SECTION 3

FRAME AND SUSPENSION

CONTENTS OF THIS SECTION

FRAME

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GENERAL DESCRIPTION

The frames used on the Chevrolet passenger cars are of all-welded, x-type construction with four crossmembers: front crossmember, rear upper control arm crossmember, intermediate crossmember and rear crossmember. The overall length is 194.45 inches. Total body mounts are 8 for the sedans and 12 for convertibles. The convertibles also incorporate steel plates welded to top and bottom of sidemember and crossbeam for greater rigidity.

SERVICE OPERATIONS

CHECKING FRAME ALIGNMENT

Vehicles which have been in a collision, upset or an accident of any nature which might result in a "swayed" or "sprung" frame should always be checked for proper frame alignment in addition to steering geometry and wheel alignment.

When checking a frame for alignment in case of damage, the most effective method is "X" checking with a tram from given points on the frame.

In Figure 1, reference points are indicated "AA", "BB", "CC", "DD", etc., on each side of the frame.

Frame alignment checks on all models should be made with the tram points set at the center of each locating point indicated and the cross bar level to insure accuracy.

When "X" checking any section of the frame, the measurements should agree within $\frac{3}{16}$". If they do not, it means that corrections will have to be made.

If a tram gauge is not available, the "plumb bob" method of checking may be used. To assure any degree of accuracy when using this method, the vehicle should be on a level floor and tires properly inflated.

By using this method, it is only necessary to have a piece of cord attached to an ordinary surveyor's plumb bob. When measuring the distance between two points, the free end of the cord should be placed on the reference point allowing the plumb bob to hang on the floor. A check mark should be made on the floor just under the tip of the plumb bob. This operation should be repeated at all reference points. With these points located on the floor, they may easily be measured with a rule.

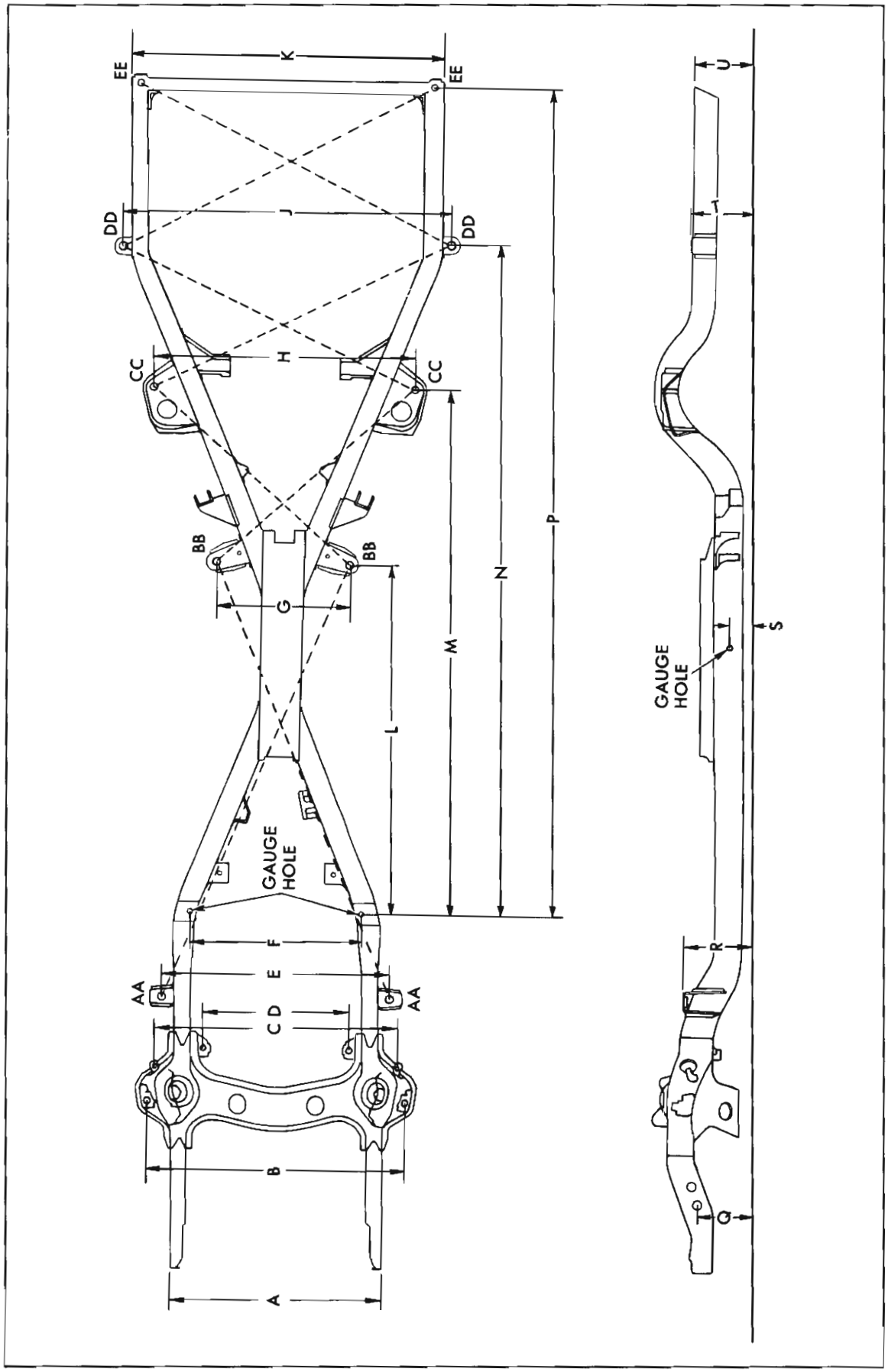

Fig. 1—Frame Dimensions

LETTER	DIMENSION	LETTER	DIMENSION	LETTER	DIMENSION	LETTER	DIMENSION
A	34 11/32	F	27 1/2	L	57 13/64	R	11 17/64
B	41 27/64	G	21 1/8	M	85 29/32	S	3 3/4
C	38 29/32	H	42 23/64	N	106 35/64	T	10 33/64
D	23 15/64	J	50 9/32	P	139 5/32	U	10 29/64
E	36 13/32	K	47 1/2	Q	8 7/8		

SUSPENSION

INDEX

GENERAL DESCRIPTION

The 1961 Chevrolet Passenger Car front suspension system is of the S. L. A. (short-long arm) type, with spherical joints connecting the upper and lower control arms to the steering knuckles. Tapered roller front wheel bearings are used.

The rear suspension uses a three-link, coil spring suspension. The term three link means the axle is made integral with the frame at three points; two links being formed by the lower control arm, and one by the upper control arm.

MAINTENANCE AND ADJUSTMENTS

Periodic maintenance of the front suspension includes lubrication of each of the four spherical joints every 1000 miles and lubrication and adjustment of the front wheel bearings every 10,000 miles.

FRONT WHEEL BEARINGS—ADJUST

The proper adjustment of the front wheel bearings is one of the important service operations that has a definite bearing on safety. A car with improperly adjusted front wheel bearings lacks steering stability, has a tendency to wander or shimmy and causes excessive tire wear. In an effort to provide for more accurate adjustments the spindles are drilled both vertically and horizontally and the adjusting nuts are slotted on all six sides.

NOTE: Do not repack or readjust front wheel bearings as part of "New Car Conditioning." This will seriously affect the proper "mating-in" of these close tolerance bearings.

1. Jack up front end of vehicle. Remove hub cap and dust cap. Remove cotter pin from end of spindle.
2. Tighten spindle nut to 20 ft. lbs. torque while rotating wheel.
3. Back off adjusting nut one flat and insert cotter pin.
4. If slot and cotter pin hole do not align, back off adjusting nut an additional ½ flat or less as required to insert cotter pin.
5. Spin the wheel to make sure that it rolls freely. Properly lock the cotter pin by spreading the end and bending it around.

   NOTE: These tapered roller wheel bearings should have zero preload and .000" to .005" end movement when properly adjusted.

   Install the dust cap and hub cap or wheel disc.
6. Remove jack.

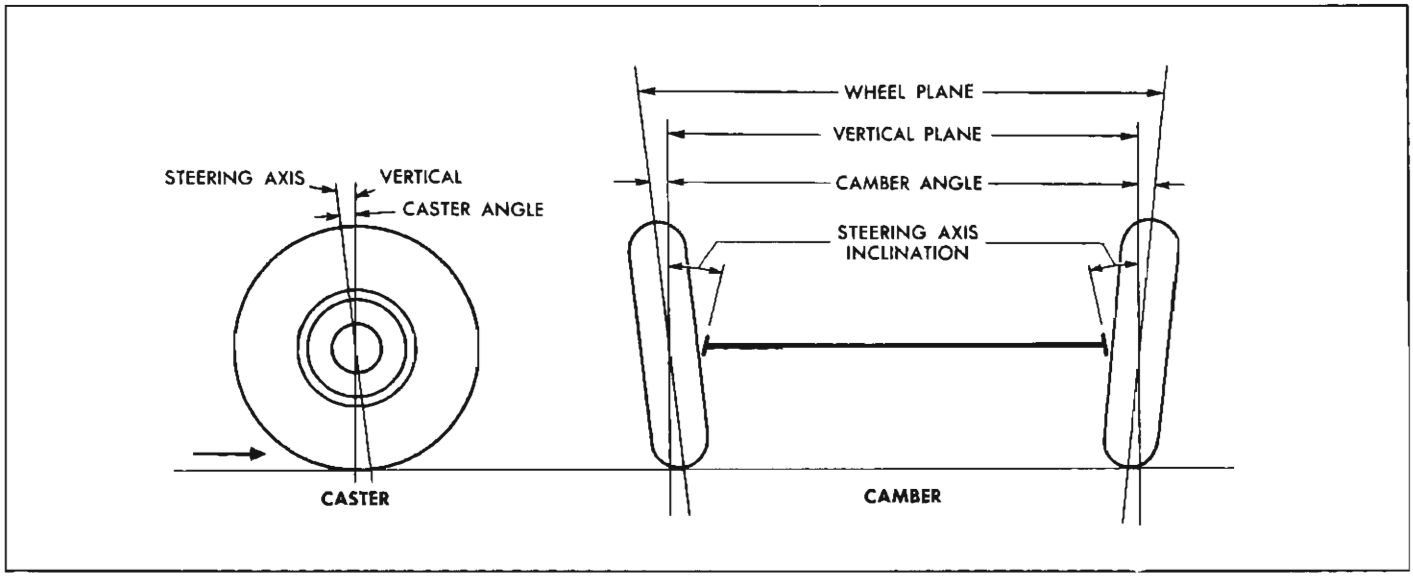

Fig. 2—Caster and Camber

FRONT END ALIGNMENT

A front end alignment is the process of checking or adjusting all the inter-related steering components of the front suspension system. Correct alignment must be maintained in order to assure ease and stability of steering and satisfactory tire life.

Alignment Preliminary Steps

There are several different types of front end alignment machines, all of which outline proper procedure for checking the factors of front end alignment. The instructions furnished by each manufacturer for the operation of his particular machine should be followed. Regardless of type of equipment used, all checks must be made with the vehicle level and with the curb weight of the vehicle on the wheels.

Steering complaints are not always the result of improper front wheel alignment. Therefore, it is recommended that the following factors be checked and corrected if necessary prior to placing the vehicle on the front end machine.

1. Loose or improperly adjusted steering gear.
2. Steering gear housing loose at frame.
3. Play or excessive wear in spherical joints, or steering shaft coupling.
4. Loose tie rod or steering connections.
5. Improper front spring heights.
6. Underinflated tires.
7. Unbalanced tires.
8. Wheel bearings improperly adjusted.
9. Shock absorbers not operating properly.

Caster and Camber Adjustment

The caster and camber adjustments are made by means of shims between the upper control arm inner support shaft and the support bracket attached to the frame side rail. Shims may be changed at either the front of the shaft or the rear of the shaft to change caster at both points equally to change camber.

The addition of shims at the front bolt or removal of shims at the rear bolt will decrease positive caster. A $\frac{1}{32}$" shim difference, one shim, will change caster $\frac{1}{4}°$. Adding shims at both front and rear of support shaft will decrease positive camber. A $\frac{1}{32}$" shim will move camber $\frac{1}{6}°$.

The procedure for adjustment is to loosen the upper support shaft to bracket bolts, add or remove shims as required and retighten the bolts (fig. 3).

NOTE: Both caster and camber can be adjusted in one operation.

Caster should be 0 plus or minus $\frac{1}{2}°$ and camber should be $\frac{1}{2}°$ plus or minus $\frac{1}{2}°$.

Fig. 3—Caster and Camber Adjustment

Steering Axis Inclination—Adjust

From the definitions of "steering axis inclination" and "camber", one being the inward tilt of the knuckle and the other the outward tilt of the wheels, it is evident that one cannot be corrected without changing the other. The correct steering axis inclination should be 7¼° plus or minus ½°. This figure is comparable to kingpin inclination on suspensions utilizing kingpins.

The addition of camber and steering axis inclination should be 7¾ ± ½°. If not within these limits, the knuckle is bent and should be replaced. If a new knuckle is installed, caster, camber and toe-in must be readjusted.

Toe-In—Adjust

Toe-in, which should be 1/16" to ⅛" can be adjusted by loosening the clamp bolts at each end of each tie rod and turning each tie rod to increase or decrease its length as necessary, until proper toe-in is secured and the steering gear is on the high point for straight ahead vehicle travel.

The procedure to be used is dependent upon the type of equipment being used. If equipment measuring the toe-in of each wheel individually is available, the following procedure should be used.

1. Set steering gear on high point, mark on steering shaft at 12 o'clock position, and steering wheel positioned for straight ahead driving.
2. Loosen the clamp bolt at each end of each tie rod and adjust to a total of 1/16" to ⅛" toe-in (fig. 4).
3. Position inner tie rod clamp bosses forward to 90° down to avoid stabilizer link bolt interference on cars with stabilizer shaft.

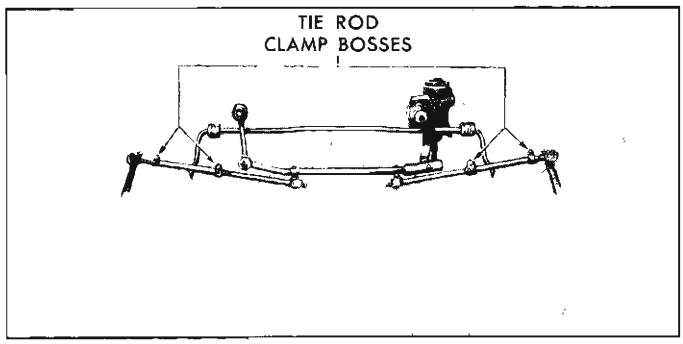

Fig. 4—Tie Rod Clamp Bosses (Two Per Side)

If a tram gauge is utilized, the following procedure should be used.

1. Set the front wheels in a straight ahead position.
2. Loosen the clamp bolts on one tie rod and adjust for 1/16" to ⅛" toe-in.
3. Loosen the other tie-rod clamp bolts. Turn both tie rods the same amount and in the same direction to place the steering gear on its high point and position the steering wheel for straight ahead driving.
4. Position inner tie rod clamp bosses forward to 90° down to avoid stabilizer link bolt interference on cars with stabilizer shaft.

Cornering Wheel Relationship

Cornering Wheel Relationship, or toe-out on turns, is determined by the angle of the steering arms. If, when checking, toe-out does not fall within the limits given in the specifications, it will be necessary to replace the steering arm on the wheel side that does not come within limits.

SERVICE OPERATIONS

FRONT BRAKE DRUM

Removal

1. Remove hub caps, partially loosen wheel nuts and raise vehicle from floor. Remove wheel nuts and wheel.
2. Remove brake drum. In some cases it may be necessary to back off brake adjustment because of scored drum or unevenly worn brake linings.
3. Check brake drum for concentricity, damaged pilot diameter or scored braking surface. Lightly sand braking surface and wipe clean.

