

Front Axle Alignment

Steering Gear and Spring Suspension

The spring suspension are all important factors in obtaining proper handling of an automobile. Because of their relation in this respect they should all be treated together in service operations. The servicing of these units will be divided into four sections as follows:

Section 1. Disassembly, repair and reassembly of front axle.

Section 2. Removal, disassembly, reassembly and installation of springs and stabilizer.

Section 3. Disassembly, repair, reassembly and adjustment of steering gear

2. Pry off front wheel outer and inner hub caps, pull spindle nut cotter keys.

3. Remove spindle nuts, spindle washer, outer bearing cage and front wheels and brake drum assemblies.

4. Remove nuts from four bolts holding brake backing plate to spindles.

5. Remove brake backing plates and hang on fender supports with hooks made from heavy wire.

6. Remove cotter keys from inner ends of bolts (78) which attach torque arms (76) to frame brackets

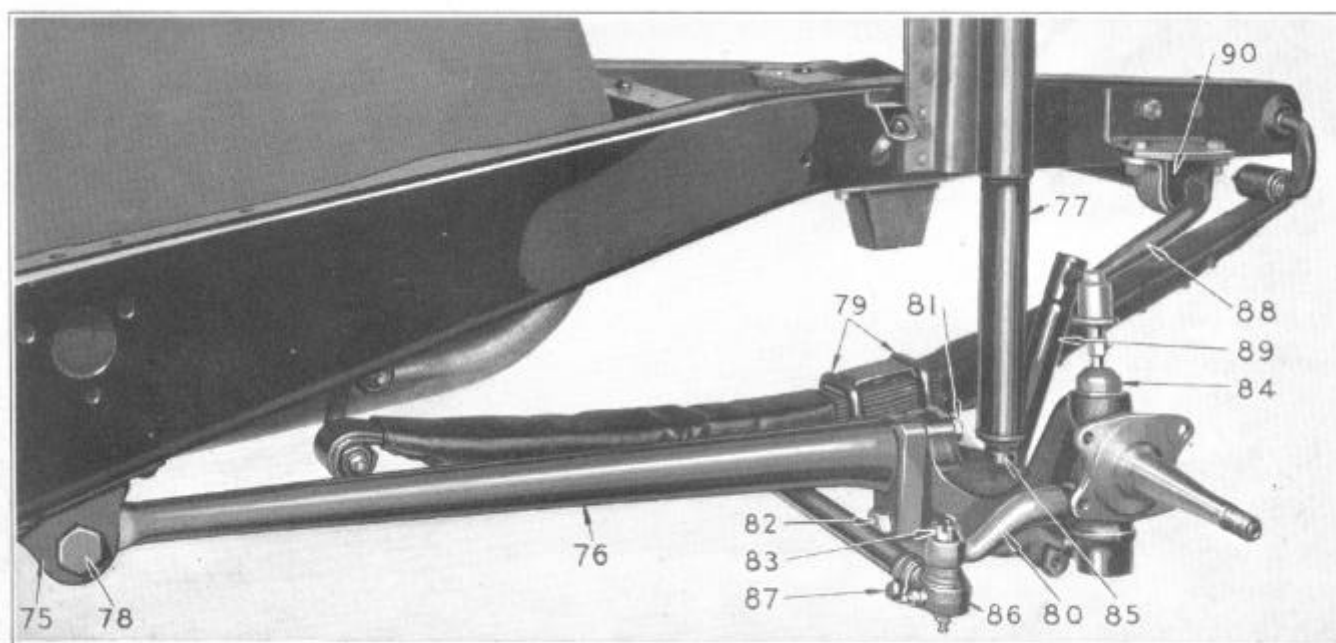


Figure 8

Section 4. Front wheel alignment and steering corrections.

Sections 1, 2 and 3 deal with the operations pertaining to the units individually, while Section 4 deals with the inter-related effects and final adjustment for correct steering and roadability.

SECTION 1 FRONT AXLE

Removal of Front Axle

1. Jack up front of car with a roller jack under the front axle and place two stand jacks under the frame side rail just back of the torque arm frame brackets. Lower roller jack until car weight is held on stand jacks but leave roller jack in place to support front axle.

(75), remove nuts and press out bolts, using press J-885, Figure 2.

NOTE: Due to the rubber grommets clinging to the bolt a constant pressure is required to remove the bolt.

7. Remove nuts, grommet seats and grommets (85) from bottom shock absorber mounting studs.

8. Remove cotter key from front end of drag link, unscrew plug, remove ball seat and remove drag link from steering arm.

9. Remove nuts from spring U bolts (79) (4 each side) and remove stabilizer plates and spring seat caps.

10. Lower roller jack until axle is clear of spring and remove axle assembly from under car.

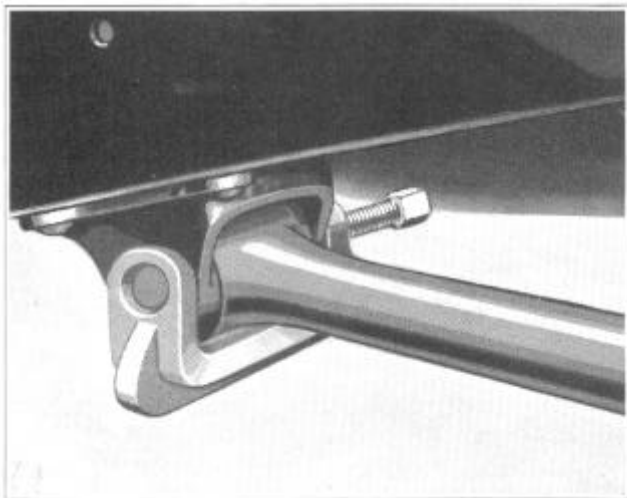


Figure 2

REBUILDING FRONT AXLE

Replacement of Spindle Pins and Bushings

NOTE: It is not necessary to remove the axle from under the car for this operation. This can be done by proceeding as follows either with the axle removed from the car or after operations 1 to 5 inclusive under removal of front axle. The special tools required are shown in Figure 3.

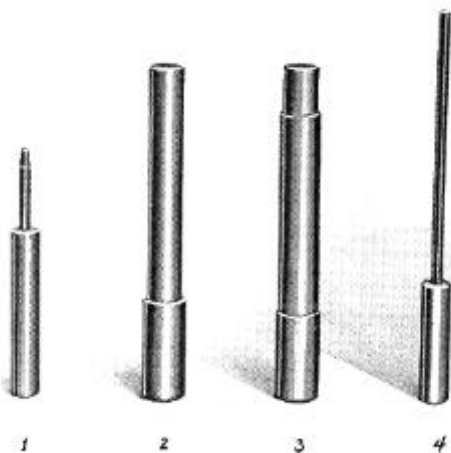


Figure 3

11. Remove tie rod and stud nuts (83, Figure 1), and disconnect tie rod from right and left steering arms.

12. Remove the cotter keys and nuts from the front ends of the steering arms (80, Figure 1) and remove the arms from the spindles.

