TM 9-2610-200-20

TECHNICAL MANUAL

ORGANIZATIONAL CARE, MAINTENANCE AND REPAIR OF

PNEUMATIC TIRES
INNER TUBES
AND
RADIAL TIRES

HEADQUARTERS, DEPARTMENT OF THE ARMY

FEBRUARY 1977

WARNING

LOCKRING HAZARD

An improperly seated lockring may blow off causing serious injury to operator or any person in its path. A sprung ring, or one which is bent or twisted may be difficult to install and, if used, is a safety hazard. Before applying any air pressure to the tire, be sure that lockring is seated against rim of wheel through its entire circumference. Inflate to 5 to 10 p.s.i., then tap lockring carefully with a mallet.

WARNING

PREVENT PERSONAL INJURY

Place tire and wheel in safety cage before inflating. The operator should be at least 10 feet from the safety cage. Minimum hose length used is 10 feet.

WARNING

When dislodging tire beads, lockrings, or split flange rings be absolutely certain that no air pressure remains in tire or personal injury may result.

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No. 9-2610-200-20

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *28 February 1977*

ORGANIZATIONAL CARE, MAINTENANCE AND REPAIR PNEUMATIC TIRES, INNER TUBES AND RADIAL TIRES

* This manual supersedes TM 9-2610-200-20, 24 November 1972.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Purpose
These instructions are published for the information and guidance of organizational maintenance personnel responsible for the inspection, care, and use of pneumatic tires and inner tubes.

1-2. Scope
This manual covers the description, inspection, care, and common causes of tire and inner tube failures.

1-3. Forms, Records, and Reports
Maintenance forms, records, and reports which are to be used by maintenance personnel are listed in and prescribed by TM 38-750. Field reports of accidents involving injury to personnel or damage to materiel are to comply with the requirement of the Army Safety Program listed in and prescribed by AR 385-40. Tires retreaded and repaired by commercial contractors and repaired by commercial contractors will be reported on DA Form 2088-R (Report of Tire Retreading (RCS AMC-154(R1)). (fig. 1-12)

1-4. Reporting of Errors and Ommissions
You can improve this manual by calling attention to errors and by recommending improvements. Your letter or DA Form 2028 (Recommended changes to Publications and Blank Forms) should be mailed direct to Commander, US Army Tank Automotive Command, ATTN: DRSTA-MTP, Warren, MI 48090. A reply will be furnished direct to you.

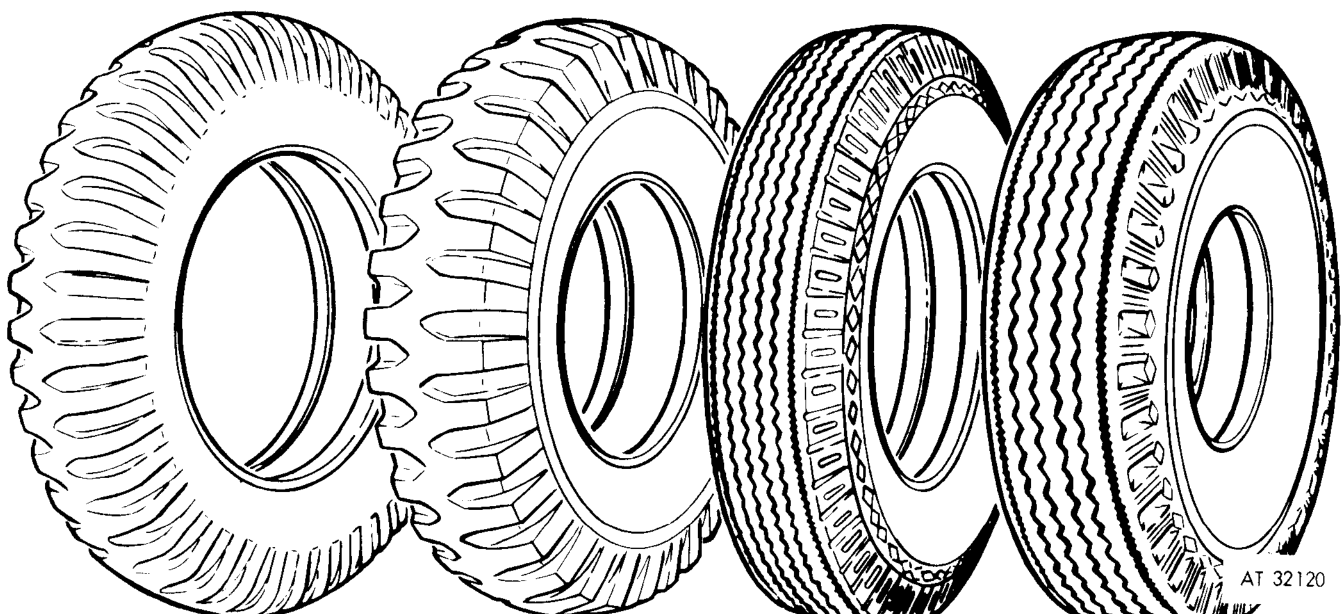


Figure 1-1. Types of tires.

Section II. DESCRIPTION AND OTHER DATA

1-5. Description
a. Types of Tires. The following descriptions are applicable to both tubeless and tube-type tires.

(1) *Tactical tires.* These tires have non-directional tread design, bar-type lugs which supply adequate traction for most cross-country terrain for wheeled vehicles. (A and B, fig. 1-1).

(2) *Combat tires.* These are of much heavier construction than commercial type tires. They have more rigid sidewalls and heavily cussioned plies that are spaced wider apart (fig. 1-2). They are designed to operate without air pressure for a limited distance, and only in combat where the tactical situation requires it.

(3) *Truck and bus tires.* These are of standard construction as used on commercial type vehicles (C, fig. 1-1).

(4) *Passenger tires.* These are of standard construction as used on commercial type vehicles (D, fig. 1-1).

(5) *Rock-service tires.* These are large size tires of standard construction as used on commercial type vehicles for off-the-road service and on unpaved roads. These tires are characterized by narrow voids so that loose rock cannot be caught in the voids and tear the lugs loose from the tire body (A, fig. 1-3).

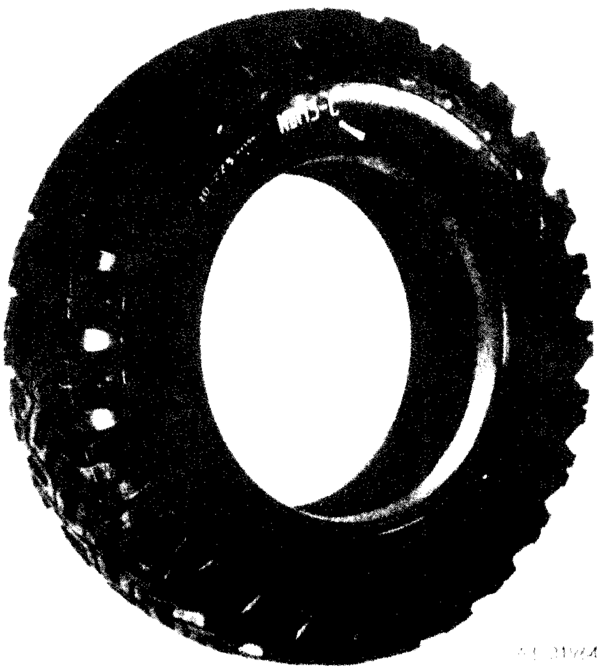


Figure 1-2. Types of tires.

(6) *Earthmover tires.* These are large size tires of standard construction as used on commercial type vehicles for off-the-road service and for maximum traction (B, fig. 1-3).

(7) *Grader tires.* These are similar to earthmover tires, except they are designed for lower inflation pressures (C, fig. 1-3) and for service involving extreme angular ground contact.

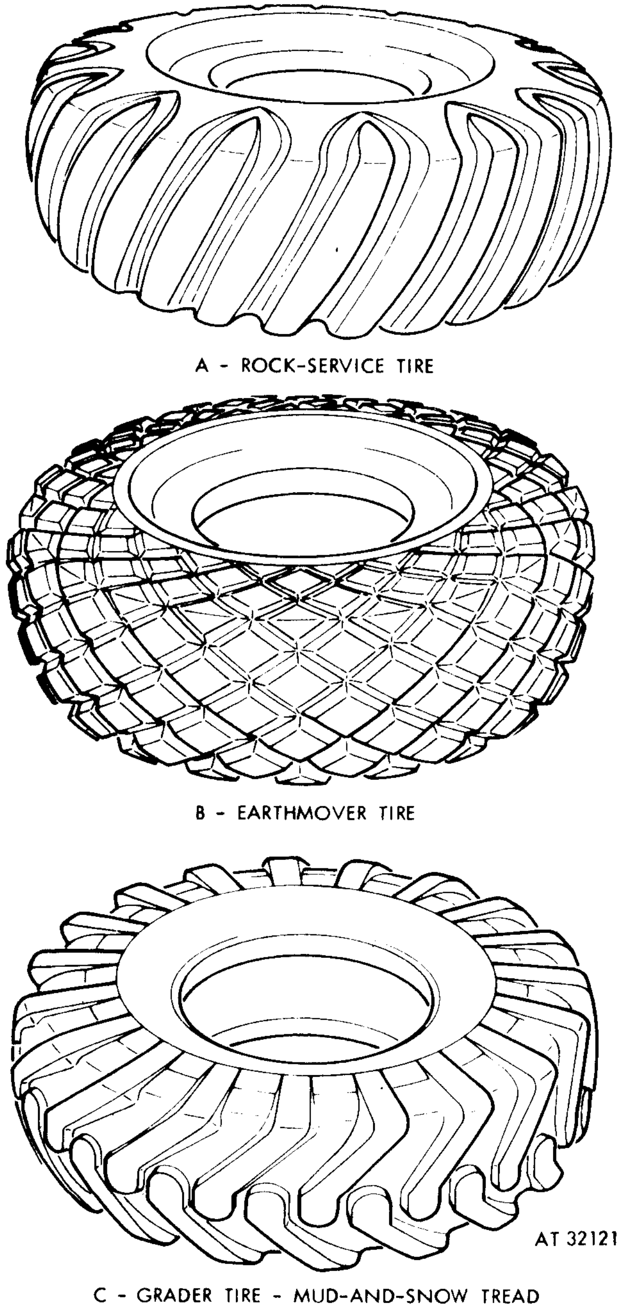


Figure 1-3. Types of tires.

(8) *Tractor tires.* These are standard construction as used on commercial type speed tractors. The agricultural tractor tires are characterized by extremely wide voids to provide maximum tractive effort in soft soil.

(*a*) Front tractor tires are of small or medium size (A, fig. 1-4).

(*b*) Rear tractor tires are of large size and are designed for maximum traction (B, fig. 1-4).

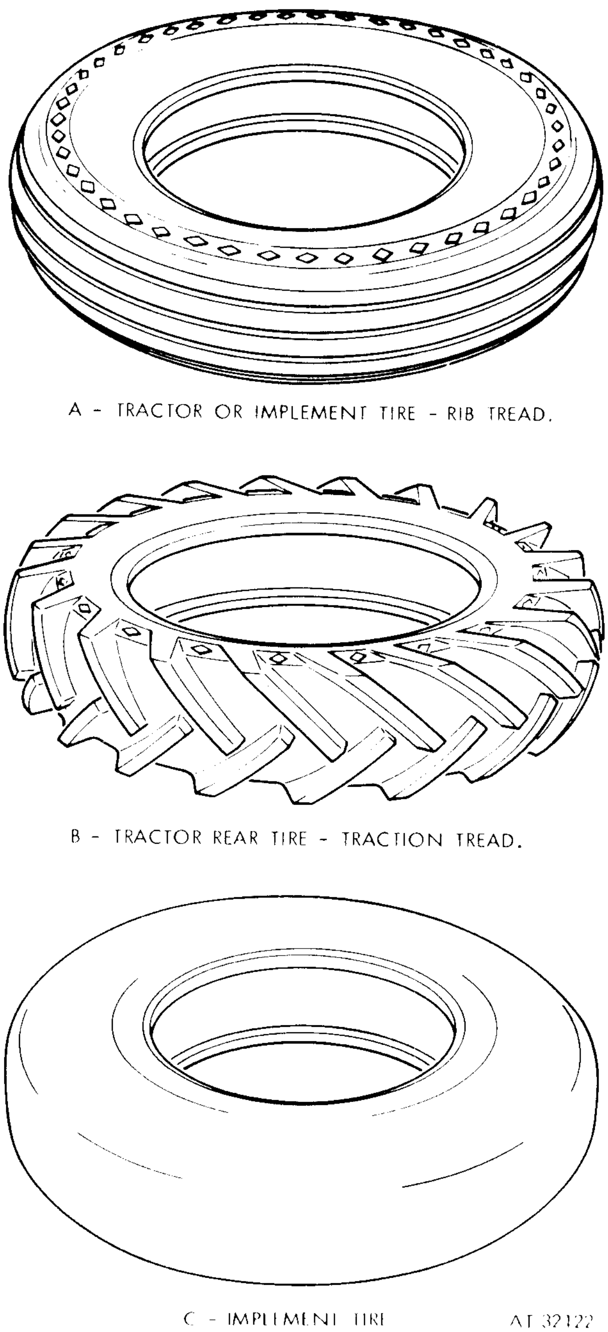


Figure 1-4. Types of tires.

(9) *Industrial tractor tires.* Industrial tractor tires are applied to farm tractor vehicles which have been adapted to industrial use and which do not need the aggressive characteristics of the agricultural tractor tire tread.

(10) *Straight-side industrial tires.* These are of standard construction and are similar to truck and bus tires in appearance, except that most of them are of small size.

(11) *Low-platform trailer tires.* These are of moderate size and are designed to carry a very heavy load.

(12) *Implement tires.* These are similar to front tractor tires, except that they are designed for towed vehicles (A and C, fig. 1-4).

b. Types of Treads.

(1) *Mud-and-snow tread (MS).*

(*a*) *Nondirectional.* Nondirectional Mud-and-snow tread design is used on tires for military purpose (B, fig. 1-1). This tread gives good traction in either direction in mud-and-snow, on dirt or temporary roads and cross-country. They are also practical for hard-surface roads.

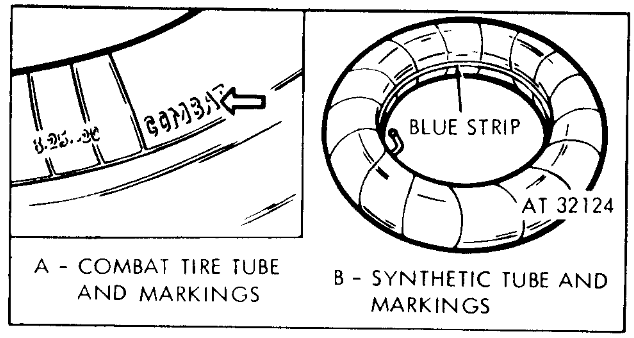


Figure 1-5. Inner tube.

(*b*) *Directional.* Tires with directional mud-and-snow treads are generally used in the military services only on certain earthmovers, graders, and on the GOER and armored car (figs 1-3 and 1-4). These tires will be mounted in accordance with instructions in paragraph (7) below.

(2) *Cross-country-tread (CC).* This is similar in appearance and application to the mud-and-snow tread (B, fig. 1-1), except for the rounded shoulders.

(3) *Regular tread.* This tread is common on passenger tires, truck and bus tires (C and D, fig. 1-1), and industrial straight-side tires. It gives satisfactory traction on highways and delivers long mileage.

(4) *Rock-service tread.* This tread design is used on tires for service on rough terrain (A, fig. 1-3).

(5) *Earthmover tread.* This tread design is used on earthmover tires (B, fig. 1-3). Earthmover treads may also be directional, similar to Figure 1-3C or nondirectional, Figure 1-3A. Figure 1-3B is considered a nondirectional, free rolling tread.

(6) *Rib tread.* This tread design is used on front tractor tires, front implement tires, and other tires for easy steering where traction is unimportant (A, fig.

1-4).

(7) *Traction tread.* This is common on tractor tires (B, fig. 1-4). On tractors and live axles, tires are mounted so that the point of the V in the tread design meets the ground first.

(8) *Smooth tread.* Tires with smooth tread (C, fig. 1-4) are used where neither steering nor traction are of importance.

(9) *Desert tread.* This is very similar to the cross-country tread. While there are certain differences in design and construction these are not readily discernible. The tread depth of desert tires is .40 inch compared to the tread depth of MS or CC which is .67 inch of comparable sizes.

c. Inner Tubes. The inner tube, which is generally made with butyl (IIR) rubber, is a continuous, circular container that fits inside the tire and holds the air that supports the vehicle. The tube is only strong enough to withstand a few pounds of air pressure when not confined, yet it bears extremely high pressure when enclosed in the tire. Because the tube is made of comparatively soft rubber to fulfill its functions, it is easily chafed, pinched, punctured, or otherwise damaged. The two types of tubes are described in (1) and (2) below.

(1) Standard tubes are made of one layer of rubber molded in the shape of a doughnut. They are regularly used for standard-type tires (B, fig. 1-5).

(2) Tubes for combat tires (A, fig. 1-5) are constructed the same as standard tubes, except that they are smaller than standard tubes, except that they are smaller than standard tubes with the same markings, since the inside cross-section of combat tires is smaller. Combat tubes should always be used exclusively with combat tires. However, in the event that combat tubes are not available, it is permissible to use the next size smaller standard tube. For example, a 9.00-20 combat tube may be replaced with an 8.25-20 standard type tube.

d. Types of Valves. Valves are used to admit and control the air pressure within an inner tube, or a tubeless tire. The valve consists of a metal stem, generally brass, a removable valve core which acts as a check valve and a valve cap. Military tubes are provided with slotted screw driver caps to permit removal and replacement of the valve core. The cap itself is capable of retaining air within the tire even if the valve core fails. For valves used on inner tubes, a base is provided which is vulcanized to the tube. For tubeless tire applications, the valve is fastened or inserted into a round hole in the tire rim. Figure 1-6 shows a passenger car tubeless tire valve. For truck and bus tubeless tires the valve is fastened to the rim base with a jamnut. In the event an inner tube is required to obtain remaining useful service from a tubeless tire, run-out service, the rim valve hardware is removed, and the inner tube valve passed through the existing hole in the rim. Valves are classified according to the methods of mounting on the tube or rim.

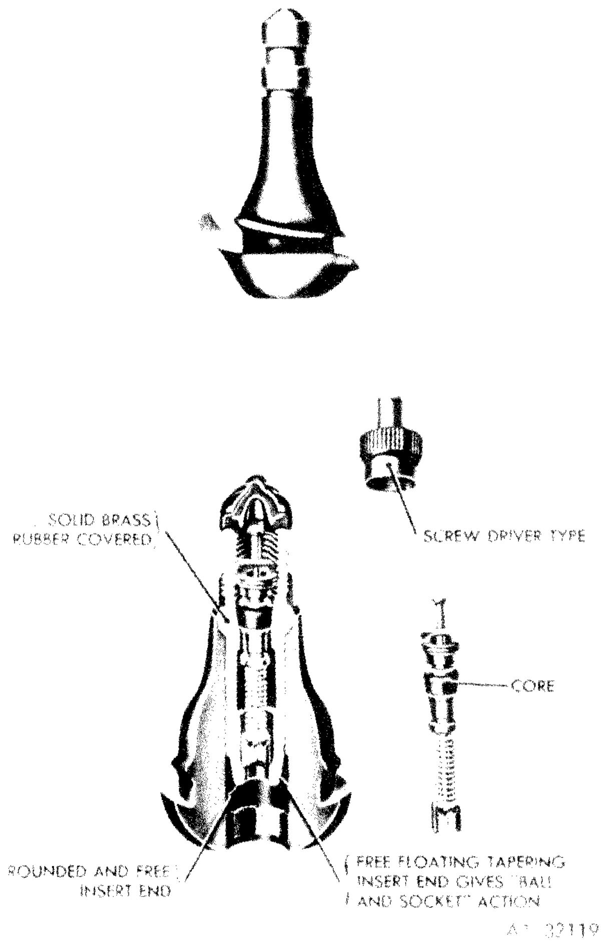


Figure 1-6. Tubeless tire valves.

(1) *Cured-on valve.* The cured-on valve has a rubber base that is vulcanized on the outer surface of the tube and cannot be removed unless cut off for replacement. They are available in two types, nonbendable and bendable.

(*a*) *Rubber-covered valve (A, fig. 1-7).* The stems of the rubber-covered valves are handbendable, when the stem is longer than 3 inches.

(*b*) *All-metal-stem cured-on valve.* These are provided as standard and oval-base types.

1. Standard. Standard all-metal-stem cured-on valves have round rubber bases that are vulcanized to the tube body. A bridge washer is fastened to the bottom of the stem by a hex locknut.

2. Oval base. Oval base all-metal-stem cured-on valves are similar to standard all-metal-stem cure-on valves, except they have a large oval base.

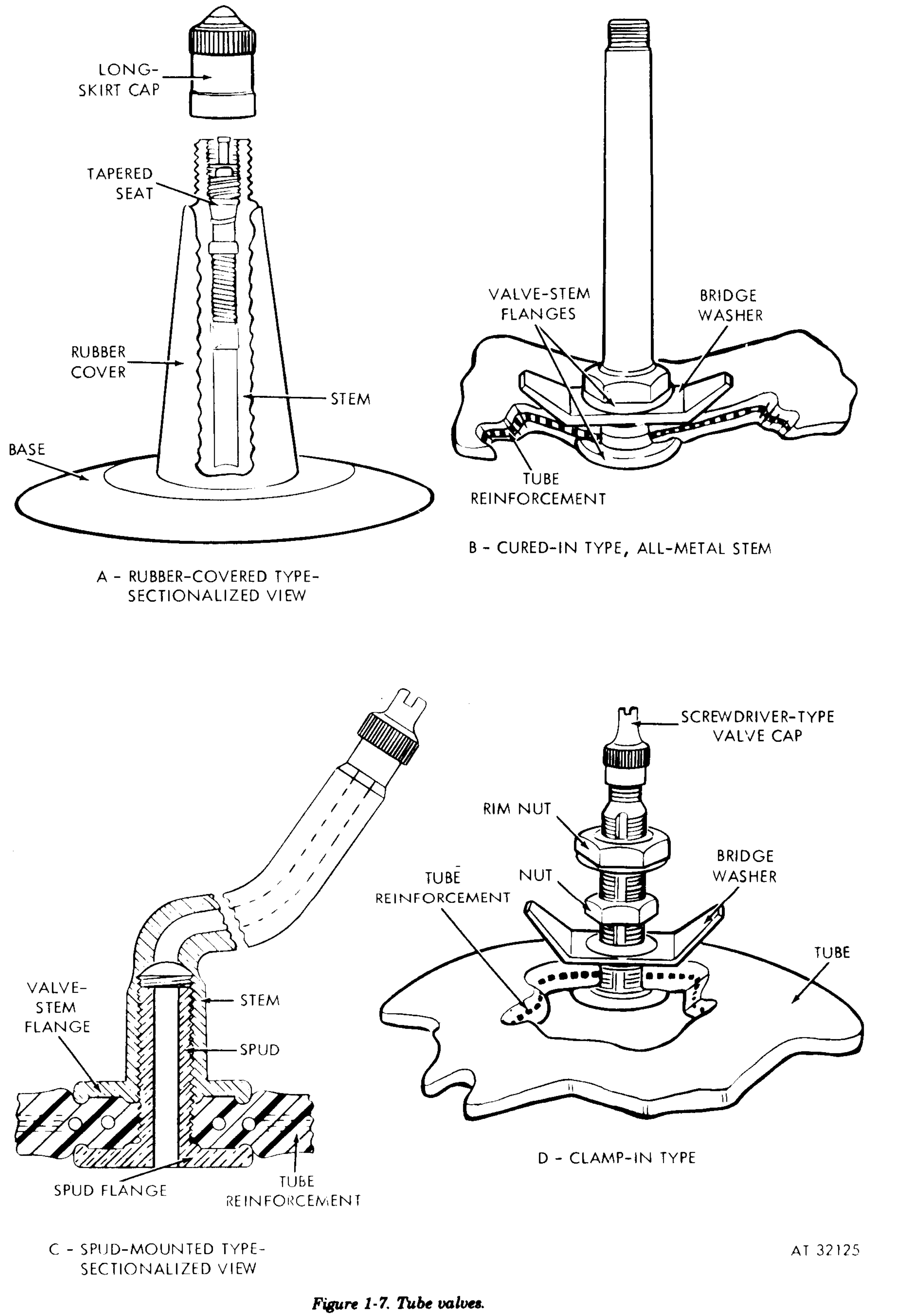


Figure 1-7. Tube valves.

(2) *Cured-on-large-bore valve.* Large bore valves are used on tubes for very large earthmover tires. The large bore affords rapid inflation and deflation. Except for size, they are similar to the cured-on valve described in (1) above.

(3) *Cured-in-valve (B, fig. 1-7).* This type valve is similar to cured-on valves, except that, either the rubber base is inverted (vulcanized to the inner surface of the tube), or it is vulcanized directly into the rubber body of the tube.

(4) *Spud-mounted valve (C, fig. 1-7).* Spud-mounted valves (Eger-type) are constructed in two parts for attaching to the tube. These valves are air-tight at the base, through the clamping action between the spud and valve flanges. They are readily identified on tubes by the absence of bridge washer and hexnuts. The Eger spud has become obsolete. The principle of the two-part valve has been continued by some manufacturers wherein the 5/16 inch diameter Eger spud has been replaced by a cured-in-spud whose outside thread size .482-26 accepts valve stems with preformed packing in replacement valve stems.

(5) *Clamp-in valve (fig. 1-7).* Clamp-in valves are no longer used, except on motorcycle and bicycle tubes and some tubeless tires. Such a valve is air-tight at the base, through the clamping action of the bridge washer and nut. Some of these valves have stems that are fully threaded, in which case, a second nut, called a rimnut, is used to hold the valve stem firmly in place on the rim. The bridge washer is positioned so that the ends lie length-wise with the tube.

(6) *Snap-in tubeless tire valve (fig. 1-6).* Snap-in type valves are used with tubeless passenger tires and light truck tubeless tires. This type valve used with tubeless tires is mounted on the wheel rim through a circular hole of controlled dimensions. The valve stem is incased in a heavy, pear-shaped, rubber cover. The unit is held in place by the compression fit between the edges of the valve hole and the rubber cover. The base of the valve is shaped like a mushroom head and below the head, on the shank, is a slight ridge. When the valve is properly installed, the edges of the rim valve hole will lie between the mushroom head and the ridge. The valve cores and caps are interchangeable with standard valve caps and cores used with pneumatic tubes.

(7) *Clamp-in tubeless tire valve.* This type valve is a straight, rigid type valve used with tubeless tires. It is mounted on the wheel or rim through a circular hole of controlled dimensions. This valve is air-tight at the base, through the clamping action of the ring washer and hexnut. For tightening of rim valve nut, see table 1-1.

(8) *Clamp-in-air-liquid valve tubeless.* This clamp-in valve is used with tubeless tires which require air and liquid for traction of vehicle. The valve stem is all metal and is mounted on wheel or rim through a circular hole of controlled dimensions. This valve is sealed around circular hole, through the clamping action of the ring washer and hexnut. Tightening of rim valve nut is shown in table 1-1.

(9) *Large-bore tubeless tire valve.* Large-bore valves are available in three types which consist of a straight valve, swivel valve, and non-swivel valve. Large-bore valves are used on rims for very large earthmover tires. The large bore affords rapid inflation and deflation of the tire. An air-tight seal is formed by the rubber washer when the valve is clamped in the rim by tightening the hexnut. For tightening of the rim valve nut, see table 1-1.

