OAKLAND SERVICE SHOP MANUAL

1932 Supplement to Section One

FRONT AXLE

This Supplement contains full Information and Specifications for the 1932 Pontiac V-8 and Pontiac 6 not included in the 1931 Edition of the "Oakland Service Shop Manual." Specifications not listed herein are the same as for 1931 and will be found in the 1931 Supplement of the "Oakland Service Shop Manual."

Insert this supplement in the "Oakland Service Shop Manual" following the 1931 supplement to Section 1

FRONT AXLE

The front axle I beam on both the 1932 Pontiac V-8 and Pontiac 6 has a jack lug forged on the under side of the drop at either end of the I beam. This will permit placing a jack under this lug when the tire has been deflated to the point where it becomes impossible to place the jack in the normal position under the axle.

**Front Axle Specifications—
1932 Pontiac V-8**

Caster Angle................1½° to 2½°
Camber..........................1¾°
Toe-in (8″ from ground).........0″ to $\frac{1}{16}$″
King-pin Inclination...............9½°

**Front Axle Specifications—
1932 Pontiac 6**

Caster Angle................1½° to 2½°
Camber..........................1½°
Toe-in (8″ from ground).........0″ to $\frac{1}{16}$″
King-pin Inclination...............7° 10′

Dimensional layouts for the front axle and steering mechanism will be found in Section 1 of the 1931 edition of the Oakland Service Shop Manual.

FRONT WHEEL ALIGNMENT

In the past few years it has become necessary for the service man to readjust his understanding of the various factors underlying front wheel alignment. The fine balance built into the modern automobile through precision methods in manufacture makes absolutely necessary a thorough knowledge on the part of every service man of just what constitutes a correct adjustment of the front axle and steering mechanism. When a car owner complains of front wheel shimmy, of tire cupping or scuffing, of tramping or of wandering, the service man must know that these difficulties may result from a combination of several misadjustments, all of which must be considered if the trouble is to be corrected. Front wheel alignment is a complex subject, but it is the aim of this text to present a simple discussion which will enable the service man to recognize and adjust difficulties arising from incorrect alignment of front wheels.

The present Pontiac 6 and V-8, as well as previous models of Oaklands and Pontiacs, will perform in a highly satisfactory manner providing the front axle and steering specifications are held within the limits specified by the factory. The chief difficulty experienced in the average dealer's shop results from the lack of necessary equipment for checking these specifications. The equipment mentioned herein has been found most satisfactory in recognizing and correcting front axle misalignment and is priced within reach of all dealers.

Before attempting a discussion of wheel alignment it is necessary that all service men have a uniform understanding of the various terms used. Following are definitions of the fundamental factors underlying front wheel alignment:

CAMBER—The amount in degrees that the front wheels lean outward at the top.

TOE-IN—The adjustment whereby the distance between the front wheels is greater at the rear than at the front.

CASTER—The amount in degrees that the top of the king-pin is tilted toward the rear of the car.

KING-PIN INCLINATION—The amount in degrees that the top of the king-pin leans toward the center of the car.

STEERING ARM ANGLE (Toe-Out or Steering Gometry)—Angle in degrees at which the steering arms point towards the center of the car and which holds the front wheels in proper relative alignment when the wheels are turned right or left.

The Reason for Caster

Caster is designed into the front axle for the sole purpose of securing easy steering by preventing the car from wandering. An excellent example of this is the casters used on furniture. These casters have a king-pin so designed that the force applied tends to lead the wheels, and should the force be so applied that the king-pin is *behind* the wheel, the caster action immediately swings the wheel around so that it follows the king-pin. In the automobile, the king-pin is inclined with the top toward the rear, so that the center line projected will strike the road just in front of the contact point of the tire.

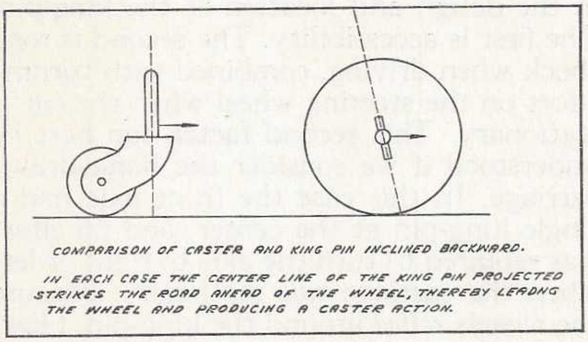

Illustration 32-1-1

This produces the same caster action mentioned above, the wheel showing the same tendency to follow the king-pin.