Installation

1. Install drum over hub bolts making sure alignment dowel on drum web indexes with hole in wheel hub. This will assure proper drum alignment with hub bolts and hub pilot diameter.
2. Install wheel and partially tighten wheel nuts.
3. Re-adjust brake shoes to original setting. It may be necessary to re-adjust brake shoes on both front and/or rear wheels to assure balanced brake adjustment. See Section 6 for brake adjustment procedure.
4. Lower vehicle to floor, tighten hub wheel nuts and install hub cap.

FRONT WHEEL BEARINGS

Removal

1. Remove wheel and brake drum as outlined above.
2. Remove hub grease cap, cotter pin, spindle nut and washer. Remove hub.

NOTE: Discard cotter pin if badly bent or weakened from repeated bending.

3. Remove outer roller bearing assembly from hub with fingers. The inner bearing assembly will remain in the hub and may be removed after prying out the inner bearing felt seal assembly. Discard seal.
4. Wash all parts thoroughly in cleaning solvent and blow dry.

Inspection

1. Inspect all bearings for damaged roller separators and worn or pitted rollers.
2. Inspect bearing races for heat discoloration, cracks or pitting.

Repairs

1. Make two bearing cup removers out of 7/16" square steel stock as shown in Figure 5.

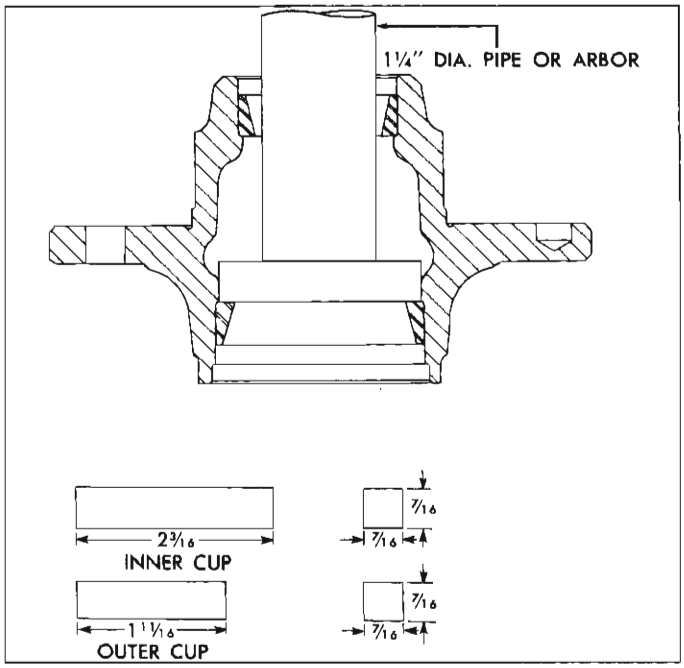

Fig. 5—Front Wheel Bearing Cup Removers

2. Insert removers through hub, indexing ends into slots in hub shoulder behind bearing cup.
3. Using a suitable extension pipe or rod, press bearing cups from hub.
4. Install new bearing cup in hub using Tool J-8849 on the outer and Tool J-8850 on the inner cup (fig. 6). Use driver handle J-8092 with the installers. Make sure that the bearing cups are not cocked and are fully seated against shoulder in hub.

FRONT WHEEL HUB

Replacement

When replacement of wheel hub is necessary because of excessive distortion of the wheel flange, bearing bore diameter out-of-round, or damage to hub bolts, the hub is available as an assembly with bolts installed at the factory. Install wheel roller bearing cups as outlined under "Front Wheel Bearings—Repairs."

Fig. 6—Installing Bearing Cups

It may be necessary, however, to replace only damaged wheel hub bolts. In this case, service the hub in the following manner:

1. Remove the hub bolts with a press or hammer. These bolts are not peened into the hub. Do not damage wheel mounting surface on hub flange.
2. Install new serrated bolt into hole in hub. Tap lightly with a hammer to start bolt serrations in hole, making sure that bolt is square with hub flange.
3. Press bolt into flange until head is fully seated against hub flange (fig. 7).
4. If bearing cups have been removed, install new cups using Tool J-8849 on the outer and Tool J-8850 on the inner cup.

Installation

1. Pack both inner and outer bearings using a high melting point wheel bearing lubricant.
2. Place inner bearing in hub, then install a new inner bearing felt seal assembly. Seal flange should face bearing cup.
3. Carefully install wheel hub over steering spindle.
4. Install outer bearing, pressing it firmly into the hub by hand.
5. Install spindle washer and adjusting nut. Draw up tight and adjust wheel bearings as outlined under "Front Wheel Bearings—Adjust."

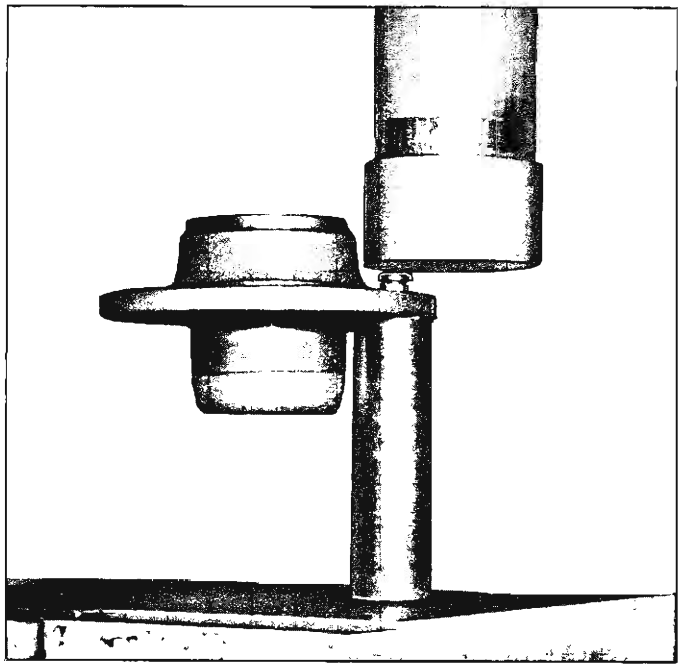

Fig. 7—Installing Front Wheel Hub Bolts

REAR SHOCK ABSORBERS

Removal

1. Remove lower attaching bolt, lockwasher and spacer (fig. 8).
2. Remove upper two attaching nuts, bolts and washers (fig. 8).
3. Pull shock absorber off lower anchor pin.

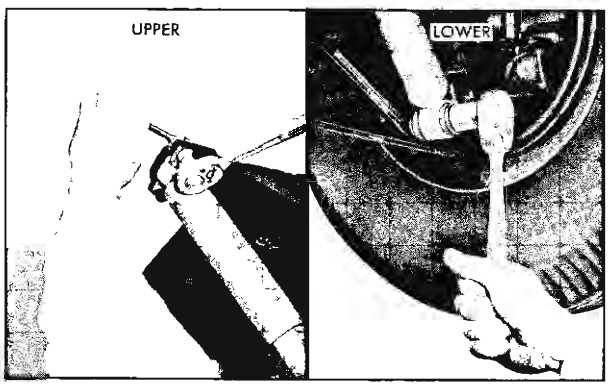

Fig. 8—Removing or Installing Rear Shock Absorber

Installation

1. Assemble the two piece bushing into the eye on the shock absorber.
2. Install spacer, lockwasher and nut. Do not tighten at this time.
3. Install and tighten upper bolts, flat washers, lockwashers and nuts.
4. Tighten lower attaching nut.

FRONT SHOCK ABSORBERS

Removal

1. With a ¼" open end wrench, hold upper stem from turning and remove upper stem retaining nut and lockwasher.
2. Remove two bolts retaining lower shock absorber pivot to lower control arm and pull shock absorber assembly and mounting out at bottom of spring housing.

Installation

1. Install shock absorber up through lower control arm and spring housing.
2. Index upper stud through mounting hole in top of spring housing.
3. Install lockwasher and retaining nut over upper stem of shock absorber.
4. Holding stem and with a ¼" wrench, tighten nut until it bottoms on shoulder of stem. Then tighten to 15-25 lb. ft. torque.
5. Install pivot bolts through lower pivot to lower control arm and tighten securely.

REAR SHOCK ABSORBER LOWER ANCHOR PIN

Removal

NOTE: Two different shock absorber lower anchor pins are used. They are of different length and have separate locating flats. Refer to Figure 9 for proper installed position.

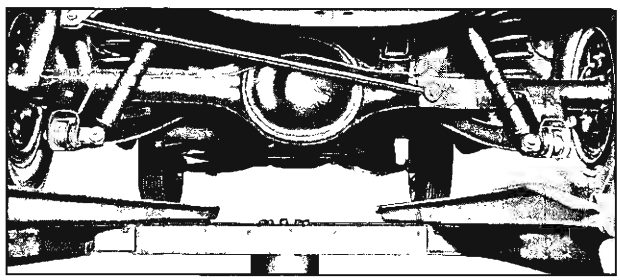

Fig. 9—Rear Shock Absorber Lower Anchor Pins

CAUTION: To perform this operation the coil spring must be removed or the rear suspension lower control arms must be supported.

1. Remove rear shock absorber lower attaching nut, lockwasher and spacer. Pull shock absorber off lower mounting. Remove anchor pin nut and lockwasher.
2. Install Tool J-7063 as shown in Figure 10. Attach Tool J-2619 and drive pin out of rear suspension lower control arm.

NOTE: It may be necessary to put a horizontal load on the lower control arm rear bushing to keep it from flexing.

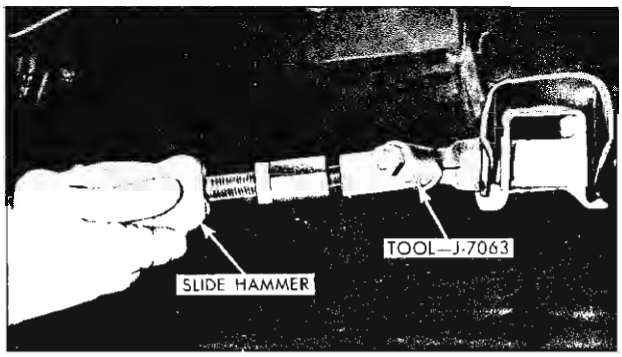

Fig. 10—Removing or Installing Rear Shock Absorber Lower Anchor Pin

Installation

1. Using chalk, mark the flat spot location on the anchor pin threads and on the corresponding flat on the lower control arm bracket (fig. 11). It is advisable to remove the rear wheel and tire assembly to aid in the alignment of these two chalk marks.

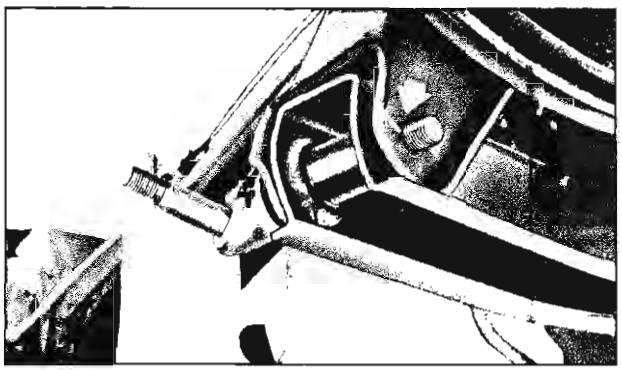

Fig. 11—Anchor Pin Alignment

2. Install Tool J-7063 to the anchor pin and enter into lower control arm. Attach Tool J-2619 and drive into place, keeping the two chalk marks in alignment. Refer to Figure 8 for proper installed position.
3. Attach shock absorber and bushings to the anchor pin with the spacer, lockwasher, and nut. Install the anchor pin attaching lockwasher and nut.

FRONT STABILIZER

NOTE: There is no front stabilizer bar on models equipped with 6-cylinder engines, except all Impalas and all Station Wagons.

Removal

1. Place car on suitable hoist or jack stands.
2. Remove stabilizer link from lower control arm (both sides) by removing lower attaching nut, spacer and grommet (fig. 12).
3. Withdraw top grommets, spacers and links (both sides).
4. Reaching through hole in frame (fig. 12), hold bolt heads and remove two nuts and washers attaching the stabilizer support (both sides).
5. Remove stabilizer bar.

Installation

1. Attach the stabilizer and supports to the frame (fig. 12).

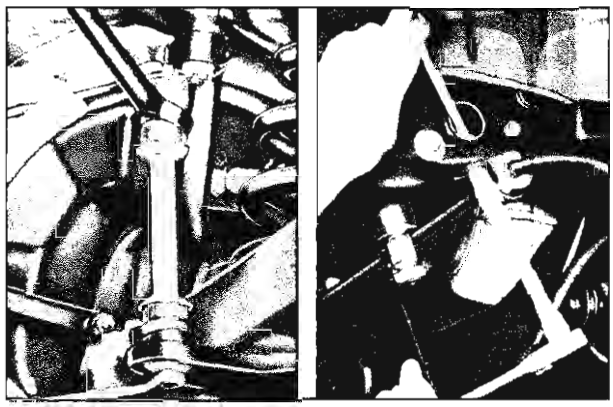

Fig. 12—Removing or Installing Front Stabilizer

2. Assemble the lower ends of the stabilizer links to the lower control arm (fig. 12). Assemble the upper ends of the stabilizer links to the stabilizer bar.
3. Lower car to the floor and bounce and rock the front end several times to settle the rubber bushings.
4. Retighten both ends of the stabilizer links and the stabilizer to frame support.

RIDING HEIGHT AND FRONT COIL SPRING SAG

In cases of vehicle riding height complaints, a coil spring height check will show if the front suspension is at the right height.

1. Position car on smooth, level floor.
2. Bounce and rock the car several times and allow it to settle to a normal height.
3. Measure the distance from the floor to the center of the front inner pivot of lower control arm (fig. 13). Record this measurement.
4. Measure the distance from the floor to the lower face of the lower steering knuckle boss for the spherical joint on the same side of the vehicle. Record this measurement.
5. The difference between these two measurements should be as outlined below, with the vehicle at curb weight.
6. Measure the opposite side of the vehicle in a similar manner. It is essential that the two differences be close.

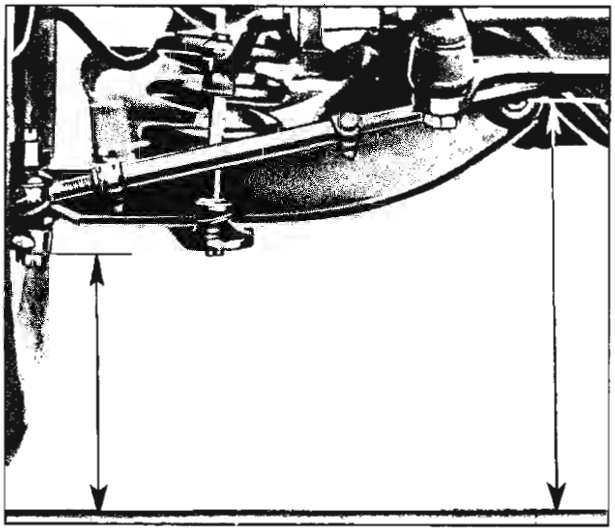

Fig. 13—Checking Riding Height

Model	Allowable Spring Sag
*2 & 4 Dr. Sedan (6 cyl. only)	3" ± ¼"
*2 & 4 Dr. Sedan (8 cyl. only)	3 5/16" ± ¼"
*2 & 4 Dr. Sport Sedan (All)	3⅝" ± ¼"
Convertible (All)	3½" ± ¼"
Station Wagon (All)	4⅛" ± ¼"

*If equipped with 8.00 x 14 tires—add 19/64" to specifications.

