SAM WALKER

MC-9 CRUSADER II

MAINTENANCE MANUAL

January 1989

Power Steering Oil = 10W-40 Engine Oil

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MAINTENANCE MANUAL

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740 Oil = Detroit

Oil Types = page 10-3

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MC-9 MAINTENANCE MANUAL

SECTION INDEX

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INTRODUCTION

This manual contains operation, maintenance and overhaul information on MC-9 Model Coach. Information in this manual pertains to standard and commonly used optional equipment.

Vehicle operation from the driver's standpoint is contained in a separate operator's manual. Detroit Diesel engine information is found in a separate service manual. Allison transmission information is contained in the appropriate vendor service manual which, like the engine manual, is supplied separately.

All information contained in this manual is based on the latest product information available at time of publication. We reserve the right to make publication changes at any time.

HOW TO USE THIS MANUAL

This manual is divided into major sections in the sequence shown on the section index. All major sections are divided into sub-sections containing descriptions, operation, maintenance, replacement, overhaul and specification information on related systems and components. A section index appears on the first page of each major section.

PAGE AND ILLUSTRATION NUMBER

Manual pages and illustrations are numbered consecutively within each major section.

SPECIFICATIONS

Service data, torque limits and tolerances are listed at the end of most sections under the heading "Specifications." Manufacturer's model or part numbers are provided where applicable for component identification. Detail service part numbers must be obtained from the MC-9 Model Parts Manual.

SERVICE INFORMATION BULLETINS

Service Bulletins are issued, when required, to supplement or supersede information in this manual. Information in the bulletins should be noted and filed for future use.

CUSTOMER SERVICE

Universal Coach Parts of Northlake, IL and Motor Coach Industries, Ltd., Service Parts Division of Canada, know your coach best and are interested in your complete satisfaction. Both offer genuine factory parts for this MC-9 Model and all other TMC/MCI Coach Models.

Service departments in both Roswell, N.M. (U.S. service) and in Winnipeg, Canada (all Canadian service) stand ready to serve you. Their addresses are:

Transportation Manufacturing Corporation
Service Department
P.O. Box 5670 (R.I.A.C.)
Roswell, N.M. 88202-5670

Motor Coach Industries, Ltd.
Service Parts Division of Canada
1149 St. Matthews Ave.
Winnipeg, Manitoba, Canada R3G0J8

Proper maintenance is important to the safe and reliable operation of the MC-9 Model coach. The service procedures recommended and described in this manual are effective methods for performing service operations. In some instances, the use of special tools is recommended. These tools should be used when and as recommended.

Various WARNINGS, CAUTIONS and NOTICES are contained in this manual. They should be read carefully to minimize the risk of personal injury or the possibility that improper service methods may be used which could damage the coach and render it unsafe. It is important to note that these cautions and notices are not all inclusive. We could not evaluate and advise users of all conceivable ways in which service may be done or of the possible hazardous consequences of each way. We have not attempted to do this. Therefore, anyone who uses a service procedure or tool not recommended by the manufacturer should first satisfy himself that neither his safety nor vehicle safety will be jeopardized by the particular method he selects. REFER TO PAGE ii FOR CAUTIONARY INFORMATION PERTAINING TO WELDING.