The Reason for Camber

The chief reason for camber is to reduce the stress on the king-pin and to direct the thrust or load on the wheel towards the large or inner wheel bearing. The former contributes towards easy steering and the latter towards long bearing life. However, camber alone, without some compensating adjustment, produces tire wear. This can best be explained by considering the extreme camber condition shown in the illustration. Here the tire has flattened on the road at an angle to the center line of the wheel, which has resulted in a condition which is equivalent to three wheels of different diameters running side by side. The center "wheel" is the tire diameter; the outside "wheel" is less than the tire diameter, while the inside "wheel" has the greatest diameter. The inside wheel therefore has a tendency to travel a greater distance in one complete revolution than the center wheel, while the outside wheel would travel a lesser distance if this were possible. The result is excessive friction between the tire and the pavement and is a cause of tire scuffing and cupping.

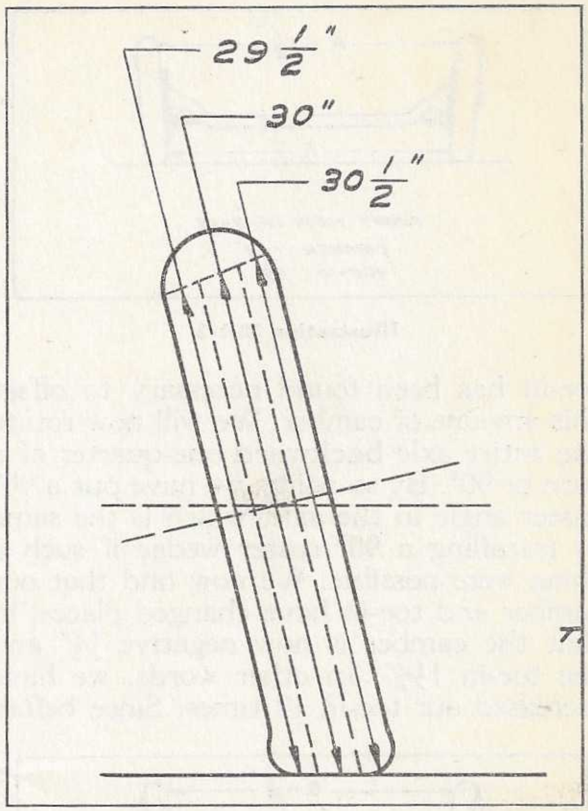

Illustration 32-1-2. Theoretical Three Wheels Produced by Camber

The Reason for Toe-in

The entire reason for toe-in is to offset the effects of camber. In the foregoing paragraph, where the theoretical three wheels were rolling side by side, the tendency of the front wheel as a whole will be to roll outward towards the side of the least diameter. This can be offset by setting the wheel to roll slightly towards the side of the greatest diameter—or by putting in toe-in; and the greater the amount of camber in a wheel, the greater the amount of toe-in necessary to offset it.

The Relation of Caster to Camber and Toe-in

It should be remembered that **for every camber there is a definite toe-in.** Now let us assume that we have a front axle alone with the front wheels assembled to it. To make the illustration definite, we will further assume that we have a camber which measures a difference of $1\frac{1}{2}''$ in the distance between the wheels at top and bottom. Let us say that, by experiment, $\frac{1}{8}''$

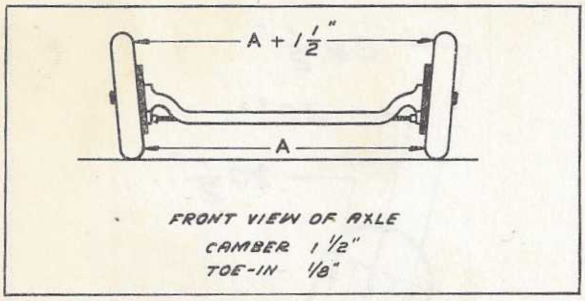

Illustration 32-1-3

toe-in has been found necessary to offset this amount of camber. We will now rotate the entire axle **backward** one-quarter of a turn or 90°. By so doing, we have put a 90° caster angle in the axle, which is the same as installing a 90° caster wedge if such a thing were possible. We now find that our camber and toe-in have changed places, in that the camber is now negative ⅛″ and the toe-in 1½″. In other words, we have increased our toe-in 12 times. Since before

