SECTION N

WHEELS AND TYRES

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Section N.1

DESCRIPTION

The Austin-Healey Sprite is fitted with 5.20—13 tubeless tyres upon 15×4J ventilated steel disc wheels. each wheel being secured by four nuts.

Section N.2

ADJUSTMENTS IN THE VEHICLE

The purpose of the following adjustments is to obtain the best performance from the wheels and tyres. Proceed as detailed below. Other faults should be diagnosed after consulting Section N.4.

(1) Tighten the road wheel nuts to a torque wrench reading of 37 to 39 lb. ft. (5·02 to 5·4 kg. m.). **Do not overtighten.**
(2) Check the tyre pressures regularly with a gauge and inflate them to the recommended pressures.
(3) Change the position of the wheel and tyre assemblies at the recommended intervals.
(4) Remove any oil, grease or foreign objects from the tyres.

Section N.3

WHEEL AND TYRE ASSEMBLIES

To Remove

(1) Apply the handbrake and scotch one of the wheels.
(2) Jack up the vehicle sufficiently to ensure that the wheel with a fully inflated tyre can be removed or installed.
(3) Remove the hub cover.
(4) Remove the four wheel nuts, which have right-hand threads, *i.e.* turn anti-clockwise to loosen. Lift off the wheel.

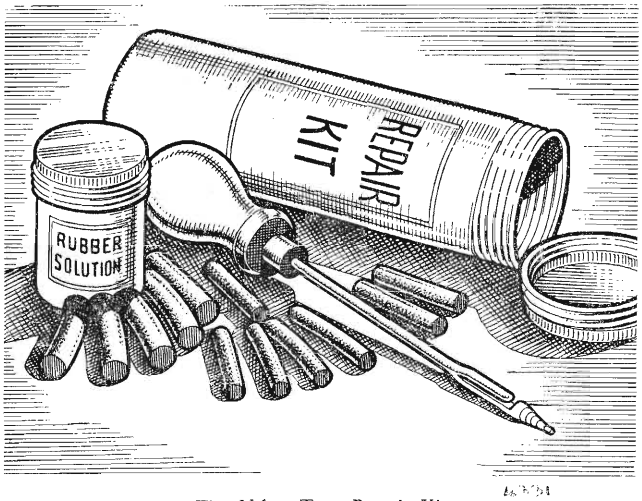


Fig. N.1. Tyre Repair Kit.

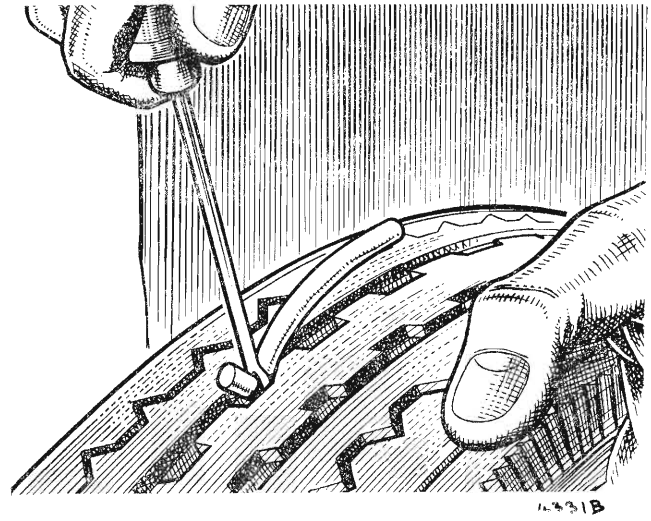


Fig. N.2. Inserting the plug and needle through the hole in the tyre

To Repair Simple Tyre Penetrations

Normally a tubeless tyre will not leak as the result of penetration by a nail or other normal puncturing objects provided that it is left in the tyre, but repair should be effected at the earliest convenient time.

In the case of a nail penetrating the tyre, a repair can be carried out externally without removing the tyre from the rim, providing the special repair kit is available. If the hole fails to seal, mark the spot and extract the nail, taking note of the direction of penetration. If the tyre is leaking and the puncturing object cannot be located by sight, immerse the wheel and tyre in water.

