EO 110-5-2

ROYAL CANADIAN AIR FORCE

DESCRIPTION AND MAINTENANCE INSTRUCTIONS

INSPECTION OF AIRCRAFT TIRES & TUBES

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PART 1

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PART 1

CARE IN SERVICE, INSPECTION AND DESCRIPTIONS OF DAMAGE TO AIRCRAFT TIRES AND TUBES

GENERAL

1 To obtain the greatest economical service from aircraft tires and tubes, consistent with safety and efficiency, it is essential that the following conditions be observed by runway and aircraft maintenance crews, supply personnel, aircrew and others concerned:

(a) Casings and tubes are to be protected to prevent undue deterioration during storage (see EO 110-5-9).

(b) Tires are to be protected from excessive heat, bright sunlight, and contact with oil, fuel, glycol and hydraulic fluid, all of which are injurious to rubber. Canvas or other covers are to be placed over the tires when aircraft are parked for any appreciable time, or during periods when the oil, fuel, coolant or hydraulic systems are being drained.

(c) Ensure that the air supply used for tire inflation is free from oil vapour, (see EO 00-25-6).

(d) Ensure that tires are kept inflated to the correct pressures (see EO 110-5-2).

(e) Ensure that the tail wheel is unlocked when ground handling the aircraft.

(f) Ensure that the brakes are not applied before landing.

(g) Avoid excessive braking and sharp turns when taxiing.

(h) Maintain correct alignment, castor angle and toe-in of landing wheels.

(j) Runway surfaces are to be kept in a good state of repair, and free from stones, nails, etc.

EQUIPMENT AND TOOLS REQUIRED

2 The following equipment and tools are required for inspection and repair:

(a) Tire spreader.

(b) Tube testing tank.

(c) Awl for probing injuries and dislodging foreign material.

(d) A light weight ball peen hammer or, if preferred, a piece of pipe approximately eighteen inches long, to be used in sounding casing for separation.

(e) Air line with hose so that a blow gun can be attached for cleaning out the inside of the tire, and an air chuck attachment for inflating tubes.

(f) Pliers for removing nails and foreign material.

(g) Red crayon to indicate repairs and spot repairs on tires.

(h) Indelible pencil to indicate tube repair.

SYMBOLS

3 Legible letters and symbols are to be placed on the side of the tire on a surface that will not be effected by the work. Indicating symbols will also be placed on the area affected. If affected part is on the inside of the tire as well as on the outside, the inside will also be marked.

NOTE

Symbols other than those used herein will not be recognized and are to be removed by the Inspector.

SYMBOL	REPAIR REQUIRED
REP - (X)	Repair nail hole
REP - ( )	Spot repair requiring no inside reinforcement.

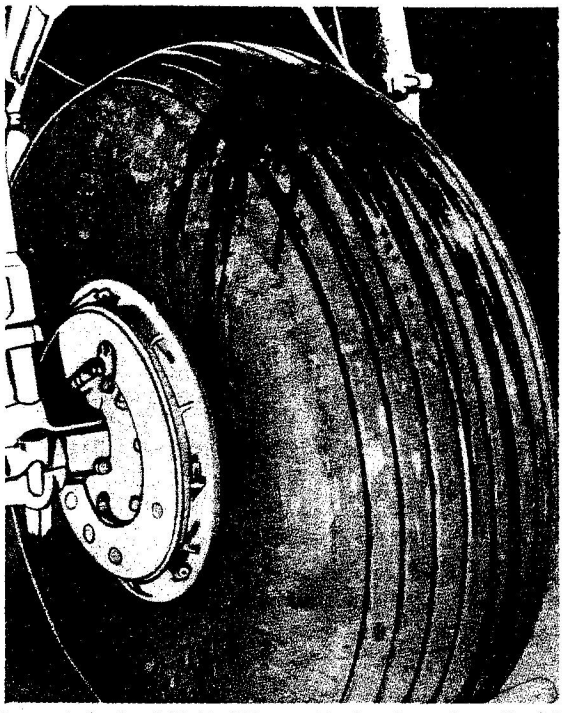

Figure 1-1 Oil Spillage Deteriorates Rubber and Seeps into Carcass of Casing Destroying Fabric