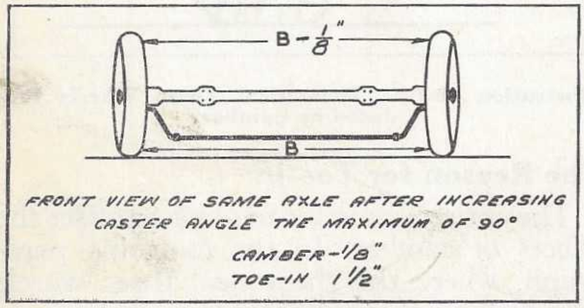

Illustration 32-1-4

rotating the axle, we found that ⅛″ toe-in corrected 1½″ of camber, and since by rotating the axle we have increased the toe-in 12 times, making it 1½″, it is only logical to suppose that this amount of toe-in will correct a 12 times greater camber, which in this case would be 18″.

Of course, such an extreme camber in a car does not exist. However, the above illustration clearly proves that we cannot change the caster angle without considering the effect this will have on camber and toe-in. As a result, when installing caster wedges, the following fact must be remembered. **Changing the castor angle has a definite effect on the camber.** Whenever the caster angle is adjusted, a check must be made of the toe-in to insure its conforming with the change in camber. The use of caster wedges should be limited to **bringing the caster angle to that specified by the factory,** then see that both the camber and toe-in meet factory specifications. If, with the proper caster angle, the camber does not meet specifications, the axle should be realigned or replaced.

The Reason for King-pin Inclination

Two distinct factors must be considered in the design and location of the king-pin. The first is accessibility. The second is road shock when driving, combined with turning effort on the steering wheel when the car is stationary. This second factor can best be understood if we consider the horse-drawn carriage. In this case the front axle had a single king-pin at the center, and no effort was required to turn the axle to right or left when the carriage was stationary, because the wheels *rolled* around the king-pin. However, when under way, considerable road shock was experienced when either front wheel struck a bump, as indicated by the shafts jerking from side to side. On an automobile, the ideal condition for *least road shock* would be vertical king-pins set directly above the center line of the tires. Such a construction would present the condition of greatest tire friction with the car stationary, necessitating considerable turning effort on the steering wheel, since there would be no rolling action of the wheels on the bearings. This would also make the king-pin inaccessible. It has been found that if the king-pin is so placed that the center line projected strikes the road about 1″ inside the center line of the tire, the turning effort at the steering wheel is greatly reduced, while the road shock remains negligible.