(10) *Clamp-in-double-bent tubeless.* These double-bent clamp-in valves have an extra low vertical height. They are attached by tightening a hexnut against the rim which will assure an airtight seal for the valve stem. For tightening of the rim valve nut, see table 1-1.

e. Valve Cores. The valve core is that component of the valve that is screwed into the stem and permits air under pressure to enter, but prevents it from escaping. There are two types and two sizes of valve cores in use. The two types (A, B, fig. 1-8) are the visible-spring type and the concealed-spring type, and are used interchangeably. Two sizes are provided, for standard-bore and large-bore valves. The core shell has a rubber washer, which provides an air-tight fit against the tapered seat inside the stem (fig. 1-8). Directly below the shell is a cup that contains a rubber seat. In the closed position, the rubber seat is forced against the bottom of the shell, forming an airtight seal. In the open position, the pin forces the cup away from the shell.

Table 1-1. Torque Values for Valves

Valve No.	Inch-Pounds Torque	
	Spud Nuts	Valve Nuts
416 500 501 570 571 572 573 618	......	45-55
503 505 507 508	100-125	70-80
503 A 505 A 507 A 508 A 510 513 515	......	100-125
J-650 J-670	175-200	70-80
J-690	......	175-200

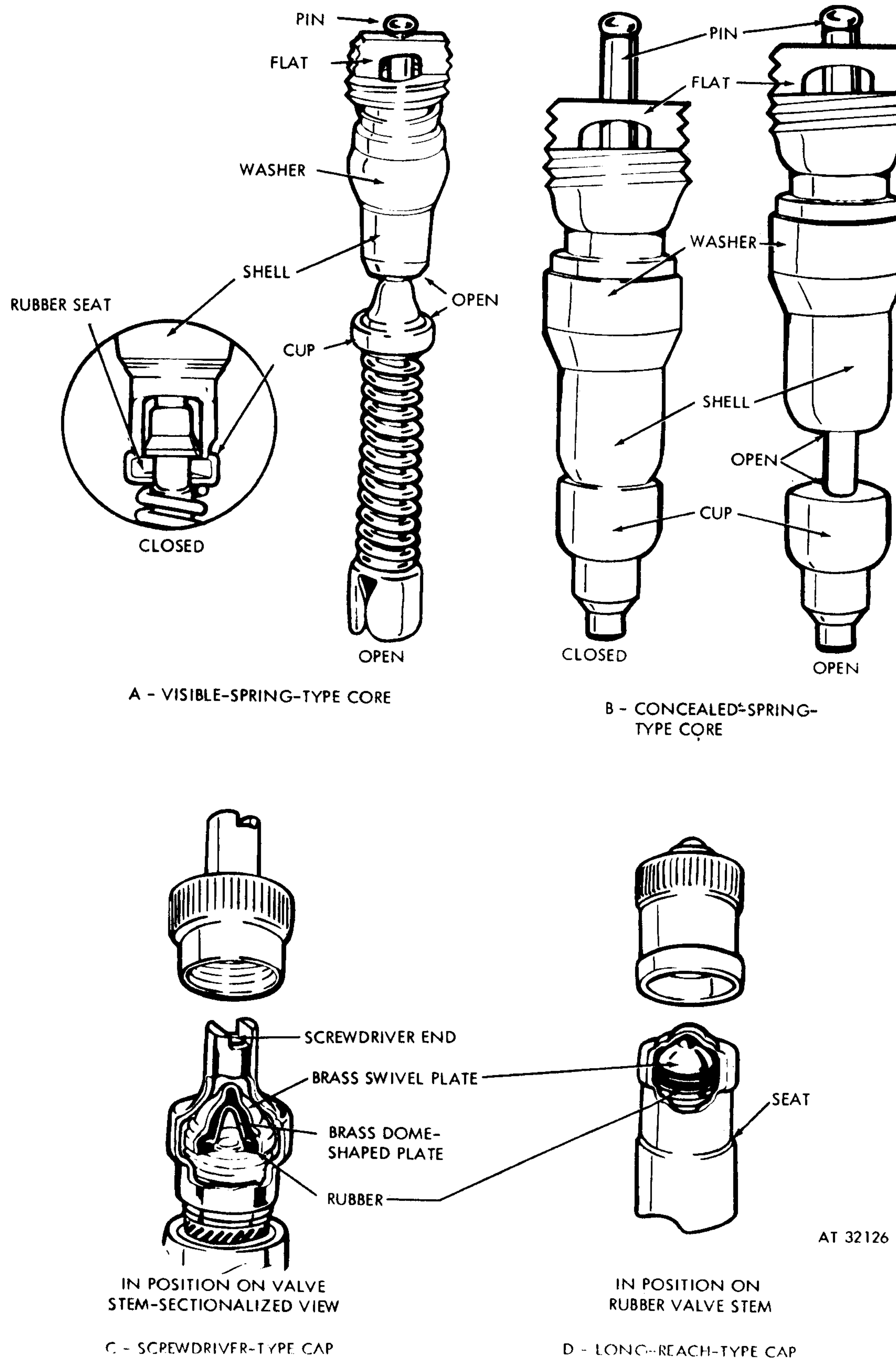


Figure 1-8. Valve cores and caps.

f. Valve Caps. The valve cap is also a component part of the valve and is screwed on the end of the valve stem, furnishing a second airtight seal. The valve cap also protects the threads on the end of the valve stem and keeps out dirt and moisture from the interior of the valve. Two types of valve caps are provided, each containing a dome-shaped, rubber sealing cup (C, D, fig. 1-8).

(1) *Screwdriver-type valve cap (C, fig. 1-8).* The screwdriver-type valve cap has a forked tip. By means of this tip, the cap may be used as a tool for inserting and removing valve cores.

(2) *Plain valve cap (D, fig. 1-8).* The plain cap is used on rubber-covered valves and has a skirt that contacts the rubber covering on the valve stem. Screwdriver-type valve caps may be substituted for these.

g. Tire Flaps. A flap is usually constructed of a strip of semi-hard rubber with tapered edges and with ends spliced together forming a circle. Flaps are required in tube type tires used on flat-base rims, to protect tubes from the toes of the bead and from the bases of rims (B, fig. 1-9).

h. Types of Rims. The rim completes the enclosure for the tube, holds the tire beads rigidly in place, and connects the tire to the wheel. Usually, rim and wheel are permanently fastened together as one unit and bolted to the hub. On spoked wheels, the rim is attached with lugs. For correct mounting, demounting, and tire fit, it is necessary to recognize the difference in rim types (fig. 1-9).

(1) *Flat-base rim (B, fig. 1-9 and A, fig. 1-10).* The flat-base rim is generally fastened permanently to the wheel when used on a military vehicle. It has a flat seat for the bead and, as the name indicates, the rim has no well. This type rim has a demountable side flange to permit mounting and demounting the tire. Flaps are provided for protection of the tube (para 1-4h).

(2) *Drop-center rim (C, fig. 1-9).* This type of rim is made in one piece, and it is permanently fastened to the wheel. Its important feature is a well, which permits mounting and demounting the tire. Bead seats are tapered to match corresponding tapers on the tire beads. Drop-center rims are generally used on smaller vehicles, such as passenger cars and 1/4-ton 4 x 4 trucks.

(3) *Safety rims (A, fig. 1-9).* These rims have slight humps at the edges of the bead ledges, which hold the beads in place when tires go flat.

(4) *Semi-drop-center rim (D, fig. 1-9).* This type of rim is also permanently fastened to the wheel. It has a shallow well, beveled bead seats to fit the tapers of the beads of the tire, and a demountable flang. The demountable flange, or side ring, which fits into a gutter on the outside edge of the rim, holds the tire in place. The semi-drop-center rim has been modified to accommodate a tubeless 16-20 military tire and is equipped with safety humps.

(5) *Advanced rim (E, fig. 1-9).* Advanced rims are replacing flat-base rims on vehicles of recent manufacture. The advanced rim, like the flat-base rim, has no well. These rims are manufactured in a variety of designs, which are of two or three piece construction. The characteristics of all advanced rims are the 5-degree tapered bead seats on both sides and that one of the bead seats bears on a removable ring. One type of advanced rim is mentioned in paragraph (6) below. Other types of advanced rims may be considered as variations.

(6) *Military rim (F, fig. 1-9 and B, fig. 1-10).* This is the type of advanced rim adopted as standard by the Army. It is of two-piece construction and cannot be used with tubeless tires.

(7) *Divided rim.*

(*a*) *Small size.* (A, fig. 1-11) shows a wheel with divided rim used only with small size tires. Note that the sections, fastened together by studs and nuts, are of equal width.

(*b*) *Large size.* (B, fig. 1-11) shows the type of divided rim wheel found on some military trucks. The two sections of this type of rim are not of equal width. They are fastened together with studs and nuts or with bolts.

(8) *Variations.* Variations occur in most of the described types of rims (2 thru 7 above), i.e., (fig. 1-9) shows two types of semi-drop-center rims, one where both bead seats are on the main part of the rim and another where one of the bead seats is on the removable flange. There is, however, a semi-drop-center rim where a portion of one bead seat is on the main part of the rim and the other portion of the bead seat is on the removable flange. Another variation is the three-piece construction of flat-base rims. The described rims, however, represent characteristic construction and any variation encountered will present no difficulties.

(9) *Earthmover rims.* Earthmover rims are used for extremely large tires. Earthmover rims are characterized by several additional features beyond those previously described. The rim base has a 5 degree taper bead seat on the back side of the rim, but the bead flange is separate, and is identical with the bead flange on the mounting side of the rim. The bead flanges for the 8-ton, 4 x 4, M520, M553, and M559 vehicles contain a small ear on the outer surface which fits into notches provided on the rim base and bead seat band to prevent slippage. The bead seat is positioned under the outer mounting side tire bead. The bead seat band is locked into position with a split lock ring which is positioned in the gutter. The split lockring includes a welded-on lug called a driver, which ties the bead seat band to the rim base to prevent slippage. Another feature which may be provided on the bead seat band is a prying notch on which a specially designed hydraulic

operated tool is used. Between the rim base and the bead seat band there is a groove to accommodate a rubber preformed packing, which seals the rim for retention of air. A rim valve hole is provided for the rim valve. The bead seat surfaces of the rim may be knurled transversely to prevent slippage between the tire bead and the rim.

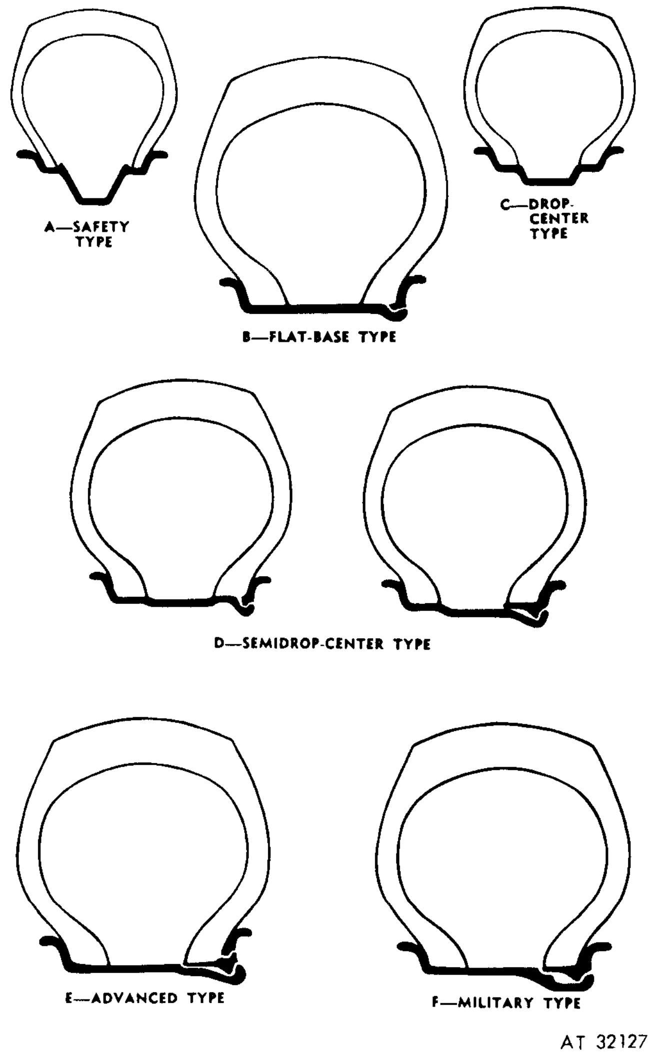


Figure 1-9. Types of rims.

(10) *Grader rims.* Grader rims are very similar to three-piece flat base rims except that the rim bead seat diameters for the tires are slightly less than those established on truck rims. For this reason only, grader tires should be mounted on such rims. Modern grader tires are designed for tubeless operation by providing a rubber preformed packing between the outer flange and rim base.

1-6. Identification *a. Tires.*

(1) *General.* All identification markings are generally in raised letters and numbers on the sidewall of the tire.

(2) *Tire size.* The tire size on the side of the tire represents the dimensions of the tire in inches. The tire size is given in two parts. The two parts are separated by a "-." The part preceding the "-" represents the tire section width. The part following the "-" represents the bead diameter and rim diameter. For example, a tire size 11.00-20 has a section width of 11 inches, a bead diameter of 20 inches, and fits a 20-inch diameter rim. A more recent method of designating the section width of commercial-type passenger car tires has been introduced by the tire manufacturers. It is a combination letter and arabic numeral. Refer to table 1-2 for tire size conversion.

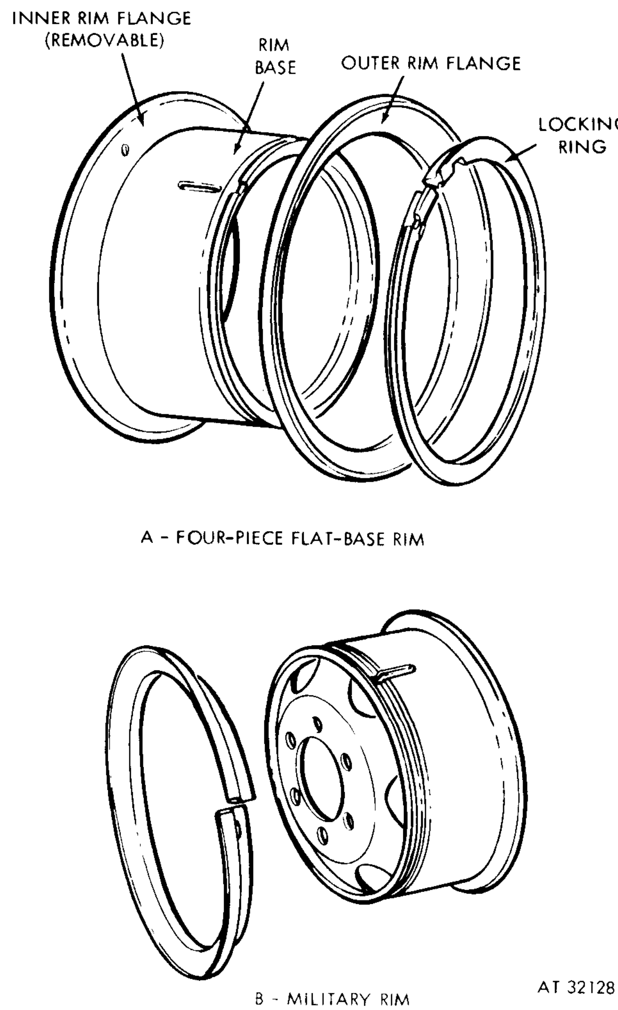


Figure 1-10. Types of rims.

(3) *Ply rating.* Ply rating is the numerical designation of the tire strength and does not necessarily indicate the actual number of cord plies in the tire. As an example, tires marked with an "8 ply" or with "8 ply rating" have the same significance and would require the same inflation pressures. A more recent method of indicating ply rating or the strength of a tire is being

used by the tire manufacturers, and referred to as the load range of a tire. The load range is designated by alphabetical letters. The letters "A" through "H" range represent ply ratings in even number 2 through 16 respectively. "J" and "L" represent 18 and 20 ply ratings respectively. "N" range represents 24 ply rating.

(4) *Manufacturer's name.* The name of the tire manufacturer is imprinted on the side of the tire.

(5) *Controlled-bead.* most tires with controlled beads are identified with the letters "BL" or "BLX" imprinted on the side of the tire, near the size marking and on the same side as the serial number. All combat and tactical tires have controlled beads even though they are not marked with "BL" or "BLX." Controlled bead tires may be used without bead locks, and when so used, they may be mounted on any type of rim of correct width and diameter.

(6) *Serial number.* The serial number is indented into the sidewall and consists of arabic numerals or a combination of letters and arabic numerals.

(7) *Balance mark.* The balance mark is a small red mark, approximately 1/4 inch in diameter, located on the sidewall near the bead. This mark indicates where the valve should be located in order to effect best balance of the tire. This mark is usually on passenger car or light truck tires.

(8) *Date of manufacture.* On military tires the date of manufacture consisting of the week (numerical) and year precedes the serial number. As an example, "012" indicates the tire was manufactured in first week of 1972.

(9) *Rayon cord.* Tires with rayon cord are identified with the word "RAYON" or the letter "R" on the sidewall.

(10) *Nylon cord.* Tires with nylon cord are identified with the word "NYLON" or the letter "N" on the sidewall.

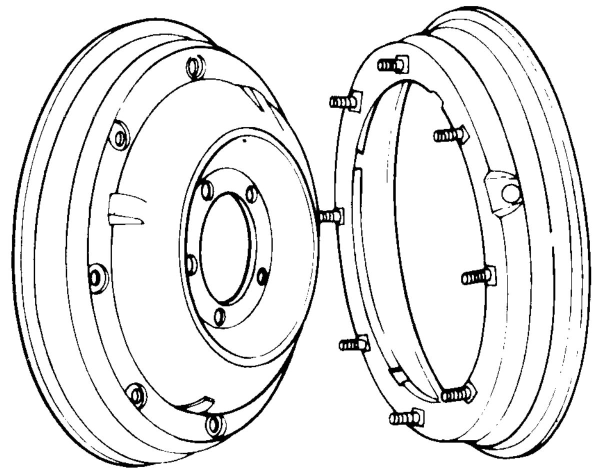
(11) *Natural rubber.* Tires utilizing natural rubber are identified with the letters "NR" on the sidewall.

(12) *Synthetic rubber.* Tires utilizing synthetic rubber are identified with the letter "S" on the sidewall.

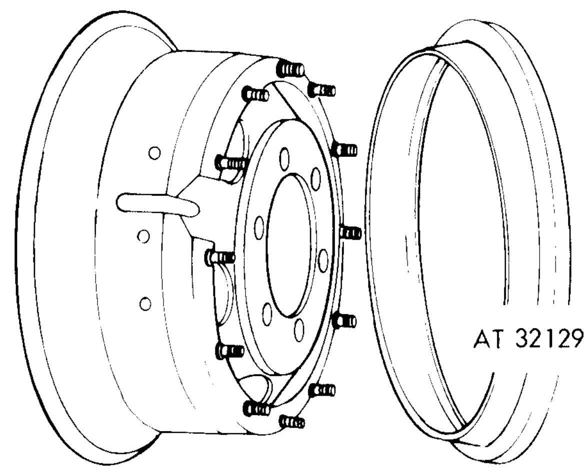
(13) *Tubeless tires.* Tubeless tires are identified by the work "TUBELESS" on the sidewall.

Table 1-2. Tire Size Conversion

Conventional Bias Ply		Bias and Belted Bias Ply		
1965 On	Replace Pre-1965	"78 Series"	"70 Series"	"60 Series"
6.00-13			A70-13	
		A78-13		
6.50-13		B78-13	B70-13	
7.00-13		C78-13	C70-13	
			D70-13	
			E70-13	
			A70-14	
6.45-14	6.00-14	B78-14	B70-14	
6.95-14	6.50-14	C78-14	C70-14	
		D78-14	D70-14	
7.35-14	7.00-14	E78-14	E70-14	
7.75-14	7.50-14	F78-14	F70-14	
8.25-14	8.00-14	G78-14	G70-14	
8.55-14	8.50-14	H78-14	H70-14	
8.85-14	9.00-14	J78-14	J70-14	
			K70-14	
			L70-14	
	6.00-15			
6.85-15	6.50-15	C78-15	C70-15	
		D78-15	D70-15	
7.35-15		E78-15	E70-15	E60-15
7.75-15	6.70-15	F78-15	F70-15	F60-15
8.25-15	7.10-15	G78-15	G70-15	G60-15
(8.15-15)				
8.55-15	7.60-15	H78-15	H70-15	
(8.45-15)	8.00-15	J78-15	J70-15	
8.85-15	8.20-15		K70-15	
9.00-15		L78-15	L70-15	
9.15-15	8.90-15	N78-15		



A - DIVIDED-RIM WHEEL FOR SMALL VEHICLES



B - DIVIDED-RIM WHEEL FOR LARGE VEHICLES

Figure 1-11. Types of rims.

(14) *Ozone resistant.* Tires constructed of ozone resistant material are identified with the letters "OZ" or "O" on the sidewall. Ozone is defined as being a form of gas caused by static electricity in the air. Ozone is the greatest cause of rubber deterioration. The first sign of ozone attack is usually referred to as minor weather checking, which will in a short time render the rubber item unserviceable. In recent years all pneumatic tires procured for military use have built-in ozone resistance.

(15) *Combat tires.* Combat tires are identified with the word "COMBAT" on the sidewall.

(16) *Military tires.* Most tires used in the military service are marked "MILITARY" on the sidewall.

(17) *Grader tires.* Tires for use on grader equipment only are identified with the word "GRADER" on the sidewall.

(18) *Other marking.* Passenger car and truck and bus tires are now being marked with load-carrying limits.

b. Inner Tubes.

(1) *Size.* Inner tubes are marked with the tire size with which they are intended to be used.

(2) *Combat tubes.* Tubes for use with combat tires have the word "COMBAT" marked on the tube.

(3) *Butyl.* Butyl rubber is widely used in inner tubes because it holds air better than most other types of rubber.

c. Tire Flaps. Size marking on tire flaps vary with each manufacturer. Some use a code, some use the actual tire size or groups of tire sizes, and some use the actual flap diameter and width in inches.

REPORT OF TIRE RETREADING For use of this form, see AR 750-36; proponent agency is USAMC.		REPORTS CONTROL SYMBOL AMC-154 (R1)
THRU: *(Include ZIP Code)*	TO: Command General US Army Tank-Automotive Cmd ATTN: AMSTA-FXM Warren, Michigan 48090	FROM: *(Include ZIP Code)*
PERIOD COVERED	DATE SUBMITTED	
SUPPLIER	CONTRACT NUMBER	TYPE OF CONTRACT
DATE CONTRACT AWARDED	DATE CONTRACT EXPIRES	CONTRACT QUANTITY

QUANTITY COMPLETED *(This period)*

FSN	*Size*	*Quantity*	*Retread Unit Cost*	*Retread Total Cost*	*New Tire Unit Cost*

TOTAL QUANTITY RETREADED	GRAND TOTAL COST RETREAD
NUMBER OF NEW TIRES ISSUED	

SAVINGS

TOTAL NEW TIRE COST ____________

LESS RETREAD COST ____________

NET SAVINGS REPORTED IN ACCORD WITH AR 11-20 *(Equip Maint Mgmt)* ____________

TYPED NAME AND GRADE OF PREPARING OFFICER	SIGNATURE OF PREPARING OFFICER

DA FORM 2088-R, 1 Jul 71 Replaces edition of 1 Aug 70, which is obsolete. *(Paper size, 8" x 10½"; image, 6-6/10" x 9")*

Figure 1-12. Report of tire retreading (DA Form 2088-R).

CHAPTER 2
CARE, MAINTENANCE, AND INSPECTION

Section I. GENERAL

2-1. Importance of Proper Care and Maintenance

While natural wear and tear affects tire life, premature tire failures can be attributed to abuse and neglect. Proper maintenance of tires will result in better performance and longer service, in addition to preventing a hazardous tire failure with possible loss of life and equipment.

a. Air Pressure. Correct air pressure is the basis for reliable tire performance. Tires are designed to operate at specified air pressures for given loads and should be checked daily and, when necessary, inflated to the prescribed air pressure. When checking air pressures, always use an accurate gage. Also, when checking tire pressures, check the valve cores for leaks. Air gages should be checked periodically with a precision type gage, for accuracy.

b. Deflatio ι. Tires should never be deflated during or immediately after vehicle operation for the purpose of air pressure adjustment. The reason for this is that tires heat as they roll, causing air to expand, which increases the pressure. When the tire cools after pressure adjustment it becomes dangerously underinflated. Pressure increases of more than 20 p.s.i. should be investigated for cause, which could be underinflation, overloading, or excessive speed.

c. Proper and Improper Tire Inflation.

(1) *Proper inflation.* A properly inflated tire (A, fig. 2-1) shows proper contact with the road.

(2) *Underinflation.* An underinflated tire is shown in (B, fig. 2-1). This tire does not contain enough air for its size and the load it must carry. It flexes excessively in all directions and gets hot. In time, the heat weakens the cords in the tire, and it blows out. Underinflation also causes tread edges to scuff the road, which puts uneven wear on the tread and shortens tire life. Never run a tire flat, or nearly flat, unless the tactical situation in combat requires it. When run for even a short distance or almost flat for long distances, the tire may be ruined beyond repair.

(3) *Overinflation.* An overinflated tire is shown in (C, fig. 2-1). Too much air pressure also causes tire failure. Excessive pressure prevents the tire from flexing enough and causes it to be constantly subjected to hard jolts. When an overinflated tire hits a stone or rut, the cords may snap, causing a break in the cord body. The center of the tread wears more rapidly and does not permit equal wear across the entire tread. Hard riding from too much air pressure also increases wear and tear on the vehicle.

d. Valve Positioning. For speed and convenience during inflation, valve stems should be readily accessible. They should be properly centered in valve holes and slots, to prevent scraping against the brake drums. They should be so placed that valves extend through the wheels. Valves on inside duals should point away from the vehicle and valves on outside duals should point toward the vehicle. On dual wheels, the valve of the outside dual is placed 180 degrees from the inside valve for speed and convenience in checking pressures and inflating. With this arrangement, the locations of the valves are always known even when checking in the dark. The spare tire should be mounted on the vehicle so that the valve is accessible for checking and inflating.

e. Valve Caps. Every tire should be equipped with a valve cap to prevent dirt from entering the valve core and causing air leakage. A firmly screwed-down cap provides a final seal against air escaping. The caps should be finger tightened only.

f. Matching of Tires.

(1) For longer tire life and more efficient performance, dual tires and tires on all-wheel drive vehicles must be of the same size, tread design, and tread wear. Improperly matched tires cause rapid uneven wear and also cause transfer case and differential failures.

(2) Accurate matching of tires is necessary, because tires on all axle-drive vehicles rotate at the same speed when all axles are engaged; and, of course, dual wheels turn at the same speed because they are locked together; which means that tires on all driving wheels must be of the same circumference and diameter. If one tire of a pair of duals is worn considerably more than the other, it will not carry its proper share of the load and will scrub on the road. The result is uneven and rapid wear on both tires, or tire failures. Tires should be used in sets. Mixing different types (conventional bias ply, fiberglass belted, radial ply) must be avoided. Snow tires should be of the same size and type construction as the front tires. Radial ply tires should always be used in sets and *under no circumstances should be mixed with bias type tires.* The problems encountered when mixing tires on a vehicle are: Loss of steering control, inadequate vehicle handling and potential mechanical damage. These problems will vary depending on the stability of the tires used, differences in dimension, differences in air pressure and other operating conditions.