7. To correct the height, springs must be replaced. These springs do not have flat ends and shims should not be used.

FRONT COIL SPRINGS

Removal

1. With car on suitable hoist or jack, (support car by frame so control arms may swing free) remove wheel and tire assembly, stabilizer bar and shock absorber. Loosen the lower ball joint to steering knuckle nut, and the two lower control arm cross shaft bushing bolts.
2. Place Tool J-6874-1 across top of sixth coil (approx.), then loosely secure Tool J-6874-2 to the upper shoe, with attaching capscrews and lock washers. The upper shoe "V" notch and lower shoe raised land should contact spring.
3. Insert Tool J-6874 up through center of spring and attach to upper and lower shoe assembly with bolt and nut.
4. Position spacer under shock absorber mounting hole and against bottom of lower control arm. Install special bearing washer and Tool J-6874-5. Locate bearing against spacer and large washer against bearing. Feed screw (Tool J-6874-5) up through large washer bearing and spacer and thread into Tool J-6874 and tighten snugly (Step 1, Figure 14).
5. Center shoe assembly on spring and tighten screw until a very slight compression is placed on spring (Step 2, Figure 14). Then firmly tighten down the two capscrews securing the upper and lower shoes to lock these shoes to spring.

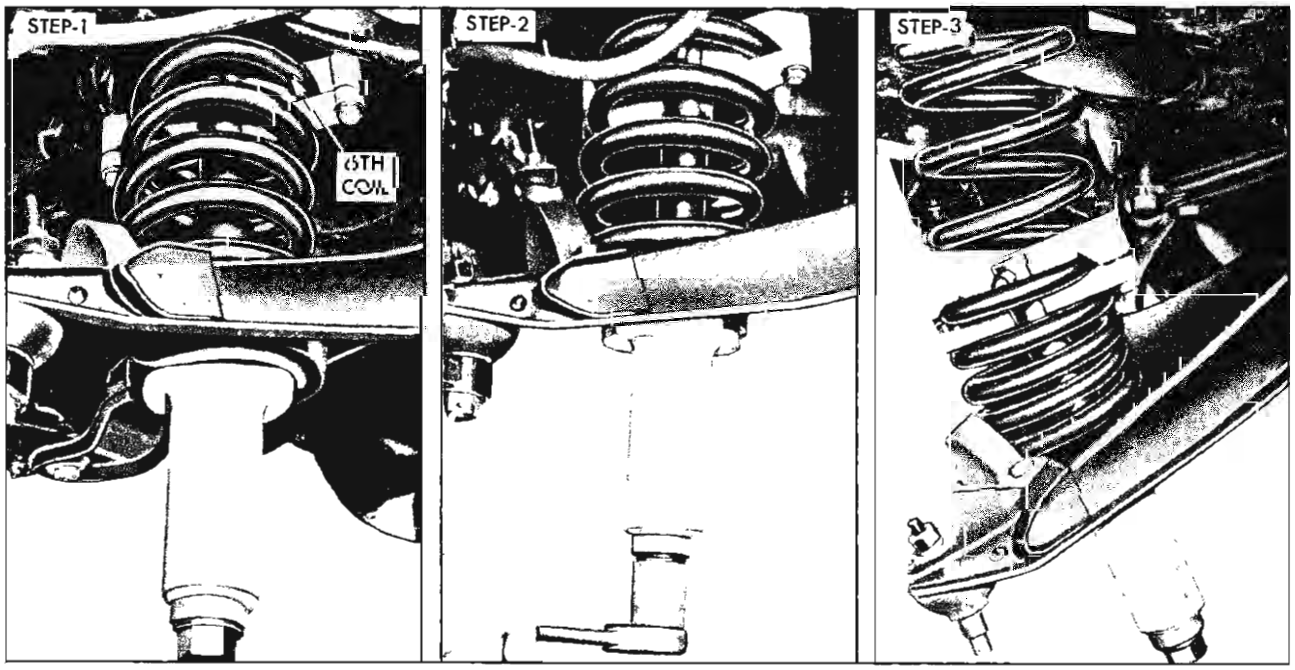

Fig. 14—Removing or Installing Front Coil Spring

6. Turn head of screw until spring is compressed just enough to clear the spring tower, then remove the lower ball joint to steering knuckle nut (Step 3, Figure 14).

   NOTE: It may be necessary to assist the spring out of the spring tower with a pry bar or similar tool.

7. Disconnect the lower ball joint from the steering knuckle and lower the control arm with the compressed spring. IMMEDIATELY, release compression on spring by backing off long screw. Release spring and tool and withdraw spring.

   CAUTION: The spring force under compression is very large. Exercise every safety precaution when performing this operation to see that individuals and materials subject to damage are removed from the path of the spring when the control arm is being lowered. ALSO, the compressed spring should be relaxed immediately after lowering the control arm to reduce the time of exposure to the large compressive force.

Installation

1. Place Tool J-6874-1 across the top of the sixth coil (approx.) then loosely secure Tool J-6874-2 to the upper shoe with attaching capscrews and lockwashers. The upper shoe "V" notch and lower shoe raised land should contact spring.
2. Insert Tool J-6874 up through center of spring and attach to upper and lower shoe assembly with bolt and nut.
3. Set coil spring in its seat on the lower control arm.
4. Position spacer centrally under shock absorber mounting hole and against bottom of lower control arm. Install bearing, large washer and Tool J-6874-5. Locate bearing against spacer and large washer against bearing. Feed the screw up through large washer, bearing and spacer and thread into yoke rod. Tighten snugly, but do not start to draw down yet.
5. Center the shoe assembly on the spring and tighten the long screw until a very slight compression is placed on spring, then firmly tighten down the two capscrews securing the upper and lower shoes. This will lock the shoes to the coil spring.
6. Turn head of screw until spring is compressed just enough to clear the spring tower.

   NOTE: It may be necessary to assist the spring into the spring tower with a pry bar or similar tool.

   IMMEDIATELY, install the lower ball joint into steering knuckle and secure in place with attaching nut.
7. Release compression on spring and at the same time use a drift to guide the coil spring into its proper seat.
8. Tighten the lower ball joint to steering knuckle nut and lock with cotter key.
9. Install shock absorber and stabilizer bar as previously described in this section.
10. Install wheel, tire and drum assembly.
11. Remove car from hoist or jack stands.
12. Tighten the two lower control cross shaft bushing bolts to 45-55 ft. lbs. torque.

    NOTE: If a suitable jack-stand (one that is not a fixed height and can be used while the vehicle is raised on a hoist) is available the following procedure is recommended.

1. Support car on suitable hoist or jack (so control arms may swing free) and remove the wheel and tire assembly, shock absorber, and stabilizer link at control arm.
2. Place suitable jack stand under the lower control arm cross shaft.
3. Follow steps 2-5 as outlined on previous page.
4. Turn head of tool screw to partially compress spring.
5. Remove the three control arm cross shaft attaching bolts, washers and nuts (fig. 15).
6. Carefully lower jack stand and if necessary increase compression on spring and when coil spring is out of its upper seat, relax tension on spring.
7. By using a pry bar to assist, if necessary, remove the coil spring from the lower control arm.
8. Installation is the reverse of the above procedure. Carefully follow instructions for installing spring tool.

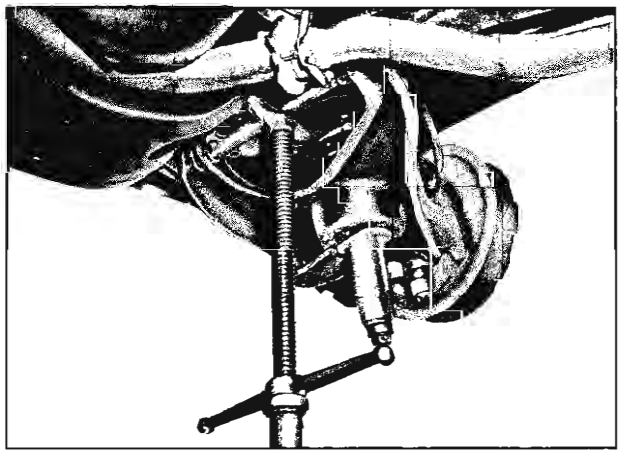

Fig. 15—Lowering Control Arm

RIDING HEIGHT AND REAR COIL SPRING SAG

In cases of vehicle riding height complaints, a coil spring height check will show if the rear suspension is at the right height.

1. Position car on smooth, level floor.
2. Bounce and rock car several times and allow it to settle to a normal height.
3. Measure the distance from the top of the rear axle housing to the frame kick-up. The height should be as outlined below.

Model	Allowable Spring Sag
2 & 4 Dr. Sedan (6 cyl. only)	$5^{43}/_{64}'' \pm 1/4''$
2 & 4 Dr. Sedan (8 cyl. only)	$5^{59}/_{64}'' \pm 1/4''$
2 & 4 Dr. Sport Sedan (All)	$5^{43}/_{64}'' \pm 1/4''$
Convertible (All)	$5^{9}/_{16}'' \pm 1/4''$
Station Wagon (All)	$6^{11}/_{64}'' \pm 1/4''$

4. Measure both rear coil springs to determine spring sag.
5. To correct these heights, springs must be replaced. These springs do not have flat ends and shims should not be used.

REAR COIL SPRINGS

Removal

To remove either or both rear coil springs, the following procedure should be followed.

1. Place vehicle on suitable hoist and support it on both frame side rails. Place a jack or post (of a twin post hoist) under rear axle. This will not be necessary on a twin post hoist.
2. Withdraw the rear suspension tie rod after removing the left hand nut, washer and bolt, and the nut and washer off the right hand stud (fig. 16).

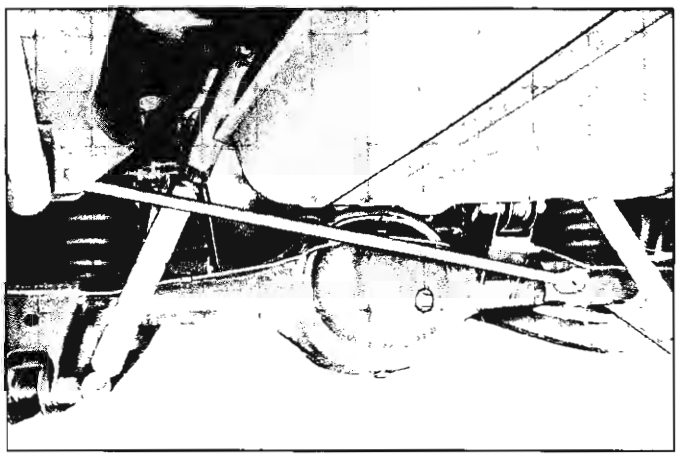

Fig. 16—Rear Suspension Tie Rod Attaching Points

3. Remove the rear shock absorber lower mounting from the lower anchor pin.
4. Remove the nut and lock washer from the upper control arm rear pivot. By using a tapered punch, tap out pivot bolt but leave punch in place (fig. 17).

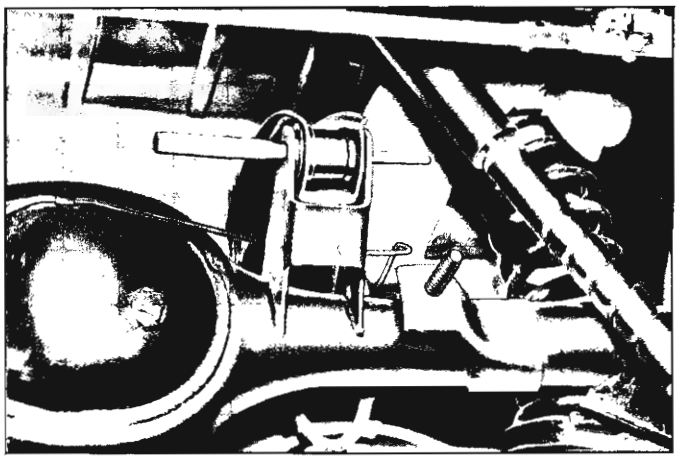

Fig. 17—Rear Spring Removal

5. Disconnect propellor shaft from differential and loosen center bearing support.
6. Carefully lower the rear axle housing until it or the tires (depending on type hoist used) just clears the hoist support at rear while using care to avoid damaging flexible brake line. Remove both rear springs from their seats.

NOTE: It may be necessary in some cases to remove the tapered punch locating upper control arm to pivot bushing on axle housing to permit hoist to clear axle housing. Also, it may be necessary to assist the springs out of their seats by using a pry bar or a screw-type jack stand that will permit raising the frame in relation to the rear axle housing.

Installation

1. Set the coil spring (s) into their respective seats on the lower control arm. The end of the bottom coil must be $3/8'' \pm 1/8''$ from end of pocket in lower seat.
2. Carefully raise the axle assembly and attach the lower shock absorber mountings.
3. Connect the propellor shaft to the differential assembly.
4. If tapered punch was removed, tap the upper control arm to start it over the pivot bushing.
5. Hold the alignment of the upper control arm and pivot with a pry bar. While doing so, remove the punch, if installed, and install the pivot bolt through upper control arm and bushing. Install lockwasher and nut but do not tighten (fig. 18).
6. Mount the rear suspension tie rod to the right hand stud. Install the nut and special washer but do not tighten.

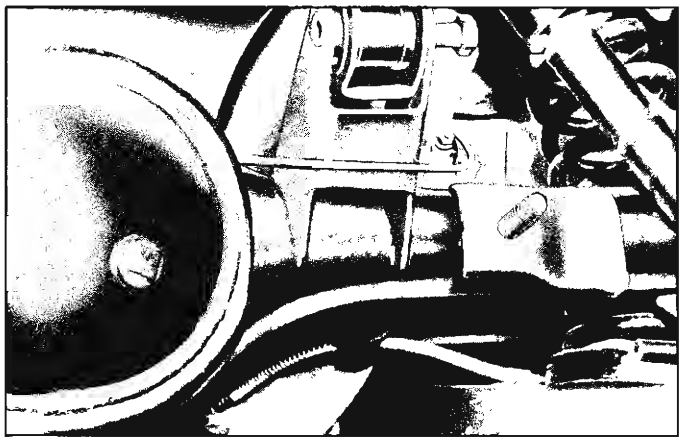

Fig. 18—Installing Upper Control Arm to Axle Housing Bracket

7. Install the bolt, lockwasher and nut to the left hand bracket. Do not tighten.

   NOTE: Bolt may be installed from either direction.

8. Attach shock absorbers and bushings to the anchor pins with spacer, lockwasher and nut and tighten.
9. Position the center propellor shaft bearing as outlined in Section 5.
10. Lower vehicle to floor, bounce rear end several times and tighten upper control arm pivot bolt attaching nut to 80-90 ft. lbs. torque.
11. Tighten tie rod right hand stud nut and left hand bolt nut to 55-70 ft. lbs. torque.

FRONT SUSPENSION LOWER CONTROL ARM SPHERICAL JOINT, CROSS SHAFT OR BUSHINGS

When replacing the lower control arm, spherical joint, shaft bushings, it is necessary to remove the control arm assembly from the vehicle.

Lower Control Arm Assembly

Removal

1. Remove the front coil spring as outlined under "Front Coil Spring Removal."
2. Remove the two front cross shaft to frame attaching bolts and lockwashers and the rear frame attaching nut and lockwasher.
3. Remove the lower control arm assembly from the vehicle.

Spherical Joint

Inspection

The lower control arm spherical joint should be replaced whenever wear is indicated in the upper joint inspection.

NOTE: The lower control arm spherical joint is a loose fit in the assembly when not connected to the steering knuckle.

Only if inspection of each upper joint indicates them both to be within limits, inspect each lower joint for excessive wear as follows:

1. After reconnecting upper joints to steering knuckles, support vehicle weight on wheels or wheel hubs.
2. With outside micrometer or caliper, measure distance from top of lubrication fitting to bottom of ball stud, and record the dimensions for each side.
3. Then support vehicle weight at outer end of each lower control arm, so that wheels or wheel hubs are free, then repeat step 2.
4. If the difference in dimensions on either side is greater than $\frac{3}{32}$" (.09375"), the joint is excessively worn and both lower joints should be replaced.

