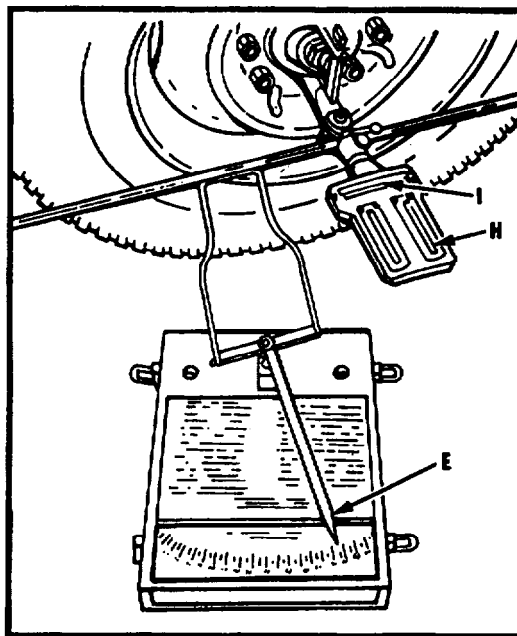


Figure 6.

- Step 3. Adjust Turning Radius Gauge Box (at each wheel) until Turning Radius Pointers, E, Fig. 4, read directly on zero of scale.
- Step 4. Apply brakes to prevent wheels from rolling. Starting with left wheel, swing front of wheel inward until pointer, E, Fig. 5, reads 20° . Go to right front wheel and read its turning radius scale. Turning radius for right wheel should be greater than 20° . Refer to vehicle manufacturers specifications.
- Step 5. On left wheel, adjust camber-caster-king pin gauge until it is square with wheel and steering axis inclination bubble, F, Fig. 5 is at zero on dial. Adjust caster level until bubble, G, Fig. 5 is at caster zero.
- Step 6. Swing front of left wheel outward, all the way, until turning radius pointer, E, Fig. 6 reads 20° in opposite direction. (From 20° in to 20° out).
- Step 7. Now read caster angle on caster scale, H, Fig. 6. Positive caster is indicated if bubble has moved from zero toward wheel. Negative caster is the opposite.
- Step 8. Read steering axis inclination angle on steering axis inclination dial, I, Fig. 6
- Step 9. Transfer Camber-Caster-King Pin gauge to right wheel and attach as previously directed. Swing front of right wheel inward 20° . Go to left front wheel and read turning radius for left wheel.
- Step 10. Adjust gauge and zero steering axis inclination and caster bubbles as directed above. Then, swing front of right wheel outward, thru 40° , to 20° on turning radius scale. Now read both caster and steering axis inclination angles as before.

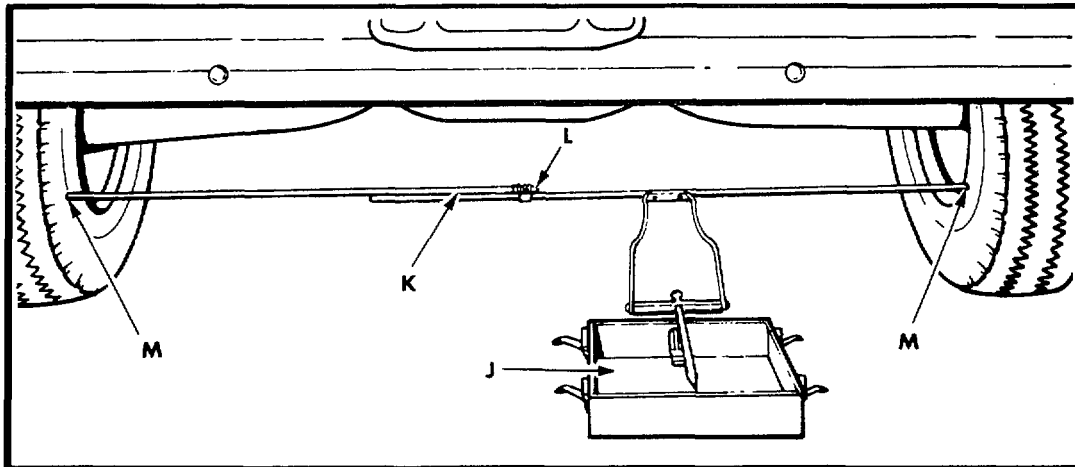


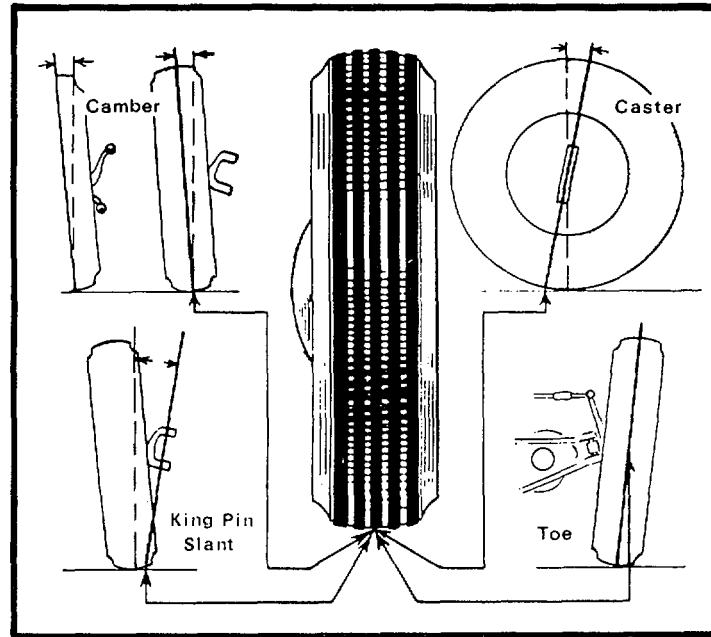
Figure 7.

TOE-IN CHECKING PROCEDURES

- Step 1. Place one of the Turning Radius Gauge Boxes, J, Fig. 7, between the tires at front of vehicle with rod end touching inside of one tire at about hub height.
- Step 2. Use rod with graduated grooves as a loose piece. Slide spring clip over stationary rod, K, Fig. 7
- Step 3. Assemble the other two turning radius gauge rods. Place end of loose rod against opposite tire. Slide clip until one edge registers with center groove, L, Fig. 7 while holding rods parallel and together.
- Step 4. Mark tires at point of rod contacts, M, Fig. 7 and remove gauge box and rods.
- Step 5. Roll vehicle forward until tire marks are at same height from ground in the rear. Place gauge box and rods in the rear as they were in front.
- Step 6. Now measure distance between tires at marks in the same manner. Edge of clip position shows difference in front and rear measurements. Each groove from center toward end represents 1/8 inch toe-in. Toe-out is indicated in opposite direction from center groove.

NOTE

Check Camber, Caster, Steering Axis Inclination, Turning Radius and Toe-In readings obtained against vehicle manufacturer's specifications. Make corrections where necessary and always recheck final settings.



By Order of the Secretary of the Army:

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The Adjutant General

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INDICATOR, WHEEL ALIGNMENT - APRIL 1980

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