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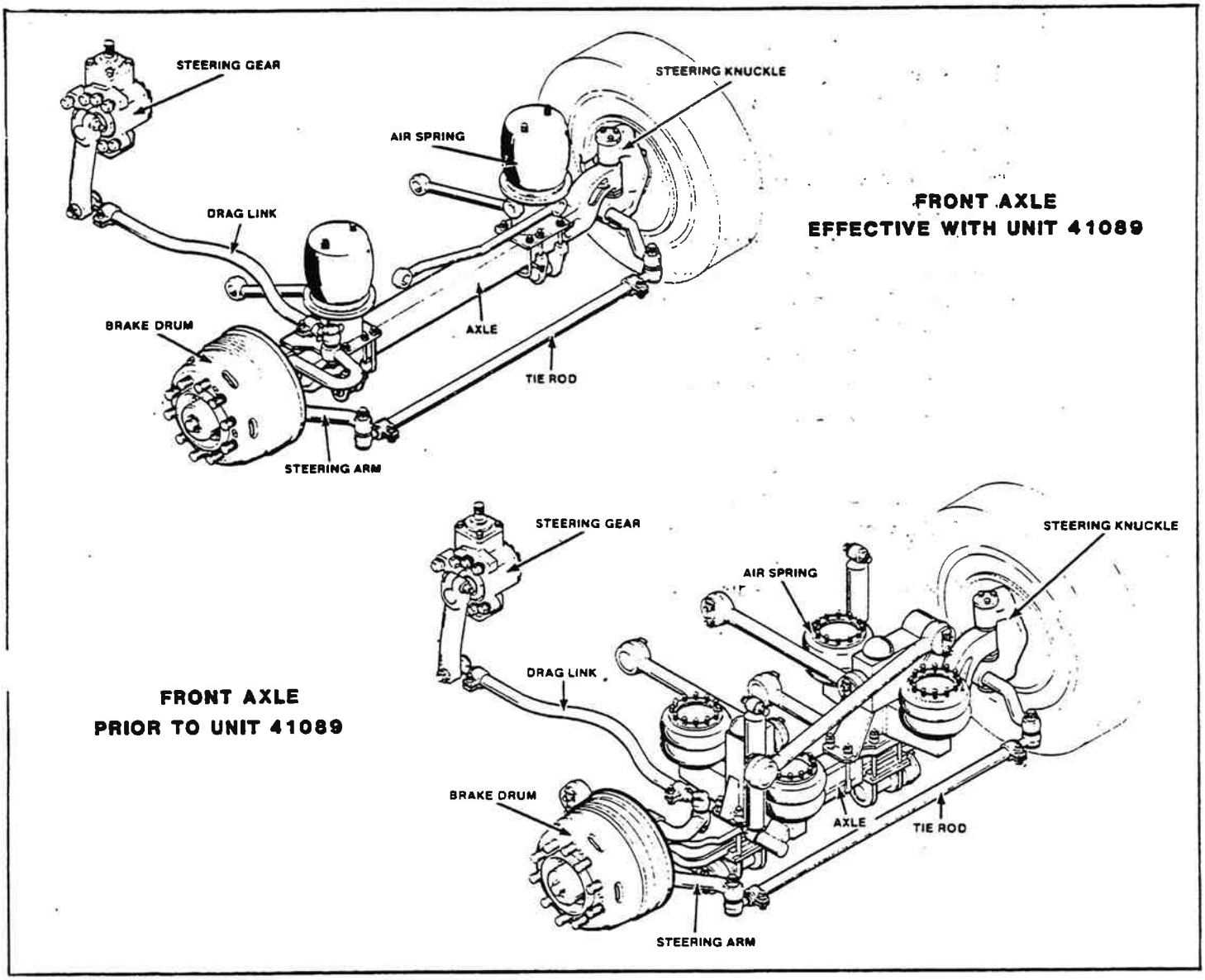

Figure 1-1. Front Axle Assemblies.

FRONT AXLE ASSEMBLY

DESCRIPTION

Effective with unit 41089 the front axle assembly is a tubular type of Reversed Elliot design. Axle construction consists of a tempered seamless steel tube with forged steel king pin ends. On units prior to 41089, the front axle is a forged steel drop center I-beam type. King pin ends are integral parts of the axle center. See figure 1-1.

Steering knuckles have grease fittings in both king pin bosses for lubrication of the knuckle bushings. The bushings are of the "Easy Steer" type on all models after September 1986. Prior to that, the bushings are bronze. Covers and plugs prevent dust and moisture from entering bushings and serve as seals.

The brake shoe spider is doweled and bolted to the steering knuckle. Dowel pins are also used to locate air suspension mountings.

The two steering knuckle assemblies are connected to each other by a tie rod. Tie rod is threaded at each end and held in position by clamp bolts. Right-hand and left-hand threads are provided on the tie rod to facilitate toe-in adjustment. Stop screws installed at each end of axle center limit turning angle of front wheels.

On the tubular style axles, to detect development of fatigue cracks, approximately two quarts of diesel fuel are installed in the hollow tube section. Any axle which leaks should be replaced.