If inspection of lower spherical joints does not indicate excessive wear, inspect further as follows:

5. Examine lubrication hole in each joint assembly after cleaning out hole. Look for evidence of the liner partially or fully blocking lubrication opening. Such evidence indicates that liner is disintegrating and that both lower spherical points should be replaced.

Another indication of lower spherical joint excessive wear is indicated when difficulty is experienced when lubricating the joint. If the liner has worn to the point where the lubrication grooves in the liner have worn away, then abnormal pressure is required to force lubricant through the joint. This is another reason to recommend replacement of both lower joints.

If the above inspections do not indicate any reason for spherical joint replacements, test the torque tightness of the lower ball stud on each side as follows:

1. Wire-brush off nut and cotter pin attaching spherical joint ball stud to steering knuckle and examine for evidence of looseness of stud in knuckle.
2. If no evidence of looseness, remove cotter pin and with prick punch or equivalent, mark nut and stud to identify relative location later.
3. Tighten nut to original position and observe torque reading. If less than 45 lbs. ft., stud may have been loose in steering knuckle and replacement of both lower spherical joints should be recommended.

Removal

1. Support lower control arm at outer end on floor jack, with hoist or jack pad clear of lower ball stud nut.
2. Remove upper and lower ball stud nuts, free ball studs from steering knuckle and wire knuckle and brake drum assembly up to fender skirt to preclude interference while performing next step.
3. Prick punch approximate centers of rivets.
4. Being careful not to enlarge the holes in control

arm, cut off rivets as shown in Figure 19. Using Tool J-6627 remove joint and seal.

Installation

NOTE: The service part will be in three pieces. The metal inner seal is to be carefully pressed in place on the joint housing. The rubber outer seal should then be placed over the inner seal.

1. Install new joint against underside of control arm and retain in place with special bolts and nuts supplied with new joint.

   CAUTION: Use ony alloy bolts supplied for this operation.

2. Tighten $\frac{5}{16}$ nuts to 20-25 ft. lbs. torque and nut on ball stud forging to 35-45 ft. lbs. torque.

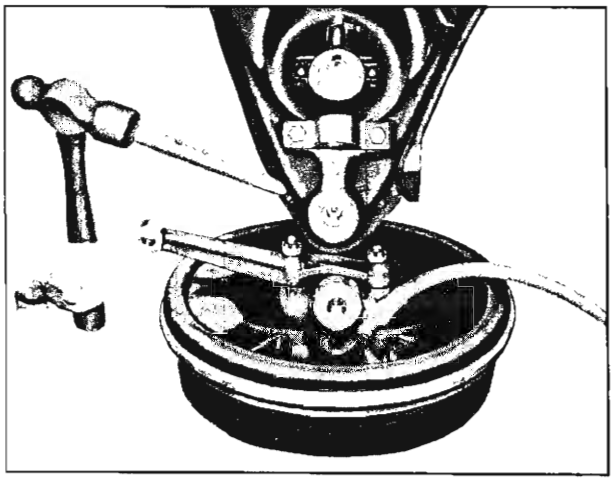

Fig. 19—Spherical Joint Removal

Cross Shaft and/or Bushings

Removal

1. Remove bolt, lockwasher and collar from each end of cross shaft.
2. Thread a $\frac{7}{16}$ x 20 capscrew (furnished with Tool J-5888) to the bottom of the threads in one end of the cross shaft.
3. Support control arm in an arbor press on Tool J-5888-3, as shown in Figure 20.

   NOTE: Be certain bushing flange does not contact support.

4. Press on cap screw until bushing is free of control arm. Discard bushing.
5. Remove cap screw from cross shaft. Insert it in other end of shaft. Invert control arm on support (fig. 21). Again be certain bushing flange does not contact support.
6. Press on cap screw until bushing is free of control arm. Discard bushing.

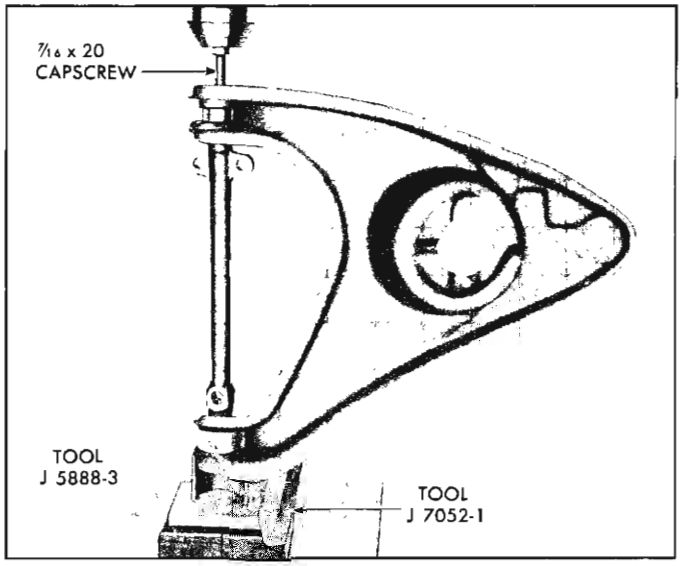

Fig. 20—Removing Lower Control Arm Cross Shaft Bushing

Installation

1. With cross shaft in control arm and Tool J-7052-1 in position, place control arm on Tool J-5888-3. Hand start bushing into control arm and over end of cross shaft.

   NOTE: The end of the shaft with the two bolt holes should be toward front of control arm.

2. Install Tool J-7052-5 over bushing. Be certain three-piece spacer is not over-lapping bushing holes in control arm.
3. Press bushing into control arm until flange contacts control arm (fig. 22).

   NOTE: In extreme cases, due to manufacturing tolerances, it may be necessary to shim under Tool J-7052-1 to assure proper contact with both flanges of control arm.

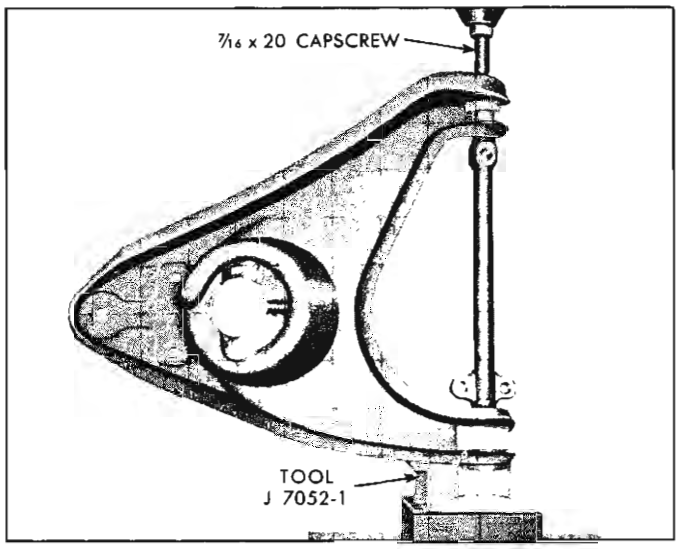

Fig. 21—Removing Second Lower Control Arm Cross Shaft Bushing

4. Invert arm in press and repeat the process on the other bushing. After installation, cross shaft should be free enough to be rotated by hand.
5. Install collar, lock washer and cap screw in each end of cross shaft. **Do not tighten.**

Lower Control Arm Assembly

Installation

1. With the control arm in place, attach in place with the three lock washers and special washers under rear bolt, bolts, and anchor nuts.
2. Install coil spring as outlined under "Front Coil Spring Installation."
3. With unit on floor, tighten cross shaft bushing bolts to 45-55 ft. lbs. torque.

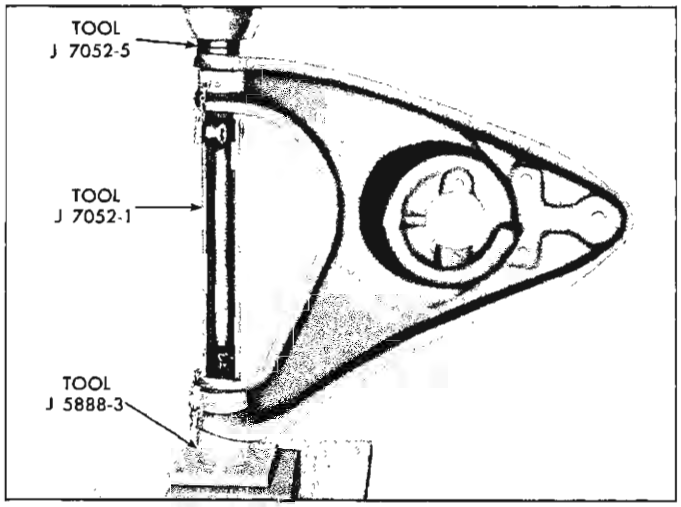

Fig. 22—Installing Lower Control Arm Cross Shaft Bushings

FRONT SUSPENSION UPPER CONTROL ARM SPHERICAL JOINT, CROSS SHAFT OR BUSHINGS

Upper Control Arm Assembly

Removal

1. Support vehicle weight at outer end of lower control arm.
2. Remove wheel and tire assembly.
3. Remove cotter pin and nut from upper control arm ball stud.
4. Remove the stud with Tool J-6627.
5. Remove two nuts retaining upper control arm shaft to front cross member. Note number of shims at each bolt.

   NOTE: The bolts attaching the control arm to the frame must be cut off or removed to allow proper clearance for control arm removal.

6. Remove upper control arm from vehicle.

Spherical Joint

Inspection

The upper spherical joint is checked for wear by checking the torque required to rotate the ball stud in the assembly. Install a stud nut on the stud and measure the torque required to turn the stud in the assembly with a torque wrench. This should be a minimum of 2 ft. lbs. If excessive wear is indicated in upper joint, both upper and lower joints should be replaced. If a tight joint is suspected, 15 ft. lbs. is the maximum allowable torque with joint well lubricated.

NOTE: This inspection does not necessitate upper control arm removal. Follow the upper arm removal procedure through Step 4 and raise the arm for the check.

Replacement

The upper control arm spherical joint is replaced as outlined for lower control arm, except that flange of joint is installed on top side of upper control arm, and holes in arm are reamed out to $^{21}/_{64}$" diameter.

Cross Shaft Bushings

Removal

1. Remove cap screws, lock washers and collars from both ends of cross shaft.
2. Install a $^{3}/_{8}$-24 cap screw (furnished with Tool J-5888) in one end of cross shaft.
3. Support control arm in an arbor press on Tool J-5888-3 as shown in Figure 23.

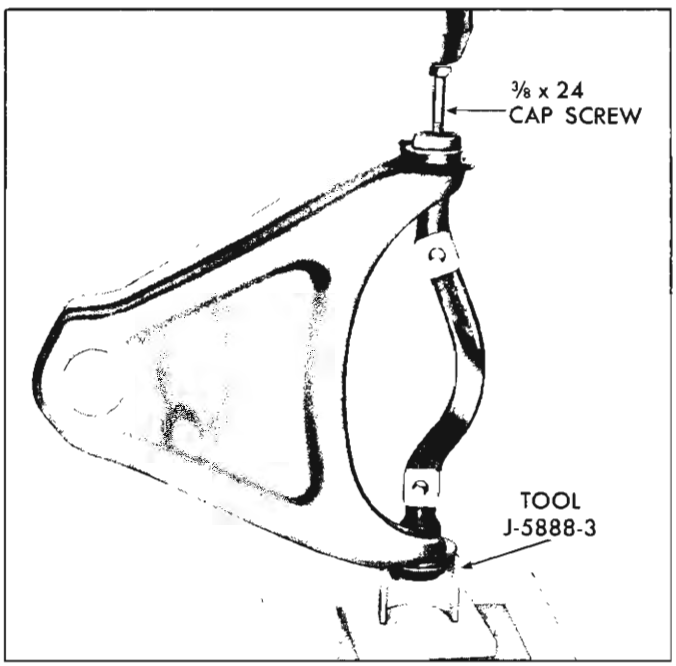

Fig. 23—Removing Upper Control Arm Cross Shaft Bushings

NOTE: Be certain flange of bushing does not contact support.

4. Press out bushing, invert control arm and repeat process on other bushing. Discard bushings.
5. Remove cap screw from cross shaft.

Installation

1. Install arm in arbor press with Tool J-7052-2 in place and press in one bushing while supported on Tool J-5888-3 as shown in Figure 24.

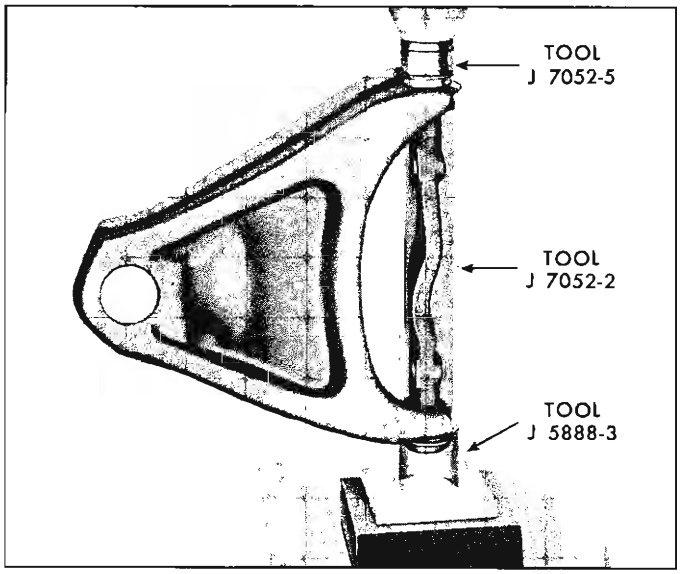

Fig. 24—Installing Upper Control Arm Cross Shaft Bushing

2. Install cross shaft in arm invert in press, and press in second bushing as above.
3. Cross shaft should be able to be turned by hand.
4. Install collar, lockwasher and cap screw in ends of cross shaft. Do not tighten.

Upper Control Arm Assembly

Installation

1. Install upper control arm to vehicle. Make certain attaching studs are in position.
2. Install two nuts and bolts retaining upper control arm shaft to front cross member. Install same number of shims as removed at each bolt.
3. Install new rubber seal on joint stud.
4. Install ball stud through knuckle, install nut, tighten securely and install cotter pin.
5. Install wheel and tire assembly.
6. Lower vehicle to floor.
7. Bounce front end of vehicle to centralize bushings and tighten bushing collar bolts to 35-40 lbs. ft.

REAR SUSPENSION UPPER CONTROL ARM AND BUSHINGS

Removal

1. Using a suitable hoist that will support the rear axle housing or wheels (such as a twin post or drive on ramp type), remove the rear pivot bushing bolt at the rear axle housing (fig. 25).

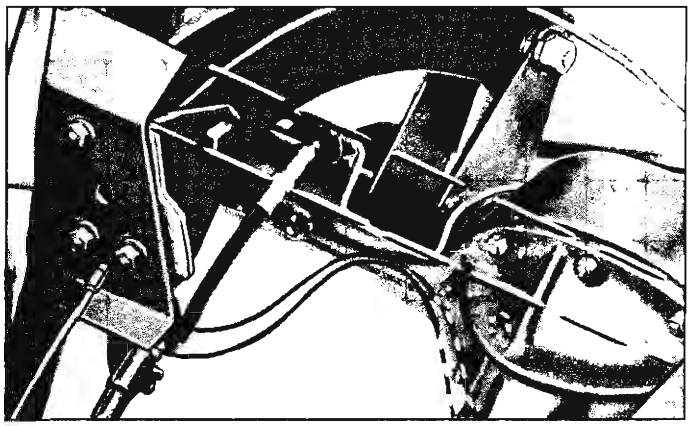

Fig. 25—Rear Suspension Upper Control Arm Attaching Points

NOTE: The rear axle must be supported in such a way as to prevent the axle housing from rotating about the lower control arm rear pivot, and to also relieve load on the pivot bushing.