13. Remove the oilers from the top of the pivot pin upper bushing (84, Figure 1).

14. Insert driver J-479-1 (1-Figure 3) through hole in upper bushing and drive spindle pin down, forcing out expansion plug at bottom of spindle,

then insert driver J-479-2 (4-Figure 3) and drive pivot pin out.

NOTE: Remove spindle pin carefully so that the five ball bearings are not lost.

15. Support the axle end solidly and drive upper bushing out with a copper hammer.

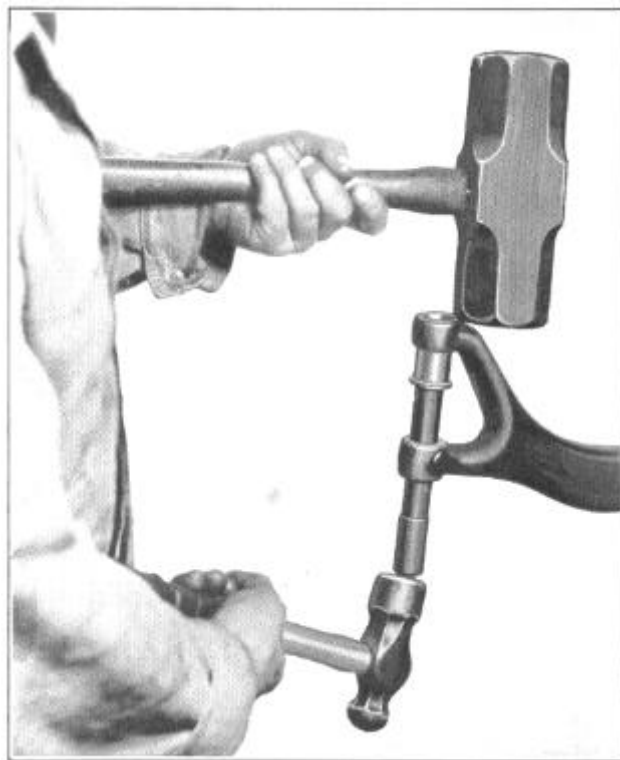


Figure 4

16. Insert driver J-469-2 (3-Figure 3) into lower bushing and drive it out.



Figure 5

17. Install new upper bushing, using driver J-469-2 (3-Figure 3) as shown in Figure 4. The top of the axle center yoke must be well supported.

18. Install new lower bushing, using driver J-469-1 (2-Figure 3), as shown in Figure 5.

NOTE: The bushings are hardened and ground and require no reaming after being put in place. Lubricate inside of bushings and top of spindle pin with viscous grease before inserting spindle pin.

19. Put the spindle in place with sufficient shims under it to give an end play of .006 to .010 and insert spindle pin from bottom about $\frac{3}{4}$ of the way with the keyway in line with the keyway in the steering arm home in the spindle.

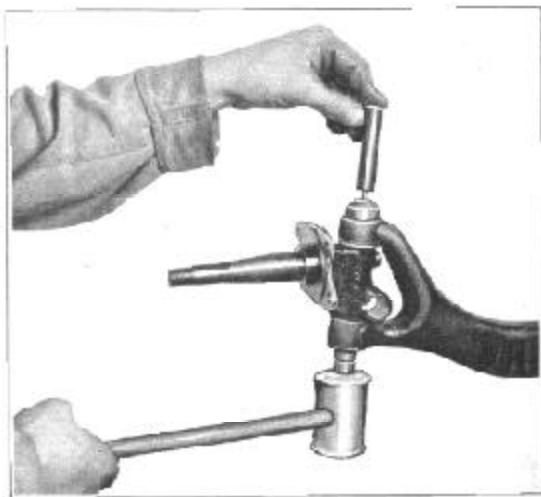


Figure 6

NOTE: This measurement must be taken without the seal in the groove in the top of the spindle (See Figure 7.)

20. Drop 5 new ball bearings through the pressure fitting hole in the top bushing and insert driver J-479-1 as shown in Figure 6 to insure keeping the balls on their race and drive the pin in until the keyways line up.

21. Assemble the steering arms to the spindle with keys and nuts. Tighten nuts securely and insert cotter keys.

NOTE: Spindles must turn free without perceptible drag.

22. Install expansion plugs in bottom of spindles.

23. Reinstall tie rod.

NOTE: The tie rod ends should be free enough to permit the stud to be turned by grasping it with the hand. Replace worn or tight tie rod ends with new ones. After the tie rod has been installed a pressure of from 3 to 5 pounds applied to the ball of the left hand steering arm should turn the spindles. If greater effort

than this is required, steering will be hard and an excess amount of caster may be required to overcome this drag to prevent car wander.

Installation of Front Axle

24. Put axle assembly on roller jack and roll into position under car.

25. Lubricate the upper and lower halves of the spring seat, put upper halves in place on axle and raise axle into position under springs.

26. Put spring U bolts, lower halves of spring seats and stabilizer link lower plates in place and install nuts on U bolts (79-Figure 1).

NOTE: Before installing jam nuts on U bolts lift rear end of torque arm. It should fall slowly under its own weight. Readjust U bolt nuts if necessary. Tight spring seat bearing will restrict spring action and cause hard riding, while with loose bearings the proper axle alignment cannot be held.

27. Dip rubber grommets in gasoline and insert two in eye of each torque arm, and drive bracket bolts (78) through bracket (75) and grommets. Install nuts and insert cotter keys.

28. Connect drag link to steering arm and connect shock absorbers.

29. Install brake backing plates.

30. Lubricate the bearings of each wheel with 4 ounces of bearing grease and install wheel and brake drum assemblies and hub caps.