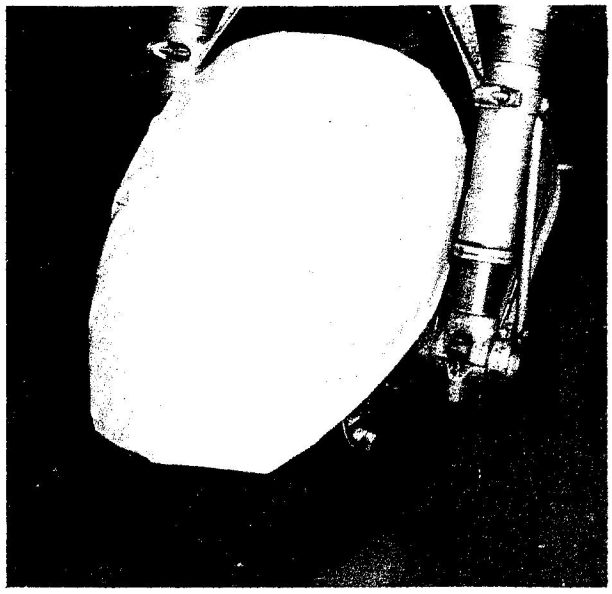

Figure 1-2 Cover Protects Tires When Oil, Hydraulic and Coolant Systems are Being Drained

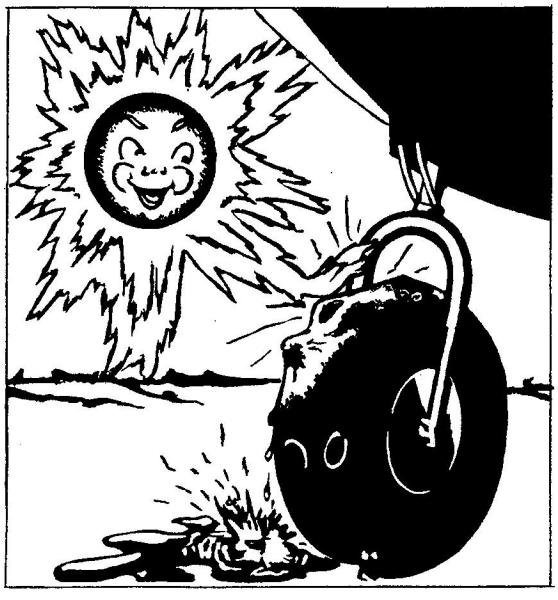

Figure 1-3 Too Much Sunlight is Injurious to Casings

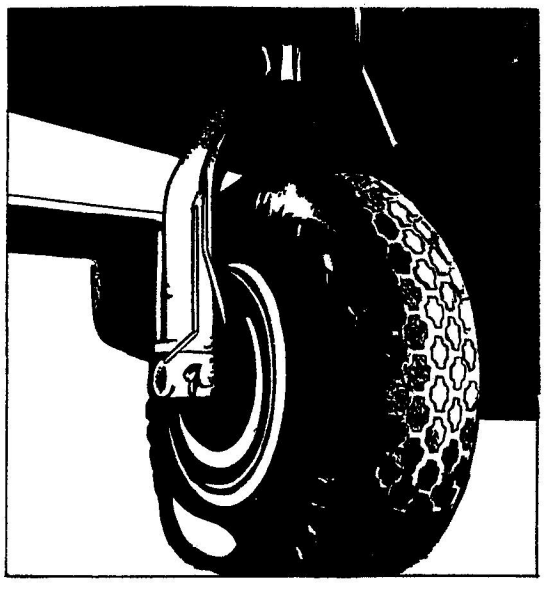

Figure 1-4 Sudden, Extra Angular Turns When Taxiing Causes Cord Damage to Casings

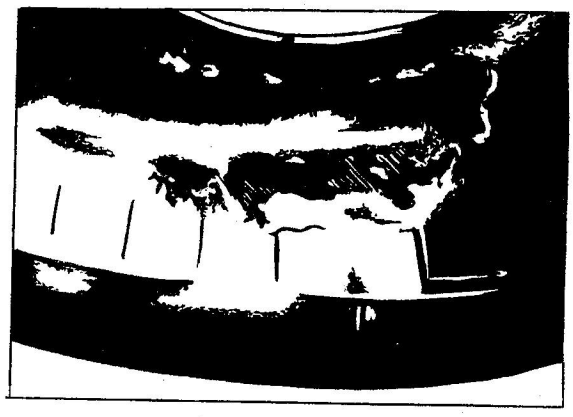

Figure 1-5 Effect of Improper Taxiing Sends This Casing to the Scrap Pile

(a) To indicate repair necessary to make a tube serviceable, draw a circle around the defective area, whether it be valve replacement or puncture.

INSPECTION OF MOUNTED TIRES

4 Adequate procedure to inspect tires, to carry out routine servicing check and corrections is as follows:

(a) When checking air pressure, check the valves for leaks by putting a small amount of saliva or water on the end of the valve and watch for air bubbles. If air bubbles appear, check the valve core for tightness, or, if necessary, replace the core.

(b) Check the valve stem to ensure that the threads are not burred, so that the valve core and valve cap fit properly. If the threads are burred, the valve can easily be re-threaded by use of a valve repair tool without dismounting the tire.