2. Remove the three bolts, lockwashers and nuts attaching the upper control arm bracket to the crossmember.
3. Separate the control arm bracket from the crossmember. Note the number of shims removed as these control the driveline angles. Remove the arm from under vehicle.
4. Remove the bolt, nut and washer attaching the upper control arm to the bracket. Separate the control arm from the bracket.

   If the control arm bushings are to be removed proceed as follows:
5. With control arm bushing centered over Tool J-7574-4 and Tool J-7574-3 in place and with arm resting horizontally by supporting at opposite end, press or tap bushing from arm using Tool J-7574-1 and Tool J-7079-2 (Driver Handle) (fig. 26).

   NOTE: Be certain to place the remover on the end of the bushing without the flange.
6. Repeat above step (No. 5) for opposite end of control arm.

Installation

If the upper control arm bushings were removed proceed as follows:

1. Turn arm to opposite side (bushing can only be installed from this one direction), center the bush-

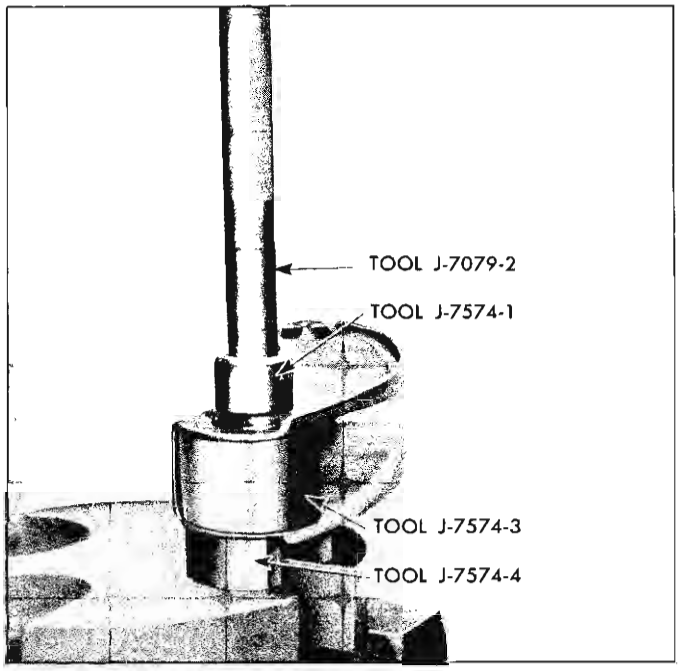

Fig. 26—Removing Upper Control Arm Bushings (Rear Bushing Shown)

ing hole over support (J-7574-4) and install Tool J-7574-3 between flanges at hole location. Tool J-7574-3 will prevent over-compression of arm during overtravel.

2. Fix Tool J-7574-2 onto Tool J-7079-2 (Driver Handle).
3. Start bushing into hole and press or tap in place. Check to see that no interference or cocking takes place. The flange of the bushing must be seated against the arm (fig. 27).

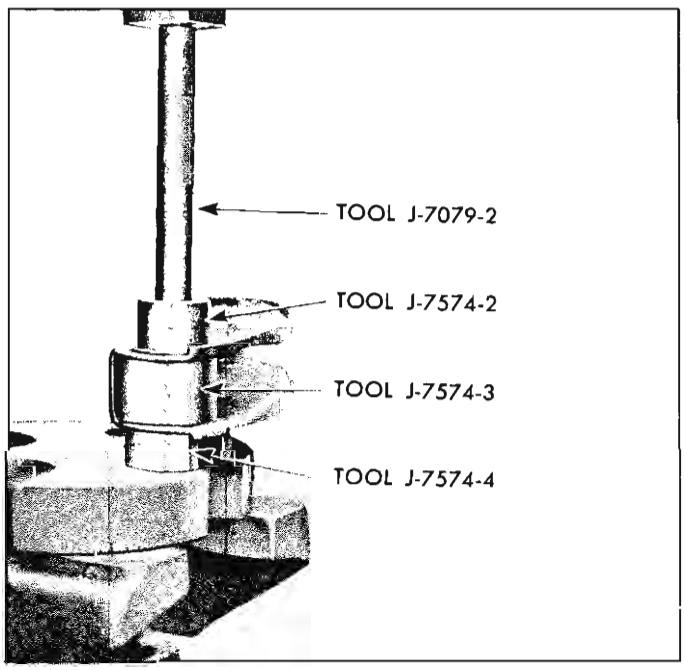

Fig. 27—Installing Upper Control Arm Bushings (Front Bushing Shown)

If neither bushing was replaced start upper control arm installation procedure with the following steps:

4. Tap the front of the upper control arm into the control arm bracket (fig. 28). Install the bolt, lockwasher and nut but do not tighten.

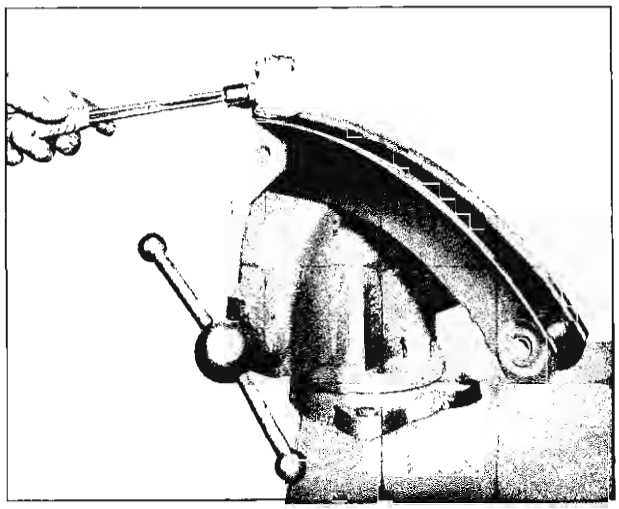

Fig. 28—Installing Upper Control Arm to Control Arm Bracket

5. Set the control arm (with front bracket installed) on the axle housing bracket and tap into place (fig. 29). Install the bolt (the head of the bolt must be towards the outboard side), lockwasher and nut but do not tighten.
6. Align the forward end of the upper control arm bracket with the frame bracket or crossmember.
7. Install the two lower bolts through the control arm bracket and frame bracket or crossmember. Be certain the shims are in place. Install both nuts and lock washers. Install the upper bolt and flat washer from the front of the bracket. Install lock washer and nut. Torque the above three nuts to 60-80 ft. lbs. torque.

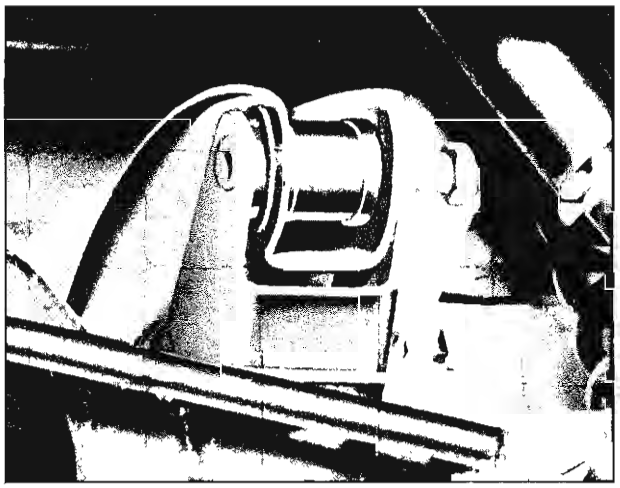

Fig. 29—Installing Upper Control Arm to Axle Housing Bracket

8. If a new control arm was installed, check "Driveline Angles" as outlined in Section 5.
9. Lower vehicle to floor.
10. Bounce the rear end of the vehicle several times to settle bushings. Tighten the two upper control arm nuts to 80-90 ft. lbs. torque.

REAR SUSPENSION LOWER CONTROL ARM AND BUSHINGS

Removal

1. Place vehicle on suitable hoist and support frame side rails.
2. Remove both rear shock absorbers as outlined in this section. Remove wheels and tires.
3. Remove both rear springs as outlined in this section.
4. Remove the shock absorber lower anchor pin as outlined in this section.

   NOTE: If both rear suspension lower control arms are to be removed support the rear axle housing in such a manner as to prevent its moving or falling from the hoist or jack.

5. Remove parking brake cable hold down clip.
6. Remove attaching nut, bolt and lockwasher on forward end of control arm. Remove arm.

Front Bushing Removal

1. With control arm and bushing centered over Tool J-7574-4 and with Tool J-7574-3 in place, and with arm resting horizontally by supporting at opposite end, press or tap bushing from arm using Tool J-7574-5 and Tool J-7079-2 (Driver Handle) (fig. 30).

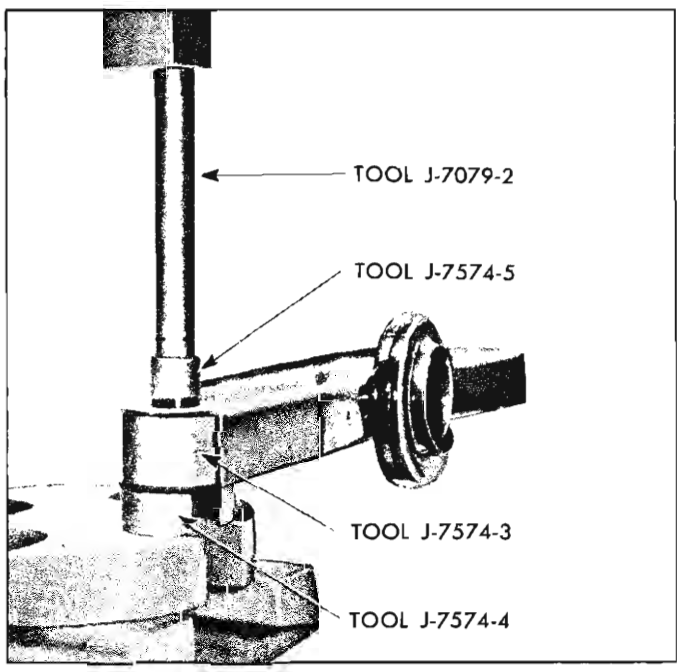

Fig. 30– Removing Lower Control Arm Front Bushing

NOTE: Be certain to place the remover on end of the bushing without the flange.

Rear Bushing Removal

3. Repeat above operations for opposite end using Tool J-7574-1 in place of Tool J-7574-5. (This operation is similar to that shown in Figure 30.)

Bushing Installation

4. Turn arm to opposite side (bushing can only be installed from this one direction), center the bushing hole over support and install Tool J-7574-3 between the flanges at hole location to prevent overcompression of arm during overtravel. Tool J-7574-4 should still be in place supporting the control arm.

Front Bushing

5. Fix Tool J-7574-6 onto Tool J-7079-2 (Driver Handle).
6. Start bushing into hole and press or tap in place. Check to see that no interference or cocking takes place. The flange of the bushing must be seated against the arm (fig. 31).

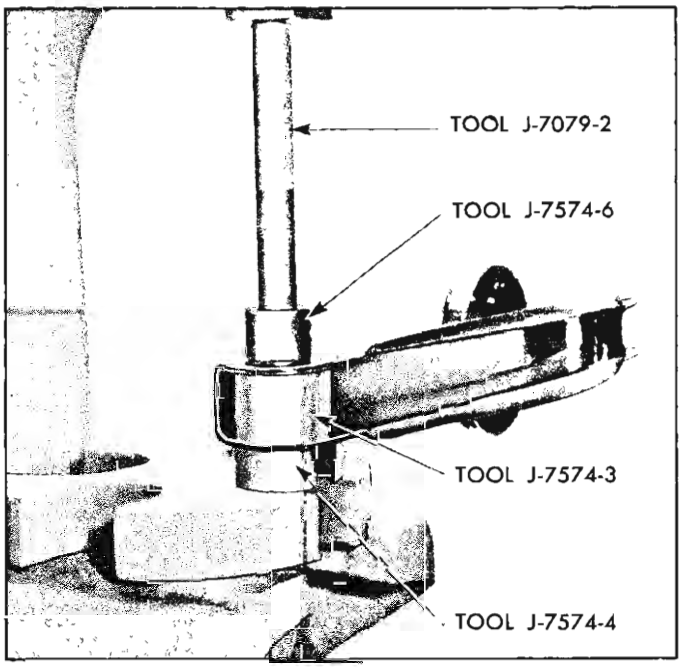

Fig. 31—Installing Lower Control Arm Front Bushing

Rear Bushing

7. Use Tool J-7574-2 in place of Tool J-7574-6 and repeat above procedure.

Installation (Control Arm)

8. Install forward end of lower control arm. Install attaching bolt, nut and lock washer. Do not tighten.
9. Swing control arm into place and install shock absorber lower anchor pin as described in this section. Do not tighten attaching bolt.

10. Install wheel and tire assembly.
11. Install both coil springs as outlined in this section.
12. Install both shock absorbers as outlined in this section.
13. Check "Driveline Angles" as outlined in Section 5.
14. Lower car to floor.
15. Bounce rear end several times to settle bushings. Tighten attaching nuts to 80-90 ft. lbs. torque.

Rear Suspension Tie Rod

Removal

1. Remove the nut, washer and bolt from the left hand side and the nut and washer from the stud on the right side that secure the tie rod to the brackets (fig. 32). Withdraw the rod from under the vehicle. An external shell service bushing is available for replacement.

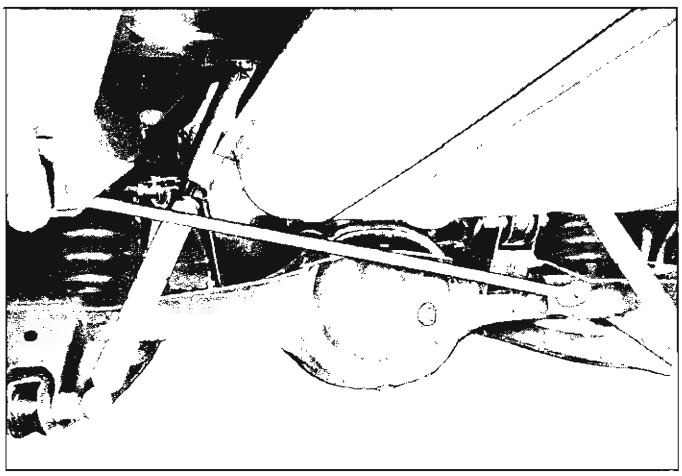

Fig. 32—Rear Suspension Tie Rod Attaching Points

NOTE: The above operations need not be performed on a hoist. However, to provide ample working space, the use of a hoist or proper jack stand is recommended.

Bushing Replacement

1. With tie rod bushing centered over Tool J-7877-2 and with tie rod supported horizontally, press or drive bushing from rod, using Tools J-7877-1 and J-7079-2 as shown in Figure 33.
2. With tie rod end centered over Tool J-7877-2 and rod supported horizontally, press or drive bushing into arm using Tools J-7877-3 and J-7079-2 as shown in Figure 33. Tool J-7877-3 should bottom on tie rod when bushing is fully installed.

Installation

1. Mount the tie rod to the right hand stud. Install nut and special washer but do not tighten.
2. Install the bolt, lockwasher and nut to the left hand bracket (fig. 32). Do not tighten.

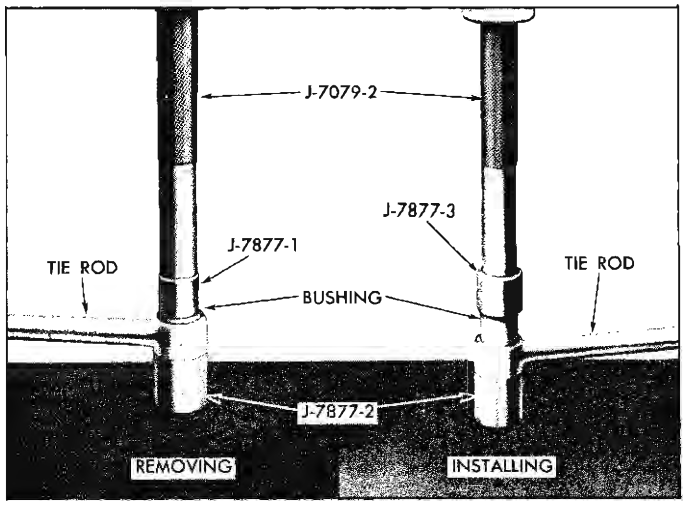

Fig. 33—Tie Rod Bushing Replacement

NOTE: Bolt may be installed from either direction.