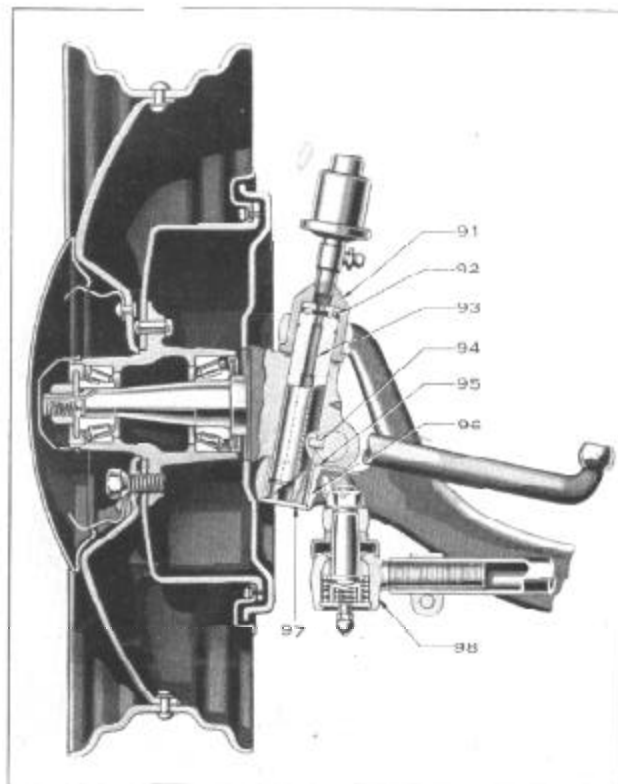


Figure 6

NOTE: The axle must now be checked for caster, toe-in and steering geometry. This is covered in Section 4.

SECTION 2—SPRINGS AND STABILIZER

Removal of Springs (front or rear)

The axle (front or rear) should be supported on a roller jack, while the chassis frame side rails should be supported on stand jacks.

31. Remove nuts from U bolts (79-Figure 1.)
32. Disconnect lower end of shock absorbers.
33. Raise or lower roller jack until axle is free of spring.
34. Unscrew frame bracket threaded bushing at front and rear of spring and remove spring from under car.

Disassembly of Spring

35. Clamp spring in vise so that center bolt is just outside of vise jaw.
36. Unscrew shackle threaded bushing.
37. Cut spring leaf clips and remove.
38. Remove center bolt nut and bolt.
39. Open vise and disassemble spring.

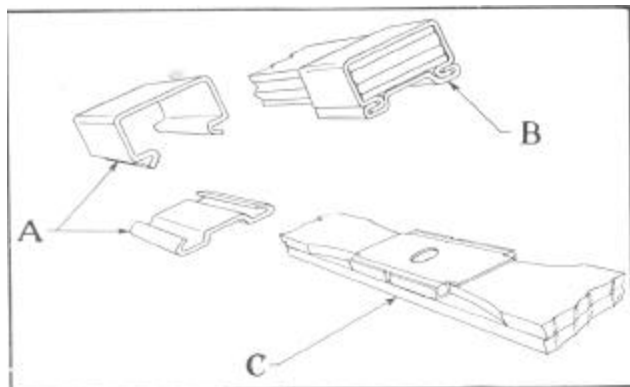


Figure 8

Assembly of Spring

NOTE: The second leaf of the front springs is made in two pieces. The outer end of each piece is formed around the eye of the main leaf, while the inner ends of each are guided by a plate (Sketch C), Figure 8, through which the center bolt passes. This plate should be assembled between the second and third leaves with the flanges upward to guide the inner ends of the second leaf.

40. Lubricate leaves with viscous grease and assemble in proper order with a piece of $\frac{1}{4}$ " rod passing through the center bolt hole of each leaf. Clamp in vise and draw leaves together, aligning them as the vise is tightened.

NOTE: The rear end of front and rear springs is the long end measured from the center bolt hole to the center of the spring eye. The rebound leaf of the rear spring is assembled to the rear. All leaves which are not equal length from the center bolt hole to both ends are assembled with the long end to the long end of the assembled spring.

41. Insert center bolt and tighten nut

42. Put service spring clips (Sketch A), Figure 8, over spring leaves from top and slide clip cover in place on bottom (Sketch B), Figure 8.

43. Lock spring clip joints with a hammer.



Figure 9

44. Insert one end of spring shackle through main leaf eye (front and rear of front spring and rear of rear spring) as shown in Figure 9, and start threaded bushing on shackle thread and draw tight into spring eye.

Install Spring on Car

45. Put spring in position under car with the shackles passing through the frame brackets.

46. Start threaded bushing on shackle and draw tight into bracket.

47. The front end of the rear spring is placed in the hanger and the bolt threaded in from the inside. The spring must be centralized in the hanger before starting to thread the bolt into it.

48. Draw bolt tight and secure with nut.

49. Replace the spring U bolts and nuts and reconnect shock absorbers.

NOTE: It is essential that the threaded bushings fit tight in the spring eyes. Sidewise movement of the springs due to loose bushings or movement due to loose U bolts will cause car wander and erratic brake action.

STABILIZER BAR

Disassembly

50. Jack up front axle. Remove nuts (A) from front spring U bolts and remove plate (B) to which bottom of connecting link (C) is attached. (Figure 10).

51. Remove rubber bearing mounting clamp bolt nuts (D) and remove assembly.

Assembly

52. Reverse operations 50 and 51.

NOTE: The rear frame bolt hole is enlarged to permit alignment of the bar bracket. The bracket should be located so that the bar does not contact the frame side rail.