WELDING CAUTION

Since welding is a procedure which may be carried out either as allowed (explicitly or implicitly) by instructions in this manual or carried out by an independent decision of the coach owner/operator, the following information pertaining to welding should be read before beginning any welding procedure. The prohibitions and requirements contained therein must be followed during the welding procedure.

1. Welding must be done only by a qualified and experienced person.
2. Adequate ground contacts and barriers must be positioned as required to protect components (wiring, brake lines, hydraulic lines, etc.) from damage due to heat, contact by weld splatter arcing or other potentially damaging events associated with welding.
3. On any coach, turn battery switch to "OFF."
4. For coaches equipped with a battery equalizer, after performing step 3 above:
    a. Disconnect the ground at the equalizer.
    b. Disconnect the battery leads.
5. If coach has ATEC or DDEC, remove the ATEC/DDEC power control fuses.
6. Any applicable welding instructions or prohibitions given by a procedure must be heeded.

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Steering knuckles are bushed in the upper and lower pin bosses so that they may turn freely about the pins. Bushings are grooved on the inside to allow grease to flow uniformly to high-pressure areas. Grease fittings are installed at both upper and lower king pin bosses.

On the earlier MC-9 front axles the tapered steering knuckle pins are drawn into the axle center by tightening the nut at the upper end of the pin. On the later MC-9s a straight type knuckle pin is used. The straight type pin is held in place by draw keys in the knuckle.

Wheel bearings, air suspension, steering and brake parts which are mounted on the front axle are described in the applicable sections of this manual.

LUBRICATION

Periodic lubrication according to the recommendations in the lubrication section of this manual should be carried out. Points which require lubrication are the steering knuckle pins, tie-rod ends and drag link ends. These are provided with grease fittings for pressure lubrication.

MAINTENANCE

Periodic inspection of the front axle assembly should be made to see that all bolts are tight and that no damage or distortion has taken place. Suspension support stud nuts, U-bolt nuts, tie-rod arm and steering arm nuts, and stop screws should be checked and tightened if necessary to the torque specifications shown at the end of this section. Attention should also be given to the condition of the steering knuckle pin and bushings. If excessive looseness is found at this point, the bushings and pins should be replaced.

The axle manufacturer recommends that the bronze or "Easy Steer" king pin bushings be replaced when the range of side-to-side tire movement reaches .030 inch or when the bushings are worn to a maximum of .010 inch on their diameter.

NOTE: These measurements are made with the wheel bearings tightened on the spindle.

With new bushings installed, the range of side-to-side tire movement should not exceed .010 inch maximum. Refer to Figure 1-2.

Looseness in the steering linkage under normal steering loads is sufficient cause to immediately check all pivot points for wear, regardless of accumulated mileage. Steering linkage pivot points should be checked each time the axle assembly is lubricated. If any indication of lateral movement is found, cross tube ends should be removed for inspection. Looseness at the steering linakge pivot points can be visually detected during movement of the vehicle steering wheel.

Steering knuckles, king pins, and bushings may be replaced without removing the axle from the coach.

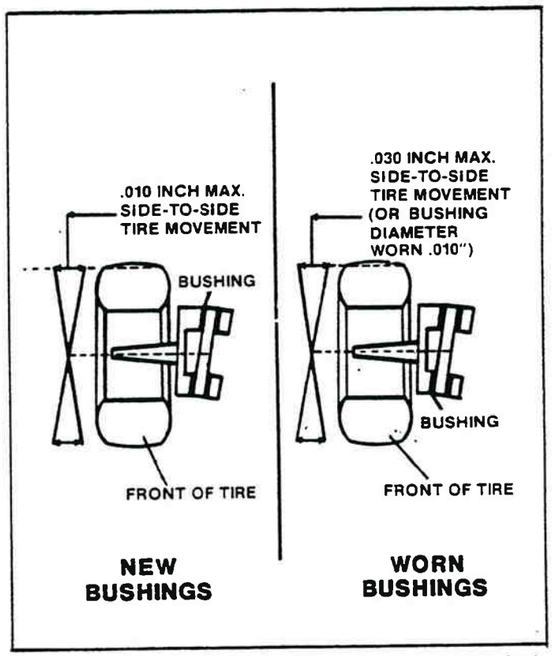

Figure 1-2. Side-To-Side Tire Movements With New And With Worn King Pin Bushings.