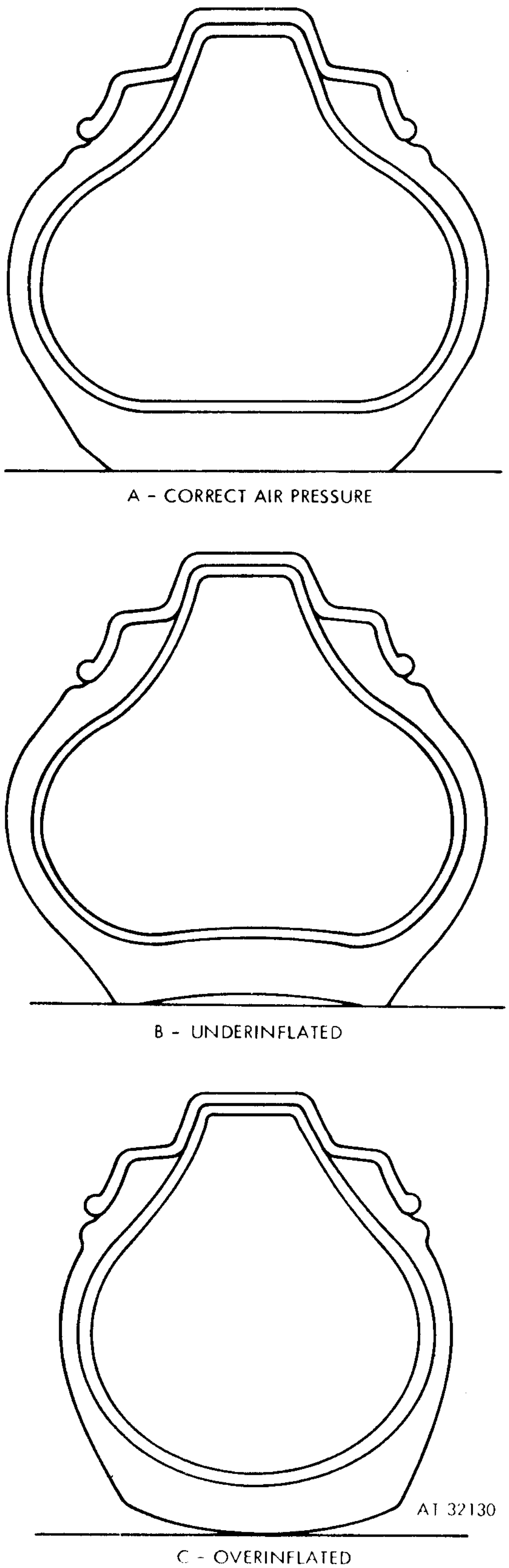


Figure 2-1. Proper and improper tire inflation.

(3) New or practically new, dual tires of the same make, size, tread type, and tread wear may be matched without measuring the circumference or the diameter. When the tires are of a different make or there is a difference in the tread wear, either the circumference or the overall diameter should be measured after mounting on rim and inflating. Tires of different tread design should not be matched regardless of make, size or tread wear. Never overinflate or underinflate tires in an attempt to compensate for tire measurement variations. When dual tires have permissible difference in measurements, (Table 2-1) the larger size tire should be mounted outside.

(*a*) Measure circumference at center of tread with a steel tape or other device (A, fig. 2-2).

(*b*) Measure overall diameter with a caliper, (B, fig. 2-2). This tool may also be improvised.

g. Tire Tread. Tire tread depth should be checked with a tire depth gage. Figure 2-3 illustrates tire depth gage, NSN 5210-00-019-3050. This gage folds up for easy storing in a person's pocket. The plunger tip is pulled in all the way before the gage is opened or the gage will be bent. Then, the contact bar is pulled out to form a "T." Gage scale markings are in thirty-seconds of an inch.

(1) The tread depth of military tires is measured from the center line (fig. 2-4) approximately 3/4" to 2" depending on tire size. The contact bar is placed parallel with the tire center line. The plunger is pressed down until its tip touches the center of the tread groove. The gage will indicate the tread depth.

(2) The tread depth on commercial tires is measured by bridging the tread groove with the contact bar and pressing the plunger into the center of the groove to get the reading.

(3) Wear limitations of off-the-road tires. Industrial/earthmoving equipment cannot be arbitrarily judgement of the user. However, the following guidance is furnished when no specific information is available: Off-road vehicles, industrial and earth moving equipment, except industrial tractors—13/32". Includes rough terrain fork trucks, loaders, graders, scrapers, ditching machines, intrenching machines, crane-shovels and snow removal equipment. Industrial tractors—17/32".

(4) Minimum tread on an on-vehicle serviceable tire is 4/32" (1/8") for military tread tires and 2/32" (1/16") for commercial passenger and commercial truck tires on both front and rear tires.

(5) TIRE TREAD IS MEASURED AT THREE EQUALLY-SPACED POINTS AROUND THE CIRCUMFERENCE OF THE TIRE STARTING AT THE VALVE STEM IF MOUNTED OR THE TIRE IS MARKED FOR STARTING POINT IF DEMOUNTED.

(6) Tire tread depth location measurements are illustrated in (fig. 2-4).

(7) THE TIRE SHOULD BE REMOVED AND REPLACED WITH A SERVICEABLE TIRE UPON REACHING ALLOWABLE REMAINING TREAD DEPTH.

Table 2-1. Tolerances in Matching Dual Tires

Outside Diameter of Tires	Permissible Difference	
	In Diameter	In Circumference
Under 30 inches	1/4 inch	3/4 inch
From 30 to 40 inches	3/8-inch	1 1/8 inches
From 40 to 50 inches	1/2 inch	1 1/2 inches
Over 50 inches	3/4 inch	1 3/4 inches

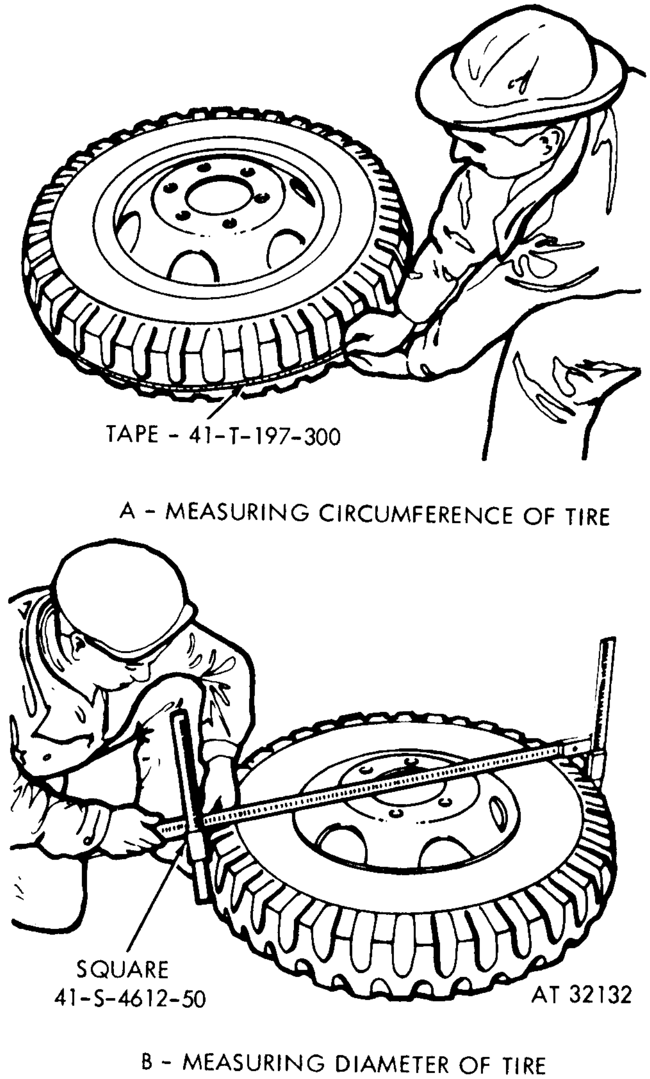


Figure 2-2. Tire measuring methods.

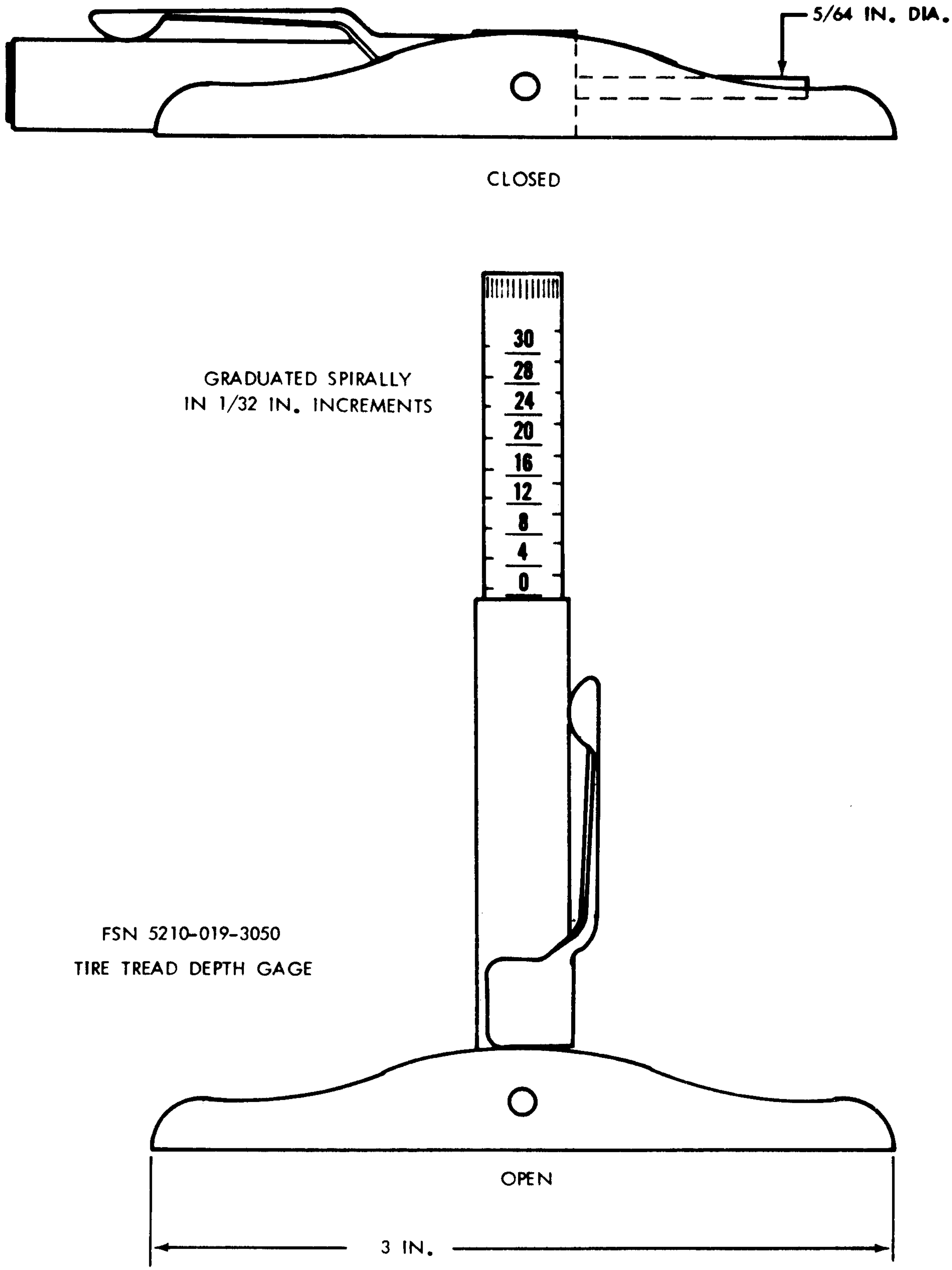


Figure 2-3. Tire Tread Depth Gage.

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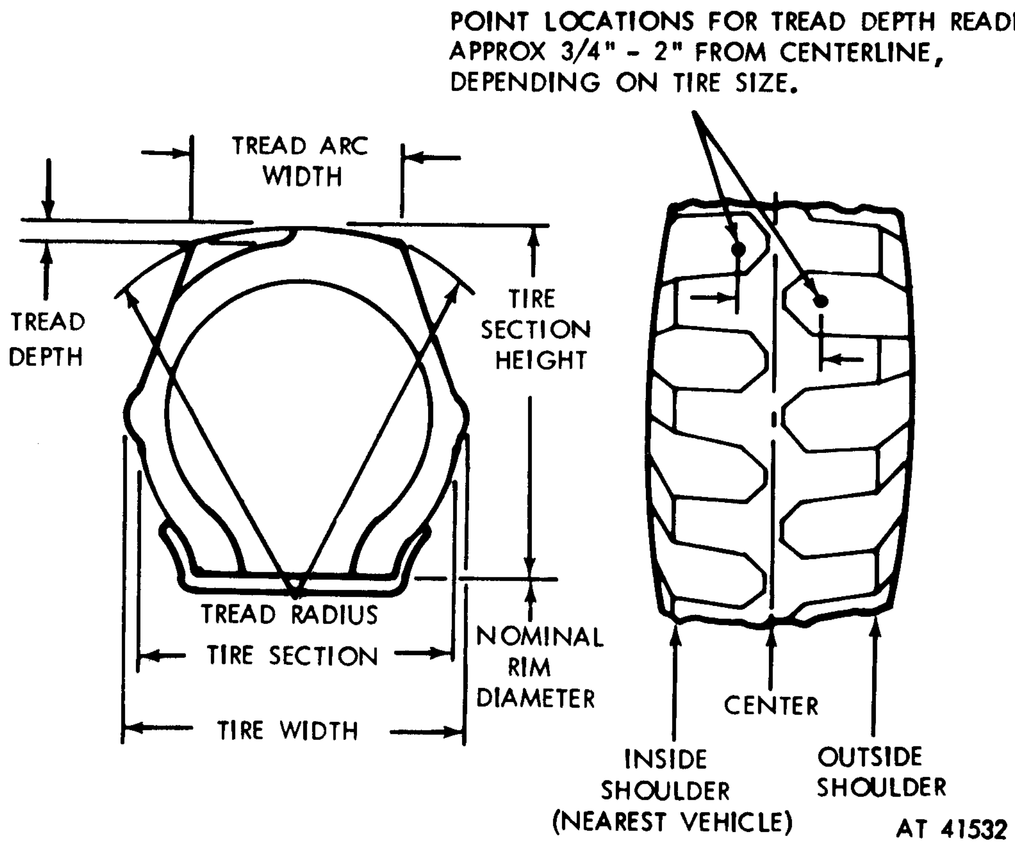


Figure 2-4. Features of tires requiring physical measurement.

h. Periodic Tire Rotation.

(1) The purpose of rotating tires is to equalize wear.

(2) Tires should be inspected for evenness of wear and should be measured after every 2,000 miles of vehicle operation. If uneven wear is indicated, conventional bias ply tires will be rotated. Method for rotating is illustrated in (fig. 2-5).

(3) Rotation of bias-belted or radial ply tires is limited to front/rear exchange (fig. 2-5) on same side of vehicle.

(4) These tires should never be rotated as shown in figure 2-5.

(5) The spare tire should be interchanged with the smallest diameter tire on the vehicle after rotation, If this is not contrary to proper matching.

i. When to Retread Tires.

(1) Tires should be watched carefully and removed at just the right time (fig. 2-6). If removed too soon, usable rubber is wasted. If removed too late, the cord body will be injured beyond repair. Once the tire is worn too far, retreading becomes impossible.

(2) When the tread design is worn off in the center so that the tire is smooth in the center (B, fig. 2-6), the tire will be removed for retreading. Tires with irregular wear, worn to the extent that the cord body shows in any one spot, or worn through the tread design in several spots (D, fig. 2-7 and A, fig. 2-7) will be removed.

(3) The tires shown in (C-E, fig. 2-6) are not worn enough. Plenty of tread design still remains in the center, and the tires will render considerable service before retreading is necessary.

(4) The tire shown in (A, fig. 2-7) has been run too far before removal. The tread design is worn off as is the rubber under the tread design, and the cord body is exposed. Also shown in (A, fig. 2-7) is a tire that has been run too far while subject to irregular wear. Rubber has been wasted. If the position of the tire had been changed when wear started, the wear would have been equalized.

(5) The tire shown in (B, fig. 2-7) has been destroyed and rubber has been wasted by failure to remove it at the proper time for retreading.

(6) The tire shown in (C, fig. 2-7) has been destroyed by the use of a boot on an emergency repair. If such a boot or patch is installed during emergency, this must be considered temporary repairs and the tire should be replaced as soon as the situation permits.

(7) The tire shown in (D, fig. 2-7) shows a tire destroyed by irregular wear. Tire has blown out; rubber in tread and cord body has been wasted by failure to change wheel position and failure to take corrective measures.

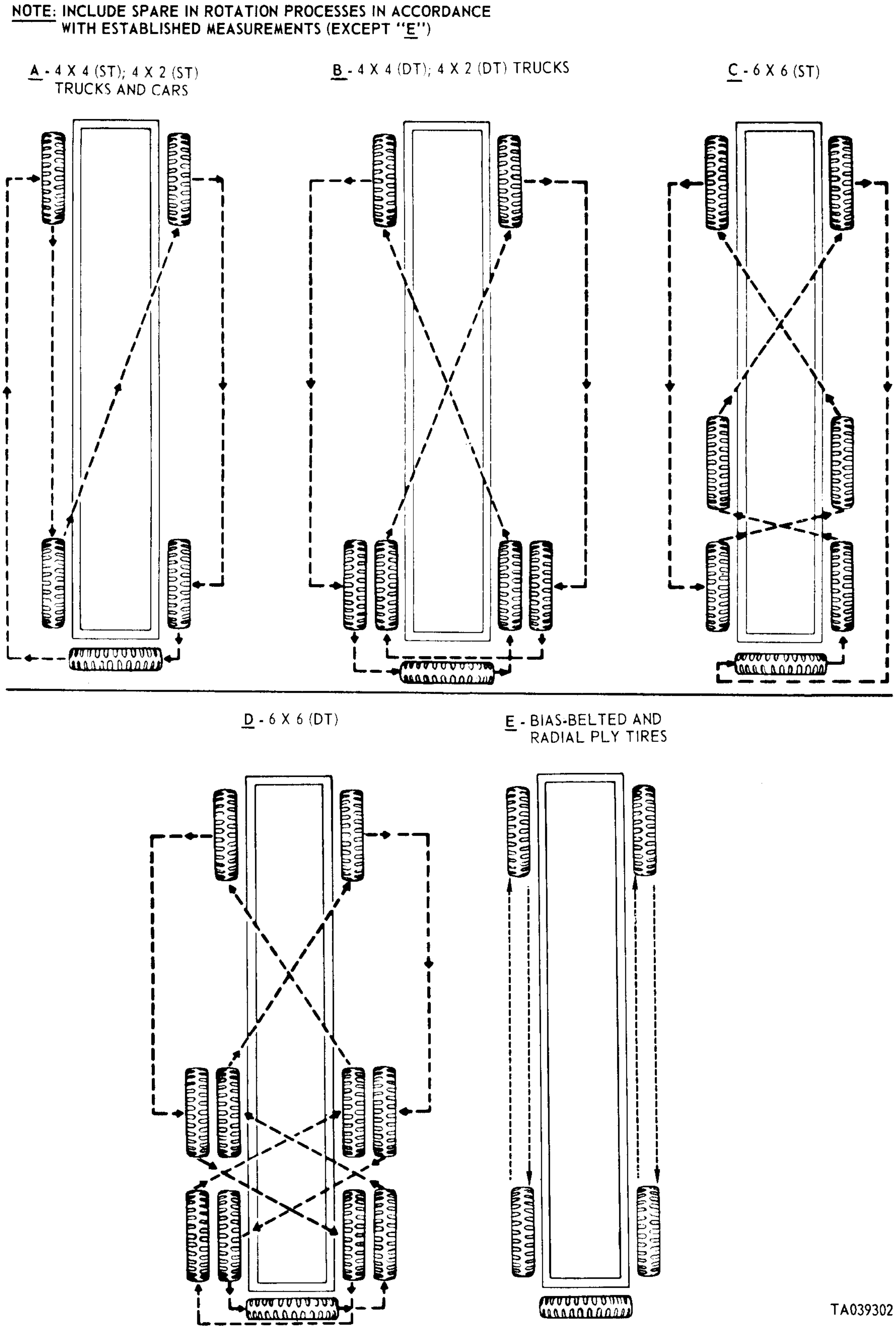


Figure 2-5. Guide for tire rotation.

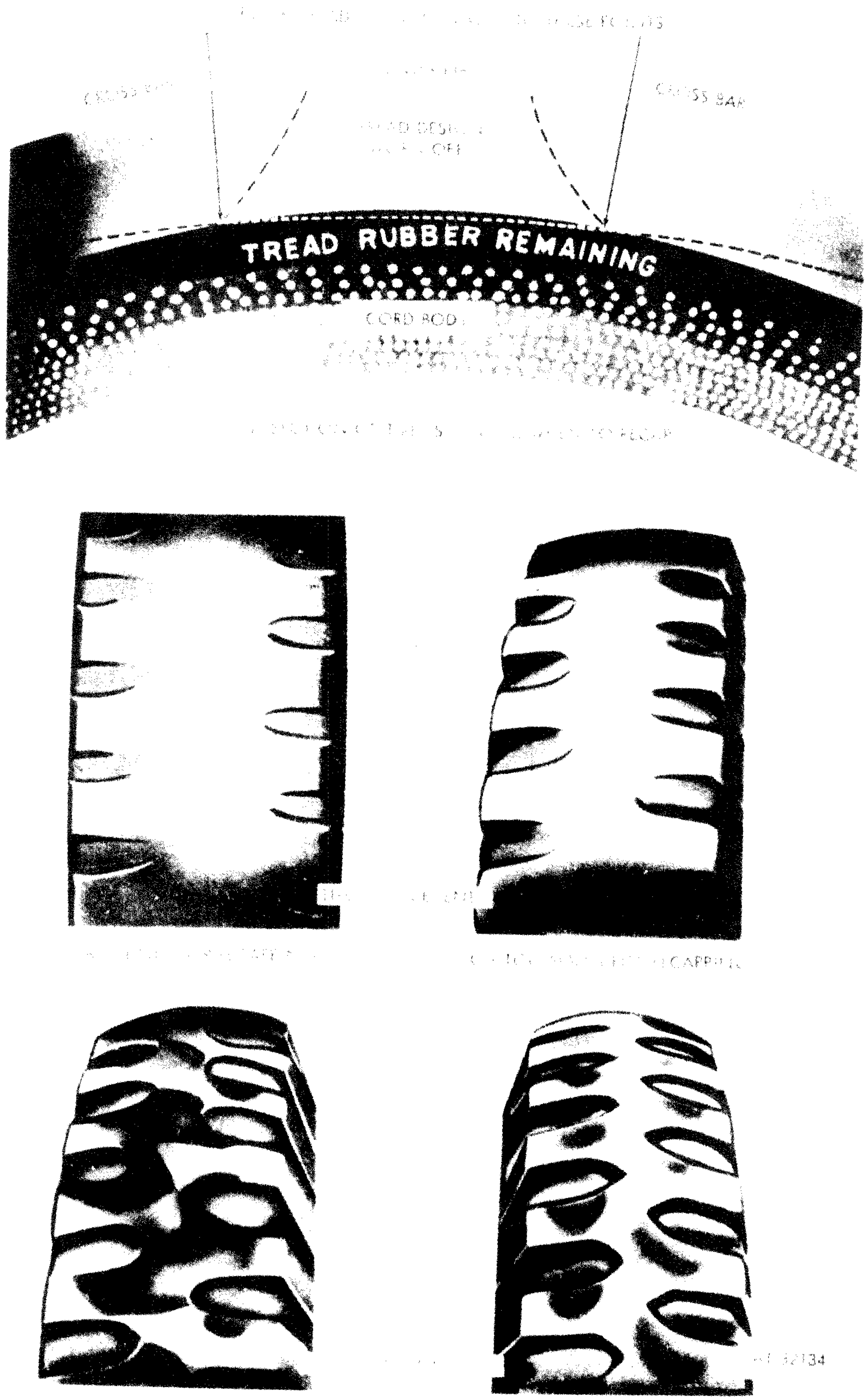


Figure 2-6. Tire wear study for retreading.

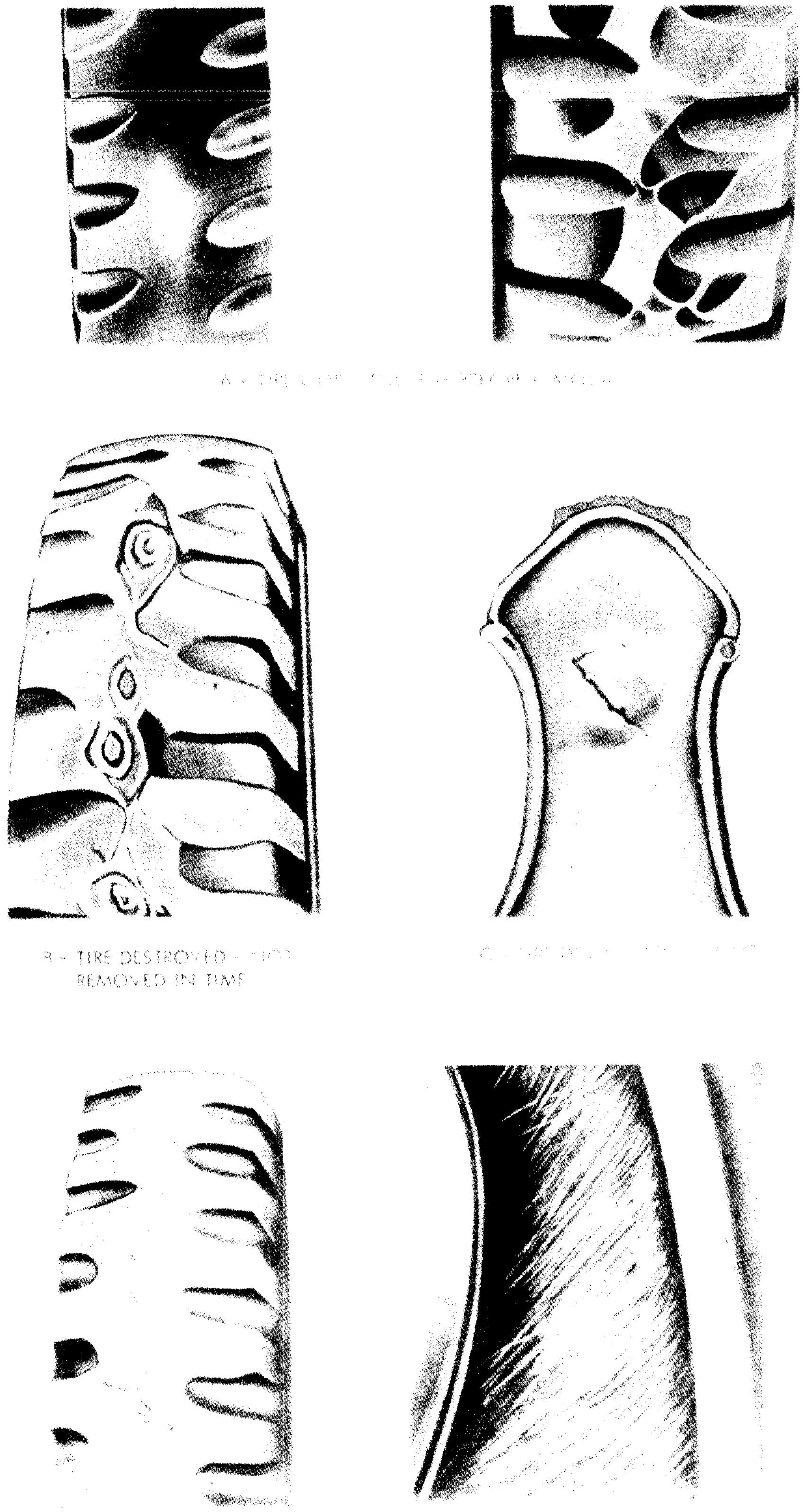


Figure 2-7. Causes of tire failure.