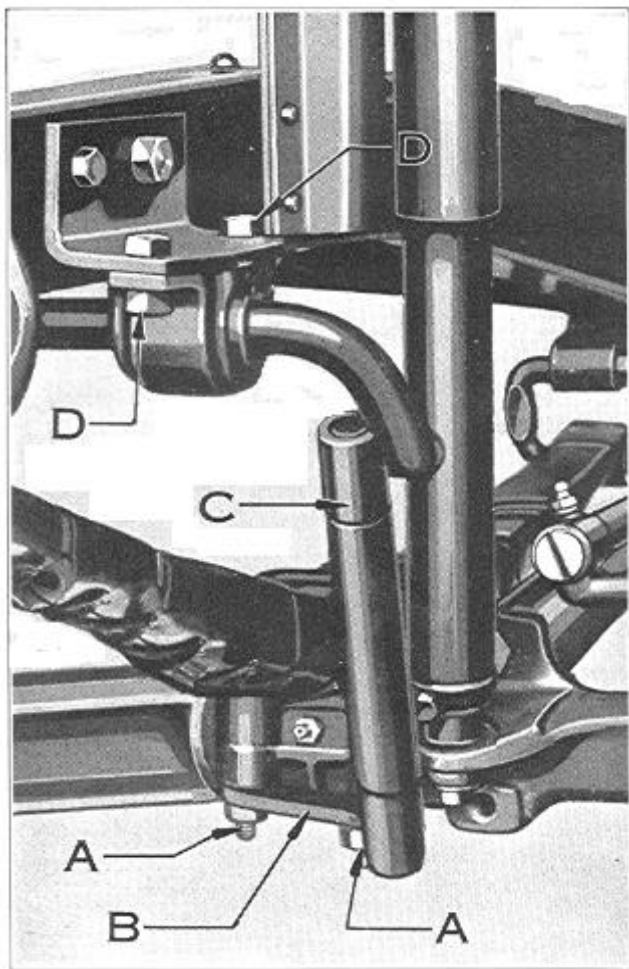


Figure 10

ASECTION 3-STEERING GEAR

Removal of Horn Button and Steering Wheel

53. Disconnect horn wire at bottom of steering column.

54. Depress horn button (2) and turn to release. (See Figure 11.)

55. Remove horn button and tension spring (3).

56. Remove cup and tension spring assembly (4).

57. Remove rubber silencer (5).

58. Withdraw horn wire (6) from steering column together with fiber washer and steel washer on wire.

59. Remove steering column nut (9).

60. Remove contact spring (11).

61. Remove horn button retainer (10).

62. Remove steering wheel using J-739 steering wheel puller.

Removal of Steering Gear

63. Disconnect electric hand jack at bottom of jacket tube.

64. Remove two cap screws which attach column tube bracket to dash bracket.

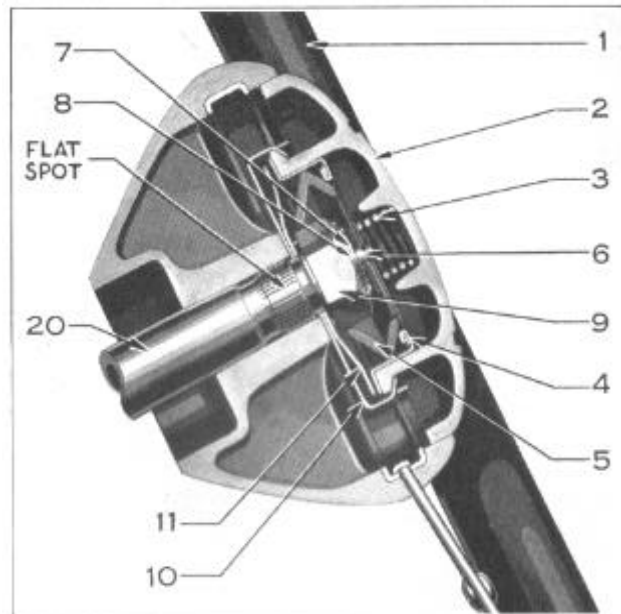


Figure 11

65. Loosen the steering column clamp at bottom of jacket tube and remove jacket tube.

66. Remove the pitman arm nut and lockwasher

67. Remove pitman arm, using HM-871 pitman arm puller.

68. Remove floor mat and transmission opening cover.

69. Remove the three steering gear mounting stud nuts from outside of chassis frame side member and remove steering gear.

Disassembling Steering Gear

70. Remove 4 roller shaft cover screws, Figure 12.

71. Withdraw cover plate and roller shaft assembly.

72. Disengage roller shaft thrust plate from groove in roller shaft.

73. Remove 4 worm cover screws and remove cover and shims.

74. Push column tube out of bottom of housing which will remove the lower thrust bearing cup, bearing rollers, worm and upper thrust bearing rollers.

75. Pull upper bearing cup.

Reassembling of Steering Gear

Before reassembling the steering gear, all parts should be carefully inspected and worn or damaged parts replaced.

a. Worn roller shaft bearings-Replace housing assembly with factory rebuilt unit. These bearings are not replaceable except with special burnishing equipment.

b. Worn or scored roller shaft-Replace shaft and roller assembly.

c. Worn roller or worn roller needle bearing-Replace Roller Shaft Assembly.

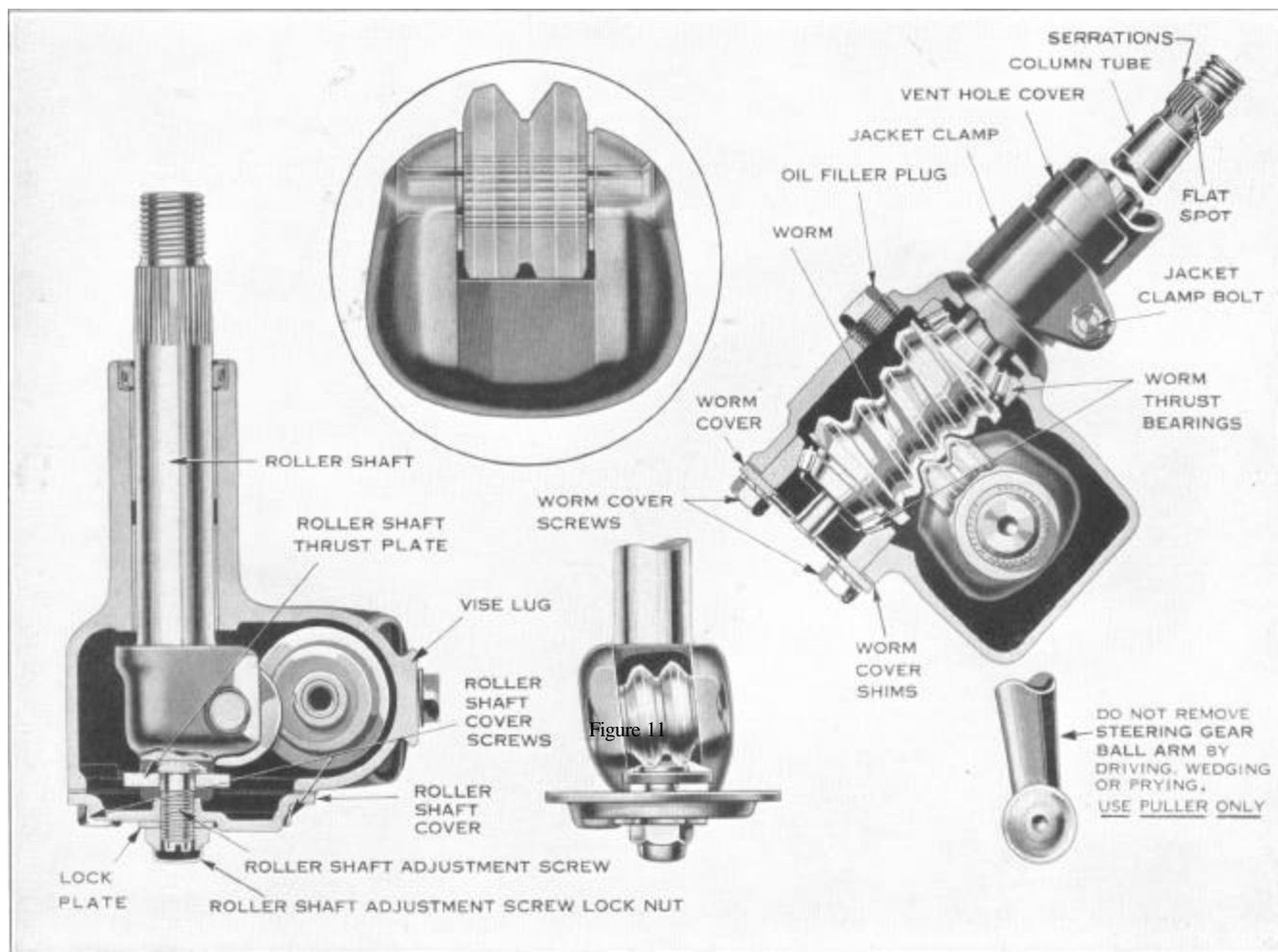


Figure 12

d. Worn worm—Replace Worm and Column Tube.

e. Bent column tube—Replace Column Tube.