If extensive overall work or straightening of the front axle center is necessary, the axle should, of course, be removed.

WARNING: Do not attempt to repair, remove or reinstall front axle with the vehicle supported by jacks only.

FRONT AXLE REMOVAL (Prior to unit 41089)

To remove the entire front axle assembly first block the rear wheels to prevent the vehicle from rolling. Raise the front end of the coach with jacks until the bottom of the coach body is approximately 18" (457.2 mm) from the floor. Block the body in this position as indicated in Section 3 under Coach Jacking Points.

CAUTION: Do not raise the body in such a way that the entire weight of the front axle will hang on the suspension bellows assemblies. Damage to the bellows may result.

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1. Remove tires and wheels from axle. See Section 15.

2. Exhaust air pressure from the suspension air tank by opening the drain cock at the bottom of the air filter.

3. Disconnect the height control valve link, and pull down on height control valve arm to exhaust air from the front inner beams.

4. Disconnect the hose from the front brake chambers.

5. Disconnect the steering drag link.

6. Disconnect both ends of all radius rods as outlined in this section under Radius Rods.

7. Remove nuts from all bolts attaching air springs to the bracket assemblies.

8. Remove shock absorbers as outlined in this section under Shock Absorbers.

9. Lower the axle assembly on jacks until air spring bead ring bolts are cleared of the suspension supports. The axle can now be carefully removed from under the vehicle.

Reinstallation of the axle assembly is the reverse of removal. Make sure that air springs mounting pads on axle towers are clean.

FRONT AXLE REMOVAL (Effective with Unit 41089)

To remove the entire front axle assembly first block the rear wheels to prevent the vehicle from rolling. Raise the front end of the coach with jacks until the bottom of the coach body is approximately 18" (457.2 mm) from the floor. Block the body in this position as indicated in Section 3 under Coach Jacking Points.

CAUTION: Do not raise the body in such a way that the entire weight of the front axle will hang on the suspension bellows assemblies. Damage to the air springs may result.

1. Remove tires and wheels as detailed in Section 15.

2. Exhaust air pressure from the suspension air tank by opening drain tank at bottom of the air filter.

3. Disconnect the height control valve link, and pull down on the height control valve arm to exhaust air from the front inner beams.

4. Disconnect the hose from the front brake chambers.

5. Disconnect the steering drag link.

6. Disconnect both ends of all radius rods as outlined in this section under Radius Rods.

7. Remove nuts from all bolts attaching air springs lower bead rings to the axle tower.

8. Remove shock absorbers as outlined in this section under Shock Absorbers.

9. Lower the axle assembly on jacks until air spring bead ring bolts are cleared of the suspension supports. The axle can now be carefully removed from under the vehicle.

Reinstallation of the axle assembly is the reverse of removal. Make sure that air springs mounting pads on axle towers are clean.

STRAIGHTENING AXLE CENTER - Before Unit 41089

The earlier MC-9 front axle center is a steel forging, heat treated for strength and resistance to bending and torsional strain. If the center is bent or twisted less than approximately 5 degrees from the original shape, it may be straightened. However, it is recommended that this work be done only by mechanics who are thoroughly familiar with such operations and where the proper facilities are available. Parts which are distorted more than approximately 5 degrees from the original shape must be replaced, since such distortion exceeds the elastic limit of the material causing fractures which may result in failure under ordinary operating conditions.