(c) Check for valve cap. Every valve is to have a cap on it - screwed on firmly with the fingers. The cap prevents dirt, oil and moisture from getting inside the valve and damaging the core. It also seals the air and serves as a double protection in a case where a leak develops in the valve core.

(d) Check the valve to ensure that it is not rubbing against the wheel; if it is, the tire is to be dismounted. Usually such a valve will only require slight bending in order to prevent it rubbing against the wheel. If the valve is badly bent, cracked, or severely worn, it is to be replaced.

(e) Go over the tread and sidewall of the tire carefully. Look for cuts - remove pieces of glass, stones, nails, or any other foreign objects embedded in the tread. It is recommended that a blunt awl be used for this purpose, although a medium sized screwdriver can be used if an awl is not available. In probing for foreign material, care is to be exercised so as not to drive the awl or screwdriver into the cord body of the tire, or to enlarge the injury.

(f) Remove tires with cuts which expose or penetrate the cord body below the breaker so they can be repaired. Tires with minor scratches or cuts which do not expose or penetrate the cord body plies, do not have to be taken out of service, but where such cuts are deep (through more than 50% of the remaining tread thickness) and are over two inches in length, they are to be repaired by a spot repair.

(g) Remove any tires which show signs of bulging. A bulge in the tread or sidewall region may be the result of an injury to the cord body, or may indicate tread or ply separation. Mark such a bulged area with crayon before deflating the tire, since after deflation it may be very difficult to locate the area.

(h) Check tires for tread wear.

(j) Check tires for evidence of misalignment. Tires showing uneven wear should be dismounted and turned around, and remounted in order to even up the wear. Also check for spotty wear due to defective brakes or bad braking. Report any evidence of misalignment and poor brakes so that mechanical corrections can be made if possible.

(k) Inspect the entire wheel for damage. Wheels which are cracked or injured are to be taken out of service for repair or replacement.

(l) When inspecting a wheel mounted on an aircraft, always check the landing gear to be sure that there is nothing caught between the landing gear and the tire. Remove mud and other similar foreign material from the tire.

(m) Inspect the well into which the wheel retracts. As the clearances are sometimes close, any foreign material or loose or broken parts in the well might cause severe damage to the tire, or even cause it to fail upon landing.

(n) At each daily inspection, and between flights, the tire creep mark is to be checked, and any necessary corrective action taken.

INSPECTION OF DISMOUNTED TIRE

5 Tires and tubes are to be dismounted and a thorough inspection made as laid down in the relevant maintenance schedule. If an aircraft has made a particularly severe or rough landing, the tire and tube are to be dismounted as soon as possible and inspected to determine if any hidden damage has occurred. The following checks are to be carried out:

(a) Inspect questionable tread cuts or other defects which have been marked for possible need of repairing.

(b) Check the entire bead and the area just above the bead on the outside of the tire for evidence of rim chafing, and for damage from tire tools in mounting and dismounting.

(c) Check tires which have been marked for bulges when the tire was mounted and inflated. If no break exists, probe with an awl to determine if separation exists.

(d) Spread the beads of the tire, and, with a good light, examine the inside for injuries or breaks.

(e) When tire inspections are carried out, the limitations or casing damage are to be kept in mind, and all relevant instructions are to be used to supplement the above inspection instructions.

INSPECTION OF TUBES

6 The following inspections will be made on aircraft inner tubes when the tire and tube are dismantled.

(a) Inspect valve stems for base leakage due to excessive stress and strain, and for jammed threads causing core leakage and/or improper seating of the valve.

(b) Inspect for chafing due to improper fit or pinching between the tire bead and rim.

(c) Inspect for wrinkles caused by the tube not being properly shaped to the casing or being too large. New tubes will be inspected before using for wrinkles and chafing at the edge of the crease, due to packaging.

(d) Inspect for punctures and cuts caused by a sharp object that may have entered through the tire.

(e) Inspect for fatigue and age. This condition can be readily recognized by fine cracks or checks.

(f) Inspect for thinning out due to brake drum heat.

(g) Inspect previous repairs. Look for weak spots, bulges, and loose edges.

(h) Visual inspections conducted on tubes are to be supplemented by a water immersion test.