All parts other than above specified can be replaced individually.

Before assembling, dip all wearing surfaces steering gear lubricant.

76. Install upper worm thrust bearing cup in housing.

77. Place upper worm thrust bearing rollers on worm and install with worm and column tube assembly.

78. Install lower thrust bearing rollers and cup.

79. Replace shims, worm cover and 4 worm cover screws.

When the cover screws are drawn tight there should be no perceptible end play in the column tube while not more than 3% pounds at the rim of the steering wheel (9" radius) should be required to turn the column tube.

Adding shims under the cover increases clearance and reduces pull required to turn column.

80. Engage roller shaft thrust plate in groove in

roller shaft and insert shaft cover and cover gasket as an assembly.

81. Install 4 cover plate lock screws.

82. Install pitman arm on roller shaft and steering wheel on column tube to check adjustment.

83. Turn steering wheel to exact mid-position of travel.

84. If pitman arm ball can be moved more than 1/32 of an inch without the steering column tube turning, the roller shaft lock screw nut and lock plate should be removed and the roller shaft adjusting screw turned in until the movement is reduced to 1/32".

85. If more than 2 pounds pull is required at the rim of the steering wheel to move it from its mid-position the roller shaft adjusting screw should be turned out.

86. After adjustment, replace the lock plate and lock nut and re-check the pitman ball arm movement and the pull required to turn the wheel from the mid-position.

87. Fill the housing through the filler plug with S.A.E. 160 E.P. lubricant for summer or S.A.E. 90 E.P. lubricant for winter and replace the filler plug.

Installation of Steering Gear

88. Insert steering column main tube through hole in toe board and roller shaft through hole in frame side member with three mounting studs passing through elongated holes in frame.

89. Install plain washers, lockwashers and nuts in frame bracket mounting bolts, turning up until the nuts just start compressing the lockwashers.

90. Install steering column jacket tube over steering column main tube and secure by tightening jacket clamp bolt at bottom of tube.

91. Secure column to dash bracket with bracket cap and two screws.

92. Turn steering gear until flat spot (See Figure 11) on column tube is straight down.

93. Install steering wheel with trademarked spoke straight down.

94. Reverse operations 54 through 61.

95. Reconnect horn wire at bottom of steering gear.

96. Install pitman arm lockwasher and nut. Tighten securely.

97. Turn steering wheel from right to left several times to align column and tighten three steering gear frame bracket nuts on outside of frame side members.

98. Install transmission opening cover and floor mat.

99. Connect rear end of drag link to pitman arm.

100. Set steering gear on high point by turning steering wheel to middle of its travel with trademarked spoke pointing down. Front wheels should be straight ahead.

NOTE: Unless steering wheel has just been installed and the position of the trademarked spoke in relation to the flat spot on the shaft is known, the horn button should be removed so that the flat spot can be seen.

101. If front wheels are not straight ahead remove part of shims (B), Figure 19, from front of drag link ball seat and place at rear of ball seat to turn wheels to left. Remove parts of shim (B) from rear of drag link ball seat and place at front of ball seat to turn wheels to right.

SECTION 4-FRONT END ALIGNMENT

NOTE: The front end alignment is checked with the Jiffy caster and camber gauge and turning angle plates available through the Hinckley-Myers Company of Jackson, Michigan. When these are used it is important that the car is level. A level section of the floor should be marked with zone line paint for the position of the front wheels while checking. Wooden blocks 1¼" thick should be placed under the rear wheels to compensate for the height of the turning angle plates.

102. Inflate all tires 16 x 6.00 and 16 x 6.25-front 24 pounds, rear 32 pounds. 15 x 7.00 front 22 pounds, rear 28 pounds.

103. Tighten all spring U bolt nuts.

104. Test shackle threaded bushings with pinch bar for looseness in spring eyes.

105. Disconnect bottom of shock absorbers and check control-the lower portion of the shock absorbers should move up and down under a steady pressure but should resist a sudden downward jerk. Remove and fill if necessary.

106. Jack up front axle.

107. Check spindle pins and bushings for wear and tie rod and drag link ends for looseness. See that torque arm end rubbers are in good condition.

108. Disconnect rear end of drag link from pitman arm. Wheels should turn free throughout their travel.

109. Lower front wheels in straight ahead position onto turning angle plates (Figure 13) and apply the brakes with a pedal jack. A pull or a push of 20 pounds on the rim of the tire should turn the wheels in either direction. If greater pull is required to turn the wheels, lubricate the front axle parts. If this does not reduce the pull required, remove the wheels and tie rod and check as in notes under paragraphs 21 and 23, Section 1.

110. Loosen the frame bracket bolts just enough to allow gear to shift in frame to line up at angle determined by height of setting at instrument board gear bracket and re-tighten frame bolts.

111. Loosen the instrument board gear bracket and allow it to shift to match gear column position and re-tighten. This will correct any possible misalignment of gear column.

112. Turn hand wheel to the mid-position of its complete travel or turning limits. (Drag link previously disconnected.) Hand wheel has a trademark or large depression on the underneath side of the spoke that should now point straight down. (See note under Paragraph 100.) Place this marked spoke in correct position and shake ball arm to determine amount of lost motion.

113. If pitman arm ball can be moved more than 1/32 of an inch without the steering column tube turning the roller shaft lock screw nut and lock plate should be removed and the roller shaft adjusting screw turned in until the movement is reduced to 1/32".

114. Turn hand wheel throughout full travel to test for free operation. If too tight, re-adjust as above more carefully.

NOTE: The worm is generated in such manner that close mesh with SECTOR teeth is provided at the mid-position or place corresponding to the straight ahead driving range with gradual relief toward the extremes. Since any normal wear is most pronounced at mid-position, this provision allows for subsequent adjustment without fear of binding toward the extremes.