3. Lower vehicle to floor (if raised) and bounce rear end several times to settle bushings. Tighten to 55-70 ft. lbs. torque.

WHEELS AND TIRES

INDEX

GENERAL DESCRIPTION

All passenger car models carry disc type wheels with tubeless type tires. The wheels are connected to the front wheel hubs and rear axle shaft flanges by five studs and nuts each. All vehicles have a $10\frac{11}{16}$" diameter snap-on type hub cap made of stainless steel.

The tires used on all models except station wagons and convertibles are 7.50-14 4 ply. The station wagon and convertible models utilize 8.00-14 4 ply tires.

The spare tire is mounted horizontally in the front section of the trunk compartment on all models except the station wagon, where it is mounted vertically in a well near the inside of the right rear fender. A bumper-type jack with a wide base, and a combination jack handle, wheel nut wrench and hub cap remover are supplied with all models.

MAINTENANCE

TESTING TIRE PRESSURES

The correct cold tire pressure for all 4-ply tires is 24 lbs. for all sedans front and rear, and 28 lbs. for 6 and 9 passenger station wagons rear. Frequent checking is essential with low pressure tires as variations of only a few pounds make an appreciable difference in riding qualities, handling ease and tire wear. It should also be general practice to check tire pressures each time a car is brought in for service, not only as a convenience to the owner, but also to reduce the possibility of owner complaint of riding, steering or tire wear due solely to improper tire inflation. Checking inflation pressures should be a part of every lubrication job.

The following recommended pressures must be maintained to obtain maximum tire performance.

Starting Pressures—when car has been standing three hours or driven less than a mile: 24 lbs. for sedans front and rear, and 28 lbs. for 6 and 9 passenger station wagons rear.

City Pressure—27 lbs. after driving car three miles or more below 40 miles per hour.

Highway Pressure—29 lbs. after driving car three miles or more above 40 miles per hour.

The pressures do not increase more than 5 pounds when heated under hard driving. Do not "bleed" tires to reduce this higher pressure.

When checking tires, servicemen should be careful to reinstall valve stem caps. These caps provide an essential function in keeping dirt out of the valve thus reducing the possibility of slow leaks through the valve.

PUNCTURE INSPECTION

Every 1000 miles or at each lubrication, the tires should be inspected for puncturing objects. If such are found, they should be removed and the tire repaired as explained in this section.

CHANGING ROAD WHEELS

To change the road wheels using the jack that comes with the car, observe the following procedure:

1. Set hand brake and block front wheels if rear wheel is being changed.
2. Remove hub cap or wheel disc and break wheel mounting nuts loose.
3. Place the jack directly under the bumper brackets and raise car until wheel clears ground.
4. Remove wheel mounting nuts and remove wheel from hub or drum.
5. To replace road wheel, reverse the above instructions. Proper torque on nuts is 45-65 ft. lbs.

CAUTION: On models equipped with discs, index the pilot hole in the disc on the valve stem. (To insure that the anti-rotation notches in wheel disc register on lugs in wheel rim.)

INTERCHANGING TIRES

Normal tire wear is uneven between the front and rear wheels because of the difference in the functions of the front and rear tires. To minimize tire wear and tire noise, it is recommended that tires be interchanged both as to front or rear use and as to change of direction at intervals of from 4,000 to 5,000 miles.

In addition, utilizing the spare tire in rotation with the other four tires gives 20% more total car mileage before replacement tires must be purchased.

The recommended plan for interchanging tires is based on the following steps.

Move the left front wheel to left rear, left rear to right front, right front to spare, spare to right rear and right rear to left front.

In detail, the plan provides the changes as shown in Figure 34 each time the tires are interchanged.

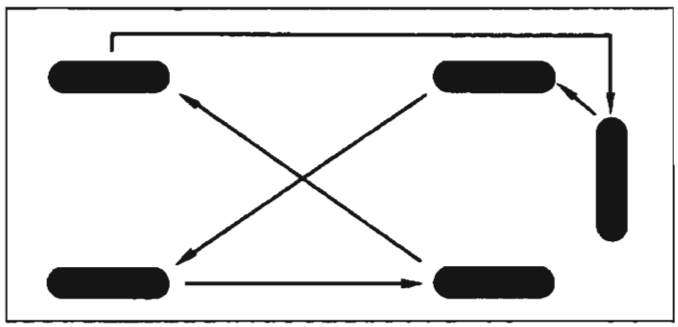

Fig. 34—Tire Rotation Plan

CLEANING WHITEWALL TIRES

A great deal of ordinary road dirt which collects on white sidewall tires may be sponged off with clear water or a mild soap solution.

Chevrolet Whitewall Tire Cleaner however, is a quicker and more effective cleaner for removing dirt and stains from whitewall tires and in many cases it will remove stains and discoloration that the simpler method of soap and water will not remove.

Under no circumstances should gasoline, kerosene or any cleaning fluid containing a solvent derived from oil be used to clean whitewall tires. Oil in any form is detrimental to rubber and a cleaner with an oil base will discolor or injure whitewall tires.

SERVICE OPERATIONS

CORRECTION OF IRREGULAR TIRE WEAR

Heel and Toe Wear—This is a saw-toothed effect where one end of each tread block is worn more than the other.

The end that wears is the one that first grips the road when the brakes are applied.

Heel and toe wear is less noticeable on rear tires than on front tires, because the propelling action of the rear wheels creates a force which tends to wear the opposite end of the tread blocks. The two forces, propelling and braking, make for more even wear of the rear tires, whereas only the braking forces act on the front wheels, and the saw-tooth effect is more noticeable.

A certain amount of heel and toe wear is normal. Excessive wear is usually due to high speed driving and excessive use of brakes. The best remedy, in addition to cautioning the owner on his driving habits, is to interchange tires regularly.

Side Wear—This may be caused by incorrect wheel camber, underinflation, high cambered roads or by taking corners at too high a rate of speed.

The first two causes are the most common. Camber wear can be readily identified because it occurs only on one side of the treads, whereas underinflation causes wear on both sides. Camber wear requires correction of the camber first and then interchanging tires.

There is, of course, no correction for high cambered roads. Cornering wear is discussed further on.

Misalignment Wear—This is wear due to excessive toe-in or toe-out. In either case, tires will revolve with a side motion and scrape the tread rubber off. If misalignment is severe, the rubber will be scraped off of both tires; if slight, only one will be affected.

The scraping action against the face of the tire causes a small feather edge of rubber to appear on one side of the tread and this feather edge is certain indication of misalignment. The remedy is readjusting toe-in within $\frac{1}{16}$" to $\frac{3}{32}$", or rechecking the entire front end alignment if necessary.

Uneven Wear—Uneven or spotty wear is due to such irregularities as unequal caster or camber, bent front suspension parts, out-of-balance wheels, brake drums

out-of-round, brakes out-of-adjustment or other mechanical conditions. The remedy in each case consists of locating the mechanical defect and correcting it.

Cornering Wear—Since the introduction of independently sprung front wheels, improvements in spring suspension have enabled drivers to negotiate curves at higher rates of speed with the same feeling of security that they had with the older cars at lower speeds. Consequently, curves are being taken at higher speeds with the result that a type of tire wear called "Cornering Wear," frequently appears.

When a car makes an extremely fast turn, the weight is shifted from an even loading on all four wheels to an abnormal load on the tires on the outside of the curve and a very light load on the inside tires, due to centrifugal force. This unequal loading may have two unfavorable results.

First, the rear tire on the inside of the curve may be relieved of so much load that it is no longer geared to the road and it slips, grinding off the tread on the inside half of the tire at an excessive rate. This type of tire shows much the same appearance of tread wear as tire wear caused by negative camber.

Second, the transfer of weight may also overload the outside tires so much that they are laterally distorted resulting in excessive wear on the outside half of the tire, producing a type of wear like that caused by excessive positive camber.

Cornering wear can be most easily distinguished from abnormal camber wear by the rounding of the outside shoulder or edge of the tire and by the roughening of the tread surface which denotes abrasion.

Cornering wear often produces a fin or raised portion along the inside edge of each row in the tread pattern. In some cases this fin is almost as pronounced as a toe-in fin, and in others, it tapers into a row of tread blocks to such an extent that the tire has a definite step wear appearance.

The only remedy for cornering wear is proper instruction of owners. They should be shown that rubber is being ground off of their tires and they should be instructed to drive a little more slowly on curves and turns. Also, the tires should be interchanged at regular intervals.

DISMOUNTING AND MOUNTING TIRES

Dismounting tubeless tires presents no problems if the correct procedures are used and the following precautions observed.

1. Remove the valve cap and valve core. Let out all the air.
2. Press the **inner side** of the tire into the rim well. Use bead loosening tool or if regular tire irons are used, take particular care not to injure or tear the sealing ribs on the bead.

   CAUTION: Never use tire irons with sharp edges or corners.

3. Using tire irons on the opposite side, remove bead, taking small "bites" around the rim.
4. Turn the tire over, and use two tire irons, one between the rim flange and the bead to pry the rim upward, the other iron to pry outward between the bead seat and bead.

Mounting Tubeless Tires

The general procedure is the same as for tube and tire installation except that extreme care must be exercised to prevent injury to the sealing bead and circumferential bead when forcing tire over rim.

Newly designed tire mounting machines or tire irons should be used.

1. Apply a light film of Ruglyde or other suitable rubber lubricant to sealing bead of tire.
   NOTE: The use of excessive lubrication may lead to rim slippage and subsequent breaking of oil seal.
2. Carefully mount the **outer bead** in usual manner by using tire irons, taking small "bites" around rim, being careful not to injure the tire bead.
   CAUTION: DO NOT use a hammer, as damage to the bead will result.
3. Install the **inner bead** in the same manner.

   NOTE: If a seal cannot be effected in the foregoing manner with the rush of air it can be accomplished by applying to the circumference of the tire a tire mounting band or heavy sash cord and tightening with the use of a tire iron. On tire mounting machines, bouncing the tire assembly is not required. The tire should be lifted on the rim to force the top tire bead against the top rim flange. The weight of the tire will seat the bottom bead.

TIRE AND RIM REPAIR

Different types of tubeless tire repair equipment

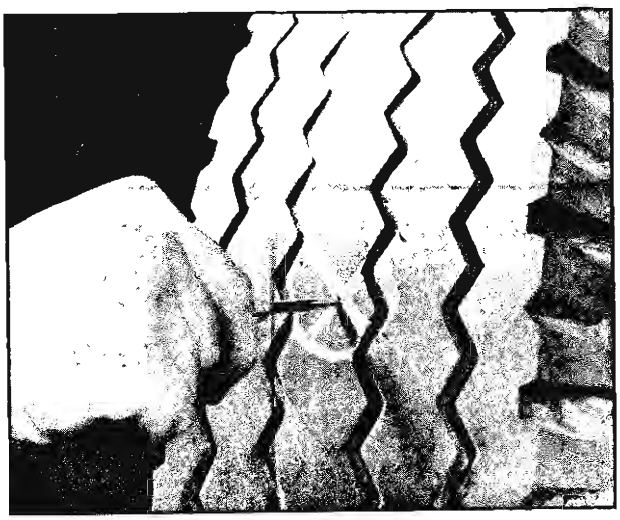

Fig. 35—Cleaning Hole with Awl

and various methods of repair are recommended by the tire manufacturers. The two methods recommended by Chevrolet are as follows:

The Hot Patch Method

With this method the patch uses its own fuel to be ignited when vulcanization takes place. This method is recommended for repairing punctures not exceeding $\frac{3}{16}$" in diameter. Size of puncture can be determined by size of puncturing object.

1. Clean out the injury with an awl or hand rasp furnished with the tire repair kit (fig. 35).
2. Using sealing gun, fill puncture from outside of tire, see Figure 36.
3. Thoroughly clean inside of tire around injury with carbon tetrachloride (a good grade of non inflammable clear dry cleaner may be used as a substitute). Allow the cleaned area to dry.
4. Roughen area around injury with hand buffer or wire brush, see Figure 37.
5. Spread an even coating of a good grade of rubber cement over the puncture, slightly larger than the patch area, and allow to dry for 5 minutes.
6. Prepare patch material for igniting by loosening material slightly with point of a knife blade in then center of each side.
7. Carefully center hot patch over injury and hold in place using special hot patch clamp. Tighten clamp, maximum finger tight. (See Figure 38).

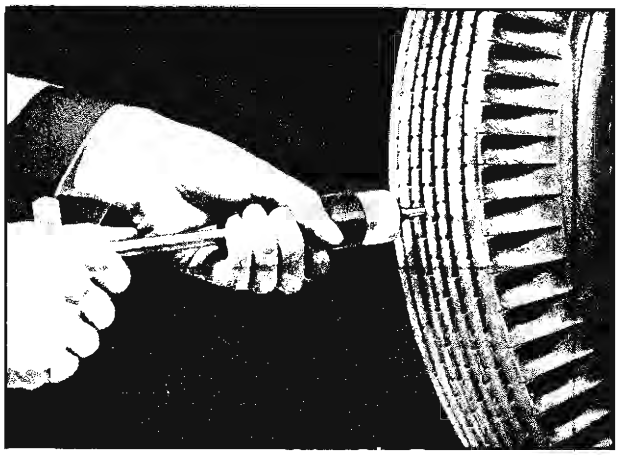

Fig. 36—Filling Hole with Sealing Gun

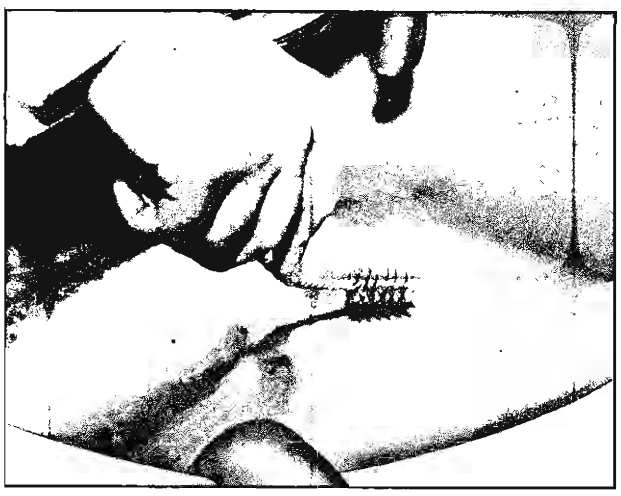

Fig. 37—Roughening Injury Area

Fig. 38—Using Hot Patch Clamp

8. Ignite patch material. Allow to cool 15 minutes or until cool enough to touch.
9. Carefully remove metal cup and blow out any ashes remaining in tire.

The Self-Vulcanizing Outside Plug Method (Tire Mounted)

Through the use of self-vulcanizing outside plug repair kits currently on the market, passenger car tubeless tire punctures can now be permanently repaired without dismounting the tire from the rim and in many cases, without removing the wheel from the car.

Punctures which cannot be repaired, are those which are over $\frac{3}{16}$-inch diameter, or leaks caused by incisions or ragged lacerations. Outside plug repairs can be made on all passenger car tubeless tires including those containing soft puncture sealing material.

The following procedure should be followed in using these kits.