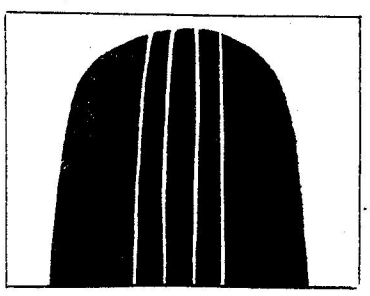

Figure 1-6 Severe Wear on Shoulders of Tread Due to Underinflation

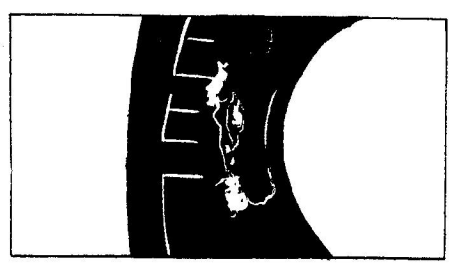

Figure 1-7 Severe Compound Bruise Break Occurs if Tire is Underinflated

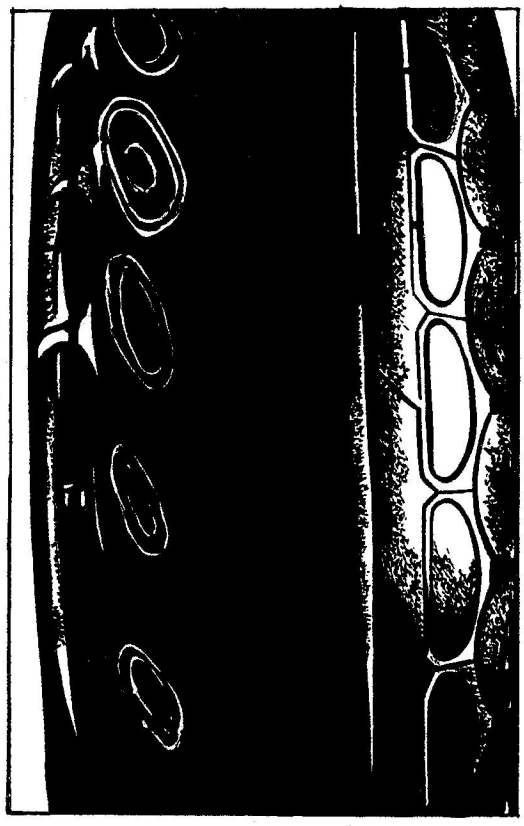

Figure 1-8 Side Shoulder Wear. This Casing Should Have Been Removed and Reversed on Same Wheel Before Wear Penetrated too Deeply