115. A pull of 1 to 2 pounds at the rim of the steering wheel should turn it in either direction from the "high point."

116. Reconnect drag link to pitman arm.

117. Set wheels in straight ahead position and adjust scales on turning angle plates to zero.



Figure 13

118. Remove outer and inner hub caps from front wheels.

119. Remove left hand spindle nut and washer and install jiffy caster and camber gauge as shown

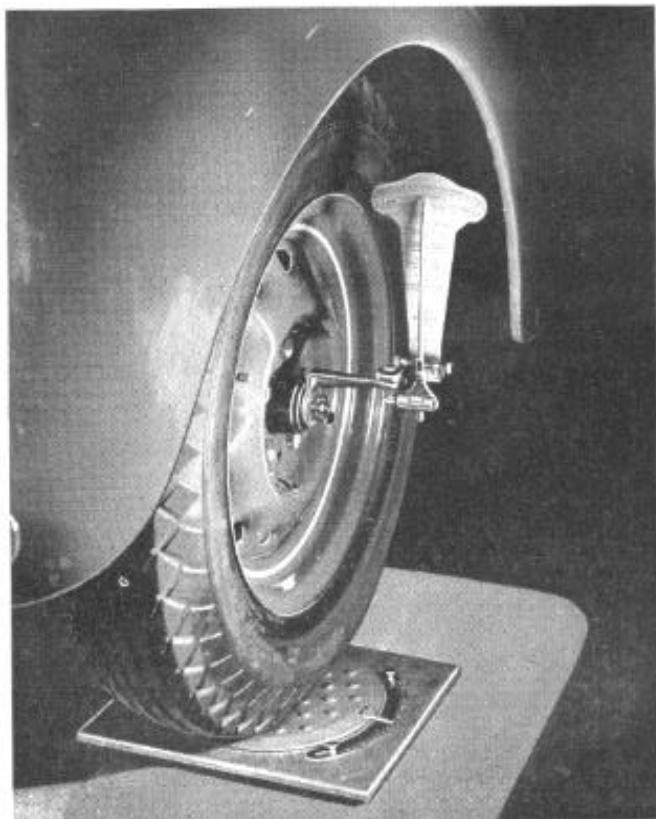


Figure 14

in Figure 13 so that level bubble is between gauge lines when pointer is set at zero.

120. Turn the head of the jiffy gauge so that it is parallel to the axle as shown in Figure 14 with wheels still straight ahead and adjust the pointer with the thumbscrew until the level bubble is between the lines on the glass. The reading taken on the lower scale is the camber of the left wheel. A reading toward the wheel is positive and away from the wheel is negative camber; the correct camber is 1° to $1\frac{1}{2}^{\circ}$ positive. If camber is insufficient or reversed, check spindle pin inclination as follows:

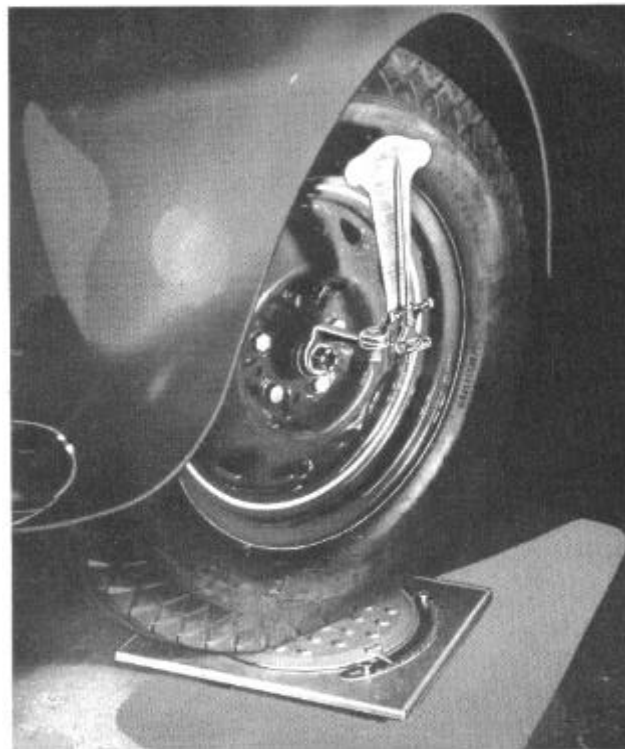


Figure 15

121. Turn the head of the jiffy gauge parallel to the wheel as shown in Figure 15 and turn wheels to left until pointer on left turning angle plate points to 25° .

122. Set pointer on zero and turn gauge on spindle until level.

123. Turn left wheel to right 25° and adjust level. The pointer reading on the top scale is the king pin inclination. This should be seven degrees.

NOTE: If the king pin inclination and the camber are of in, approximately the same amount (for example, camber $1\frac{1}{2}^{\circ}$, king pin inclination 6°), it is probably due to worn spindle pin bushings. If camber is of and king pin inclination is correct, the spindle is bent.

If spindle pin inclination and camber are both of an equal amount and there is no play in spindle pin, the axle center is bent. Camber should not be more than the specified $1\frac{1}{2}^{\circ}$; however, a decrease in caster, if spindle

pins are not loose in the bushings, is not detrimental to steering unless an actual reverse camber exists.

124. Turn the wheels back to the straight ahead position and reset the jiffy gauge as in paragraph 121, Figure 13.

125. Turn the wheels to the right until the pointer on the left turn plate is at 25° , level the gauge with the adjusting screw and take the reading of the pointer on the upper scale.

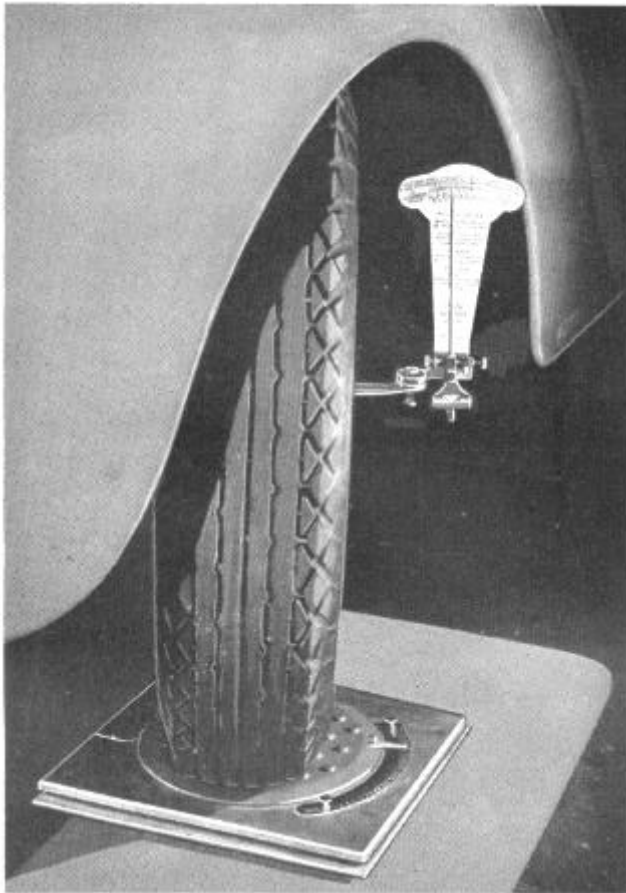


Figure 16

126. Turn the left wheel 25° to the left and level the gauge and take the reading on the upper scale (Figure 16). If both readings are on the same side of zero, subtract the one from the other to get the caster angle of the left wheel. If the two readings are on opposite sides of zero, add them to get the caster angle. Readings toward the wheel are positive and away from the wheel are negative caster angle.