1. Inflate tire to approximately 10 pounds pressure to support tire. Satisfactory repairs can be made with lower, or no pressure.
2. Locate puncture. Mark, and note direction of angle of puncture channel when removing puncturing object.
3. With cutter shaft of reaming tool in position, make circular cut (approx. ¼-in. deep) around puncture hole, using twisting action (fig. 39).
4. Flip the screw-type cleaning needle of reaming tool into position and insert into puncture (fig. 40). Apply light pressure only and turn clockwise into puncture channel right down to the handle of the tool, carefully following the direction of the puncture. Retract tool by continuing to turn clockwise but with slight pulling action. Repeat this operation twice. Clean rubber particles, if any, from round cutter of needle, after each retraction. Make sure the small circular cutout resulting from operation shown in Figure 39 has been

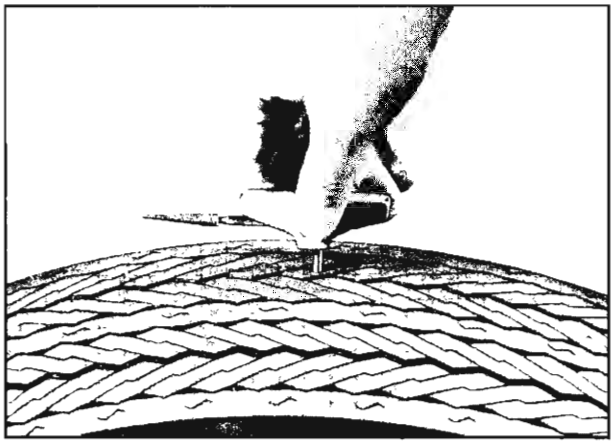

Fig. 39—Making Circular Cut With Reaming Tool

removed. Leave the needle in the puncture to prevent escape of air.

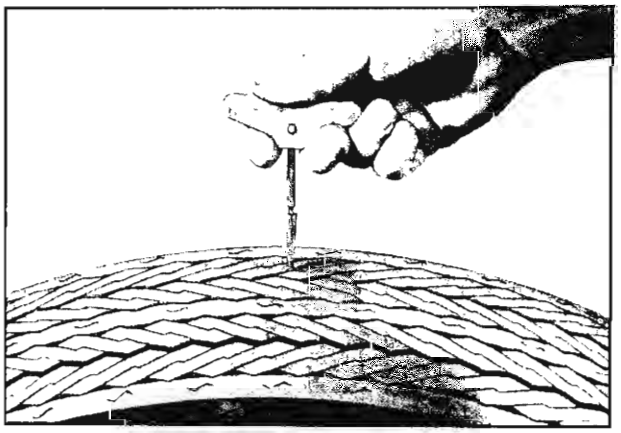

Fig. 40—Cleaning Puncture With Cleaning Needle

5. Prepare the plug for insertion into nozzle of the plug-insertion tool by pulling white stem of plug in metal tube until the head of the plug is seated tightly against the end of the tube (fig. 41). Cut off protruding end of plug stem.
6. Prepare the plug-insertion tool for insertion of plug:
   a. Insert cartridge of self-vulcanizing rubber cement into the open tool.
   b. Fit plunger into recessed cartridge base.
   c. Remove cleaning needle from the puncture and pierce cartridge with point of needle inserted through the nozzle of the tool. Enlarge the opening by twisting (fig. 42).
7. Press the nozzle of the plug-insertion tool firmly over the puncture hole and squeeze cement from cartridge until red spring on the tool stops the action (fig. 43). This deposits part of the cement. For repairs of punctures between narrow tread grooves attach short extension tube.
8. Insert the metal tube with plug into nozzle of the plug insertion tool, turning to the right until it is locked by the pin inside the nozzle. Lubricate

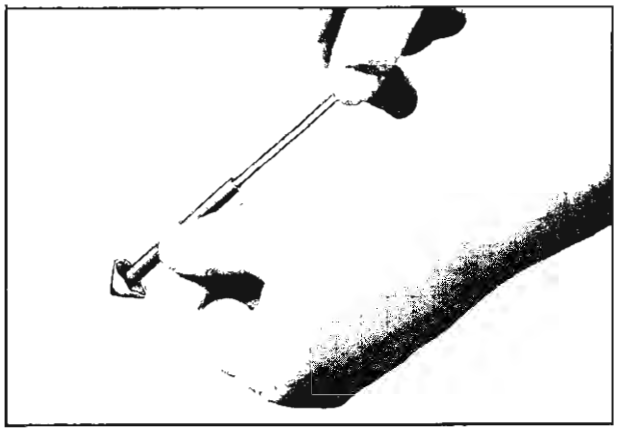

Fig. 41—Preparing Plug for Use

head of plug with rubber cement. Place plug head over puncture hole—holding lower end of metal tube to guide it and prevent bending—and push the entire metal tube into the puncture hole up to the base of the nozzle (fig. 44). Now press red spring stopper and squeeze the balance of cement into the tire (fig. 45). Retract metal tube with continuous clockwise turning and pulling action (fig. 46). Do not pull, but trim off excess of rubber

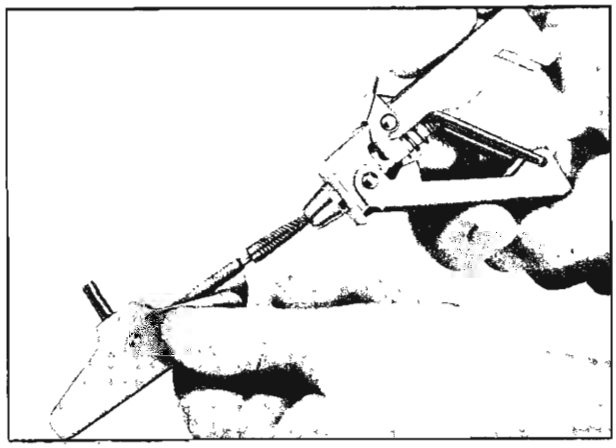

Fig. 42—Piercing Cement Cartridge

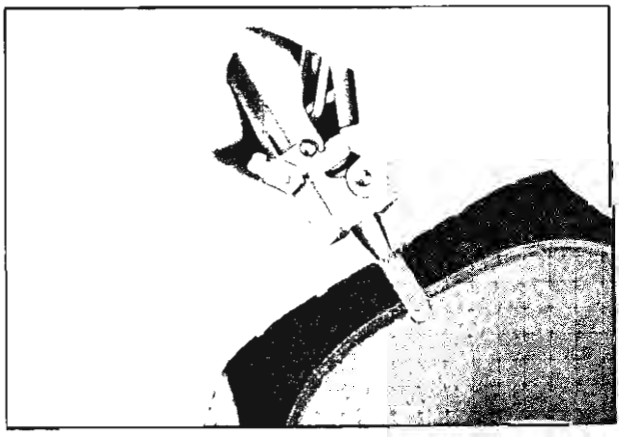

Fig. 43—Inserting Cement in Puncture

plug protruding from puncture. The repair is now complete and the tire is ready for immediate use.

9. Clean your tools. Especially remove hardened rubber cement before using the plug-insertion tool for the next repair.

NOTE: If the puncture is an irregular cut that will not seal completely by this method, a self-vulcanizing patch or hot patch repair should be made.

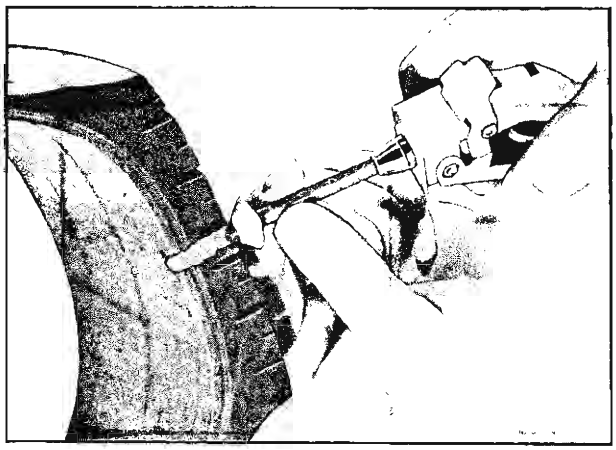

Fig. 44—Starting Plug into Puncture

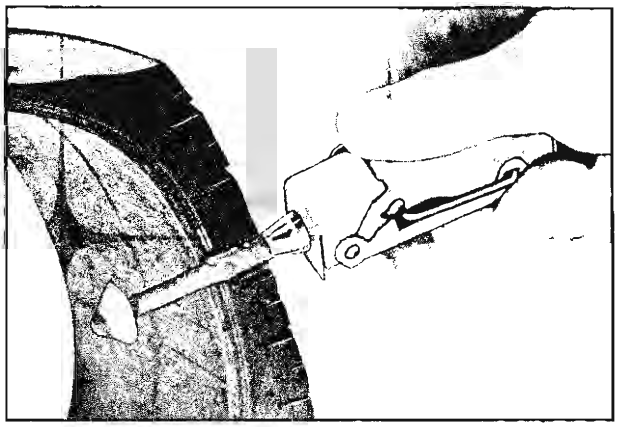

Fig. 45—Applying Remainder of Cement With Plug Inserted

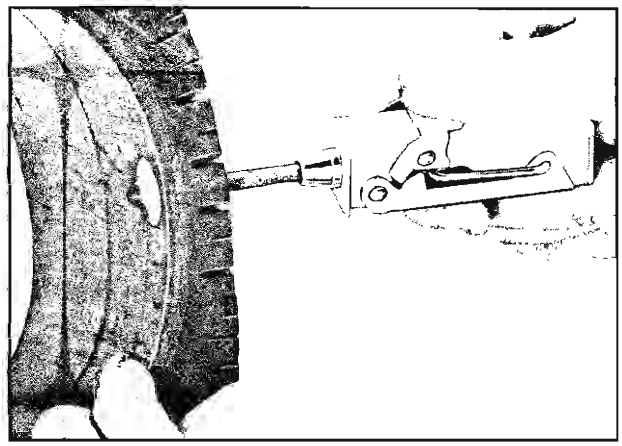

Fig. 46—Seating Plug to Complete Repair

The Self-Vulcanizing Method

(Tire Dismounted)

In this method, a chemical action vulcanizes the patch. No external source of heat is necessary. Maximum size of puncture hole must not exceed $\frac{3}{16}$" for this method of patching. (Larger size injuries must be repaired with press type vulcanizing equipment.) Many kits are manufactured and may be procured locally.

NOTE: This method should be used only for tires *without* soft puncture sealing material. The following procedure should be followed in using this kit.

1. Clean out the injury with the awl to remove puncturing object and foreign material.
2. Thoroughly clean the inside of the tire around the injury with carbon tetrachloride. Allow to dry.
3. Fill the injury with Filler Rubber (Supplied in the kit) using the awl as follows:
   a. Clean awl needle and dip in Self-Vulcanizing Fluid. From inside of tire, force needle through tire until point extends beyond tread (fig. 47).

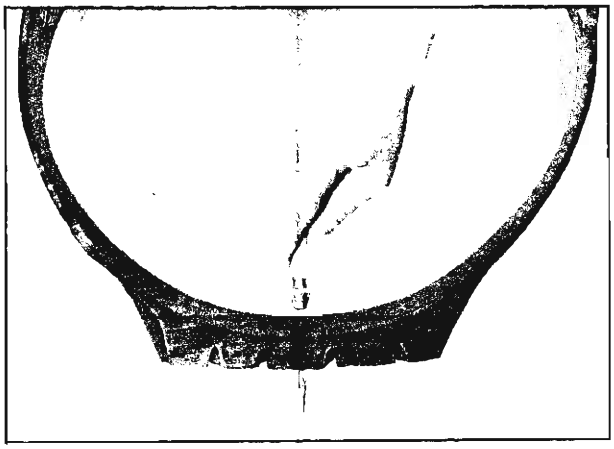

Fig. 47—Installing Needle in Tire Hole

   b. Remove detachable handle from awl needle. Cut ⅛" by 1" strip of Filler Rubber, remove protective cover and insert into hole of awl needle with end of rubber strip extending beyond the needle. (See Figure 48).
   c. Pull needle through tire with pliers. Filler Rubber will remain in the puncture. Cut off excess rubber flush with inside of tire. The injury may also be filled from the outside or inside with a sealant gun. Hold gun tip firmly against puncture and force sealant through until it comes through the other side of the tire.
4. Thoroughly roughen area around puncture, slightly larger than the patch, with wire brush included in kit. Remove all traces of lubricant, foreign matter, etc. Do not use additional solvent after buffing.
5. Apply Self-Vulcanizing fluid over buffed area. Spread evenly with **clean** finger. Allow to dry for

five minutes until no longer tacky. **This is important.**

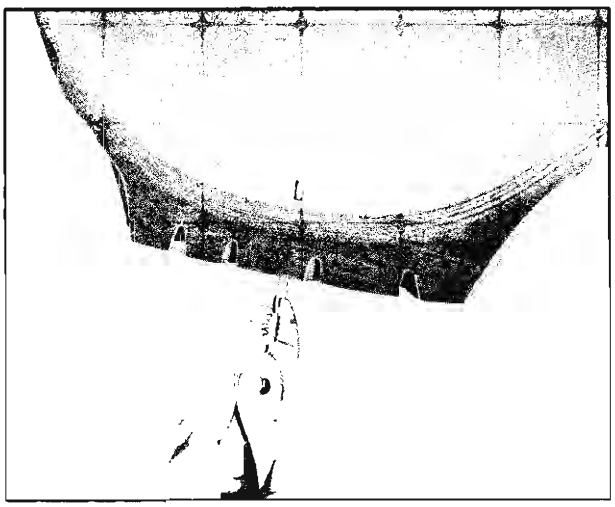

Fig. 48—Installing Filler Rubber in Hole

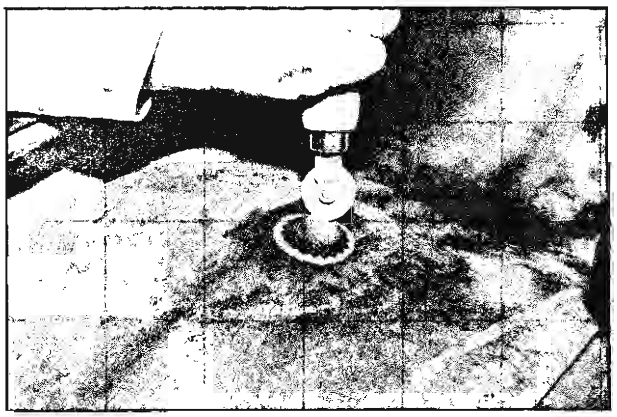

Fig. 49—Stitching Patch

6. Remove foil backing from patch. Place over injury and stitch down firmly, especially the edges, with roller tool included in kit. To prevent buckling and insure a good seal, roll patch from the center toward the outer edges. Vulcanization is completed chemically. (See Figure 49.) The repaired tire can be placed back in service immediately.

Rim Repair

1. Straighten the rim if it is bent or dented.
2. Clean rim flange thoroughly with small piece of steel wool or sand paper.
3. Inspect the butt-weld in the rim flange area to make certain there is no groove or high spot. Any grooves or high spots must be filed flat and smooth.
4. If air loss occurs at valve it can be corrected by replacing valve core or valve assembly.

Valve Assembly—Replace

NOTE: Always use new valve assembly when replacing.

1. Cut or drive old valve assembly out of rim.
2. Clean valve hole and surrounding area on inside of flange with steel wool.
3. Coat O.D. of new valve assembly liberally with the mounting compound (fig. 51).
4. Insert assembly through rim from inside. Snap into place, using a pair of slip-joint pliers with one jaw on rim and one jaw on base of valve assembly.