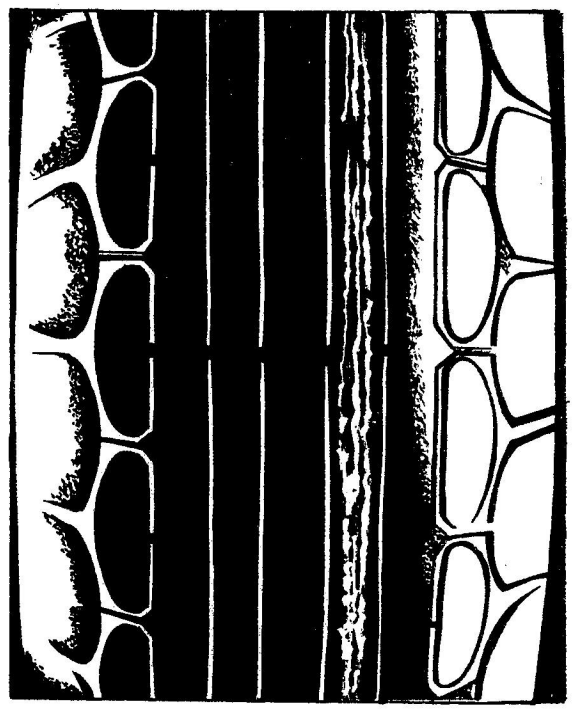

Figure 1-9 Obstruction in Wheel Well

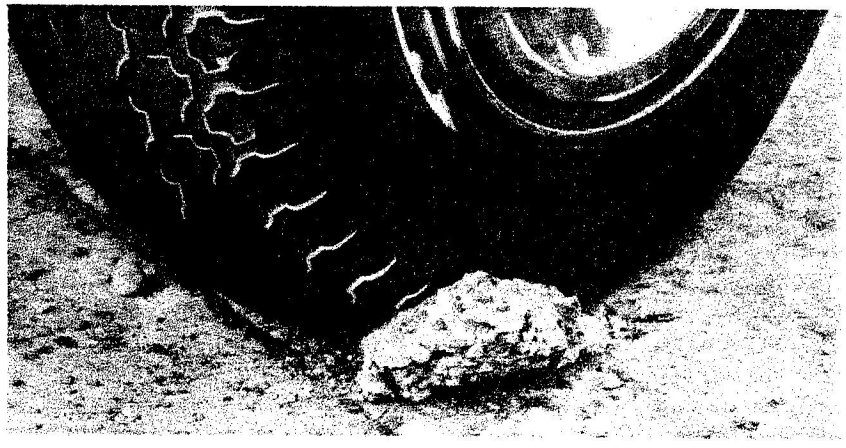

Figure 1-10 Obstacles and Hazards on Runways Damage and Ruin Casings

Figure 1-11 Inspecting for Cuts, Nail Holes, Stones and Glass

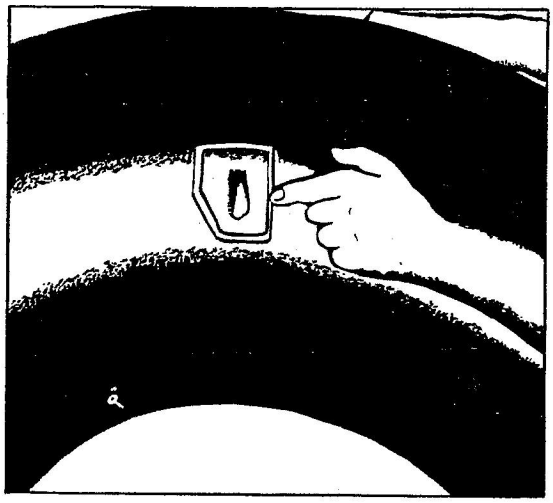

Figure 1-12 Inspection of Previous Repair

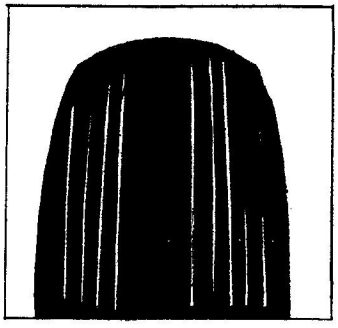

Figure 1-13 Overinflation Wear. Tire Worn Smooth in Centre of Tread - Very Little Wear on Shoulders

DESCRIPTIONS OF TIRE DEFECTS OR FAILURES

CUTS

7 Crushed stone, shale or other sharp material on or imbedded in the runway or projections from the aircraft itself may produce snags or cuts in the tread or sidewall rubber. Such jagged edges, when wet, will cut more readily than when dry. Depending on the size or depth of the cut or snag, it may extend through the tread into the cord structure.

OZONE CRACKING

8 Checking appears mainly in the sidewall of the tire and shows up as fine hair-line cracks in the surface of the rubber. This condition is primarily due to exposure to the elements, particularly sunlight, and is prevalent in the winter time as well as summer. Checking does not impair or reduce tire serviceability in the vast majority of cases, since it seldom extends below the outer surface. Ozone cracking will appear even when tires are in storage and will be further aggravated if storage procedures as outlined in EO 110-5-9 are not carried out.

BRUISE BREAKS

9 Bruise breaks or ruptures are the most common failures experienced in the fabric. They may be in the form of a diagonal split or an "X" break. The length of the failure may vary from one inch to twenty inches. The cause of such a failure is attributed to an impact or the striking of some object with sufficient force to strain the cord fabric beyond the breaking point. The degree of percussion determines the size of the rupture. If the oleo leg pressure is increased beyond that recommended, the tire may be called upon to absorb more shock than it alone can withstand and thus produce a ruptured condition.

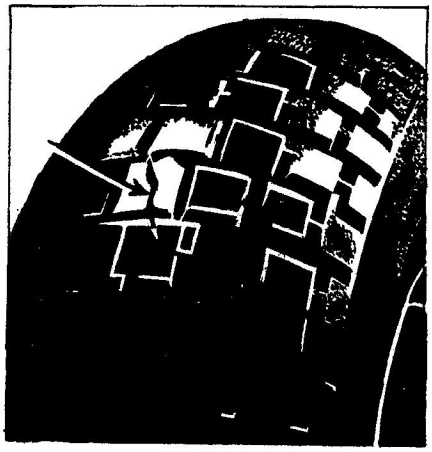

Figure 1-14 An Accidental Cut Penetrating the Rubber Only. Cover Still Serviceable

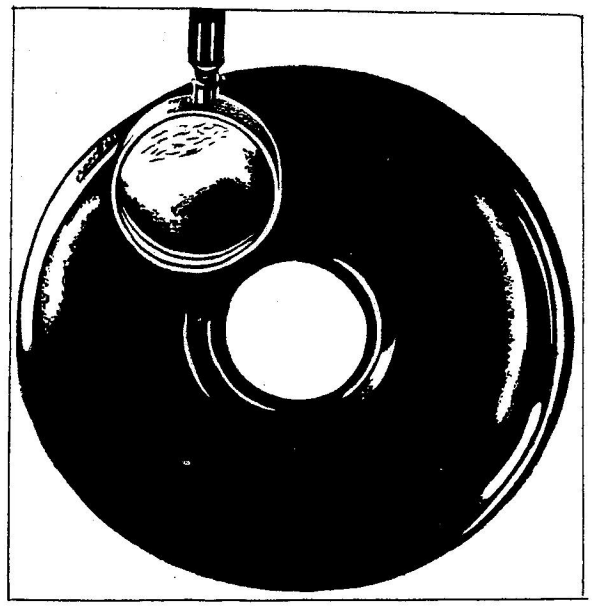

Figure 1-15 Surface Checking and Ozone Cracking Due to Exposure to Direct Sunlight for a Long Period

LOOSE CORDS

10 When a tire is run flat or extremely soft, the sidewalls are folded and crushed, setting up a severe grinding action. Due to this, the cords on the inside of the tire are frequently dislodged or separated from the carcass. Depending on the speed, the distance covered, the weight of the aircraft and the severity of brake application, the damage or loosening is circumferentially continuous or intermittent in the area between the bead region and the crown of the tire.