127. Repeat operations 112 to 119 inclusive on the right wheel, turning the wheels so that the pointer of the right turn plate reads 25° to the right for the first caster reading and 25° to the left for the second caster reading.

128. If the caster is less than 1° or more than 2° , remove the bolts 1 and 2, Figure 17, attaching the torque arm to the axle, being careful not to loosen shims 3 and 4 between axle and torque arm.

129. To increase caster, decrease thickness of

shim at (3) or increase thickness of shims at (4). To decrease caster, increase thickness of shim at (3) or decrease thickness at 4 (Figure 17). The shim thickness used on both sides of a car should always be the same.

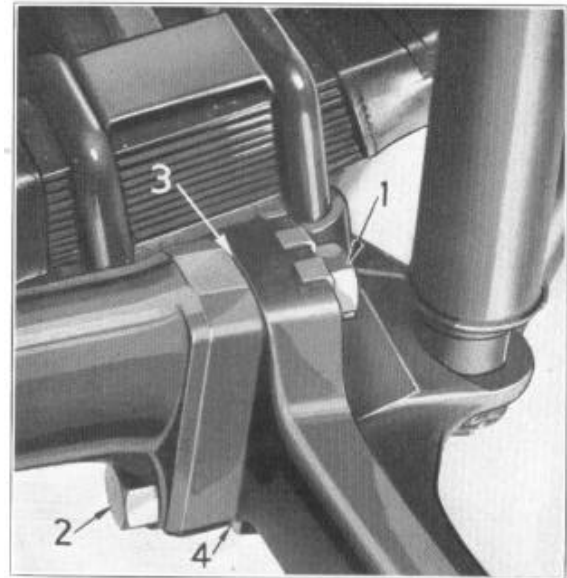


Figure 17

130. Install new shims and replace capscrews.

131. Repeat operation 125 to 128 inclusive to recheck caster.

132. Remove jiffy gauge and replace spindle washer and nut, adjust bearing and insert cotter key.

133. Turn left wheel to left 20° . Right wheel as indicated by pointer on turning angle plate should be 17° to 18° to left.

134. Turn right wheel to right 20° . Left wheel should now be 17° to 18° to the right.

If wheels do not turn to the corresponding angles, recheck tie rod ends for looseness and steering arms to see that they are drawn tightly into the spindles. If no looseness is found, the steering arms are bent and should be replaced.

135. Raise front end of car and remove turning angle plates and lower car. Release brake and roll rear wheels off blocks.

136. Pull car forward by bumper about 10 feet with wheels in straight ahead position to be sure all parts have assumed their normal road position.

137. Place toe-in gauge back of front wheels with rod (8, Figure 18) against inside felloe band of right wheel and end of sliding head (10) against outside edge of felloe band of left wheel. (See Figure 18.)

138. Be sure thumbscrew of both sliding head and rod are tight. Move sliding collar, to which scale 12 (Figure 18) is attached, out against standard bracket (11). Make a chalk mark on tire in line with sliding head.

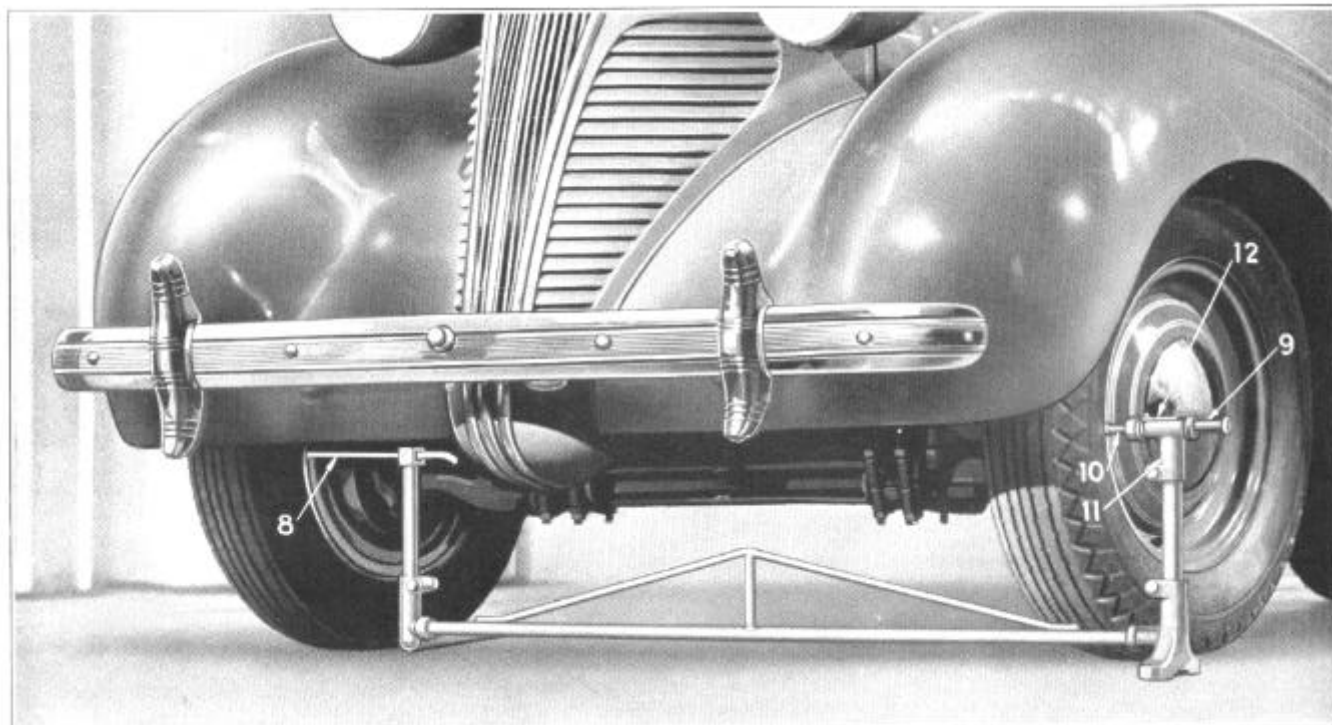


Figure 18

139. Remove toe-in gauge and pull car forward (not backward) with front bumper until chalk mark is at height of toe-in gauge standard at front of wheel.