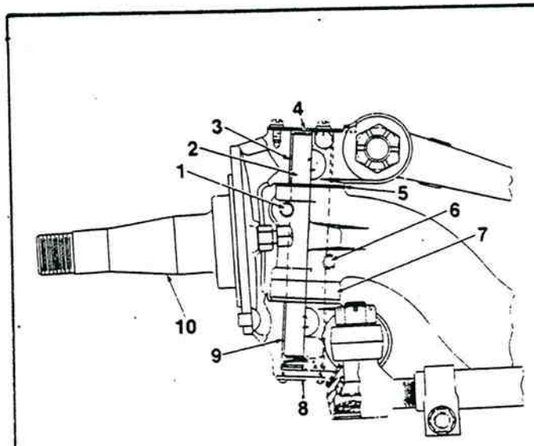
CAUTION: Do not attempt to straighten front axles with tubular style axle centers. Never apply heat to a front axle forging. Front axle should be straightened cold only.

STEERING KNUCKLE

DESCRIPTION

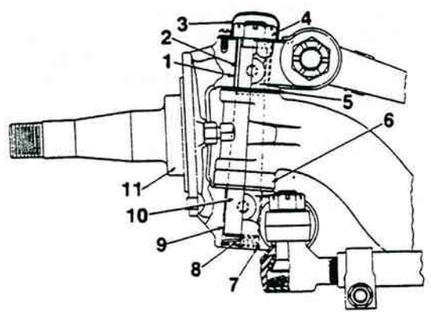
Later MC-9 coaches have front axles with straight knuckle pins. The earlier MC-9 models have axles with tapered knuckle

pins. Figures 1-3 and 1-4 show the steering knuckle construction of the two different axles.



1. Draw Key - Upper
2. Knuckle Pin
3. Knuckle Bushing - Upper
4. King Pin Cap - Upper
5. Shims
6. Draw Key - Lower
7. Thrust Bearing
8. King Pin Cap - Lower
9. Knuckle Bushing - Lower
10. Knuckle/Spindle

Figure 1-3. Steering Knuckle (Later MC-9)



1. Knuckle Upper Bushing
2. Knuckle Pin Sleeve
3. Upper Dust Cap
4. Knuckle Pin Nut
5. Shims
6. Thrust Bearing
7. Expansion Plug Lock Ring
8. Expansion Plug
9. Knuckle Lower Bushing
10. Tapered Knuckle Pin
11. Knuckle/Spindle

Figure 1-4. Steering Knuckle (Earlier MC-9).

STEERING KNUCKLE REMOVAL

1. Block the rear wheels to prevent the vehicle from rolling. Jack up front of coach so that tires clear floor. Block up securely at this position and remove jacks. Refer to Section 3. Coach Jacking Points.

WARNING: Do not attempt to disassemble or perform knuckle repair with vehicle supported by jacks only.

2. Remove front wheels, hubs and bearings as directed in Section 15.

3. Remove brake chambers and brake shoe hardware from steering knuckle. Detach brake shoe spider from knuckle and remove spider, camshaft and slack adjuster as an assembly.

4. Remove drag link and tie rod from steering arm. Refer to Steering, Section 11.

5. Remove nuts from steering arms and drive arms out of steering knuckles.

NOTE: It is not necessary to remove steering arms unless service or inspection is necessary.

6. Upper and lower knuckle pin covers are present on the newer style axles with straight type knuckle pins. The original MC-9 axle, with the tapered knuckle pin, has a cover on the top of the pin only. Remove the capscrews from the cover(s) and the gasket(s) beneath the cover. See figure 1-5.

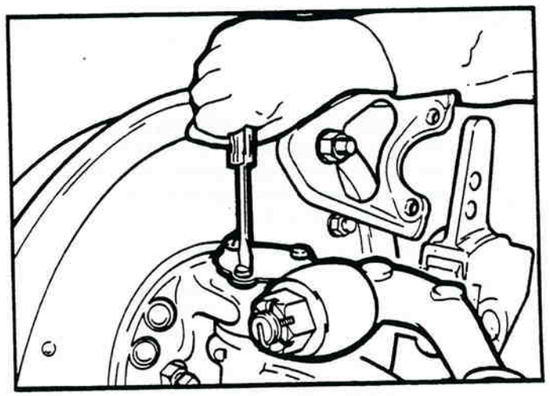


Figure 1-5. Removing Knuckle Pin Cover.

The tapered type knuckle pin has an expansion plug and lock ring at its lower end. Remove the lock ring with a pair of snap ring pliers. Dislodge and remove the expansion plug with a small drift.