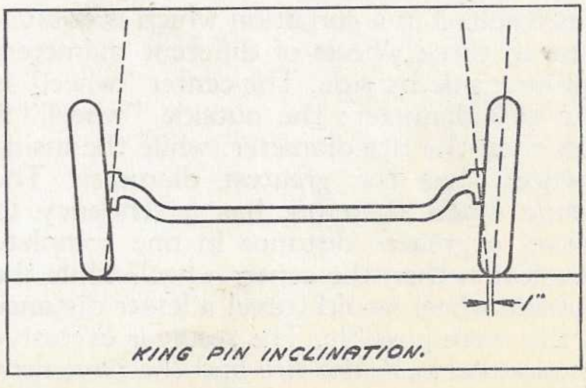

Illustration 32-1-5

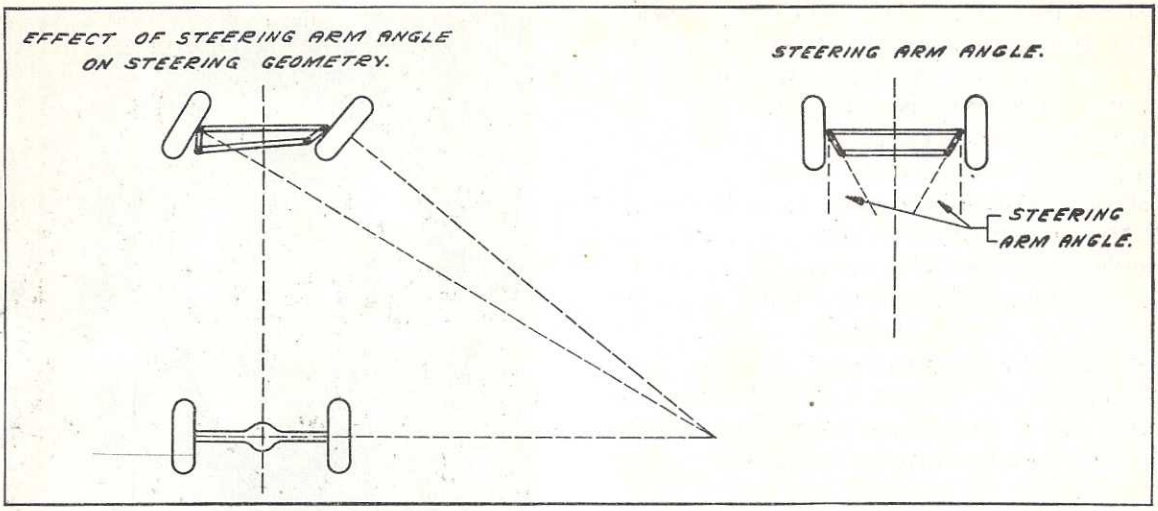

Illustration 32-1-6

Accordingly the designers have placed the king-pin far enough away from the wheel to make it accessible, but have **inclined** it so that the center line projected strikes the road at a point approximately 1″ inside the center line of the tire.

The Reason for Steering Arm Angle

The need for steering arm angle can best be understood by studying the illustration. In order to reduce tire wear, it is essential that both front wheels and the rear wheels roll around the same center in making a turn.

In making a right turn, the left wheel describes a larger circle and is behind the right wheel, so that it must not be turned at such an acute angle as the right wheel. For this reason, the steering arms are pointed toward the center of the car at the proper angle to give the least tendency for the front wheels to slip relative to each other in making a turn.

Checking Front Wheel Alignment

Before starting the check-up on front wheel alignment, the service man must first satisfy himself that all related factors and adjustments are satisfactory. The following procedure is recommended:

1. See that all four tires are inflated to the correct pressure.

2. Jack up front axle and see that both wheels and rims run true within ⅛″. At the same time, test wheels for balance. If seriously out of balance, the cause should be determined and corrected.

3. Test for looseness in front wheel bearings, king-pins and tie rod. There must not be more than $\frac{1}{16}$″ total play in wheels or tie rod.

4. See that both front and rear axles are in correct position on spring saddles and that all U bolts are tight. Also check for sheared spring center bolts.

5. See that springs are not sagged and that there is equal deflection between both front springs.

6. Check shock absorbers for uniform tension.

7. Adjust steering gear. See that entire unit is in good condition and shows no excess wear or binding.

8. Remove any equipment which is not standard and which will in any way affect the front axle alignment or operation.

Checking Camber

Before attempting to check camber, it is essential that the front axle be absolutely level to insure accuracy. Both front and rear wheels should be on a floor which is level to within ⅛″. In leveling the front axle, use the 3-way Camber and Caster Gauge with one V-point attachment at either end of the bar. Set them the proper distance apart so that each V-point comes in contact with the bottom of a front spring close to the axle. The spirit level in the tool handle will indicate whether or not the axle is level. Pieces of stiff cardboard may be placed under the tires until the axle is level.

caster or forward tilt of the king-pin. Should the front reading be minus or below zero the readings must be added to secure the caster angle. For example:

Left Wheel

Back Reading....3°
Front Reading..—1°
Caster.......4°

Checking Toe-in

After the caster angle has been corrected and the camber checked and corrected *if necessary*, the proper amount of toe-in should be put in the front wheels. It must be remembered that there is a definite toe-in for every camber, since the toe-in is put in for the specific purpose of offsetting the effects of camber. The toe-in is checked on the 3-Way Wheel Aligner, commonly called the Wee-Gee Board, as follows: With all wheels approximately in line, grasp the center of the bumper and pull the car slowly over the center of the Wee-Gee Board. If

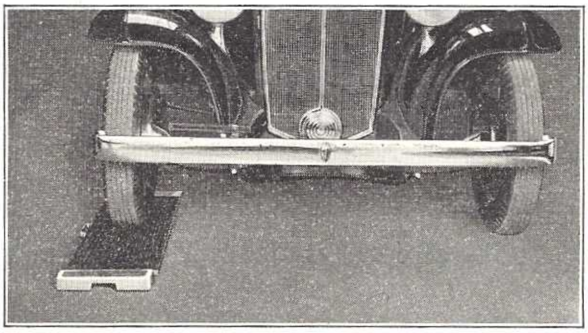

Illustration 32-1-9. Checking Toe-in with Wee-Gee Board

the indicator arrow moves *toward* the center of the vehicle the wheels toe out. If the indicator arrow moves *away* from the center of the vehicle the wheels toe in. Shorten the tie rod if the wheels have toe-in. Lengthen the tie rod if the wheels show toe-out. The indicator arrow must not move over ½ a graduation in either direction in this test. The ideal condition is to have it remain stationary. If the aligner reading is not the same on both front wheels it is an indication that the caster is not the same at each axle end.