140. Put toe-in gauge in place as in Figure 18 with rod (8) against inside edge of right felloe and sliding head (10) in line with outside edge of left felloe at chalk mark on tire. (See Figure 18).

141. Loosen sliding head lock screw and push head against edge of felloe. Tighten lock screw.

142. The scale reading at the inner edge of the standard bracket is the toe-in in inches.

This should be zero to 1/2", preferably 1/2".

143. To adjust the toe-in, loosen the clamp bolt nuts on the tie rod ends and turn the tie rod with a Stillson wrench. Pulling the wrench handle forward at the bottom decreases toe-in.

144. After getting correct toe-in, tighten tie rod end clamp bolt nuts.

145. Set wheels straight ahead and check steering wheel to see that trade-marked spoke is pointing straight down. (See Note under Paragraph 100.)

146. If front wheels are not straight ahead remove part of shims (B) from front of drag link ball seat and place at rear of ball seat

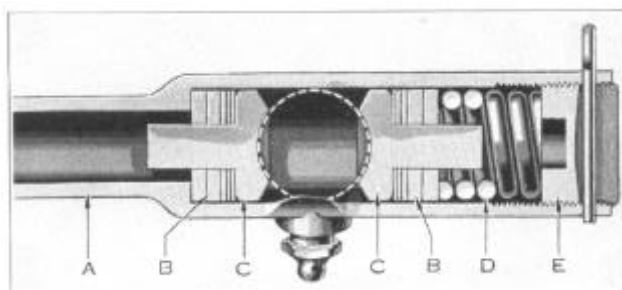
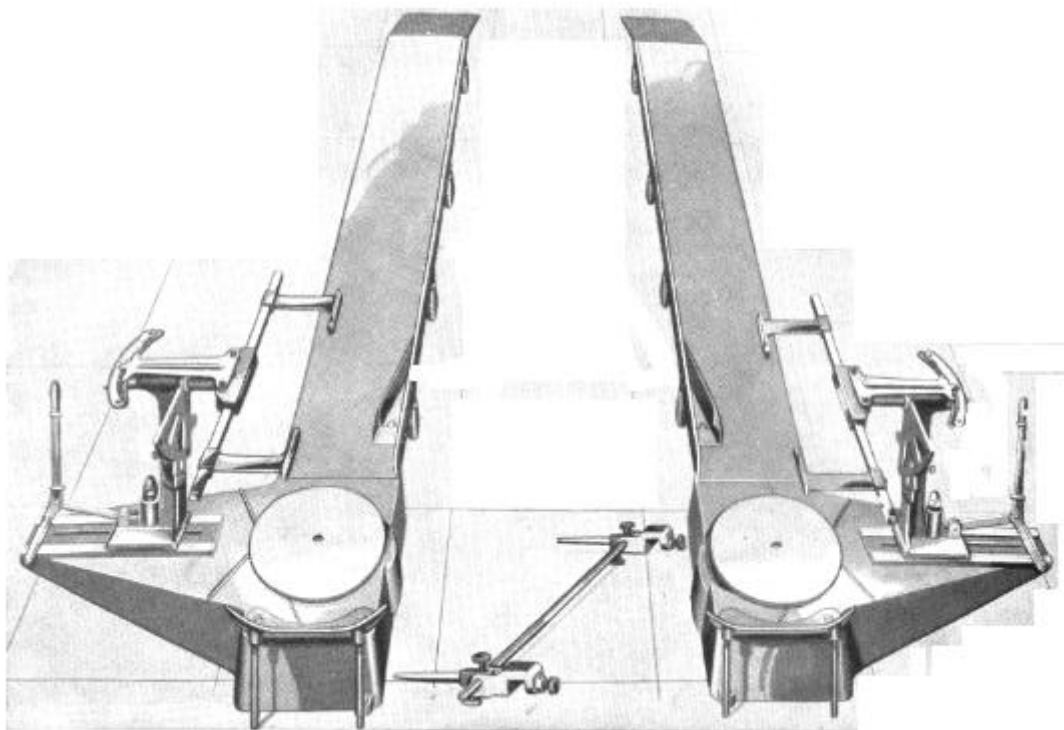


Figure 19

to turn wheels to left. Remove parts of shims (B) from rear of drag link ball seat and place at front of ball seat to turn wheels to right. (See Figure 19.)

NOTE: Whenever the thickness of shims between the torque arms and brackets are changed to increase or decrease caster it is necessary to put the steering gear back on the high point.

147. Reconnect the drag link to the pitman arm and lubricate thoroughly. and place at rear of ball seat to turn wheels to left. Remove parts of shims (B) from rear of drag link ball seat and place at front of ball seat to turn wheels to right. (See Figure 19.)



HMO-20—\$285.00

Runway Type Wheel Aligner

This all-in-one runway type of aligner is designed particularly for the larger shop with a sufficient potential of wheel aligning business to justify the purchase of this type of equipment. It is speedy in operation, accurate in its readings and checks with the weight of car either on or off the wheels.

Checks Scientifically Caster, Camber, King Pin Inclination, Toe-In, Turning Radius. All readings are direct.

Requires very little floor space. Easily installed because of adjustable leveling legs on runways and leveling screws on checking units

Complete operating instructions furnished with equipment.

Front Axle, Steering Gear, and Alignment Tools and Equipment

| | | |
|-----------|---|---------|
| J-885 | Torque Arm Bolt Press | \$ 2.90 |
| J-990-1-2 | Spindle Bushing Remover and Replacer Set (1937) | 3.50 |
| J-479-1-2 | Spindle Pin Remover Set | 1.40 |
| J-992 | Tie Rod Stud Remover | 3.25 |
| J-739 | Steering Wheel Puller | 5.50 |
| HM-871 | Pitman Arm Puller | 3.85 |
| J-751 | Turning Angle Indicators (Set of Two) | 25.00 |
| J-800 | Jiffy Caster and Camber Gauge | 15.00 |
| J-710-H | Toe-in Gauge | 12.50 |
| HMO-20 | Runway Type Wheel Aligner | 285.00 |
| HMO-72 | Wheel Balancer | 39.75 |
| HMO-8 | Wheel Balancing Weights (Box of 50) | 8.75 |
| J-134 | Brake Pedal Depressor | 3.75 |

Place orders for tools and equipment with the Hinckley-Myers Co., Jackson, Mich.