MISAPPLICATION

11 Many aircraft tires are damaged beyond repair in the process of dismounting. Regardless of the type of wheel, the tire bead must be loosened from the wheel rim flange and bead seat before proceeding with dismounting. This is the most important operation in the entire procedure of dismounting. Extreme care must be exercised in order not to injure the beads of the tire or the relatively soft metal of the wheel. Even with approved tools, this is a delicate operation. The important point is, proper utilization of available tools in order to avoid damage to the tire, tube, and wheel.

BEAD KEY

12 The bead key, which is common to Dunlop Aircraft casings only may become torn or severed from the bead proper due to improper mounting or centering, or damage at the time of mounting. These projections must be fitted properly and care must be exercised to prevent their destruction.

BRAKE BURNS

13 Due to the small braking surface and the constant application of brakes, the resultant heat generated may destroy the protective covering around the beadwire. The temperature reached may be great enough to devulcanize the bead and leave a sticky residue of no strength or binding quality and through which the bead wire may be exposed. This generally occurs in the region just below the rim flange and in service will be hidden by the flange.

SKID BURNS

14 These are caused by the friction of a tire on the runway. Such friction may be generated by the excessive application of brakes, faulty brakes, or a wheel that does not rotate freely. These injuries can be readily identified since they occur at one position and will leave a flat spot on the tread or scrub right through to the carcass. The appearance shows a rippled effect from the scrubbing action.

BEAD CRACKS

15 These occur at the top edge of the rim flange and appear as if the rim had cut into the fabric. When the tire is removed, it may be

Figure 1-16 Internal Break-Up of Cords Due to Foreign Object Remaining in a Neglected Cut Which Has Gradually Worked its Way Through Every Ply

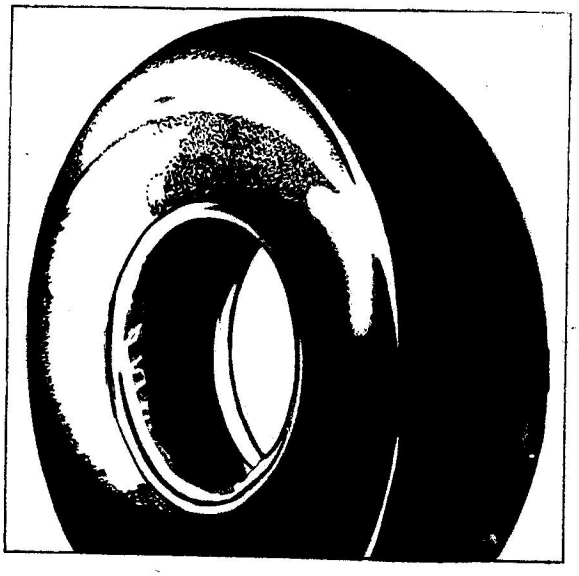

Figure 1-17 Damage Caused by Improper Use of Tools in Loosening Bead From Flange and in Prying Tire Bead Over Rim Flange

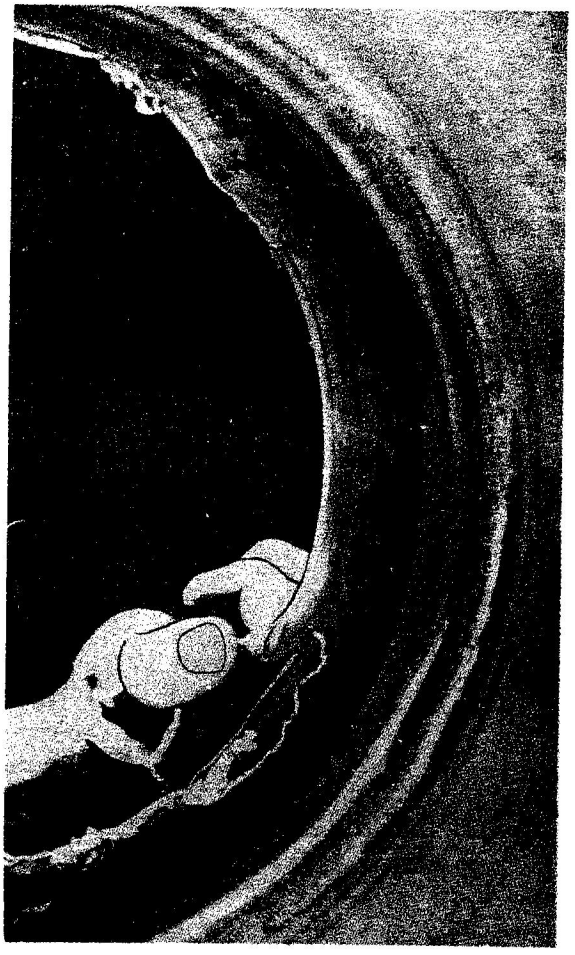

Figure 1-18 Damage on Inside of Tire Bead Due to Improper Tools or Use of Tools, Damage too Severe to Permit Repairing