Checking Steering Arm Angle or Steering Geometry

The Wee-Gee Board is also used for checking steering arm angle. The toe-in should first be checked and corrected in the straight ahead position. Turn the wheels approximately 15° to the right. Place the Wee-Gee Board in front of the left or outside wheel in the direction of wheel travel and pull the car forward so that the wheel travels slowly across the center of the Board. The arrow

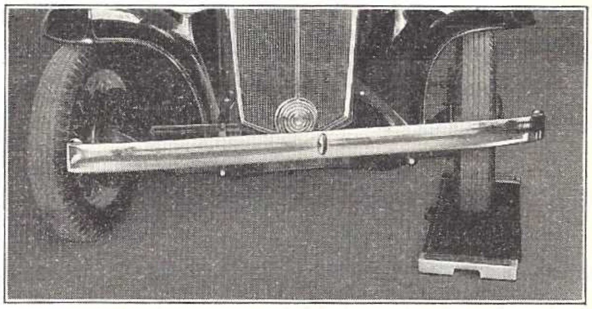

Illustration 32-1-10. Checking Steering Geometry—Right Turn

should not move in either direction from zero more than ½ a graduation. This checks the steering arm on the RIGHT knuckle. Now turn the wheels the same degree to the left and repeat the operation with the right wheel on the Board. This checks the steering arm on the LEFT knuckle. If

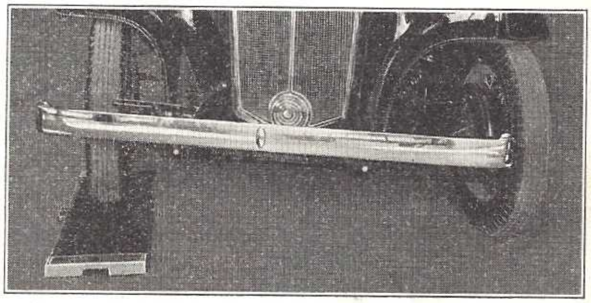

Illustration 32-1-11. Checking Steering Geometry—Left Turn

the indicator arm moves *toward* the center of the vehicle, we may say that the *wheels are toed out too much on the turns*. If the arrow moves *away* from the center of the car it indicates that the wheels *are not toed out enough on the turns*. A balanced error in steering geometry is preferable to having the turn register perfect in one direction and out in the other.

Shimmy. Causes and Remedies

1. Tires underinflated. Inflate to recommended pressure.

2. Wheel and tire assembly out of balance. Bring to proper balance.

3. Loose front wheel bearings. Adjust properly. (Usually occurs at low speeds.)

4. Loose steering connections. Improperly adjusted steering gear. (See Section 11 of 1930 Oakland Service Shop Manual.)

5. Safety plug in drag link bottoming on ball cup. Grind $\frac{1}{32}''$ off end of safety plug.

6. Badly worn king-pin or bushings. Rebush and replace pins if necessary.

7. Too much caster. Use caster wedges to bring to proper specifications.

8. Unequal caster. Caster must be the same within limits on both ends of the axle.

9. Side play in front spring shackles. Adjust shackles or install new rubber bushings.

10. Too much camber. Generally the result of a bent front axle. Replace axle.

Wandering—Diving—Darting. Causes and Remedies

1. Improperly adjusted steering gear. Adjust.

2. Insufficient or negative caster. Bring caster angle within specified limits.

3. Unequal caster. Caster angle must be the same within limits on both ends of axle.

4. Incorrect toe-in. Correct toe-in with Wee-Gee Board.

5. Insufficient camber. Re-align or replace axle.

6. Loose wheel bearings. Adjust.

Tramping. Causes and Remedies

1. Low tire pressure on one or both front wheels. Raise to specified pressure.

2. Front wheels out of balance. Bring to proper balance.

3. Unequal operation of shock absorbers. Check Ride Control linkages. (See Section 10 of 1932 Oakland Service Shop Manual.)

Cupping or Uneven Wear on Tires. Causes and Remedies

1. Low tire pressure. Raise to proper pressure.

2. Incorrect caster or camber. Correct, or install new front axle I beam if necessary.

3. Incorrect relation of toe-in to camber. Use Wee-Gee Board to correct toe-in.

4. Incorrect steering geometry. Use Wee-Gee Board to correct. Replace arms if necessary.

Hunting. Causes and Remedies

1. Excessive caster. Reduce caster angle.