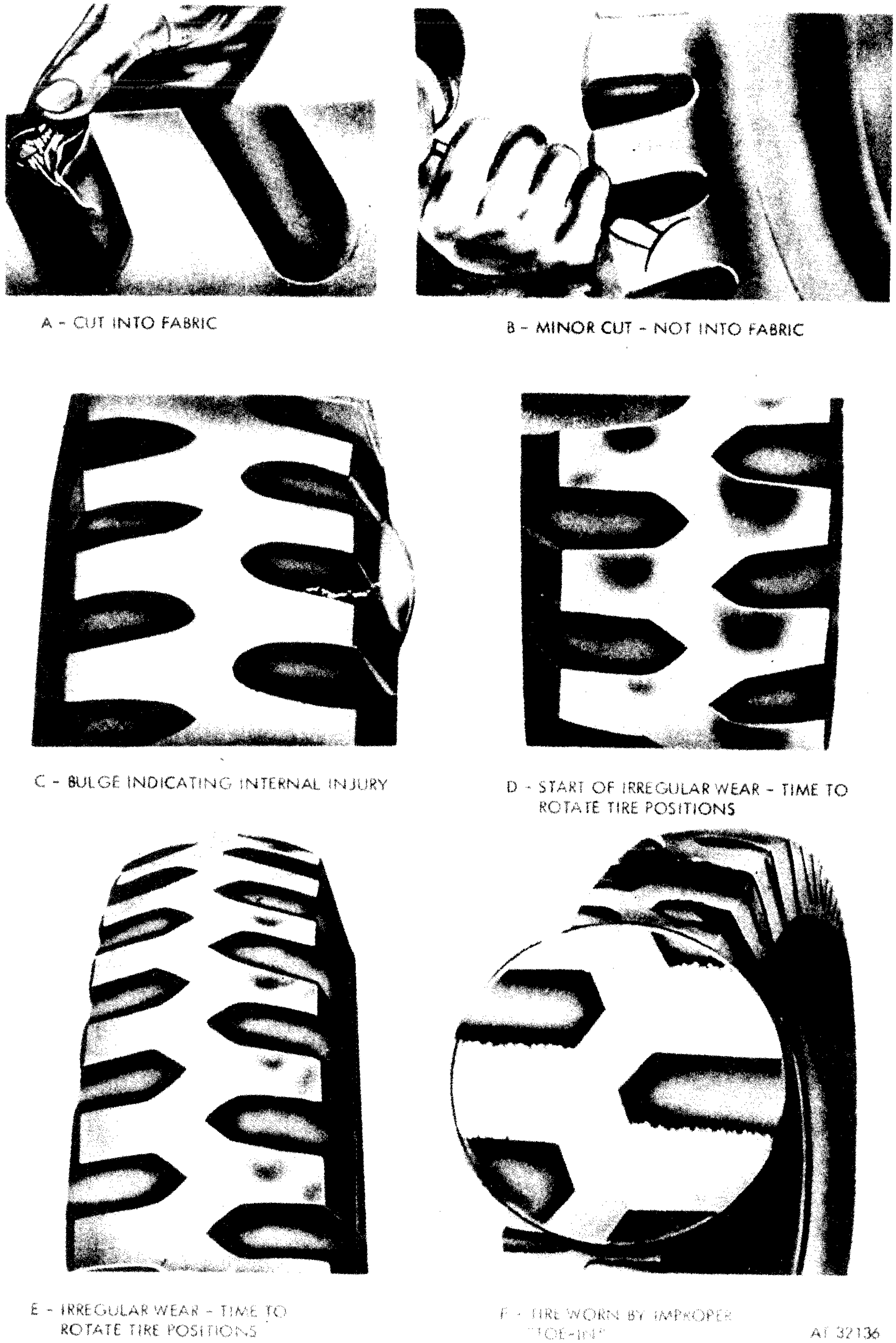


Figure 2-8. Causes of tire wear.

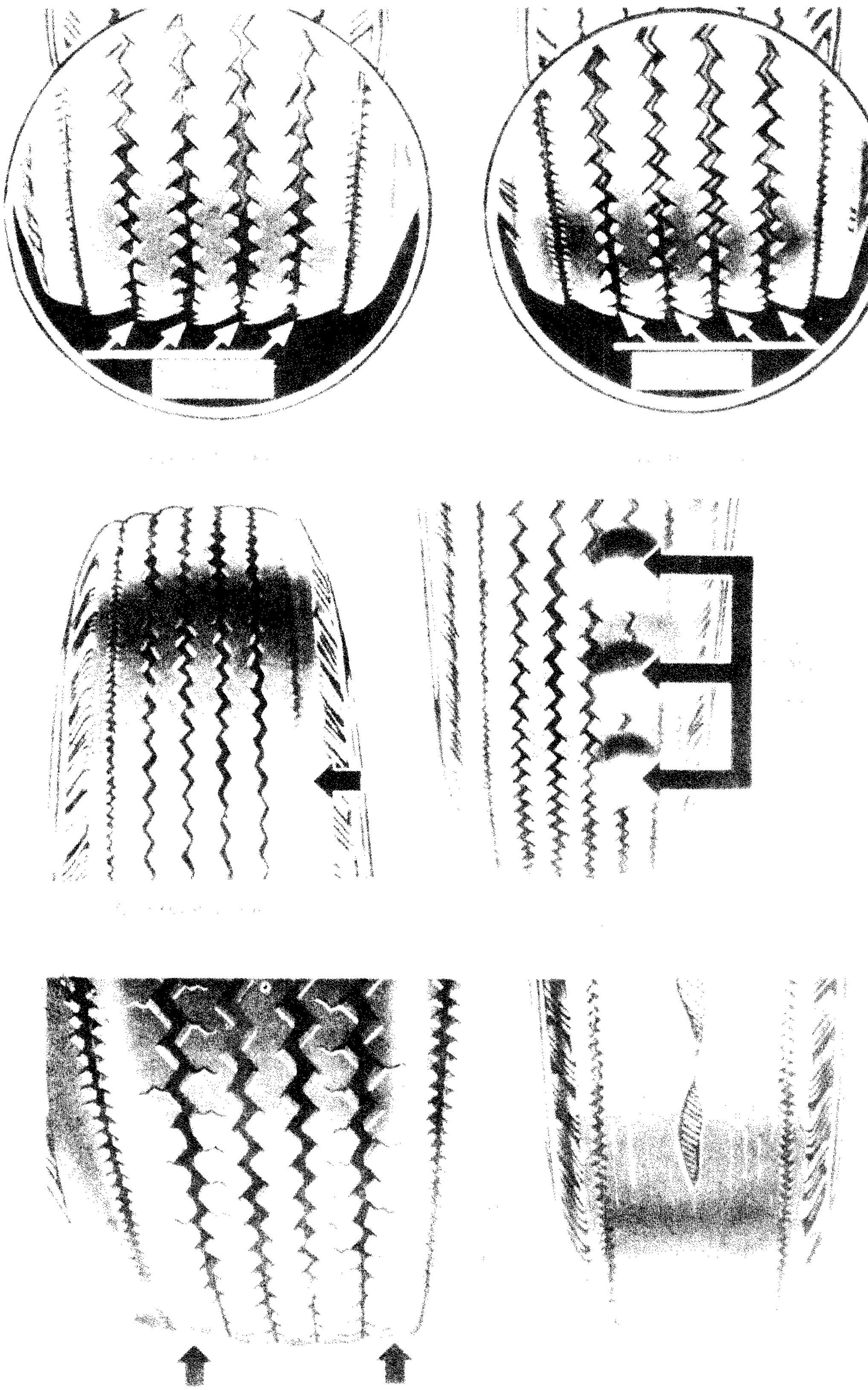


Figure 2-9. Causes of tire wear.

j. Tire Injuries.

(1) Tires are constantly subject to injuries (figs. 2-7, 2-8 and 2-9). They are cut by sharp objects, bruised by bad roads, stones, etc., and they will be injured by road shocks in general. It is dangerous to drive with a seriously injured tire, because it may blow out, causing the driver to lose control of the vehicle with the possibility of serious injury or putting the vehicle out of action. Carefully inspect your tires after every run. Remove glass, nails, stones, and other foreign materials imbedded in tires. Tires will give longer mileage and safer driving when injuries detected are repaired immediately.

(2) Always be on the alert for the tire conditions described in (*a*) through (*c*) below.

(*a*) Remove tire for repair when tire is cut to the extent that the cut extends to or through the fabric (A, fig. 2-8).

(*b*) Small tread cuts not extending to the fabric (B, fig. 2-8) need not be repaired, but must be inspected for penetration to the cord body and for enlargement. Tires having large cuts should be removed for repair.

(*c*) A bulge in the tire indicates internal injury (C, fig. 2-8). Tire should be removed for further inspection and repair if required.

k. Irregular Tire Wear.

(1) Mechanical maladjustments or operating conditions cause irregular and excessive tire wear. Improper toe-in (B, fig. 2-9) and improper toe-out (A, fig. 2-9), caster, or camber; wobbly wheels; sprung axles, faulty bearings, brakedrums, or springs cause irregular wear, as do severe use of brakes and engine power, and turning at high speeds.

(2) At the first sign of irregular tire wear, change tires to different wheel positions, determine the cause, and take corrective measures. (D and E, figs. 2-8 and A and B, 2-9 show tires that should be changed to other wheel positions). When irregular wear develops on tires used on front or on trailer wheels, change tires to driving wheels, where tires tend to wear more evenly.

l. Painting of Tire.

(1) Painting tires to make them look like they are new or clean is not recommended. This is a wasteful procedure that does not provide any functional benefits. Soap and water at the time of vehicle washing will suffice.

(2) The way to protect tires from atmospheric attack is described in paragraph 2-28 (of this manual). This instruction is for tires in storage. Tires in use need no such protection because the rubber from which military tires are made has protective compounds mixed into it. These compounds remain active as long as the tires are exercised.

m. Painting Tire to Prevent Pilferage.

(1) To prevent stealing of tires use a latex base paint, yellow or white and paint the letters "US" across the face of the tire tread.

(2) Make sure that the paint is put on carefully and thoroughly enough so that the paint gets well into the grooves of the tire. The "US" should be visible as long as there is still some tread on the tire.

NOTE

Tire should be thoroughly cleaned before painting. Oil-base paints are not compatible with rubber.

2-2. Extreme Weather Conditions

a. Cold Weather

(1) *Tires.* If vehicles are allowed to rest directly on ice, snow or frozen mud for long periods of time, initial thawing may occur and subsequently the tire will freeze in. The best means of avoiding tires from freezing to the ground is to keep the vehicle off the ground by parking on a hard surface or any other available materiel, such as planks, logs, flatstones, etc. The vehicle must be moved periodically to rotate the tires approximately 180 degrees.

(2) *Inner tubes.* Synthetic tubes become brittle when temperatures drop below -40° F. and will fail faster than natural rubber tubes. To minimize the effect of low temperatures, lubricate the inside of tire, tube, flap, bead, bead lock and the rim portion exposed to the tire with tire lubricant solution instead of talcum and increase tire pressure by 10 percent.

b. Hot Weather. Do not apply cold patches to inner tubes, as they will not stay in place during extremely hot weater operation.

2-3. Effect of Vehicle Operation on Tires

a. Flat Tire Operations. Never run on a flat tire or under-inflated tire unless the tactical situation demands it. Let the vehicle roll to a stop without jamming on the brakes when you first notice a flat. Running flat a few feet or under-inflated for a long distance will ruin a tire and the tube (E, fig. 2-7).

b. Excessive Speed.

(1) Excessive speed grinds off rubber, particularly when the vehicle is driven around turns at high speeds. Continuous operation at high speed weakens the tread and cord body, causing rapid wear and tire failures. To obtain greater tire mileage, the prescribed speed limit for all military vehicles should not exceed that given in the technical manual.

(2) Tires get heated by internal friction in the rubber as the sidewalls of the tires are flexed. The higher the vehicle speed, the higher the rate of this flexing, and the hotter the tires get. When the vehicle is overloaded or the tires are underinflated, the tire flexes more, causing more internal friction, hence, more heat. Naturally, hot climate also causes higher temperatures.

c. Improper Loading. Overloading vehicles beyond their rated capacity is a common cause of tire failures. Overloading makes a tire flex excessively, resulting in a weakening of the cord body, especially if the vehicle

is driven at high speeds. Even if the total load does not exceed the capacity of the vehicle, uneven distribution of the load may overstress certain tires. If one side of a vehicle is overloaded, and if the overstressed tire blows out, the vehicle is likely to turn over during operation. On semitrailers, the load should be so distributed that each axle and the fifth wheel carries its share of the load in accordance with the load carrying capacities of the tires. All loads should be lashed to the vehicle in such a manner that the load will not shift when the vehicle is in motion (A, fig. 2-10).

d. Use of Chains. Tire chains must not be used longer than road conditions require, since continued travel on hard surface will cause rapid wear on the chains and early failure of tires. Chains must also be properly installed to avoid damage to the affected parts.

2-4. Effect of Vehicle Maintenance on Tires

a. Mechanical Irregularities. In addition to proper and regular care of tires and tubes, better and longer service will result if the vehicle itself is kept in good mechanical condition, particularly the steering assembly. Excessive toe-in, improper camber, improper caster, axle misalinement, faulty wheel bearings, incorrect tightening of drum or axle shaft, faulty brakes, bent wheel, and sagging or weak springs will prevent a tire from rolling properly and will cause uneven, spotty, and excessive tread wear, shortening tire life and wasting rubber. Should the vehicle have any mechanical irregularity, correction should be made promptly.

b. Misalinement of Wheels.

(1) Faulty alinement of the front wheels is a common source of rapid tire wear. Previous to making wheel alinement, adjust the kingpin inclination. The spindle body should be checked to determine if it is bent, and if bent, should always be replaced. Front wheels frequently encounter obstructions that jolt the wheels out of alinement. Rear wheels likewise may get out of alinement.

(2) Excessive toe-in causes the tire to wear rapidly and develop feathered edges (F, fig. 2-8) on the inner edge of the tread design. When toe-in is excessive, the feathered edge will appear on the outside. When this condition develops, immediate corrective action should be taken.

(3) A tire on a wheel that is ½ inch out of alinement is dragged sidewise 87 feet in every mile.

(4) When correctly alined, the front wheels should toe-in slightly towards the front of the vehicle, in accordance with the specifications given in the technical manual for the specific vehicle (C and D, fig. 2-10).

(5) Axles out of line cause the drive wheel and trailer tires to roll sideways, scuffing their treads and causing fast wear.

(6) All tires on a sagging axle wear excessively. Inside tires usually show cupping wear, while outside tires wear flat across the tread, with very pronounced wear in the tread center.

(7) Excessive wheel tilt increases slippage between the center and side sections of the tread and causes wear on one side of the tire.

(8) Too little caster, usually caused by weak springs, bent axles, or wobbly wheels, will make the tire wander from one side to another.

c. Excessive Wear of Vehicle Components.

(1) Tie rods, steering gears, drag links, and spring shackles should be checked for excessive wear and maintained in accordance with the pertinent technical manual for the vehicle, to prevent rapid uneven tire wear.

(2) Flat spots develop across the tire tread when wheel bearings are worn loose. Even slight bearing irregularities may develop these flat spots in a relatively short time.

d. Faulty Brakes. Brakes should be properly adjusted and maintained. Out-of-round brakedrums usually wear tires in one place, while improperly adjusted brakes may produce several worn spots. If one brake grabs, the tire will skid and wear off rubber rapidly.

e. Clutch. The clutch should be kept properly adjusted. A grabbing clutch starts the vehicle with a jolt and causes rapid wear on tires.

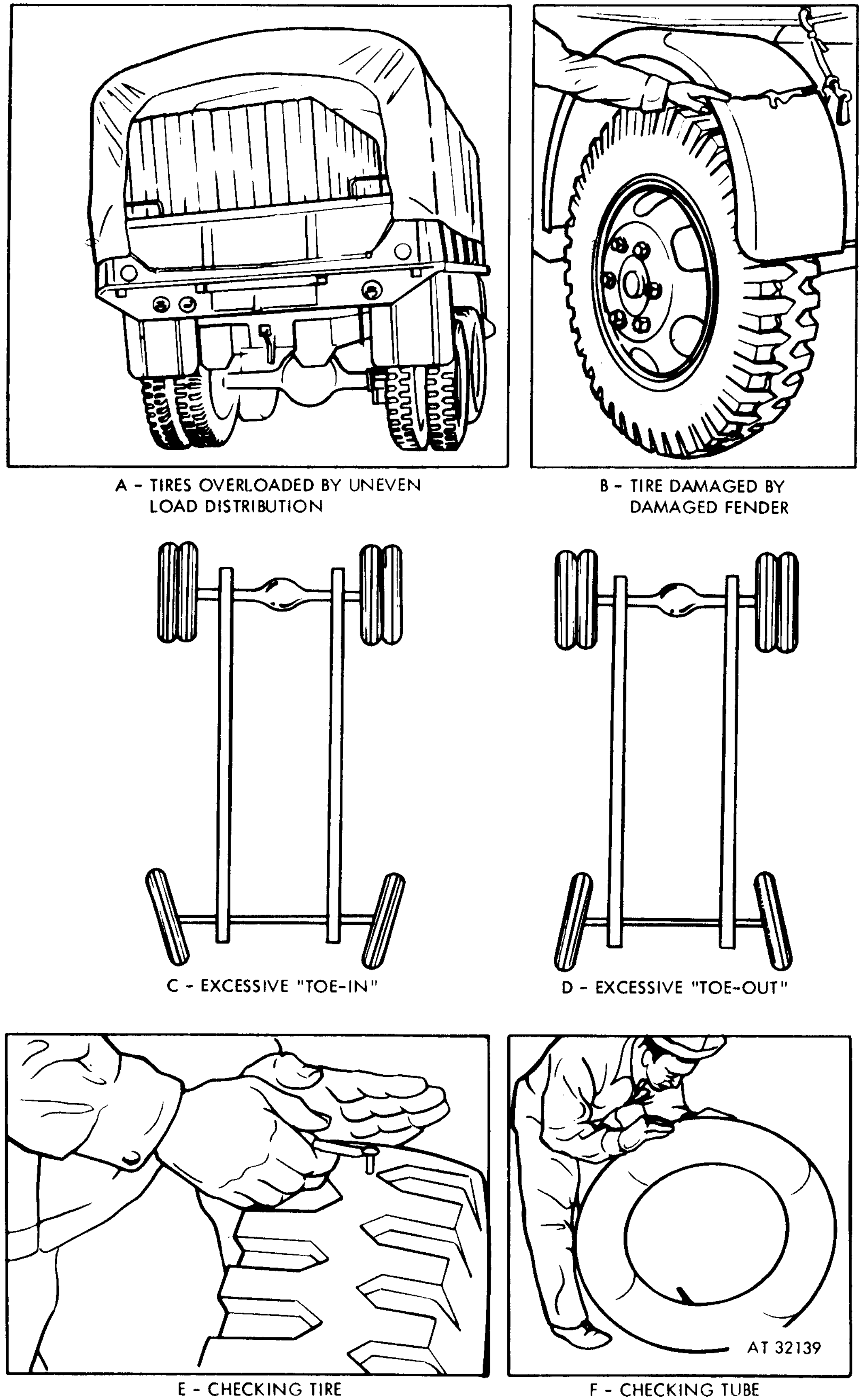


Figure 2-10. Points of inspection for tires and tubes.

Section II. TIRE REPAIRS—NON-CHEMICAL

2-5. Tube Type Tires

Tube Type tire repair will be performed only be higher echelon. Unserviceable tires should be immediately exchanged through proper channels for sutiable replacement.

2-6. Tubeless Tires

a. Tubeless tire puncture injuries may be repaired using the methods described in this manual. Repairs should not be made on injuries larger than 3/8 inch except in an emergency on a military tire or large size off-road tire. Tires with injuries requiring sectional, reinforcement, spot repairs, or retread will be exchanged through proper channels for serviceable tires. Injury size is determined by size of the penetrating object. Puncture injuries repaired without removing the tire from the rim are considered temporary repairs, although such repairs often last until the tread pattern is worn to removal limits.

b. If the location of the injury in the tire is not obvious, locate the leak by inflating the tire on the rim and dipping it into a water tank. If tank is not available or the tire is too large, run soapy water over tire, or apply with a sponge over entire surface. Leak can be identified by formation of bubbles. Mark location of leak or leaks with chalk or crayon.

c. If leak appears at valve stem in the rim, tighten, locknut on valve. If leak appears at bead, dismount tire to determine if rim flange has been bent or tire bead has been damaged.

d. If leak is found to be caused by a cut or puncture, kits listed below are available for tubeless tire repair.

(1) *Tubeless passenger tires.* Use the tubeless tire simplug kit (Goodyear Tire and Rubber Co.) or equal, which contains 24 1/4-inch plugs, or equal, 24 5/16-inch plugs, 24 3/8-inch plugs, 4 ounce bottle cement and inserting needle. The materials in this kit are sufficient for 72 repairs.

(*a*) It is necessary to remove the tire from the rim by this method.

(*b*) Determine size and location of injury. Make sure it is not over 1/4 inch. Determine by measuring the puncturing object, if it is available.

(*c*) Remove puncturing object.

(*d*) Lubricate and clean the injury by pushing the needle, dipped in cement, back and forth several times.

(*e*) Select rubber plug of proper size, attach to the plug inserting tool and dip the plug in rubber cement.

(*f*) Insert plug into the tire injury slowly by using steady pressure.

CAUTION

Pushing the rubber plug too fast may cause plug to be forced completely through the tire or may cause inside plug end to be cut off by eye of inserting tool.

(*g*) Trim off plug slightly above tread surface.

(*h*) Inflate tire to recommended air pressure. Test for leakage with soap-water solution applied around plug.

(2) *Tubeless-type truck and earthmover tires.* Use the tubeless truck and tractor simplug kit (The Goodyear Tire and Rubber Co.) or equal, which contains 25 1/4-inch plugs, 25 5/16-inch plugs, 10, 5/8-inch plugs, two 1/2-pint cans of cement, two inserting tools, two buffing tools, and one cement injection gun. The materials in this kit are sufficient for 125 repairs.

(*a*) Deflate tire completely, remove tire rim, and repair puncture from inside of tire.

(*b*) Remove puncturing object if it is still in tire.

(*c*) Clean and cement injury by applying cement to knurling on the buffing tool. Insert buffing tool, and work back and forth several times to work cement into fabric walls of the injury. Apply more cement as needed until hole is thoroughly lubricated. When repairing small punctures, be careful not to force buffing tool, if opening seems to be blocked. Instead, twist and turn tool to follow path of puncture.

(*d*) Select a plug approximately twice the size of the puncturing object.

(*e*) Insert small end of plug into eye of inserting tool.

(*f*) Cement plug and end of inserting tool by dipping plug into cement.

(*g*) Force rubber plug into injury slowly by using steady pressure. Plug will stretch down and can gradually be pushed into the hole. Continue pushing until end of plug is within 1/4 inch to 1/2 inch from inside surface or until tool handle contacts the tire.

(*h*) Earthmover repairs. Where plugs are applied to larger and higher ply rating tires such as earthmover tires, it is essential that the plug be inserted completely through the carcass and into as much of the tread rubber as possible. A patch must then be applied over inner end of plug.

(*i*) Remove inserting tool while holding thumb against end of plug. Use a back and forth twisting motion while exerting a steady pull on inserting tool handle.

(*j*) Trim inside end of plug 1/8 inch to 1/4 inch from inside surface.

(*k*) Trim outside end of plug even with outside surface of tire.

(*l*) Buff in surface of repair, then cement buffed area with chemical curing cement.

(*m*) Allow cement to dry as recommended by vendor, then apply patch.

(*n*) On-the-road repairs may be made on a temporary basis by applying the plug to the tire from out-

side without removing tire from rim. These repairs should be converted, at the earliest convenience, to a permanent repair by removing tire from rim and applying an inside patch. Failure to do this may reduce service life of tire considerably.

Section III. TUBE REPAIRS

2-7. General

Repair preparations are the same for all tube types. Special care should be taken in repairing synthetic rubber tubes. Tube injuries, especially in synthetic rubber tubes, have a tendency to enlarge, even after they have been repaired. Punctures or tears in the tube rubber are mended by placing a patch over the injury.

2-8. Preparation for Repairs

a. If location of injury to tube is not obvious, locate leak by submerging either the entire inflated tube or part of tube in water (locate leaks in extremely large tubes by running water over surface and watching closely for bubbles). Check valve core, especially for slow leaks. If leak is thought to be around the valve stem but does not show up under water, work stem around to break any possible temporary or low-pressure seal. If leak cannot be located (for lack of adequate equipment), replace it with a good tube and forward faulty tube to higher echelon. The more common causes for leaks are discribed in subparagraphs (1) through (3) below.

(1) Punctures or cuts through tube.

(2) Valve base not sealing (caused by loose hexnut or split fabric in valve base).

(3) Holes chafed through the tube by a tire break or rough bead toe.

b. (A, fig. 2-30), illustrates the appearance of most injuries resulting from rust and punctures. To prevent enlargement, the precautions in c and d below must be taken.

c. Round out ends and any sharp corner with shears to prevent further tearing (B, fig. 2-30). Trim edges to slightly widen injury, so that new patch rubber will flow into and fill injury.

d. Use emery cloth, sandpaper, or scraper provided with vulcanizer to thoroughly buff directly across injury (C, fig. 2-30). Completely roughen, but do not deeply groove the rubber, buff the outside surface ½ inch in all directions from the puncture.

2-9. Inspection

Inspect inner tube for obvious punctures such as nail holes and cuts. If the location of puncture is difficult to find, submerge entire inflated tube in water in a tube-testing tank. To locate leaks in large tubes, run a soap solution or water over tube and watch closely for bubbles indicating leaks. Minor injuries such as cuts or nail holes should be marked with a circle around injury.

2-10. Tube Body Repair

Chemically curing patch repair procedures are fast and easy. The following detailed instructions are recommended.

a. Cut around injury with sharp shears. Leave no sharp edges or corners. (Nail holes can be repaired without round injury.)

b. Buff thoroughly around injury, ½ inch beyond patch. (Use of abrasive band, budding, spoon, wire brush, or equal is recommended.)

c. Clean buffed area with a cleaning solvent or rubber buff. Work solvent in with a clean rag, surface clean and dry.

d. Apply a coat of chemical vulcanizing cement to buffed surface of tube and allow to dry.

e. Select correct patch size for injury. Remove half of the backing being careful not to touch adhesive surface.

f. Apply exposed adhesion surface to treated part of tube. Then remove rest of backing and press whole patch down. Stitch from center of patch to outer edge. Make sure patch is down tight. Stitch outer edge firmly.

g. Place tube into the tire casing and inflate to normal pressure.

Section IV. INSPECTION AND PREPARATION PRIOR TO MOUNTING

2-11. Tube-Type Tires

Inspect tires for nails, glass, and other injurious particles in tread (E, fig. 2-10). Inspect for tread wear, cuts in fabric, fabric breaks, or damaged beads, and do not install tires unless satisfactory for service. Remove any dirt and foreign material from inside of tire.

2-12. Tubeless-Type Tires

Inspect tires for nails, glass, and other injurious particles in tread. Inspect tire for irregular wear, cuts, and blisters appearing on tire. Inspect beads of tubeless tires for damaged rim seal ridges (fig. 2-11). Inspect complete inside surface of innerliner (fig. 2-11) for inperfections or irregular surface that may indicate breaks or other fabric damage. Remove all dirt and foreign material from inside of tire.

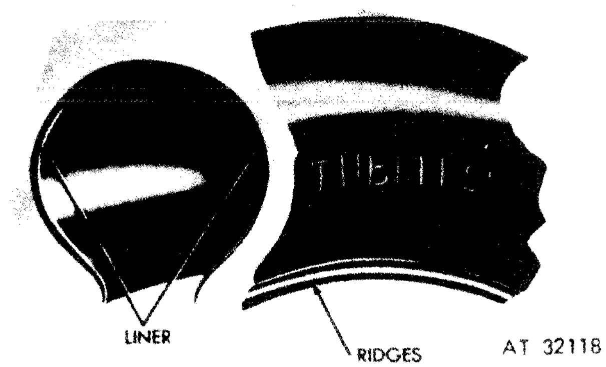


Figure 2-11. Tubeless tire construction.