7. The straight style knuckle pin is retained in the knuckle by means of threaded draw keys at the top and bottom of the knuckle. Remove the draw keys as follows:

a. Loosen locknut on key and turn it out to the end of the threads. The end of the nut should be flush with the draw key end.

b. With a brass drift and a hammer, firmly strike the end of the nut to loosen the draw key.

NOTE: Failure to strike the draw key squarely may result in a damaged key, causing removal difficulties.

c. Remove the nut and key from the axle center.

The tapered style knuckle pin is retained in the knuckle by a nut on the threaded upper end. Remove the knuckle pin cotter pin and nut. Refer to figure 1-6.

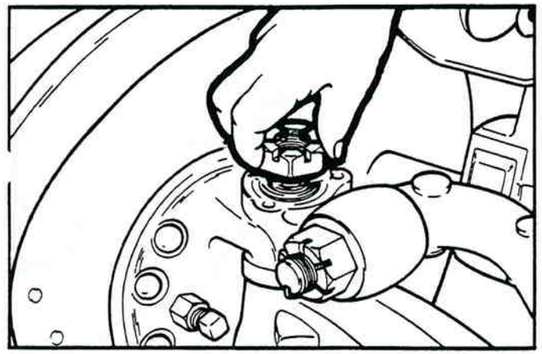


Figure 1-6. Removing Nut From Top of Tapered Knuckle Pin.

8. The knuckle pin, straight or tapered, is removed from the knuckle by tapping it out using a **bronze** drift. See figures 1-7 and 1-8.

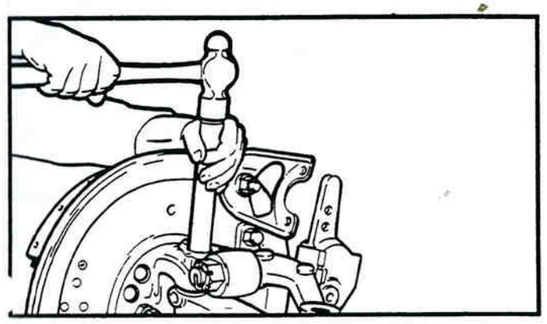


Figure 1-7. Removal of Straight Style Knuckle Pin.

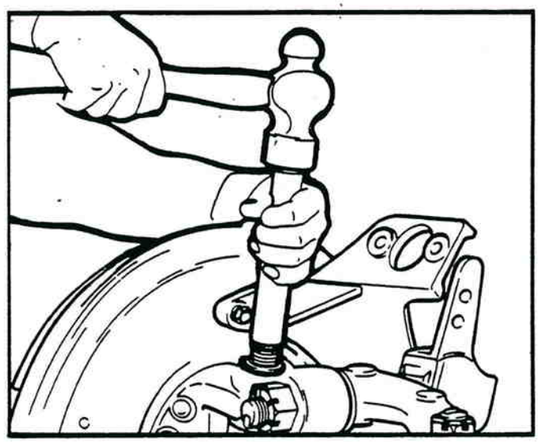


Figure 1-8. Removal of Tapered Style Knuckle Pin.

The following precautions and procedures will allow the pins to be removed with minimum danger of personal injury or damage to the knuckle pins and bushings.

a. Straight type knuckle pins may be removed through either the top or bottom of the knuckle. Tapered pins can only be removed through the bottom of the knuckle.

b. **Do not** strike the knuckle pin directly with a steel hammer. The pins are made of hardened steel. Personal injury can result from flying chips and splinters and, in the case of the tapered style pin, the threads on the upper end will be damaged.

c. If the bushings are not to be replaced, precautions must be taken not to damage them with the bronze drift. Grind off any flaring on the end of the drift which will contact the pin. Wrap tape around the drift 1/16" thick for the first inch from the end of the drift. This is especially important when the bushings are of the "Easy Steer" type used with the straight type knuckle pin.

9. If servicing the straight pin type knuckle, lift off the knuckle assembly, thrust bearing and shims. If servicing the tapered pin style knuckle, remove the knuckle pin sleeve, and lift off steering knuckle, thrust bearing, spacing washers, and backplate assembly. Refer to figure 1-9.