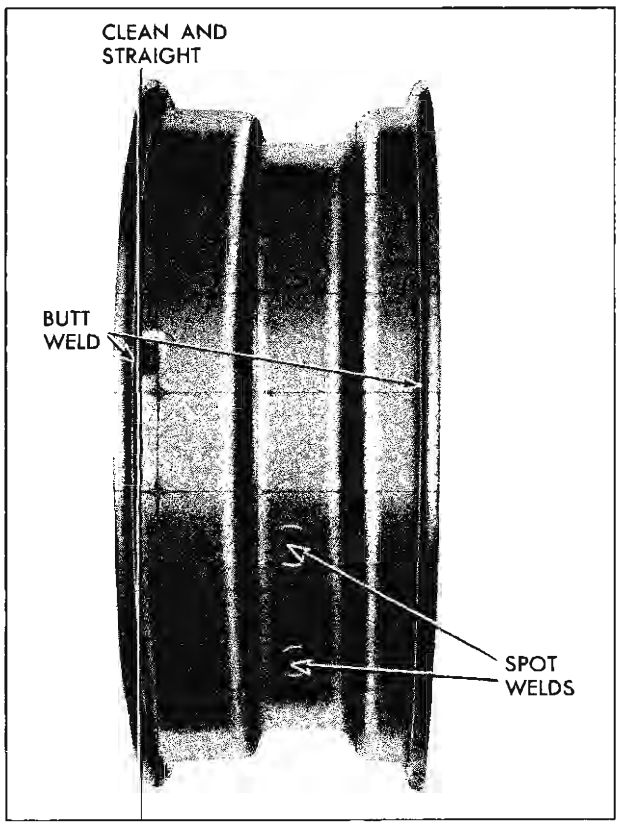

Fig. 50—Rim Inspection

BALANCING WHEELS AND TIRES

A wheel and tire assembly may lose its original balance due to irregular tire wear, tire repair or some type of misalignment. Consequently, if front end instability develops, the tire and wheel assembly should be checked for static and in severe cases, dynamic balance. The assembly should also be checked for balance whenever any original tire is replaceed or repaired, and especially in cases where nonstandard tire equipment, such as an extra ply casing, is used.

Static Balance (still balance) is the equal distribution of weight of the wheel and tire assembly about the axis of rotation so that the assembly has no tendency to rotate by itself. Static unbalance causes the pounding action of the front wheels that is called "tramp."

To correct static unbalance (front and rear):

1. Remove wheel and hub from spindle as a unit.
2. Clean all grease from wheel bearings and races.

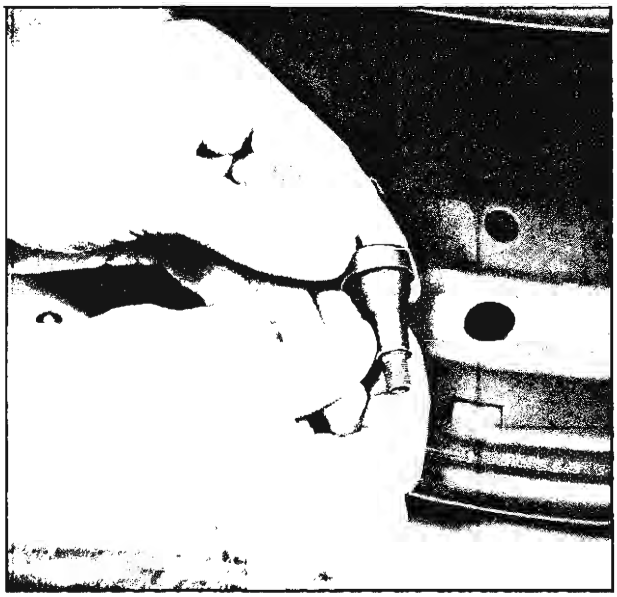

Fig. 51—Installing Valve

3. Clamp a clean spindle in a bench vise, or if the spindle on the car must be used, clean it carefully.
4. Mount the wheel on the spindle and adjust the bearings loosely so that the wheel is just held in position and is practically frictionless.
5. Make sure that the tire is inflated to the correct pressure.
6. Start the wheel in motion and allow it to stop by itself. When it stops, the heavy side will be at the bottom.
7. Mark the heaviest point and also the uppermost or lightest point.
8. Install two balancing weights on the rim opposite each other and 180° away from the heavy point.
9. Move these weights equally in opposite direction toward the heavy side until the wheel is in balance.
10. Repack wheel bearings, reinstall and adjust bearings as explained in this section under "Front Wheel Bearings—Adjust."

Dynamic Balance (running balance) requires the wheel to be not only in static balance, but balanced and running smoothly while turning on an axis which runs through the centerline of the wheel and tire perpendicular to the axis of rotation.

The quickest and best methods of testing and correcting dynamic unbalance are by the use of dynamic wheel balancers which are commercially available. These balancers include all necessary information on where and how the balancing weights should be placed. The following information, however, will help in the correction of dynamic balance.

NOTE: Before attempting to balance the wheels, check to be certain that no foreign matter has been trapped in the wheel ventilation slots or in the accessory wheel discs. This is especially important if the vehicle has been run in soft mud and then parked in freezing weather.

When a wheel that is statically unbalanced is dynamically in balance the dynamic balance can be retained while correcting the static balance by installing the corrective weights so that half of the weight required is placed on the inner edge of the rim and the other half on the outer edge of the rim.

Dynamic unbalance can be corrected without destroying static balance by installing weights so half of weight required for dynamic balance is placed on the rim opposite the heavy point, while the other half is placed 180° away and on the opposite side of the rim.

WHEEL RUN-OUT AND ECCENTRICITY

The wheels should not run out (wobble) more than $\frac{1}{16}$" as measured on the side of the rim at the base of the tire. Excessive run-out is the result of a bent wheel, an improperly mounted wheel, worn knuckle bearings or steering connections. These parts should be checked for correct adjustment, proper alignment and wear whenever excessive run-out is encountered.

The wheels should also run concentric with the steering knuckle spindle within $\frac{1}{16}$ inch as measured on the tire bead seat of the rim with the tire removed.

Wheel run-out, eccentricity and balance are closely associated with steering and front wheel alignment. Further information on these subjects will be found under "Standard Suspension."

TESTING FOR TIRE NOISE

Noise caused by the normal action of tire treads on various road surfaces is often confused with rear axle gears or other noises in the car.

The determination of whether tires are causing the noise complained of is relatively simple. The car should be driven at various speeds and note taken of part throttle, sudden acceleration and deceleration as axle and exhaust noises show definite variations under these conditions, while tire noise will remain constant. Tire noise is, however, most pronounced at speeds of approximately twenty or thirty miles per hour.

The tires may be further checked by driving the car over smooth pavement with the tires at normal pressure and again over the same stretch of pavement when the tires have been inflated to fifty pounds pressure. Reduce the tires to normal pressure (24 pounds) one at a time to determine faulty tire or tires. This high inflation pressure should immediately be reduced to normal after test. If the noise for which the test is being made is caused by tires it will noticeably decrease when the tire pressure is increased, whereas axle noise should show no change in volume.

If, on inspection, the tires on the front wheels are found to be creating most of the noise, the alignment of the front wheels should be checked, as excessive tire noise usually results from low tire pressure, incorrect alignment or from uneven tire wear.

TROUBLES AND REMEDIES

Symptoms and Probable Cause	Probable Remedy
Hard Steering	
a. Low air pressure in tires.	a. Inflate tires to recommended pressure.
b. Lack of lubrication.	b. Lubricate according to instructions.
c. Improper wheel alignment.	c. Front end alignment correction.
d. Sagging front or rear spring.	d. Replace springs as required.
e. Bent wheel or spindle.	e. Straighten or replace wheel or replace spindle.
f. Broken wheel bearings.	f. Replace necessary bearings.
g. Tight spherical joints.	g. If not corrected by lubrication, replace joints.
h. Underinflated tires.	h. Inflate tires to recommended pressure.
i. Improper steering gear adjustment.	i. Adjust steering gear.
j. Tie rod ends out of alignment.	j. Align tie rod ends with ball studs.
Front Wheel Shimmy	
a. Underinflated tires.	a. Inflate tires to recommended pressure.
b. Broken or loose wheel bearings.	b. Replace or adjust wheel bearings.
c. Worn spherical joints.	c. Replace joints.
d. Improper caster.	d. Adjust caster.
e. Unbalanced wheels.	e. Balance wheel and tire assemblies.
f. Steering gear loose.	f. Adjust steering gear.
g. Tie rod ball loose.	g. Replace tie rod end.
h. Loose wheel lugs.	h. Tighten lugs.
i. Bent wheel.	i. Replace or tighten wheel.
j. Improper alignment.	j. Front end alignment as per specifications.
k. Wheel out-of-balance.	k. Balance wheel.
Excessive or Uneven Tire Wear	
a. Wheels out of balance.	a. Balance wheels.
b. High speed cornering.	b. Instruct driver.
c. Improper air pressures.	c. Inflate tires to recommended pressure.
d. Not rotating tires as recommended.	d. Rotate tires according to instructions.
e. Improper acting brakes.	e. Correct brakes as required.
f. Improper alignment.	f. Align front end as per specifications.
g. Rapid stopping.	g. Apply brakes slowly on approaching stop.
Vehicle Too Flexible	
a. Faulty shock absorber.	a. Disconnect shock absorber and test action (there should be considerable and steady resistance in each direction when held in upright position), replace if necessary.
Hard Riding	
a. Shock absorber broken or seized.	a. Disconnect shock absorber and test action, replace if necessary.
b. Excessive tire pressure.	b. Check tire pressure, maintain 24 pounds (cold).

Road Wander

a. Underinflated tires.	a. Inflate tires to recommended pressure.
b. Lack of lubrication.	b. Lubricate chassis and steering gear.
c. Tight steering gear.	c. Adjust steering gear.
d. Improper toe-in.	d. Adjust toe-in.
e. Improper caster and camber.	e. Adjust caster and camber.
f. Worn tie rod ends.	f. Replace tie rod ends.
g. Loose relay rod.	g. Adjust relay rod joint.

Noise in Front or Rear Wheels

a. Loose wheel lugs.	a. Tighten wheel lugs.
b. Broken or loose brake shoe return springs.	b. Replace return springs.
c. Broken or rough wheel bearings.	c. Replace bearings according to instructions.
d. Scored drums.	d. Replace brake lining and machine drums.
e. Lack of lubrication.	e. Lubricate as per instructions.

Wheel Tramp

a. Wheel assembly out of balance.	a. Clean wheel and balance assembly.
b. Blister or bump on tire.	b. Replace or repair tire.
c. Improper shock absorber action.	c. Replace shock absorber.

Shock Absorber Noisy

a. Faulty shock absorber.	a. Disconnect shock absorber and test action, replace if necessary.
b. Loose dust tube on rear shock absorbers.	b. Replace shock absorber or refasten tube.
c. Improper grommet installation or loose retaining nuts.	c. Inspect and correct as necessary.

Shock Absorber Leaks Fluid

a. Faulty shock absorber.	a. Replace shock absorber.

Loss of Air (Tires)*

a. Puncture in tire.	a. Repair puncture.
b. Faulty valve or valve core.	b. Replace valve assembly or core.
c. Rim defect.	c. Correct rim defect.

*See Wheels and Tires in this section.

SPECIFICATIONS

Wheel Alignment:

Caster	$0 \pm \frac{1}{2}°$
Camber	$\frac{1}{2} \pm \frac{1}{2}°$
Toe-in	$\frac{1}{8}''$ to $\frac{1}{16}''$
Steering Axis Inclination	$7\frac{1}{4}° \pm \frac{1}{2}°$

Toe-out on Turns:

Inside Wheel	20°
Outside Wheel	$18\frac{1}{2}°$

SPECIAL TOOLS

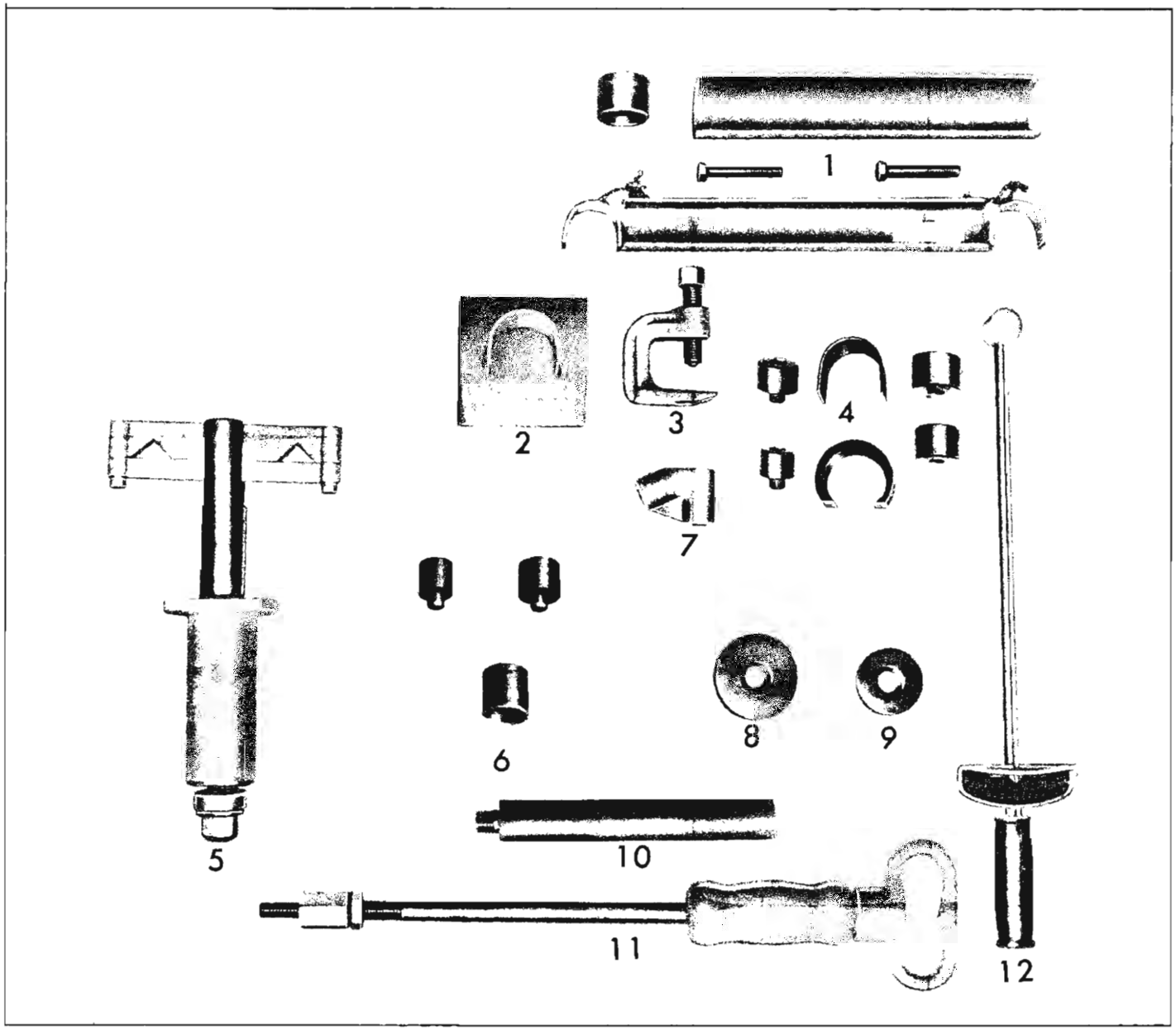

Fig. 52—Special Tools

1. J-7052 Front Suspension Control Arm Bushing Remover and Replacer
2. J-5888-3 Support
3. J-6627 (or J-6632) Pitman Arm Puller
4. J-7574 Rear Suspension Control Arm Bushing Remover and Installer Set
5. J-6874 Front Coil Spring Remover and Replacer
6. J-7877 Tie Rod Bushing Installer Set
7. J-7063 Rear Shock Absorber Lower Anchor Pin Remover and Replacer
8. J-8850 Front Hub Inner Race Installer
9. J-8849 Front Hub Outer Race Installer
10. J-8092 Driver Handle for J-7137 and J-7120
11. J-2619-B (J-2654) Silde Hammer
12. J-1313 Torque Wrench