2-13. Inner Tubes

Check tubes for punctures, pinches, cuts, and cracks (F, fig. 2-10). Inspect valves for proper bend and condition of inside and outside treads. New tubes may not have valves with proper bends. Replace any leaking cores. Install valve caps and tighten valve stem nuts, especially on new tubes.

2-14. Tire Flaps

Flaps should be of proper size and type for the tire. Check flaps for cracks, folds, tears, and cleanliness.

2-15. Rims

Check rims for cracks, dents, dirt, and rust, especially in the gutter (A, fig. 2-12). Be sure that rim lockring is of proper size and type for the rim used and is not sprung or bent. Inspect wheels for worn or out of round stud holes and cracked disks. Tire shown in (fig. 2-13) has been damaged by a bent locking ring. Side rings and locking rings are not interchangeable if they are of different manufacture. Wheel rims for tubeless tires must be free of rust, gummy rubber deposits, nicks, and gouges in the rim bead seat surface so as to provide an airtight seal with tire bead.

2-16. Preparation

a. Use lubricant solution on tire beads, to make mounting and demounting easier, particularly when mounting and demounting tires on drop center or semi-drop-center rims. Do not use oil or grease, because petroleum products cause rapid deterioration of rubber. Do not use any lubricant which does not dry for it may cause the bead to slip. Apply lubricant solution with a brush or swab, taking care not to allow excess solution to enter tire (B, fig. 2-12). Do not use lubricant when mounting motorcycle or combat tires.

b. Large size tubes should be folded before insertion in tire.

(1) Deflate the tube completely.

(2) Install valve cap.

(3) With tube in a circular position, fold quarter of tube to left of valve inward.

(4) Likewise fold two quarters opposite valve inward.

(5) Insert pointed end with valve into tire; then insert other pointed end into tire and unfold tube into tire (C, fig. 2-12).

c. When placing tubes in tires on wheels, be sure that:

(1) Valves point in correct direction.

(2) Valves that are offset in tubes are placed to match the offset valve hole of rim.

(3) Angle valves always point toward the removable flanges of rims.

Tire shown in (fig. 2-14) has been destroyed by use on wrong rim.

d. Be careful not to damage beads (B, fig. 2-15) and (fig. 2-11) with tire tools or hammer. Bead wires are easily damaged if gouged with steel tools. If proper directions are followed, severe use of tools is not necessary. When difficulties are met, check methods. The tire in (fig. 2-16) has been destroyed by improper demounting.

e. Synthetic tubes and flaps require special care, and precautions must be observed in mounting to insure maximum service. Before placing a small-size tube in tire, the tube should be inflated to about three-quarters full or to point where it starts to round out. Large tubes should not be rounded out until after being placed in tires. Inspect tire and repair all damage. Lubricate entire surface of tube with tire lubricant.

f. Remove all dust, rust, or other foreign material from inside of tire, rim, and bead-lock and lubricate with tire lubricant. Clean and lubricate well on base of rim.

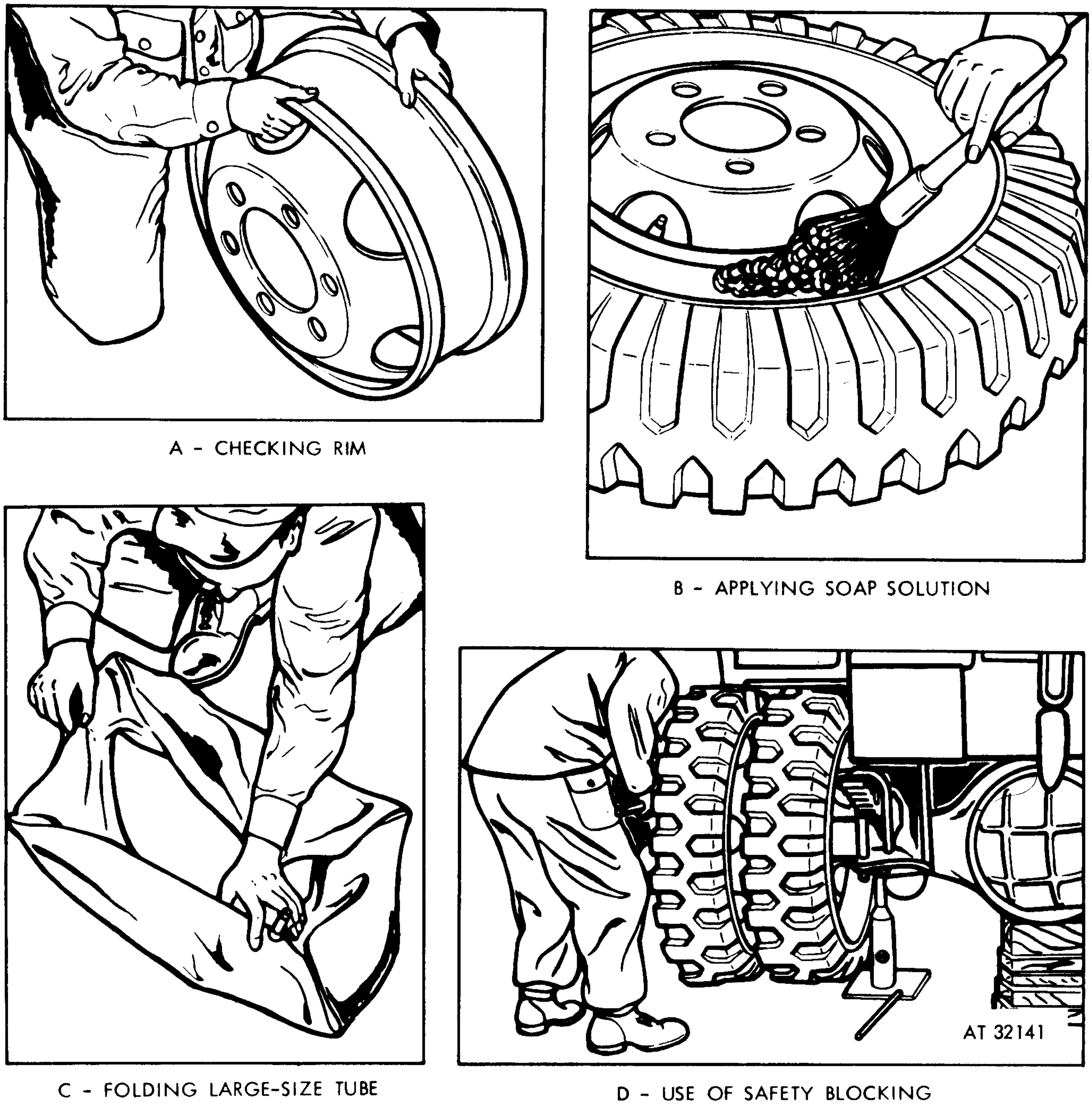


Figure 2-12. Tire mounting and demounting operation.

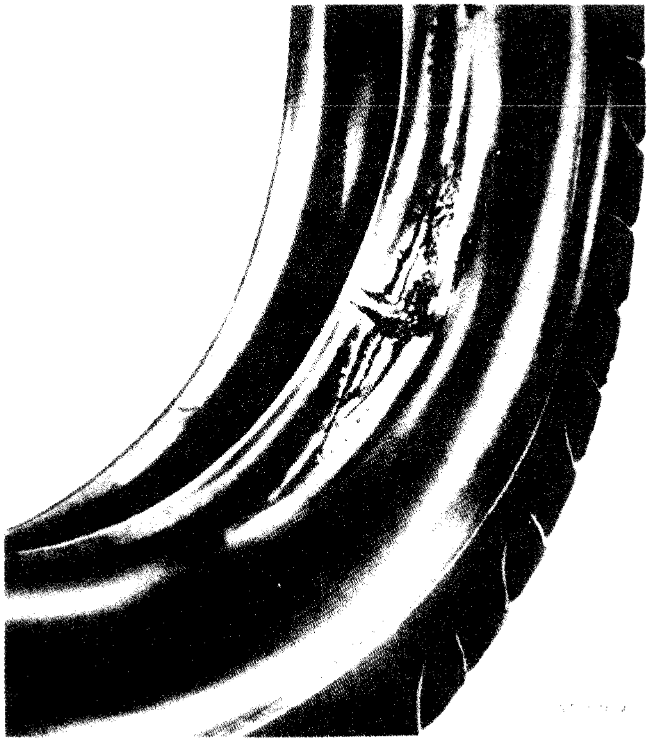


Figure 2-13. Tire ruined by bent lock ring.

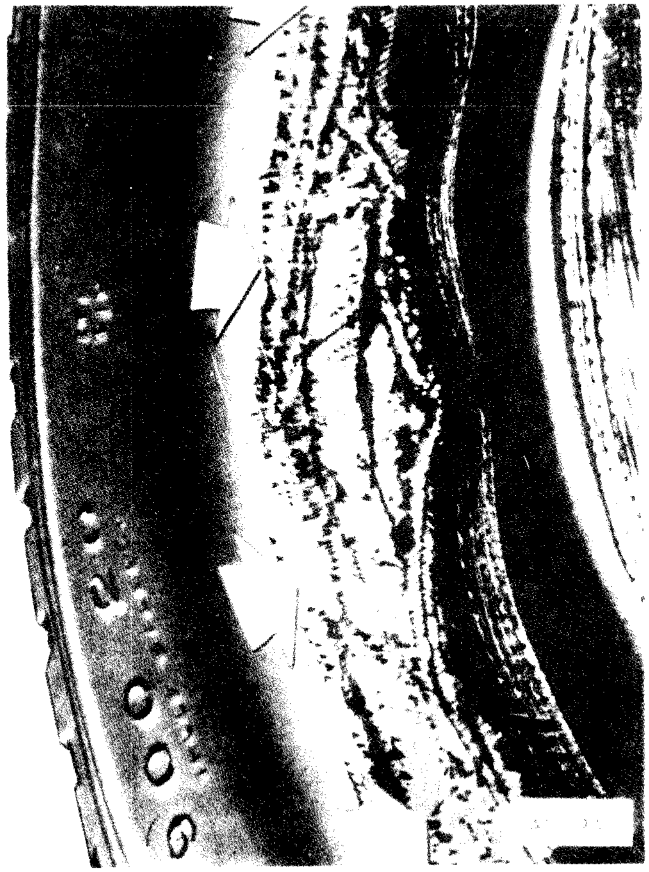
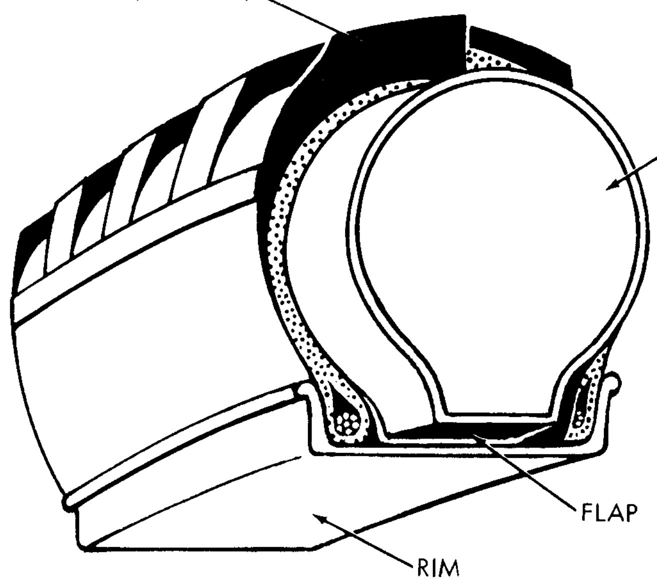
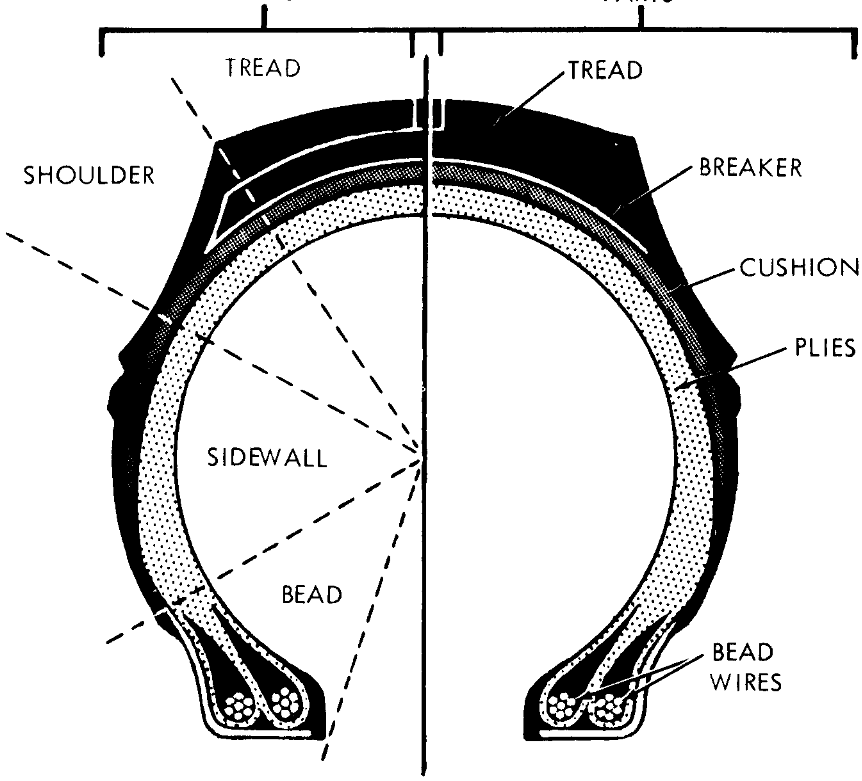


Figure 2-14. Tire ruined by use on wrong rim.



A - TIRE MOUNTED ON FLAT BASE RIM



B - CROSS-SECTION OF TIRE

AT 31968

Figure 2-15. Tire construction—sectional view.

Figure 2-16. Bead broken-tire damaged by improper mounting or demounting.

Flaps must be dusted or lubricated on both sides (in addition to tube). Natural rubber flaps used with synthetic tubes need only be dusted or lubricated on side that comes in contact with tube.

g. After properly preparing tube, tire, and rim, place tube in tire and mount in usual manner. Next, inflate tube sufficiently to force tire beads to seat properly against rim flange of drop-center and semi-drop center rims. Allow flaps to center properly between beads of flat-base rims and beadlocks; then deflate, in all cases, to relieve any unnatural strain, free creases, or wrinkles. Finally, install valve core and again inflate to recommended operating pressures.

Section V. MOUNTING AND DEMOUNTING ON VARIOUS TYPE RIMS

2-17. Detachable Rims

To demount detachable rims on duals, remove the lugs, then force off outer rims, the space band and inner rim. Reverse procedures in mounting. When mounting, be sure lugs fit in their proper place against the rim. Before lowering wheel to ground, rotate wheel and check to make sure assembly does not wobble.

2-18. Drop-Center Rims

a. This type of rim has a well in the center which permits mounting and demounting. (A, fig. 2-17) shows how the well in the rim makes these operations possible with lower part of bead in its seat; (1) the upper part would have to be stretched or broken to free it, but with the lower part of the bead pushed into the rim well, (2) it is not necessary to stretch the upper part to slip it over the flange.

b. Tires may be removed from a drop-center rim (except from a safety-type rim) without removing the wheel, especially on small size tires. Considerable skill is required to mount and demount tires on this rim when wheel is on the vehicle. For this reason, the instructions in *c* and *d* below are for procedures when the wheel is removed.

c. Demount tires as follows:

(1) Determine which rim flange is nearer drop-center well and position short side upward.

(2) Deflate tire by removing valve cap and valve core.

(3) After tire has been completely deflated, install cap to prevent damage to threads of valve stem. Loosen beads from rim flanges (B, fig. 2-17).

WARNING

Do not dislodge tire beads, lock-rings, or split flange rings until absolutely certain that no air pressure remains in tire.

(4) Insert two tire irons about 6-inches apart between upper bead and rim, near valve, kneeling on tire 180 degrees from valve to force upper vead into well.

(5) Pry outer bead over flange near valve.

(6) Work irons progressively around tire bead, lifting tire bead over flange (C, fig. 2-17).

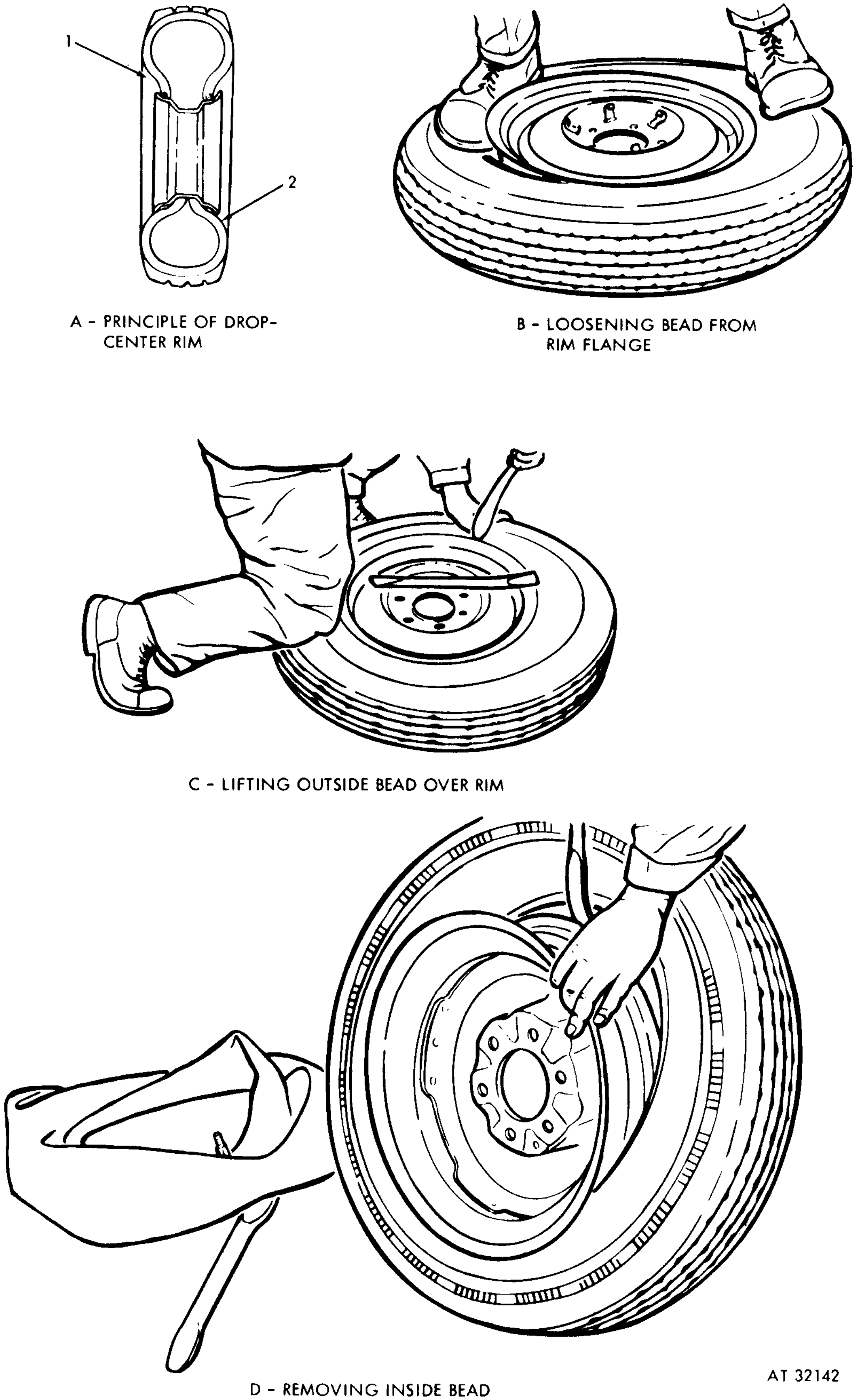


Figure 2-17. Manually demounting tire—drop-center rim.

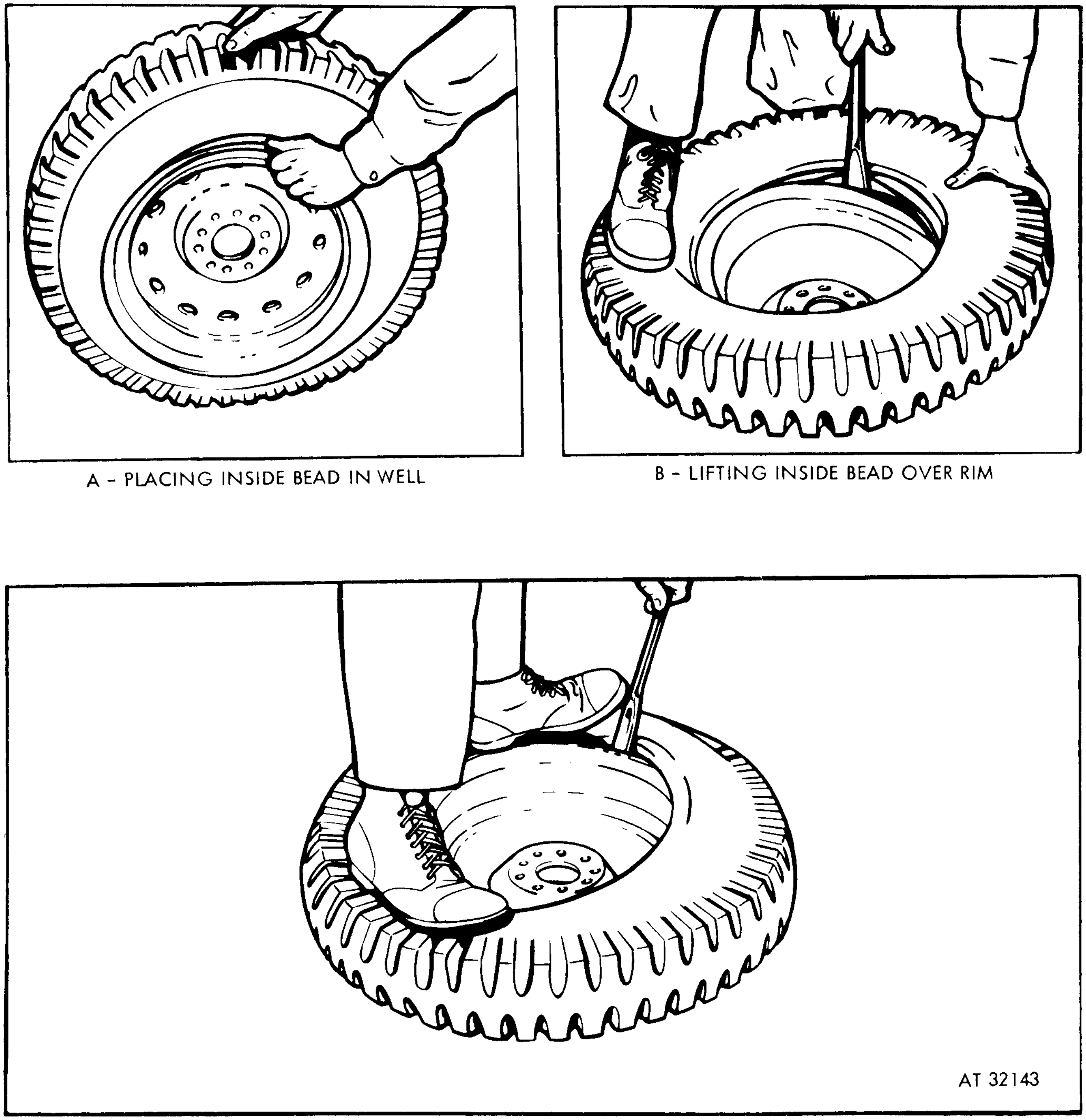


Figure 2-18. Manually mounting tire—drop-center rim.

(7) Remove tube from tire. Do not pull on valve.

(8) Push inner bead into tube well on one side. Insert tire on opposite side and pry head over flange (D, fig. 2-17).

Some passenger cars and light trucks use drop-center rims, known as safety rims (A, fig. 1-9). These have a hump in base of bead ledge to hold beads in place. Sets of military type iron are used to force beads off bead seats. Wheel must be demounted before removal of tires. After the beads are forced off the seats, proceed as directed to remove tire in same manner as above.

d. Mount tires as follows:

(1) Inspect tire, tube, and rim. Remove valve cap. Inflate tube slightly and insert in tire, placing valve at balance mark. Lay wheel flat with valve hole up. Screw a valve fishing tool on the valve stem. Start to mount tire with valve pointing toward valve hole, pulling handle of fishing tool through valve hole in rim. Place inside bead in rim well near valve hole (A, fig. 2-18).

(2) Holding inside bead in well, force remainder of inside bead over flange with a tire tool or rubber faced hammer. Spread tire and pull stem through hole in rim

(B, fig. 2-18).

(3) Place outside bead in well, opposite valve and pry on rim with tire tool or tap with rubber faced hammer, being careful not to damage beads on rim. Keep as much of bead as possible in rim well (C, fig. 2-18).

(4) Check position of valve, shifting tire in order to center valve in hole with aid of fishing tool.

CAUTION

Pull very genly with fishing tool in order not to tear tube at base of valve.

(5) Center tire around rim and inflate to about 10 p.s.i. Apply air chuck to that part of fishing tool that serves as a valve stem extension. In this operation, valve stem may be held by fishing tool. If beads fail to seat properly against rim flange at this pressure, either the tube is pinched or part of bead is still in well, in which case, deflate and make appropriate corrections. Occasionally, beads will fail to seat in rim flange due to friction between beads and rim, especially if rim has not been sufficiently or properly lubricated with solution. This can be corrected by holding tire and rim (inflated to 10 to 15 p.s.i.) upright and bouncing it on ground. If bead is properly seated romove fishing tool, inflate to full pressure, then remove valve core and deflate tire to smooth out wrinkles in tube. Install valve core and again inflate to recommended pressure. Check valve for leaks and install valve cap. Beads of tires mounted on safety rims used on some passenger cars and light trucks snap over the hump into place after approximately 20 p.s.i. is applied. A snapping noise can be heard as beads snap into place. Inflate sufficiently to force beads against rim flanges, then deflate completely and again inflate to prescribed air pressure. Do not continue to inflate tire beyond 40 p.s.i. if beads are not in position. There is danger that beads may strike flange with enough force to break and jump the flange.

2-19. Semidrop-center Rims

This type rim is similar to the full drop-center type. The chief difference is that the well in the semidrop-center rim is shallow, and the rim has a removable side ring. Like the full-drop-center, the semi-drop-center rim has tapered bead seats. (A, fig. 2-19) shows how the shallow well in this rim must be used in mounting and demounting. With the lower part of the bead in its seat (1), the upper part would have to be stretched or broken to free it; but, with the lower part of the bead pushed into the rim well (2), it is not necessary to stretch the upper part to slip it off the rim.

a. Demounting.

(1) Inspect rim and continuous-type-ring prior to removal of wheel and tire from vehicle. If either rim or ring is damaged or ring appears to be unseated, deflate tube prior to removal from vehicle. Remove valve core to insure complete deflation. Install valve cap for protection of threads on valve stem. Remove wheel and loosen both beads from bead seats in rim with tire iron by driving tire iron between flanges and tire beads, taking care not to damage beads of tire. Then pry tire loose by lifting up on iron, forcing bead toward well (B, fig. 2-19). Do not dislodge tire beads, lockrings, or split flange rings until absolutely certain that no air pressure remains in tire.

(2) Remove side ring.

(*a*) When demounting continuous-type rim, insert a lockring remover and replacer with curved side upward. Force side ring opposite prying notch into gutter. Then pry out the side ring, with a circular motion of this tool, enough to permit insertion of a tire iron adjacent to this tool. Use both tools to pry ring off, a little at a time, until the whole ring is removed, being careful not to bend the side ring (C, fig. 2-19). A continuous side ring which is not held in place with a split lock ring contains a tongue which fits into groove or gutter. Split in lockring should be positioned at 90 degrees or 270 degrees away from valve stem to minimize chance of tire irons damaging valve.