Figure 1-19 Flat Spot From Landing With Locked Brakes. Rubber Around Edge Next to Cord Body Has Been Melted

Figure 1-20 Tire Ruined From Severe Brake Application

Figure 1-21 Fold Over or Mold Flow. This Casing is Acceptable Providing the Blemishes are not Caused by Buckle of Plies in the Carcass

Figure 1-22 Showing a Cover Worn to the Base of the Tread Pattern

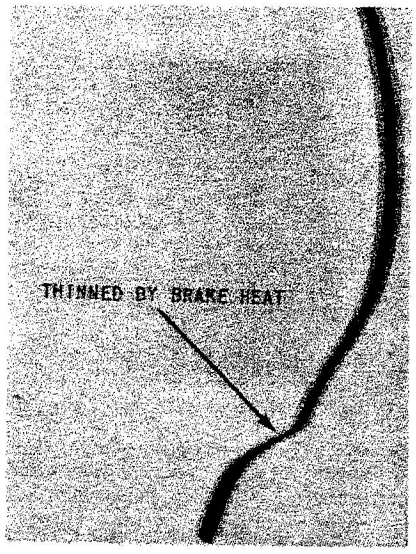

Figure 1-23 Section of Tube Illustrating the Effect of Brake Heat

seen that the fabric reinforcing strip has been broken in a circumferential line around the tire. This may be due to overloading, underinflation, a poor rim condition or an inherent structural weakness in this particular make or brand of tire.

WIRE CUT

16 This must not be confused with bead cracks or brake burns. Overload and underinflation, the incorrect size or type of tire, damaged rims or a structural weakness may contribute to wire cuts. Eventually this causes the bead fabric to separate and break down, exposing the wire bundle. The fabric may also show evidence of disintegration for some distance away from the actual point of failure. This type of failure is generally hidden by the rim flange but does not have the gummy appearance of a burn.

SEPARATION

17 Tread and ply separation are two conditions which are quite similar in character except for location. Occasionally a constructional or compounding difficulty may be the cause. By far the most common causes are internal stresses caused by a shearing action, excess loads, and underinflation, and resulting in frictional heat generation in the body of the tire and the tearing of the bond between the plies or the carcass and the tread. The separation may occur between the tread and the fabric or between two layers of fabric. The latter is known as ply separation.

FOLD OVERS

18 This condition must not be confused with tread cuts or snags. A cracking condition is generally caused by a fold over in the rubber where the two edges have not properly knit together during the cure. This may not be apparent on inspection at the factory but will open up in service when the tire is subjected to a flexing action. Fold overs in the contact area generally occur in a non-skid design tread whereas fold overs in a smooth tread tire usually occur about 1/2 inch above the rim flange.

CHAFING

19 This is due to a projection of some type in the fork of the leg or in the wheel well which cuts or gouges a continuous piece of rubber from the tread or sidewall. The clearance between the fork and the tire may be such that the metal will continually scrub the tire or dig into it. If such is the case, corrective action must be taken immediately. Do not confuse this defect with cuts or snags, which are generally of minor extent in comparison.

TREAD WEAR

20 Tread wear may be either normal general wear or wear in one part of the tread only, which produces a "flat spot". It is difficult to assess the extent of wear on smooth-treaded tires, but the depth of the pattern grooves is a good guide for pattern treaded tires. After the tread has worn to the bottom of the grooves, 25% to 30% of the total tread thickness remains.