(*b*) When demounting split-type side ring, insert lockring remover and replacer into prying notch and pry side ring out of gutter, using two tools to complete removal. Do not bend side ring while removing (D, fig. 2-19).

(3) Push valve into tire and slightly shift tire and tube assembly on rim to keep valve away from valve hole. Stand or kneel on one side of tire, forcing bead into well of rim. Hold bead in this position and insert a thin, flat tire iron under opposite part of bead and pry over edge of rim. Then, using a similar tire iron, work entire outer bead off the rim (E, fig. 2-19).

b. Mounting.

(1) After proper inspection assemble tire and tube. Apply lubricant to tire beads and rim. Inflate until tube is barely rounded out, as too much air will make mounting difficult. Never use oil.

(2) Position so that valve is in line with valve hole in rim. Force inside bead down into well of rim with aid of tire irons, progressing from each side of valve until only a small portion of bead is left outside of rim or well. Force remaining part of bead into well by tapping lightly on bead toe with round or flat end of tool (A, fig. 2-20), and insert valve through valve hole.

(3) To apply outside bead, start at point opposite valve and press bead toe over rim gutter and into rim well with knee pressure. Mount remainder of bead by means of tire irons (B, fig. 2-20). (See that bead fully clears rim gutter all around.)

(4) Install side ring.

(*a*) When mounting continuous-ring-type rim, place that portion of side ring opposite prying notch, into rim gutter. This portion (which should be inserted first) extends between two cut away portions on inside circumference of ring. Insert lockring remover and

replacer (NSN 5120-00-765-8536) in prying notch and, holding opposite portion of ring in gutter, strike side ring in area between prying notch and nearest cutaway section with a hammer and, by prying with tools and by using hammer, force ring in place. Then repeat on opposite side of prying notch and force rest of ring in place (C, fig. 2-20).

NOTE

Improperly seated rings constitute a hazard when tires are inflated.

(*b*) When mounting split-ring-type rim, place end, without prying notch, into rim ring gutter. Using a tire iron, force ring into place (D, fig. 2-20).

(5) Inflate tube to just enough air pressure to bring pressure between beads and side ring. Tap ring with hammer, in order to be sure it is anchored in place.

WARNING

In doing this, the side ring should be turned away from operator and away from any other person nearby who might be injured if ring should fly off.

c. Tire Inflation.

(1) Use a tire inflation cage (fig. 2-21a) when ready to inflate tires. If one is not available, figure 2-21b gives you instructions on how to build one.

WARNING

Make sure continuous type ring is fully seated before removing from safety cage. Length of air hose on safety cage should be a minimum of ten feet in length to allow operator to be at least ten feet from safety cage while inflating tire.

(2) Keep air compressor free of flammable gases. Any gases that are in the lines and then transmitted into the tire will blow the tire and cause injury to the user of the pump.

(3) Make sure that antifreeze is not used in a compressor. That includes alcohol, dry gas or any other flammable material. Instead, frequently drain the moisture from the compressor tank and keep the compressor indoors in freezing weather.

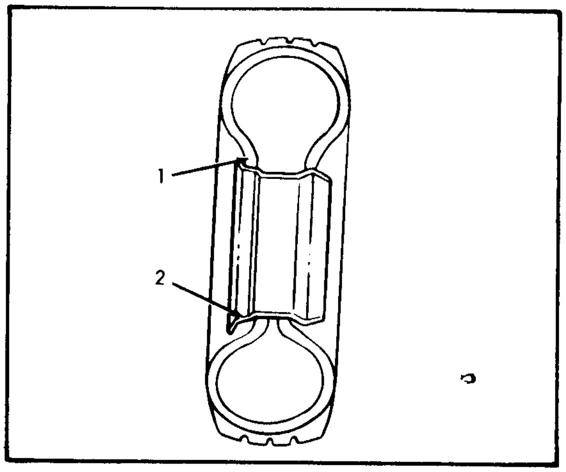
(4) Store the compressor off by itself far from rubber cement or inflammable solvent vapors that might be drawn into the air intake.

(5) Gasoline or flammable solvents are not to be used to clean the air screen of the compressor. When air screen is to be cleaned, blow it dry with an air hose before you reinstall it.

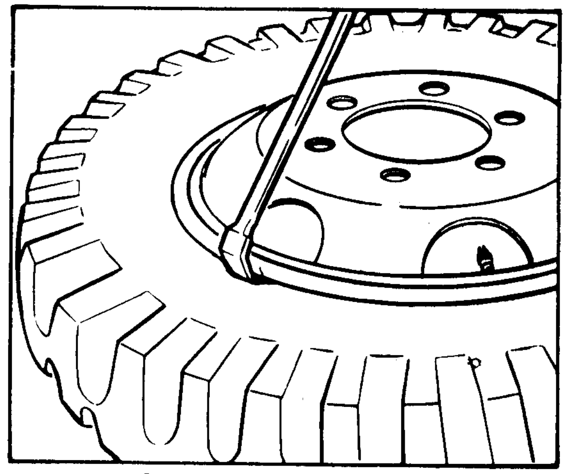
(6) Keep battery chargers well away from the air intake of the compressor. Batteries give off hydrogen gas during charging, which can cause an explosion.

2-20. Flat-Base Rims

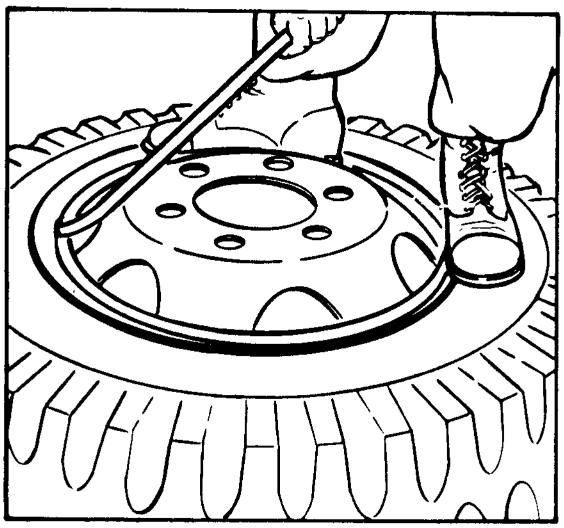
The flat-base rim is generally fastened permanently to the wheel when used on a military vehicle. It has a flat seat for the bead and, as the name indicates, the rim has no well. This type rim has a demountable side flange to permit mounting and demounting the tire (B, fig. 2-22).



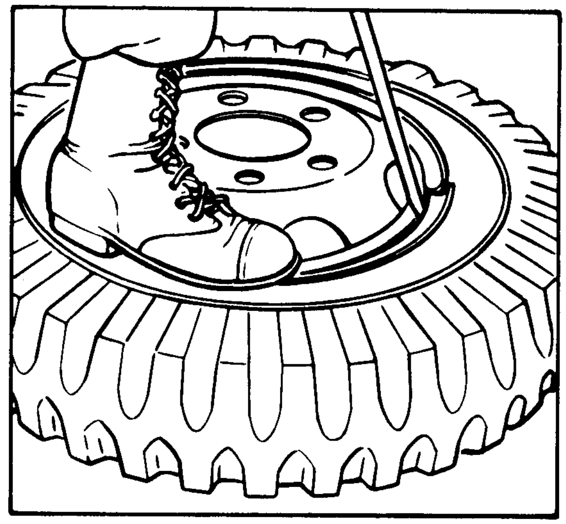
A - PRINCIPLE OF SEMIDROP - CENTER RIM



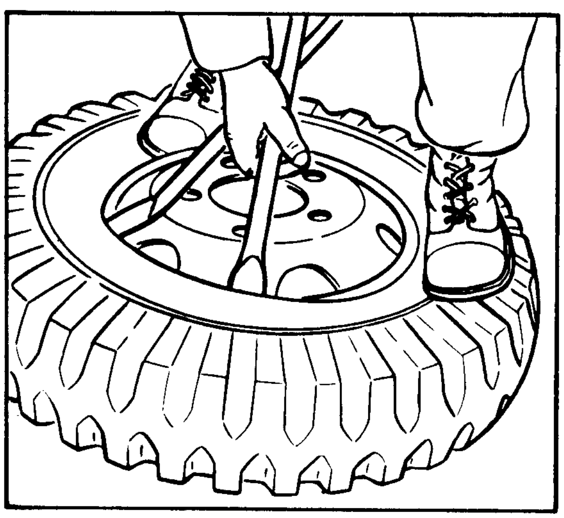
B - LOOSENING THE BEAD



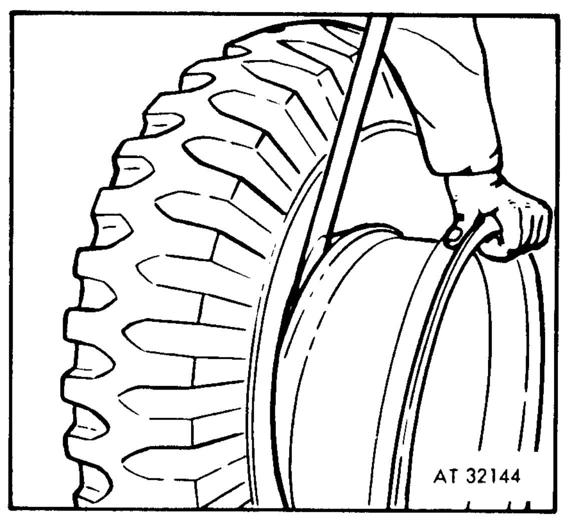
C - REMOVING CONTINUOUS - TYPE SIDE RING



D - REMOVING FLANGES HAVING SPLIT-TYPE SIDE RING

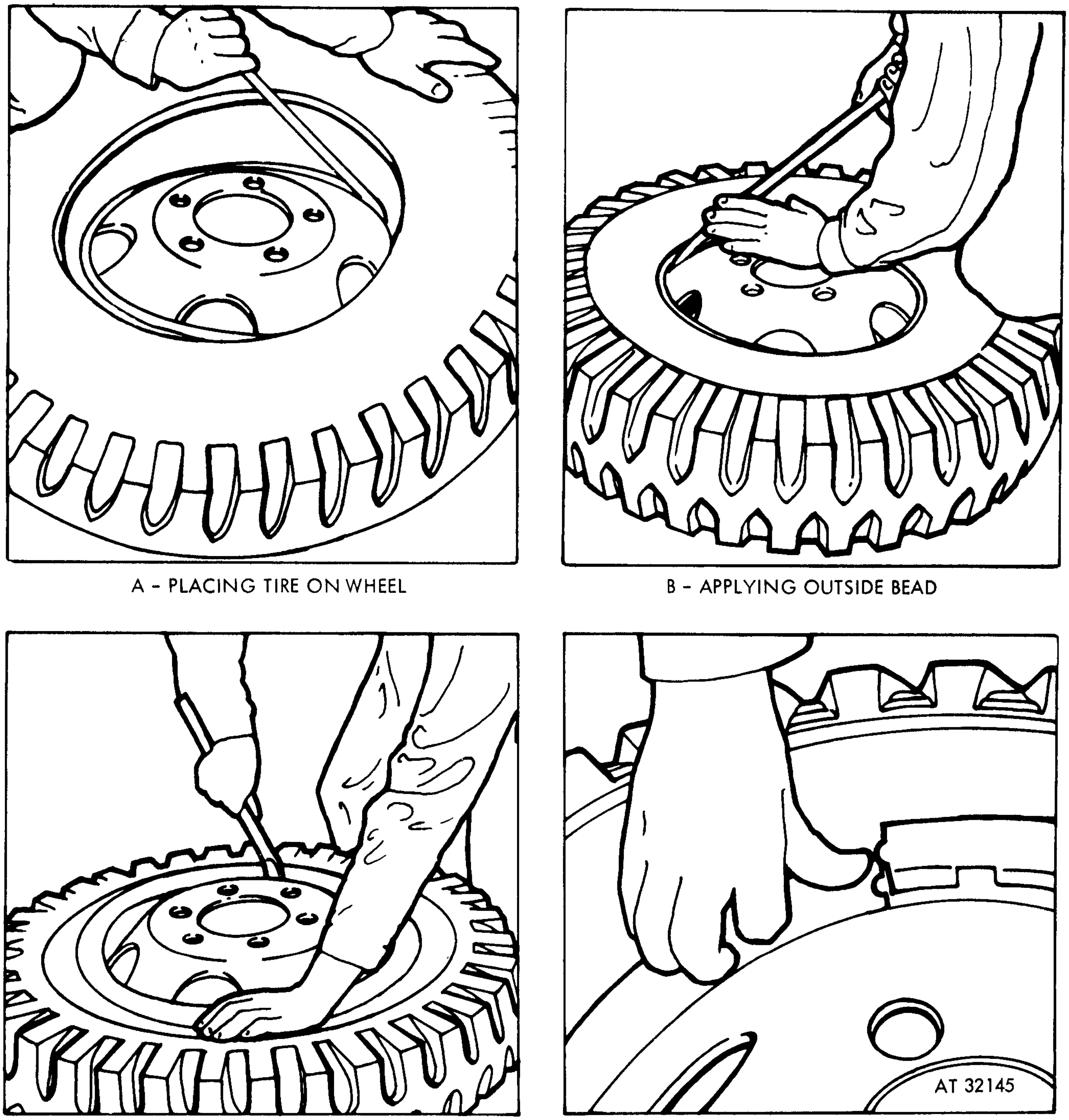


E - REMOVING OUTER BEAD



F - REMOVING INNER BEAD

Figure 2-19. Manually demounting tire—semidrop-center rim.



A - PLACING TIRE ON WHEEL

B - APPLYING OUTSIDE BEAD

C - CONTINUOUS-TYPE

D - SPLIT-TYPE

INSTALLING RIM RING

Figure 2-20. Manually mounting tire—semidrop-center rim.

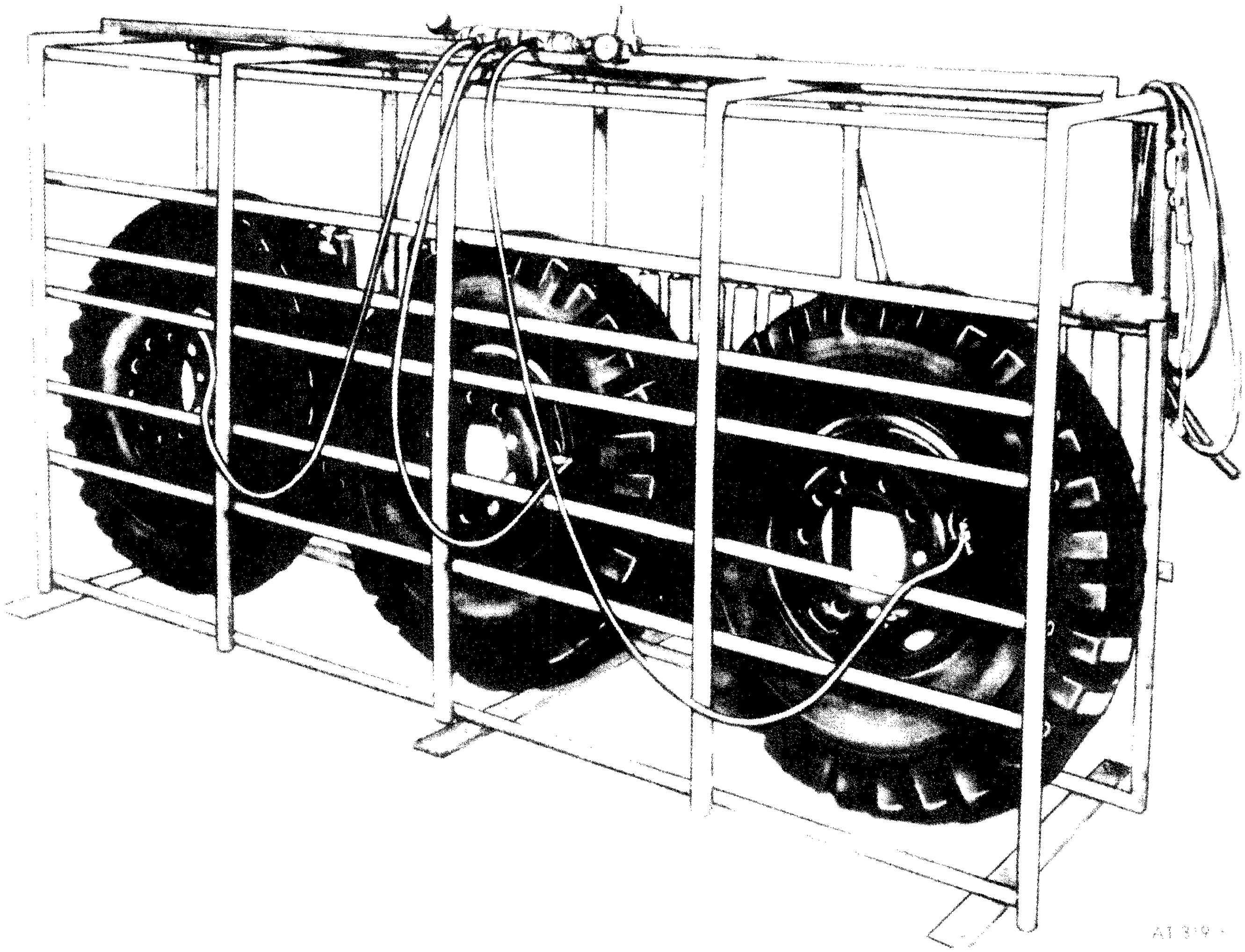
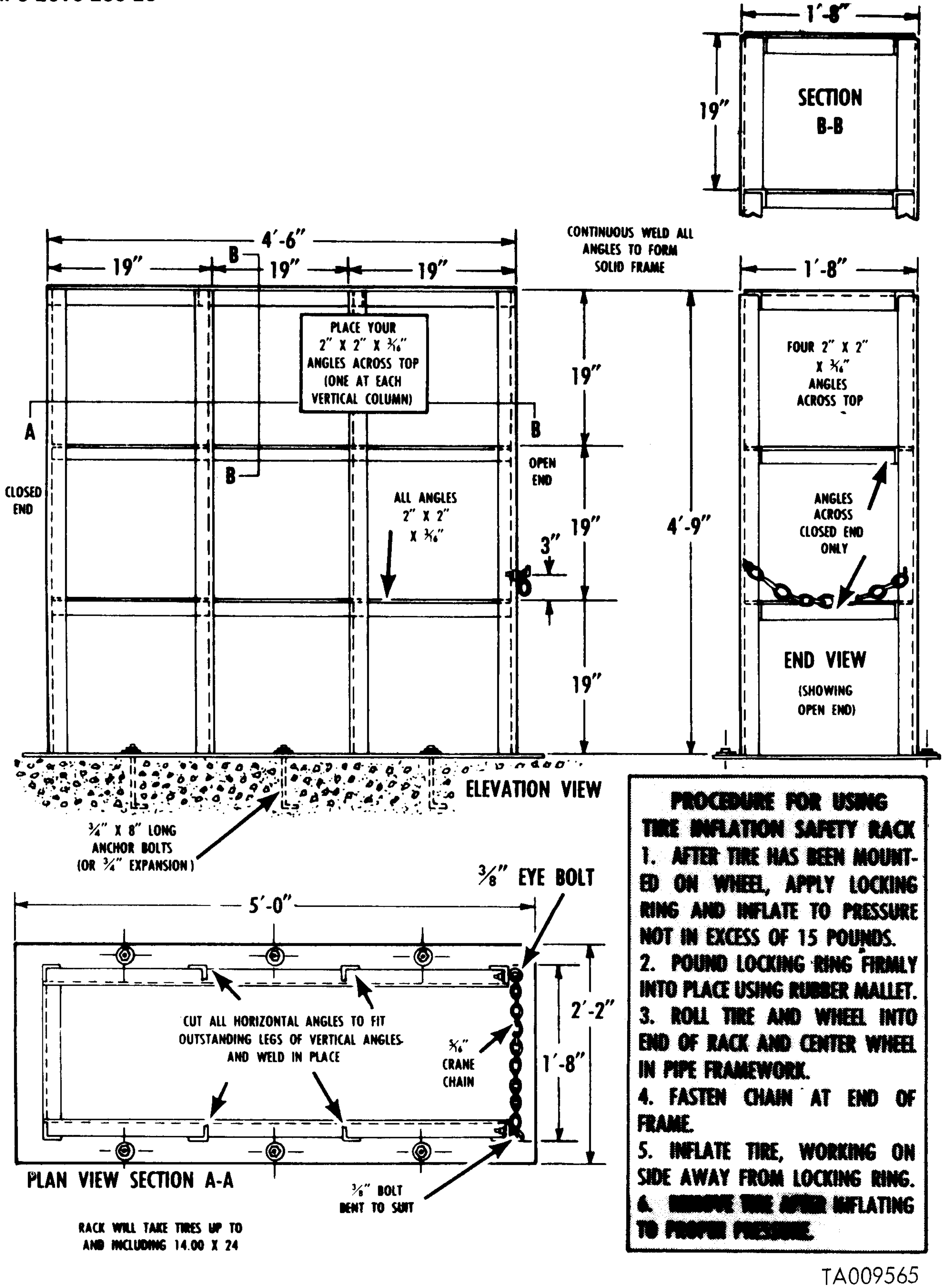


Figure 2-21a. Inflation safety cage.



1'-8"
19"
SECTION B-B
4'-6"
19"
19"
19"
B
B
PLACE YOUR 2" X 2" X 3/16" ANGLES ACROSS TOP (ONE AT EACH VERTICAL COLUMN)
A
B
CLOSED END
OPEN END
ALL ANGLES 2" X 2" X 3/16"
3"
19"
19"
19"
4'-9"
CONTINUOUS WELD ALL ANGLES TO FORM SOLID FRAME
1'-8"
FOUR 2" X 2" X 3/16" ANGLES ACROSS TOP
ANGLES ACROSS CLOSED END ONLY
END VIEW
(SHOWING OPEN END)
ELEVATION VIEW
3/4" X 8" LONG ANCHOR BOLTS (OR 3/4" EXPANSION)
3/8" EYE BOLT
5'-0"
2'-2"
1'-8"
CUT ALL HORIZONTAL ANGLES TO FIT OUTSTANDING LEGS OF VERTICAL ANGLES AND WELD IN PLACE
5/16" CRANE CHAIN
PLAN VIEW SECTION A-A
3/8" BOLT BENT TO SUIT
RACK WILL TAKE TIRES UP TO AND INCLUDING 14.00 X 24
PROCEDURE FOR USING TIRE INFLATION SAFETY RACK
1. AFTER TIRE HAS BEEN MOUNTED ON WHEEL, APPLY LOCKING RING AND INFLATE TO PRESSURE NOT IN EXCESS OF 15 POUNDS.
2. POUND LOCKING RING FIRMLY INTO PLACE USING RUBBER MALLET.
3. ROLL TIRE AND WHEEL INTO END OF RACK AND CENTER WHEEL IN PIPE FRAMEWORK.
4. FASTEN CHAIN AT END OF FRAME.
5. INFLATE TIRE, WORKING ON SIDE AWAY FROM LOCKING RING.
6. REMOVE TIRE AFTER INFLATING TO PROPER PRESSURE.
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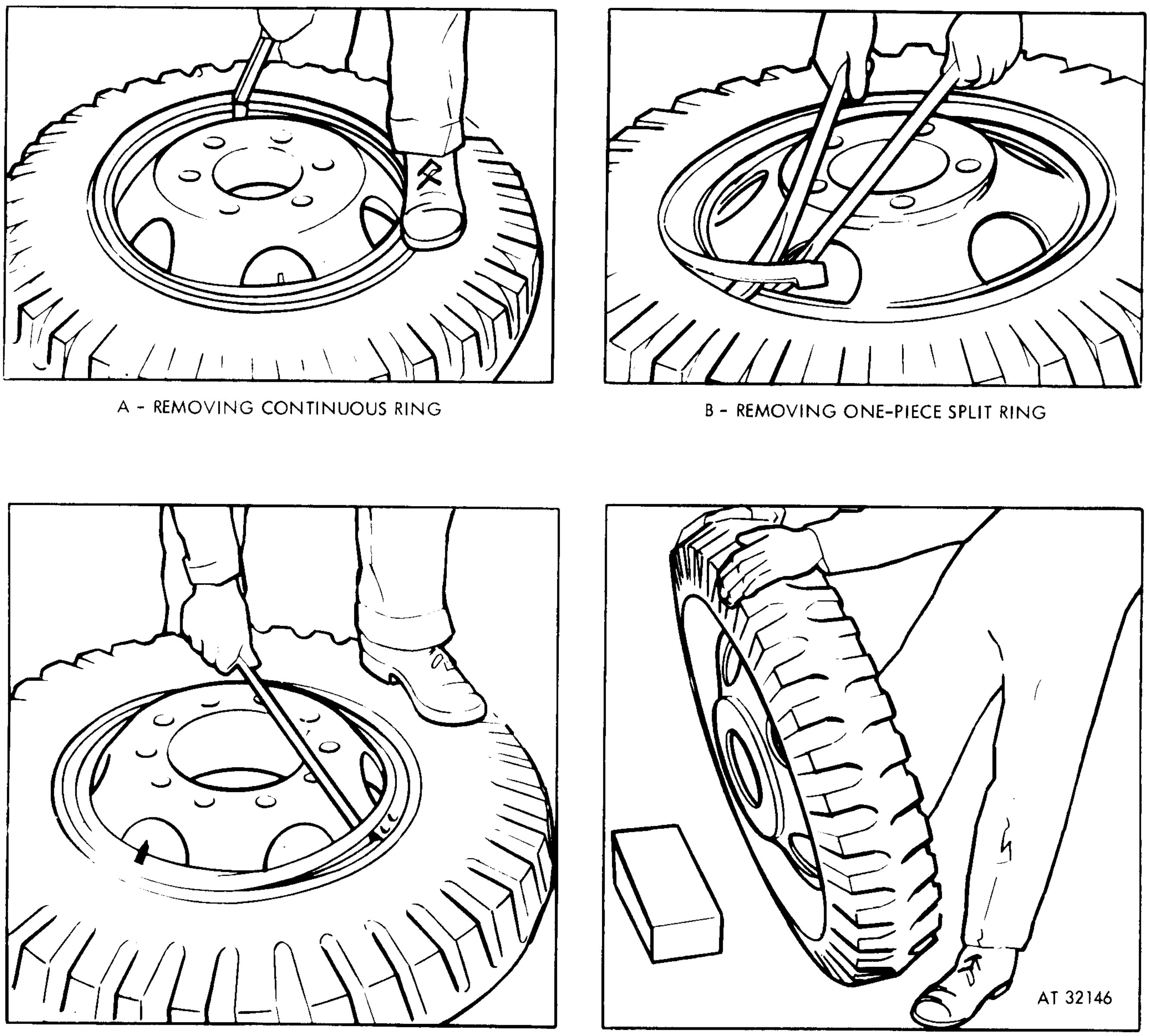
Figure 2-21b.



A - REMOVING CONTINUOUS RING

B - REMOVING ONE-PIECE SPLIT RING

C - REMOVING SPLIT LOCKING RING

D - PREPARING TO REMOVE TUBE

Figure 2-22. Demounting tire-flat-base rim.

a. Demounting.

(1) Check rim and continuous type ring prior to removal of wheel and tire from vehicle. If either rim or ring are damaged or ring appears to be out of rim base, tire should be deflated prior to removal from vehicle. Remove valve core to assure complete deflation. Install valve cap for protection of threads on valve stem. Do not dislodge tire beads, lockrings, or split flange rings until absolutely certain that no air pressure remains in tire.

(2) Remove wheel and tire from vehicle, and pry both inside and outside bead from rim flanges by the use of tire irons, taking care not to damage beads.

(3) Remove flange (side ring) as described in (*a*) through (*c*) below.

(*a*) Force section of side ring opposite prying notch into gutter. If it is a continuous ring, insert lockring remover and replacer with curved side up, in prying notch. Pry out side ring, with circular motion of tool, enough to permit insertion of tire iron adjacent to tool. Use both tools to pry ring a little at a time, until the whole rim is removed, being careful not to bend side ring (A, fig. 2-22).

(*b*) When demounting a one-piece split ring (two-piece rim), insert lockring remover and replacer in notch and, with the assistance of a tire iron, pry the ring off (B, fig. 2-22).

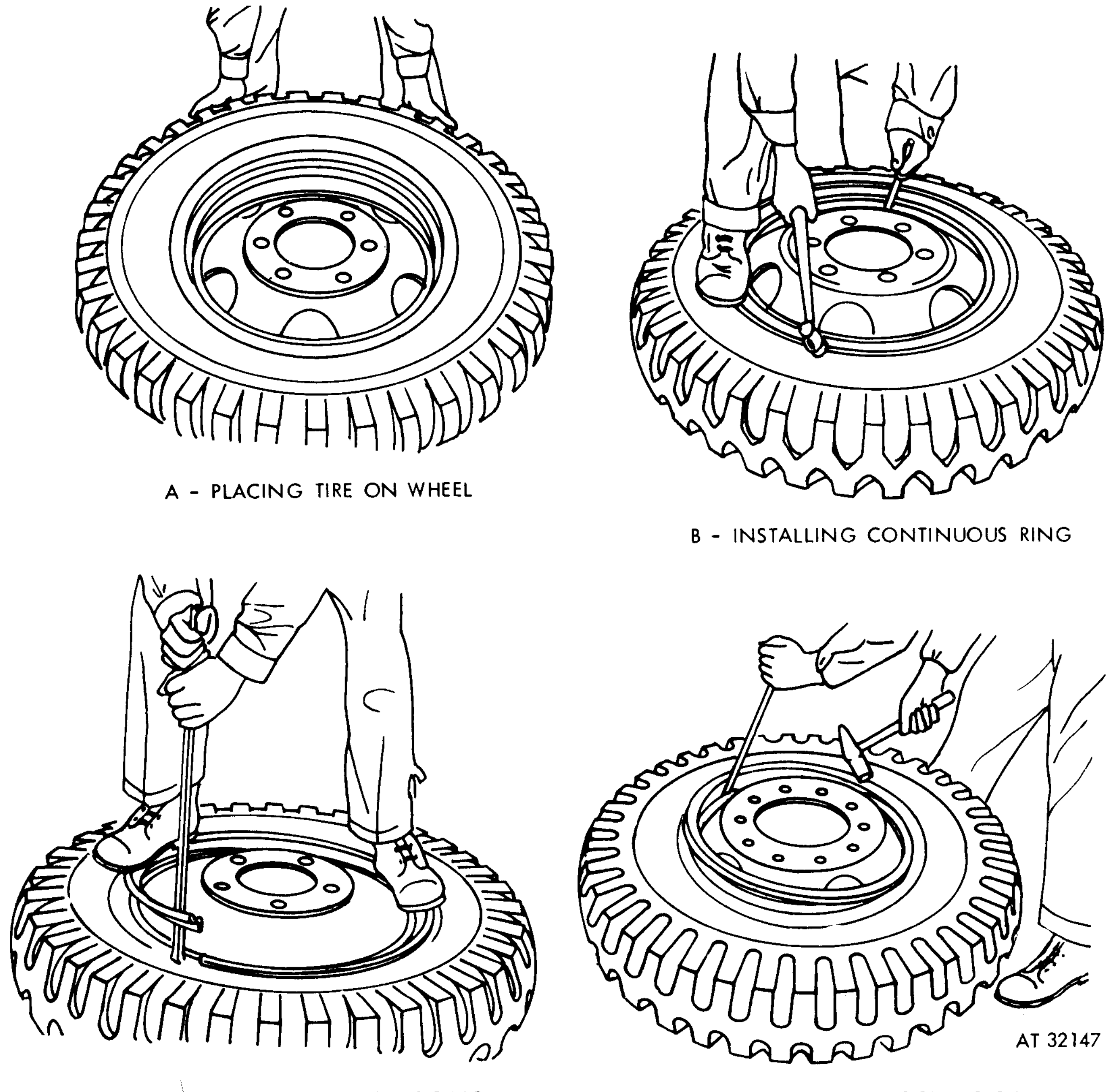


Figure 2-23. Mounting tire-flat base rim.

(*c*) When demounting a two-piece rim with split lock ring (three-piece rim), force flange (side ring) in, away from lock ring. Apply lock-ring remover and replacer in prying notch and remove lock ring. Remove the flange (side ring) as shown in (C, fig. 2-22).

(4) Force valve from slot to right or left so it will slide off and not catch in edge of slot when tire is removed. Place wheel on blocks and force tire off wheel (D, fig. 2-22). In doing this, do not allow valve stem to get caught in gutter. If tire is rusted on rim and if heavyduty hydraulic tire demounter is available, it should be used.

b. Mounting.

(1) Assemble tire, tube, and flap after inspecting carefully and after removing any foreign material on inside of tire. Inspect rim and side ring. Inflate tube enough to shape it. Place tire on wheel with valve in line with valve slot (A, fig. 2-23).

(2) Apply flange (side ring).

(*a*) When mounting continuous-type rim, place that portion of side ring that is opposite prying notch in rim gutter. This portion (which should be inserted first) extends between the two cutaway portions on inside circumference of ring. Insert lockring remover and replacer in prying notch and, holding opposite portion of ring in gutter, strike side ring in area between pry-

ing notch and nearest cutaway section with a hammer. By prying with the tool and by using the hammer, force ring in place. Repeat on opposite side of prying notch and force rest of the ring into place (B, fig. 2-23).

(*b*) When mounting one-piece split-ring-type rim (two-piece rim), place end, without prying notch, into rim ring gutter. Using a tire iron, force ring into place (C, fig. 2-23).

(*c*) When mounting two-piece rim with split lockring (three-piece rim), install the flange (side ring), force end of split lockring without prying notch into rim ring gutter, and force ring into place (D, fig. 2-23).

(3) Inflate tube to just enough air pressure to bring pressure between beads and side ring. In doing this, side ring should be turned away from operator and away from any other persons who might be injured if ring should fly off.

Before inflating tube to correct air pressure, place tire and wheel in safety cage (fig. 2-21) to prevent personal injury during inflation in event side ring is not fully seated.

(4) Inflate tube to recommended pressure and make sure side ring is fully seated before removing from safety cage. An alternate method, if safety cage is not available, is to lay the tire flat with side ring down, and reach through wheel hand hole to apply air chuck.

2-21. Flat-Base Rims on Nondemountable Wheels

These rims are of four-piece construction. In addition to the split locking ring, both inner and outer flanges are removable (a, fig. 1-10). This type of mounting is most commonly found on off-the-road equipment, especially in larger sizes. Working with an assistant is recommended.

a. Demounting.

(1) Block other wheels to prevent vehicle from rolling, then jack up wheel sufficiently for tire to clear ground, using wood blocks beneath jack to secure firm footing (A, fig. 2-24). As a safety precaution, place blocks under axle to prevent the vehicle from falling should the jack slip.

(2) Remove valve cap and core; exhaust all air using air deflating tool if compressed air is available. Install valve cap in order to protect threads on valve during removal of tire.

Do not dislodge tire beads, lockrings, or split flange rings until absolutely certain that no air pressure remains in the tire.

(3) Loosen outer bead by driving a small tool, with rounded end, between flange and bead. Work bead inward to gain sufficient clearance to free lock-ring. Pry against rim flange, using longer tool or crowbar for leverage.

(4) Insert tool in lockring slot and pry end of lockring out of the gutter (B, fig. 2-24). Work lockring out around circumference of rim, using one or more bars to hold and pry. Tapping rim flange with a lead hammer or prying with a bar will force flange back and release lock ring from gutter (C, fig. 2-24).

Do not bend or twist lockring. A sprung ring may be difficult to install and, if used, it is a serious safety hazard. An improperly seated lockring may blow off.

(5) Remove outer flange by sliding it over rim gutter.

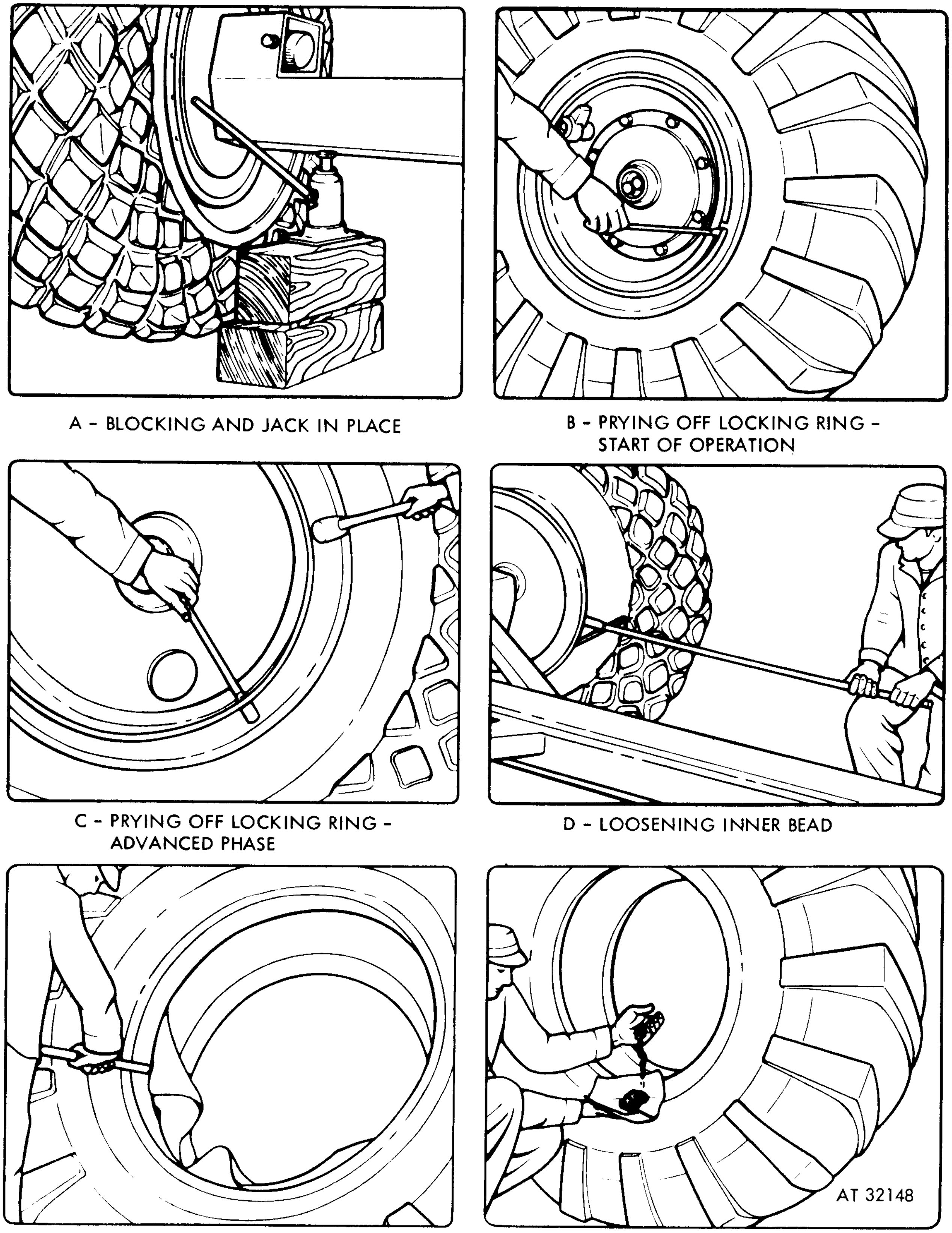
(6) Loosen inner bead in same manner outer bead was loosened (3) above. Where inner flange is loose (not welded to rim), it is possible on certain vehicles to insert a small jack between vehicle frame and rim flange to obtain pressure against flange and bead.

(7) When inner bead has been loosened, start to work tire off rim. Force tire outward as far as possible at bottom of wheel, then lower jack just enough so that weight of tire is resting on ground. This will provide clearance at the top and permit the tire to be forced out at the top. Holding upper part of tire as far out as possible, raise jack so that tire weight is resting on top of rim. By alternating at top and bottom in this way, tire can be walked off rim without having to work against the great weight of the tire binding on rim. If a hoist or crane is available, it should be used to raise and lower the tire in this operation.

(8) Completely remove tire from wheel and leave tire in vertical position, leaning against vehicle or other solid object.

(9) Remove flap from tire, using a tool with a round end to pry out and away from bead, (E, fig. 2-24). On some types of tires, it may be necessary to use a tire spreader or small jack to spread bead while removing flap.

(10) Remove tube in a similar manner, being careful not to pull on valve stem or to enlarge any injuries. In heavy-gages tubes, repairs of almost any size are possible, if rubber in tube is still in good condition.



A - BLOCKING AND JACK IN PLACE

B - PRYING OFF LOCKING RING - START OF OPERATION

C - PRYING OFF LOCKING RING - ADVANCED PHASE

D - LOOSENING INNER BEAD

E - REMOVAL OF FLAP

F - REMOVAL OF ACCUMULATED DIRT

Figure 2-24. Demounting tire—nondemountable wheel.

b. Mounting.

(1) Before installing tube in tire, inspect tire casing carefully, inside and outside, for breaks, bruises, nails, etc. Clean out all dirt and foreign matter from inside of casing. (F, fig. 2-24) shows the quantity of dirt removed from casing of a grader tire.

(2) Install tube in casing, starting at bottom and working around the tire. Adding air as tube is worked in will help to hold it in place and will eliminate the possibility of wrinkles (A, fig. 2-25).

(3) Insert flap in casing, properly centered and free of wrinkles. Rotate tire as flap is worked in, so portion being inserted is at bottom of tire (B, fig. 2-25). In some cases, it may be necessary to spread beads, using a spreader or small jack.

(4) Clean wheel of rust and dirt using scraper and wire brush. Remove all foreign matter from locking-ring gutter.

(5) Place tire (in which tube and flap have been inserted) in normal position, close to wheel, with the valve in line with valve hole or slot as shown in (C, fig. 2-25). Lower jack so that top part of inner bead can be pushed on rim, then walk tire on rim by alternately raising and lowering jack, gaining clearance alternately at bottom and top. This procedure is similar to method described in *a.* (7) above.

(6) Mount outer flange and push it in far enough to clear rim base gutter (D, fig. 2-25).

(7) Place one end of locking ring in gutter, then proceed to work around wheel, pushing flange back far enough to allow for locking ring to seat properly. This may involve a series of steps of pushing on flange as shown in (E, fig. 2-25), followed by snapping the lock ring into place or, if necessary, by driving it in with a hard rubber, rawhide, or wooden mallet. Do not drive lockring with a metal hammer.

(8) Slide flange out against lockring in order that it will not bind on the rim base during inflation. Before applying any air pressure to the tire, be sure that the lockring is securely in place. Inflate the tire to 5 to 10 p.s.i., then tap the lockring carefully with a mallet to be sure it is properly seated.

(9) Inflate tire to recommended tire pressure.

2-22. Military Rims

As shown in (B, fig. 1-10), this type rim consists of a rim base and a split retaining ring. Bead seats are tapered 5 degrees.

a. Demounting.

(1) Inspect rim and split retainer ring prior to removal of wheel and tire from vehicle. If either rim or ring are damaged or ring appears to be unseated, tire should be deflated prior to removal of tire and rim assembly from vehicle. Remove valve core to insure complete deflation. Install valve cap.

Do not dislodge tire beads, lockrings, or split flange rings until absolutely certain that no air pressure remains in the tire.

(2) Demount wheel and loosen tire bead next to side ring by use of tire irons, taking care not to damage beads.

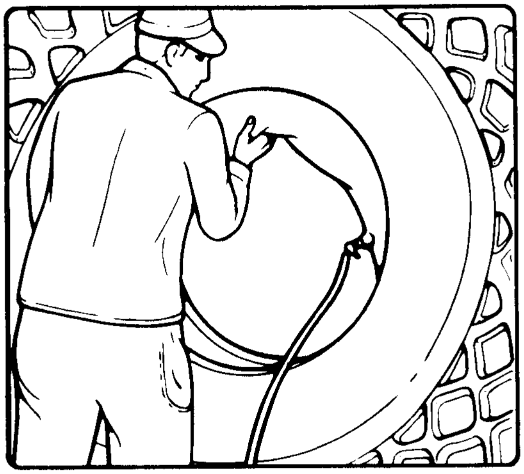
(3) Remove split retaining ring. To do this, start at prying slot as shown in (A, fig. 2-26). Complete removal of retaining ring by using two tools (B, fig. 2-26). If split retaining ring adheres to rim, tap with mallet to break loose. (C, fig. 2-26).

(4) Remove tire. Turn wheel and tire over, place on blocks or other object to raise tire about six inches above floor. Remove tire valve from slot in wheel rim by forcing through slot into tire casing cavity left by deflating tube. Weight of tire as it hangs from blocked up wheel will aid in this removal. Standing on tire will help force tire off wheel. Precaution should be taken that valve does not get caught in rim gutter while tire is being removed. Remove flap and tube from tire.

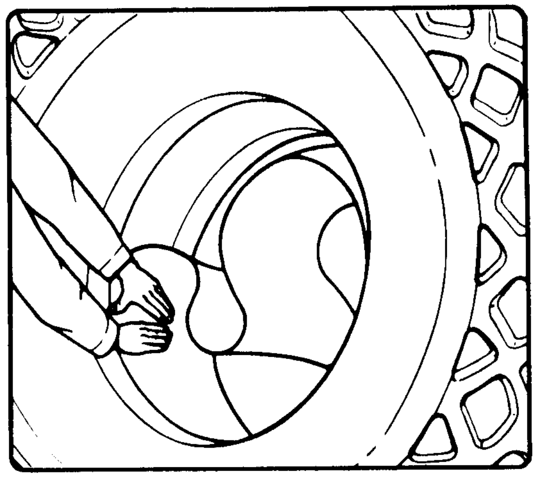
b. Mounting.

(1) Inspect tire, tube, flap, rim, and split retaining ring.

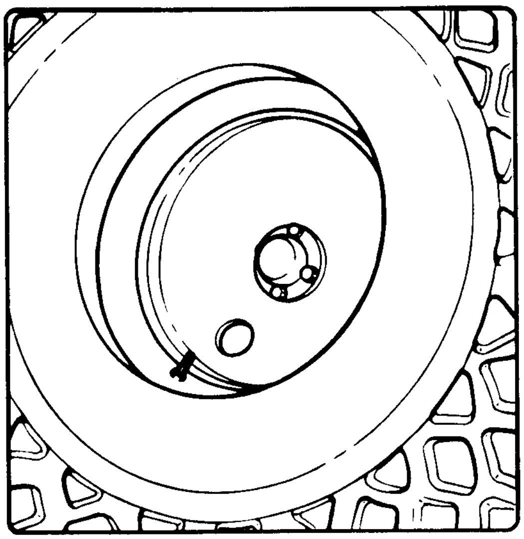
(2) Place tube in tire. Insert flap in tire with valve stem through flap. Inflate tube enough to shape it. Set wheel on blocks one inch or more off ground with beading edge of rim down. Place tire on rim with valve stem alined with slot in wheel rim and extended toward outside of wheel. Stand on tire, on opposite side of stem, and force tire onto rim.



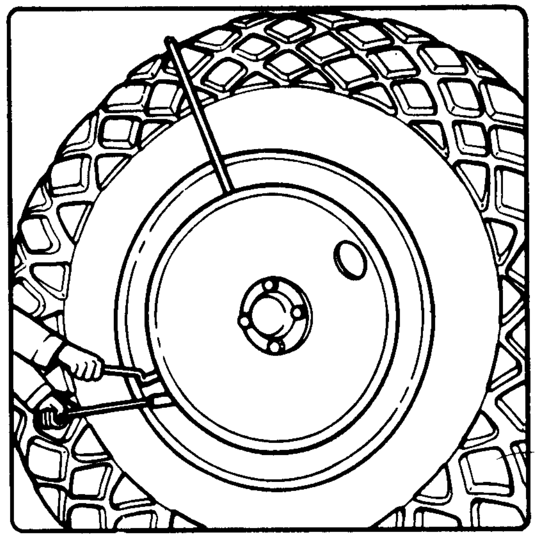
A - INSERTING TUBE



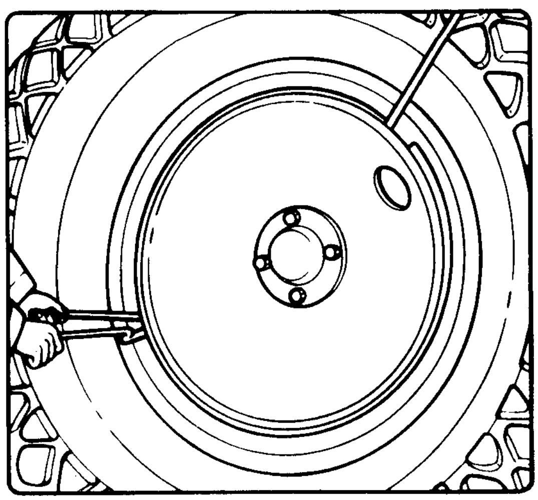
B - INSERTING FLAP



C - ALINEMENT OF TIRE



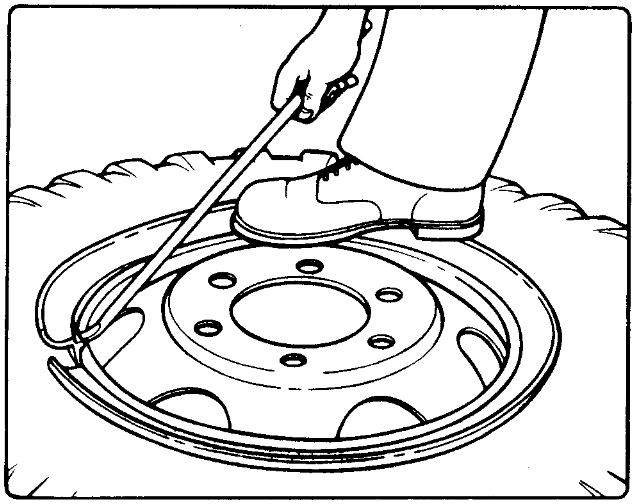
D - MOUNTING OUTER FLANGE



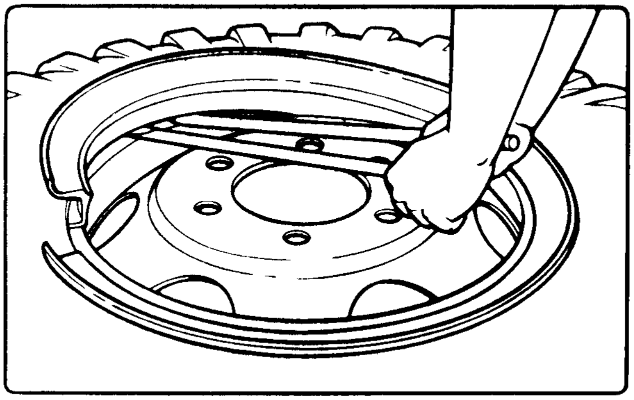
E - MOUNTING LOCKING RING

AT 32149

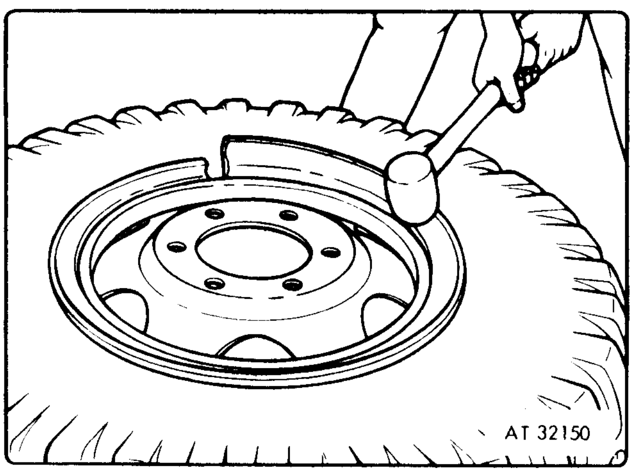
Figure 2-25. Mounting tire—nondemountable wheel.



A - REMOVING SIDE RING - START OF OPERATION



B - REMOVING SIDE RING - ADVANCED PHASE



C - INSTALLING SIDE RING

Figure 2-26. Demounting and mounting tire—military rim side ring.

(3) Install split retaining ring (c, fig. 2-26). Place split retaining ring on wheel. Start on end of ring under head of rim, by standing on end of retaining ring, hammer retaining ring into place with mallet shown in (C, fig. 2-26). Continue progressively around rim, holding retaining ring with foot, and hammering until entire ring is seated. In doing this, side ring should be turned away from any other person nearby who might be injured if side ring should fly off.

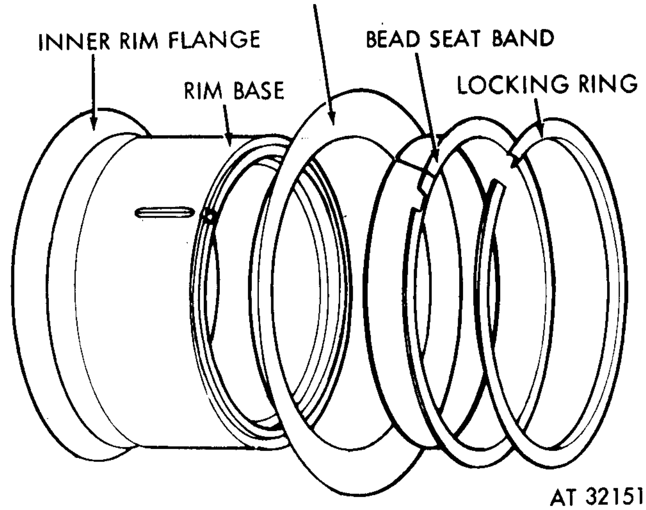


Figure 2-27. Large earthmover rim with 5-degree,—taper bead seats.

(4) Inflate tire to 5 to 10 p.s.i., then check for proper seating of retaining ring. Tap it, in order to assure proper seating.

(5) Before inflating, place tire and wheel in safety cage (fig. 2-21) to prevent personal injury during inflation in event retaining ring is not fully seated before removing from safety cage. An alternate method, if safety cage is not available, is to lay tire flat, with ring down, and reach through wheel to apply air chuck. Lockring must be seated properly against rim of wheel through its entire circumference before inflating tire. Failure to observe this will result in personal injury.

2-23. Large Earthmover Rims with 5-Degree Taper Bead Seat on Nondemountable Wheels

A 5-degree taper rim, now being used with earthmover tires 16.00 and larger, is shown in (fig. 2-27). Many of these tires, particularly on driving wheels, are mounted and demounted in vertical position. To facilitate mounting and demounting these tires, hydraulic tire remover (NSN 4910-00-793-9341) should be used. Working with an assistant will facilitate the operation.

a. Demounting.

(1) Securely block all wheels other than one from which tire is being demounted, and jack up wheel sufficiently for tire to clear ground. As safety precaution, place blocks under axle to prevent falling if jack should slip.

(2) Remove valve core and exhaust all air using air deflating tool if compressed air is available. Install valve cap in order to protect threads on valve during tire removal. Do not dislodge tire beads, lock-rings or split flange rings until absolutely certain that no air pressure remains in tire.

(3) Loosen outer tire bead and bead seat band.

(*a*) Using hydraulic tire remover:

1. Attach frame assembly to outer rim flange by slipping clamping jaws over outer edge of flange.

2. Securely tighten adjusting screws at bottom of jaws. Set hand screw against lockring and adjust until jaw assembly is in right angle position to plane of flange.

3. With spade tip down and ram in retracted position, insert spade and ram assembly between open sides of frame. Place spade top between tire bead and rim flange. Lift ram until trunion engages frame shoulder support and move stop screw into support ram.