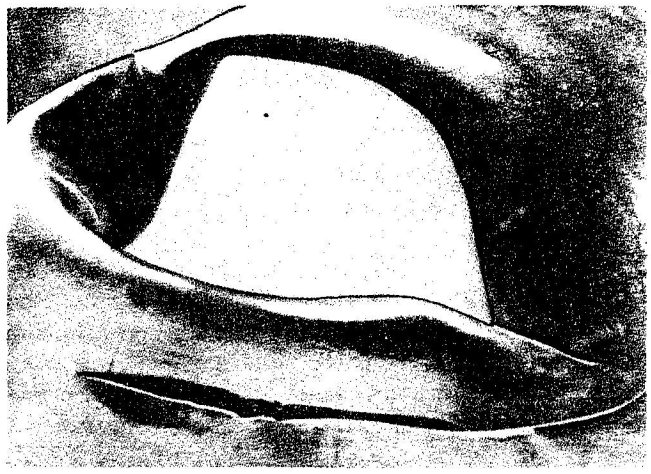

Figure 1-24 Effect of Heat From Brake Drum on Inner Tube

DESCRIPTIONS OF TUBE DEFECTS OR FAILURES

HEAT THINNING

21 The inside diameter of the tube which is next to the wheel is subjected to considerable heat from the braking action. The brake heat is transmitted to the wheel and may eventually soften the tube stock beyond its limit of elasticity. In conjunction with this, the flexing of the tire and slight movement of the bead stretches and chafes this region. Finally the rubber fails at this point and splits around the tube just off the centre of the inner diameter and always on the brake drum side which is normally the side opposite the valve stem.

PUNCTURE

22 This is a condition well known to everyone. Some foreign object penetrates the tire and tube allowing the pressure to be released gradually over a period which may extend from a few minutes to several hours.

VALVE BASE LEAK

23 This type of failure may occur at the edge of the valve pad due to poor adhesion. The location of another type may be at the radius between the stem proper and its base, and may have been cut by the valve hole or weakened by the presence of oil or grease in that region. Another case is a longitudinal break or split occurring in the rubber stem near the base caused by inflation pressure exerted there without the reinforced strength of the tire to encase it. The above are found in rubber stem valves. An all metal stem may loose its adhesion to the rubber and partially lift from the tube.

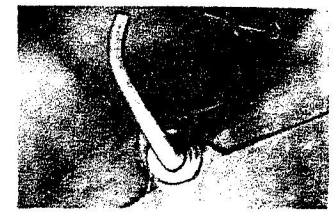

Figure 1-25 End of Valve Burred - Can Be Rethreaded. Valve Bent - Can Be Straightened

DAMAGED VALVES

24 This must not be confused with valve base leaks. Damaged valves are caused by dismounting, striking some object severely when the tire is rotating, or the creeping of the tire on the rim. The latter is the most common and is due to considerable underinflation or running the tire flat after failure and the subsequent working or movement of the valve in the valve hole which may tear the stem from the tube. Damaged valves which are ripped or torn are the effect not the cause of failure.

WRINKLED

25 This condition results when the wrong size tube is used or a stretched, or worn tube is larger than the inside of the tire in which mounted. It may happen to a new tube of the proper size when carelessly mounted. This wrinkled section chafes on itself because the normal flexibility of the folded part is seriously impaired owing to the reinforcing action of the fold and it cannot flex in harmony with the tire.

PINCHED

26 During the mounting operation, the tube may be caught between the tire irons and the tire, or the irons and the rim. Any pressure on this pinched section will cut through the tube and leave very distinctive marks in that particular locality.

FOREIGN MATERIAL

27 Particular care is exercised in the processing of tube stock to prevent foreign substances from entering the stock. Despite this, some particles are embedded in the tube wall and are not readily detected on inspection. In

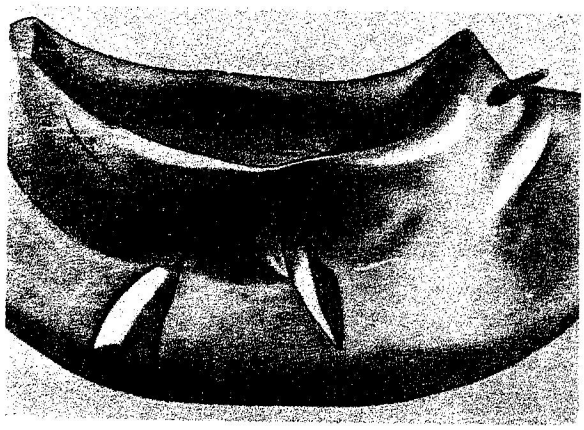

Figure 1-26 Bad Wrinkles Due to Improper Mounting, This Tube Must Be Discarded

service, however, constant flexing may dislodge the particle and result in a slow leak. Such tubes should be repaired immediately. In other cases, foreign materials such as sand, paper, a wrench or other materials due to careless installation may be left between the tube and casing resulting in damage to the tire and destruction of the tube.

SPLICE LEAKS

28 All tubes contain a splice or seam. The contacting surface may not knit together during the cure either from the result of a stock condition, foreign substances, or poor workmanship. This type of failure is not common.

BLOW OUT

29 This injury is quite extensive and covers a considerable area. The force of escaping air pressure usually rips the tube beyond repair. This sudden release of air pressure is caused by a damaged or defective casing allowing the air to be liberated explosively through the weakened area of the tire causing a tearing of the tube.