4. Apply pressure to ram and spade by means of pump until spade has moved tire bead toward center of rim assembly far enough to permit placing of bead wedge between bead and flange on each side of tool.

5. Release pump pressure. Remove spade and ram assembly from frame. Loosen clamping jaw bolts and remove from flange.

6. Move to spot approximately 90 degrees from first application (either direction) and repeat procedure. Repeat procedure until tire is freed from rim. Four to five applications usually accomplish this.

7. Bead will break loose with popping sound. Remove hydraulic remover and proceed as described in (4) through (9) below.

(*b*) When hydraulic tire remover is not available, proceed to loosen outer tire bead and bead set as given in *1 and 2* below.

1. Place hooked end of tire iron into one of prying slots between bead seat band and rim flange (fig. 2-28). With a five-foot length of pipe slipped over straight end of tire iron for leverage, twist tool in circular motion. Have assistant insert another tire iron between bead seat band and rim flange, about 18 inches from first tool, and with same twisting action, loosen bead in that portion of tire. Move first tire iron forward around rim, twist it, and have assistant follow up with second tire iron (fig. 2-28). Continue in this way around circumference of bead seat band until outer tire bead is loose all around.

2. Place tire iron in gutter, between ends of locking ring. With prying action of tool, push bead seat band away from locking ring (fig. 2-28). Employ assistant with another tire iron. By prying and holding alternately, working with assistant, push bead seat band away from lockring around tire.

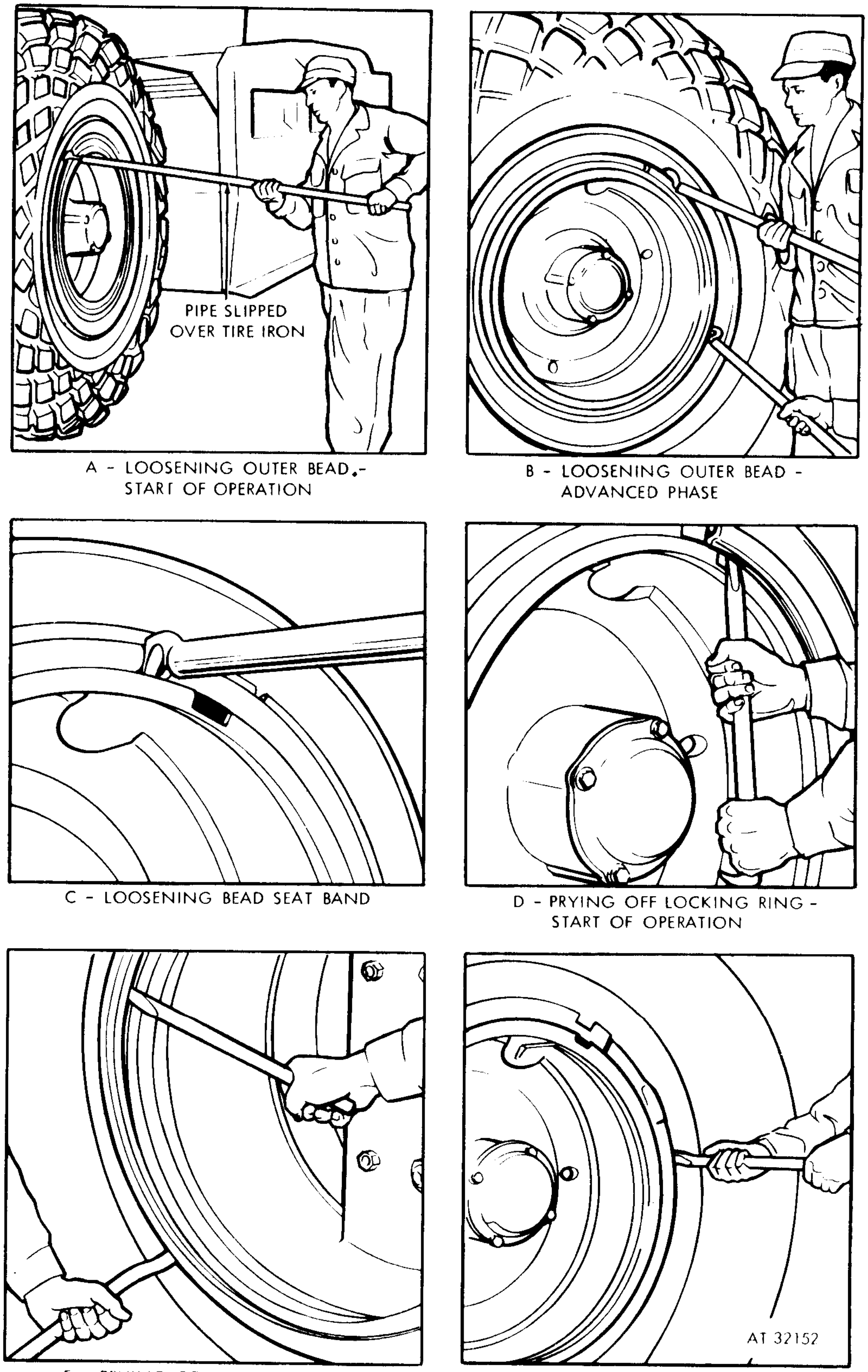
(4) Pry off lockring. Start at prying notch and work around tire, using two irons to pry and to hold (fig. 2-28).

(5) Remove bead seat band and outer rim flange. Pry with tire iron as shown in (fig. 2-28).

(6) Loosen inner tire bead in same way as outer bead, or by means of a small jack employed between inner rim flange and some other part of vehicle. Work progressively around tire.

(7) Work tire off rim, making certain that valve is pried out sufficiently to clear rim gutter. Force tire outward as far as possible at bottom, then lower jack enough so that weight of tire is resting on ground. This will provide clearance at top, making it possible to move tire out as far as possible, and raise jack so that tire weight is resting on top of rim, thereby gaining clearance at bottom. By alternating at top and bottom in this way, tire can be walked off rim without having to work against great weight of tire binding on rim. If hoist or crane is available, it should be used for this operation. After tire has been removed from wheel, leave it in vertical position, leaning against vehicle or other solid object.

(8) Remove flap from tire, using tool with rounded end to pry it out (fig. 2-24). On some tires it may be necessary to use tire spreader or small jack to spread beads and assist in flap removal.



A - LOOSENING OUTER BEAD - START OF OPERATION

B - LOOSENING OUTER BEAD - ADVANCED PHASE

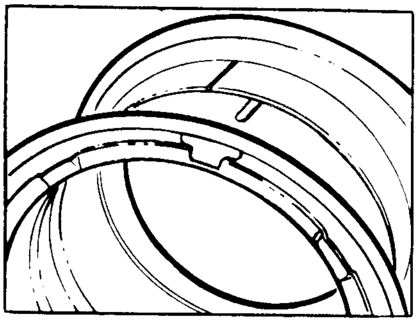
C - LOOSENING BEAD SEAT BAND

D - PRYING OFF LOCKING RING - START OF OPERATION

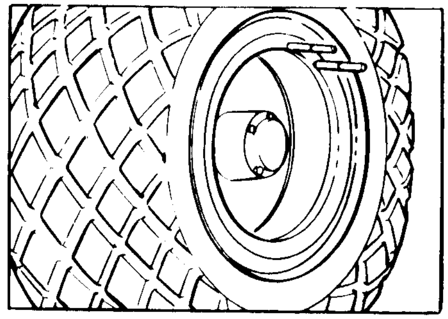
E - PRYING OFF LOCKING RING - ADVANCED PHASE

F - PRYING OFF BEAD SEAT BAND

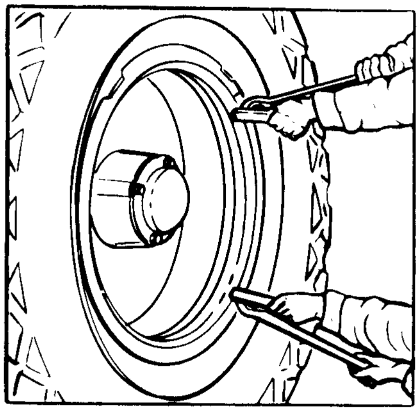
Figure 2-28. Demounting earthmover tire, using tire irons.



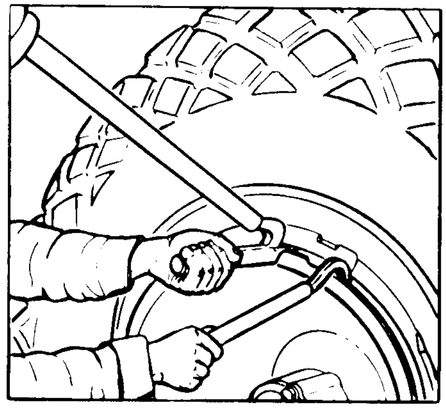
A - ALIGNMENT OF INNER RING FLANGE



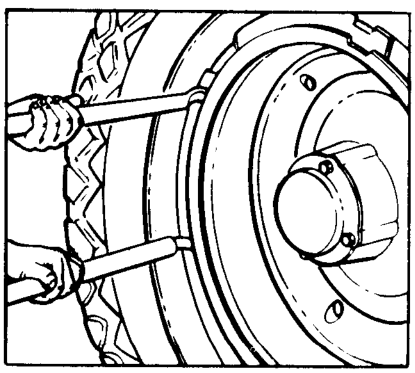
B - MOUNTING BEAD SEAT BAND - RACK TOOLS IN PLACE



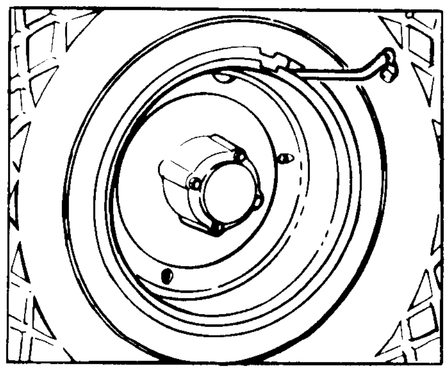
C - MOUNTING BEAD SEAT BAND - WITH RACK TOOLS



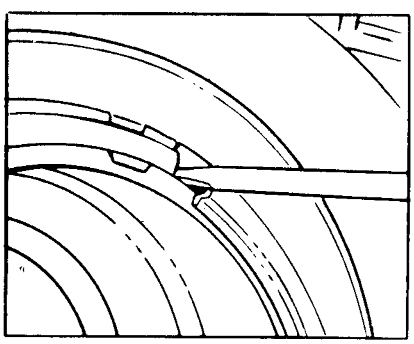
D - MOUNTING BEAD SEAT BAND - CHANGING FROM RACK TOOLS



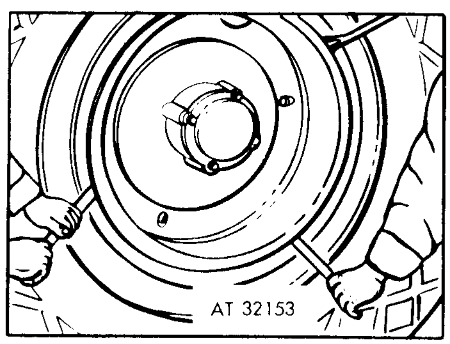
E - MOUNTING BEAD SEAT BAND WITHOUT RACK TOOLS



F - APPLYING WEDGE



G - MOUNTING LOCKING RING - START OF OPERATIONS



H - MOUNTING LOCKING RING - ADVANCED PHASE

Figure 2-29. Mounting earthmover tire.

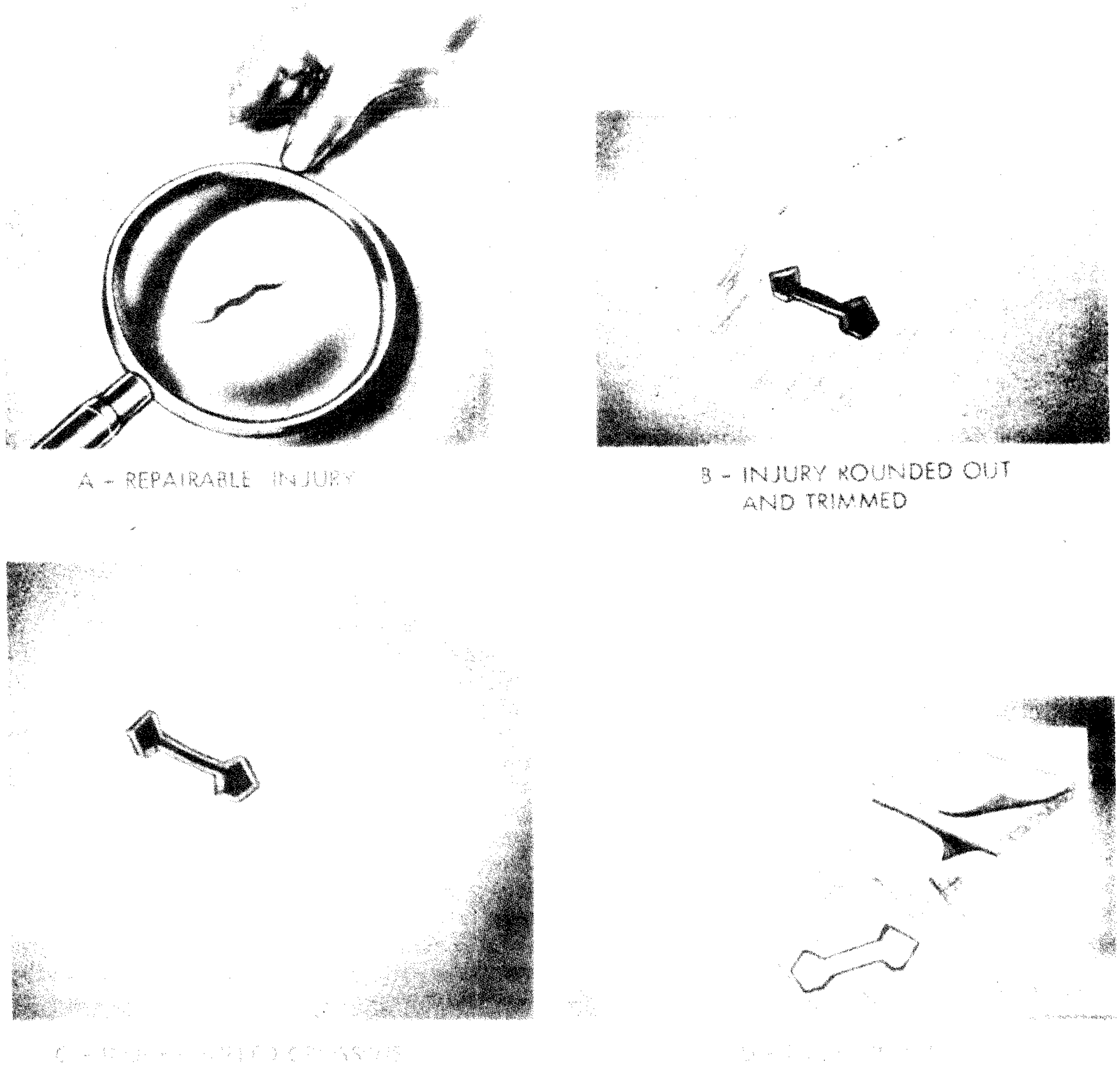


Figure 2-30. Rust and puncture injuries.

(9) Remove tube in similar manner, being careful not to pull on valve stem or enlarge any injuries. In heavy gage tubes, repairs of almost any size are possible, if rubber in tube is in good condition.

b. Mounting.

(1) Inspect tire carefully, inside and out, for circumferential breaks, bead damage, nails, bruises, impact breaks, etc. Clean out all dirt and foreign matter from inside tire.

(2) Place tube in tire, starting at bottom and working around tire. Adding air as tube is worked in, will help to hold it in place and eliminate possibility of wrinkles (fig. 2-25).

(3) Insert flap in tire, properly centered and free from wrinkles. Rotate tire as flap is worked in, so that portion being inserted is at bottom of tire (fig. 2-25). In some cases, it may be necessary to spread beads, using tire spreader or small jack.

(4) Clean off any rust or dirt from rim base, rim flange and bead seat band by scraping and using wire brush. Pay special attention to cleaning all foreign matter out of locking ring gutter.

(5) Place inner rim flange on rim base, alining driving lug on flange with slot in rim base (fig. 2-29).

(6) Hoist or roll tire into position, alining valve stem with valve slot. If hoist is not used, lower wheel far enough to permit top of tire to be hooked over top of rim, then raise wheel, and work tire on in same manner

as described for demounting (a) (7) above.

(7) Hook two toothed rim irons onto rim gutter approximately four inches from either side of valve slot. Place bead seat in outside rim flange, alining driving lug on flange with slot in bead seat band. Mount assembled bead seat band and side flange on rim base by hooking them over two rim irons and sliding on rim (B, fig. 2-29), this time alining driving lug on bead seat with valve slot in rim base.

(8) Engage on tire iron in one of notches of each rim iron and force bead seat band into position by prying. Holding pressure against band with one rim iron and one tire iron, move other two irons about a foot away from other side of first irons along circumference of rim (C, fig. 2-29). Pry again and, by working irons alternately holding and prying, push bead seat band so that tire iron can be hooked into rim gutter. Remove one of rim irons, and hook tire iron in rim gutter for additional prying (D, fig. 2-29). Continue to work around rim, using two tire irons without rim irons (E, fig. 2-29), until bead seat band has been forced 1 to 1-1/8 inches inside gutter edge.

(9) Hold band in this position and drive tapered end of tire iron, or any suitably tapered wedge, between bead seat band and rim base, directly under break in bead seat band (F, fig. 2-29).

(10) Hook one end of lockring into gutter next to wedge (G, fig. 2-29). Pry or snap lockring into place, using tapered ends of two tire irons (H, fig. 2-29). When lockring is in place, remove wedging tool.

(11) Pry bead seat band out over ledge of lockring. Move band little at time, all around, in order to avoid cocking it. When band is cocked, it has a tendency to bind. Should band become cocked, straighten it first before proceeding. Do not inflate tire unless bead seat band has been pried over lockring.

(12) Check engagement of driving lugs on both flanges, then inflate to approximately 75 p.s.i. to insure proper seating of beads. Reduce air pressure to correct operating pressure.

2-24. Semi-Drop-Center Tubeless Tire Rims

A three piece semi-drop center tubeless tire rim is being used on heavy industrial equipment and motor graders. This rim may be used with tubeless or tube-type tire, rim has rubber preformed packing which provides positive air seal for tubeless tires.

a. Demounting Tubeless Tires.

(1) Before removing tire from rim, inflate to recommended air pressure and run water over tire and rim assembly. Leaks at beads, valve, as well as in tire itself, should be located and marked.

(2) To demount tires, proceed as indicated in (*a*) through (*d*) below.

(*a*) Deflate tire by removing valve cap and valve core from valve. After complete deflation, install valve cap to protect threads of valve stem.

(*b*) Place tire and rim assembly on floor, loose flange-side up. Drive the goose-necked ends of tools between tire and flange about five inches apart. Pry both tools outward and sideways through arc of about 70 degrees. Leave one tool in position and place second about five inches beyond. Repeat above operation in successive steps until bead is completely broken loose.

(*c* After bead is broken loose, stand on flange and tire sidewall to depress flange along rim base, then pry lockring loose. Hold side flange down with hooked end of tool to remove rubber preformed packing from sealing ring groove.

(*d*) Remove side flange. Turn tire and rim over and break second bead by inserting both tools between tire bead and rim flange. Repeat until tire is completely broken loose from rim on fixed flange side. Lift rim base from tire.

b. Mounting Tubeless Tires.

(1) Inspect tire, rim, and lockring carefully, to insure that beads and bead seats are clean and smooth. Clean all dirt and foreign matter from inside tire.

(2) Install valve spud on rim and tighten to proper torque before proceeding with mounting. Place rim on block with flange side down. Place side flange over rim base and push straight down with hands as far as possible. Make sure flange does not bind on rim base.

(3) Stand on side flange to position it below both grooves in rim base and snap lockring into lockring (outer) groove. Be sure safety bulge on lockring is up toward the operator. Lubricate the rubber preformed packing and place into sealing ring (lower) groove. With some tire and rim combinations, it may be necessary to hold side flange down with flat end of tool in order to expose preformed packing groove.

(4) Inflate tire to 5 to 10 p.s.i. Side flange will slide over the preformed packing and out against lock-ring. Recheck for proper seating of lockring. Tap it lightly to assure proper seating. In doing this, lock-ring should be turned away from any person nearby who might be injured if lockring should fly off.

(5) Inflate tire in inflation case to operating pressure. Again, make sure lockring is in its proper groove completely around rim. Test tire and wheel assembly for leaks by running water over tire and wheel assembly. Install and tighten valve cap.

2-25. Drop-Center Tubeless-Tire with 15-Degree Taper-Bead-Seat on Demountable Rim and Disk Wheel

A 15-degree tapered rim, is now being used with tubeless 12-24.5 tires and smaller (fig. 1-9). Wide-base, low-section height tires, such as 12-16.5, 14-17.5, 15-19.5, 18-22.5 are also mounted on drop-center 15-degree taper tubeless tire rims. Rim has well in center which permits mounting and demounting. (A, fig. 2-17) shows how rim well makes these operations possible. With

lower part of bead in its seat, upper part would have to be stretched or broken to free it, but with lower part of bead pushed into rim well, it is not necessary to stretch upper part to slip over flange.

a. Demounting Tubeless Tires.

(1) Before removing tire from rim, inflate to recommended air pressure and immerse the assembly in water or run water over assembly. Check tire and rim for leaks at beads, valve and outside surface of tire. Mark location of all leaks.

(2) To demount tires, proceed as indicated in (*a*) through (*d*) below.

(*a*) Deflate tire by removing valve cap and valve core. After tire has been completely delated, install valve cap to protect threads of valve stem.

(*b*) To free beads from rim flange, position tire tool so that flat end can be driven between tire bead and rim flange. With flat end wedged between tire and rim flange, straighten tool to a vertical position, and hammer downward on the neck to force tire from rim. Repeat these steps at about eight inch intervals around flange until bead is free from rim. Repeat procedure on the other side before demounting.

(*c*) Place assembly on floor with wide side of well down. Lubricate bead area about 10 degrees on both sides of valve. Step on tire area opposite valve to direct first bead into well. Insert cued end of both tools between tire and rim about five inches on either side of valve with stops on tools against rim flange. Pull one tool towards center. Pull second tool in the same manner. Remove one tool and progressively insert curved end between bead and flange starting approximately four inches from spanned area and pry first bead free from rim.

(*d*) Stand tire assembly in vertical position with valve near top. Insert straight end of tool between tire beads and both rim flanges and hook stop on tool over second flange. Position inserted tool at a 90 degree angle to tire assembly at top of rim and lubricate bead areas on both sides of tool. Lean tire assembly towards tool and provide rocking or bouncing action to pry rim off tire.

b. Mounting Tubeless Tire.

(1) Inspect tire and rim carefully, to insure that beads and bead seats are clean and smooth.

(2) Place rim on floor with wide side down and position first bead in well opposite valve stem. Push first bead over rim flange as far as possible with foot. Lubricate remainder of first bead. Insert straight end of tool between bead and rim flange with stop against flange. Using short, successive bites, work bead over flange with circular motion. Follow tool with foot, putting downward pressure on bead as it is worked over flange.

(3) Locate second bead so it can enter well opposite valve stem. Clamp vise-grip pliers on rim flange at valve stem to hold bead in position. Lubricate bead behind pliers and halfway around.

(4) Using curved end of tool between tire bead and rim flange with stop-knob towards rim, push outward to work tire bead over rim flanges. Progressively repeat this operation two or three bites beyond lubricated portion of bead while simultaneously stepping on tire to hold bead in well of rim.

(5) Lubricate remainder of tire bead and position curved end of second tool between tire bead and rim next to unspanned bead area. Working in small sections, continue to pry bead over flange, with first tool and finally using both tools, force remaining bead area over flange.

(6) Position tire on wheel so that tire balance mark is at valve location. Insert valve core and inflate tire to 5 or 10 p.s.i.; if air escapes, roll tire or use bead expander (constrictor) or cargo tiedown strap to force tire beads against rim flange. Loosen and remove bead expander, and inflate tire to coreect pressure. Test for leaks by submerging or running water over tire and wheel assembly. Install and tighten valve cap.

2-26. Flat-Base Rim with Preformed Packing Seal

Rim is a three-piece, rim base, continuous side flange and split lockring. A preformed packing seal is positioned in a groove on rim base beneath continuous side flange ring. Valve hole is provided instead of valve slot. Tube and flap are used. Procedures are similar to those in (para 2-13).

a. Demounting Tires.

(1) Before removing tire from rim, make inspection described below:

Inflate tire to recommended air pressure and run water over tire and rim assembly. Leaks at beads and valves, as well as in tire, should be located and marked.

(2) To demount tires, proceed as indicated in (*a*) through (*f*) below.

(*a*) Deflate tire by removing valve cap and valve core from valve. Completely deflate tire before attempting any tire removal.

(*b*) Place tire and rim assembly on floor, loose flange side up.

(*c*) Break tire beads loose from rim on gutter side first by driving gooseneck end of tire tool between flange and tire sidewall. Twist tool with circular motion.

(*d*) Insert pointed end of tool between lockring projection and rim base and exert downward pressure. This will start lockring from its groove. Remove lockring.

(*e*) Insert downward pressure on flange with gooseneck end of tool and carefully remove preformed packing from seal groove. Remove flange from rim base.

(*f*) Turn tire and rim over and break beads loose on back side. Force valve stem back through rim valve hole. Remove tire from rim.

b. Mounting Tires.

(1) Inspect tire, rim and lockring carefully to insure that beads and bead seats are clean and smooth. Clean all dirt and foreign matter from inside of tire.

(2) Before assembly of tire to rim, lubricate both tire beads and rubber preformed packing with thin solution of high-grade soap flakes and water or its equivalent.

(3) Attach valve fishing tool to mouth of valve.

(4) Lay rim base flat on floor, gutter side up. Place tire over rim with flange over rim base. Hold flange straight, to avoid binding that may occur if flange is tilted. Guide valve through rim valve hole with fishing tool.

(5) Place lockring in lock groove, or gutter on rim base. This is done by starting one end in lockring groove and snapping ring in place. Projection (hump) on lockring must be placed in up position. If it faces down, flange will not seat and tire will not hold air.

(6) Lubricate preformed packing and exerting downward pressure on flange, insert preformed packing into seal groove below lockring. Check preformed packing to make sure it is in proper position completely around rim.

(7) Inflate tire to 5 to 10 p.s.i. Side flange will slide over preformed packing and out against lockring. Recheck for proper seating of lockring. Tap it lightly to assure proper seating. In doing this, lockring should be turned away from any person nearby who might be injured if lockring should fly off.

(8) Before inflating tire, place tire and rim in safety cage (fig. 2-21) to prevent personal injury during inflation in event lockring is not fully seated. Inflate tire to recommended operating pressure. Make sure lockring is fully seated before removing from safety cage. Test tire and rim assembly for leaks by running water over tire and rim assembly. Install and tighten valve cap.

Section VI. STORAGE OF TIRES AND TUBES

2-27. General

a. Factors contributing to deterioration of tires in storage include light, heat, air in motion, ozone (a gas sometimes found in the atmosphere and very harmful to rubber), oil, dust and dirt, and water. Cracking and checking, also known as weathering, are caused by ozone coming in contact with tires in storage.

b. Military tires are specified to contain certain oils and waxes known as antiozoants, which migrate to the surface of the tire when it is exercised. These substances protect the rubber from ozone. When the tire is in storage, there is no migration, and the tire degenerates.

c. Tires and tubes must also be protected from contact with fuels, oils, greases, and other petroleum products.

2-28. Care of Tires Mounted on Vehicles Left Standing for Prolonged Periods

a. Block the vehicles up in accordance with the pertinent vehicle TM. Wrap each tire and wheel assembly with black polyethelene material, NSN 8135-00-579-6487. Secure with twine or pressure sensitive tape.

b. Inspect semiannually to insure that the cover is in good condition and deterioration has not begun.