Repair the tyre as follows:

(1) Insert the needle of the repair kit through the hole in the tyre in the same direction as the penetration to free it from road grit. Dip the needle into the rubber solution and re-insert it through the hole, repeating this operation until the hole is well lubricated with the solution.
(2) Select a repair plug of about twice the diameter of the puncturing object, stretch and roll it into the eye of the needle, about $\frac{1}{4}$ in. (6 mm.) from its end. Dip the plug into the rubber solution and insert the needle through the hole in the tyre so that the end of the rubber plug passes through the hole into the interior of the tyre. Withdraw the needle, leaving the plug in the tyre, and cut off the plug about $\frac{1}{8}$ in. (3 mm.) from the surface of the tread.
(3) Inflate the tyre (see **"To inflate the tyre"**).

To Dismantle

(1) Lay the wheel on the ground, with the valve uppermost. Deflate the tyre by removing the valve cap and interior.

(2) Using tyre levers, which must be in good condition, separate the beads from the rim flange in the manner shown in Fig. N.6 until both beads are in the base of the rim. As inextensible wires are incorporated in the edges of the tyres, no attempt should be made to stretch the edges over the rim as the beads must in **NO WAY BE DAMAGED.** Keep the levers moistened with water.

(3) With the bead of the tyre held in the base of the rim at a point diametrically opposite the valve, insert a lever close to the valve and carefully lift the tyre over the rim. Using two levers at intervals of about 6 in. (15 cm.) apart, continue to lift the tyre bead over the rim until this bead is entirely free.

(4) Stand the tyre and wheel upright, keeping the bead in the base of the rim. Lever the bead over the rim flange, and at the same time push the wheel away from the tyre with the other hand to completely remove the tyre off the wheel.

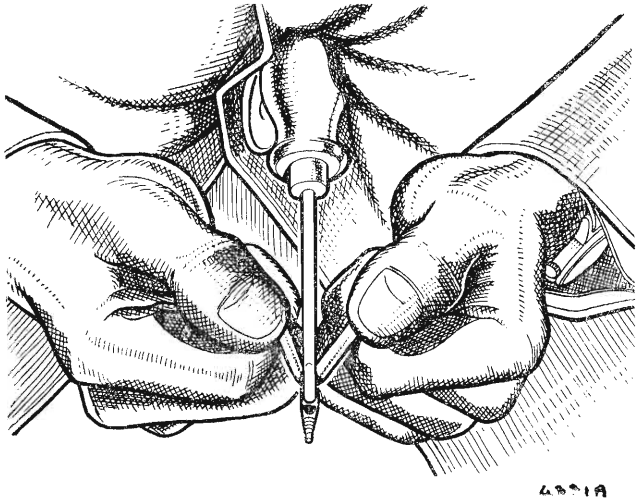


Fig. N.3. Rolling the plug into the needle eye.

To Repair Severe Tyre Penetrations

Severe penetrations which are outside the scope of the small repair kit can be repaired in a similar manner to conventional covers which will necessitate the removal of the tyre (see above).

Repair the tyre as follows:

(1) Inspect the tyre for damage and remove any puncturing objects.

(2) Clean the area around the hole on the inside of the tyre, roughen with a scratchbrush and apply a rubber solution to the surface to receive an ordinary tube patch such as the Dunlop "Vulcafix" patch, or preferably use an uncured rubber patch and vulcanise it in position.

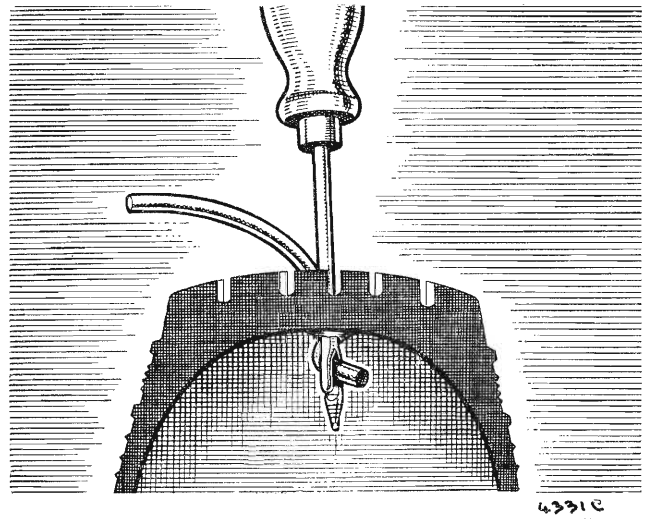


Fig. N.4. The inserted plug prior to withdrawing the needle.

(3) In the event of more serious damage, the tubeless tyre can undergo a major vulcanised repair in the same way as a normal tyre. The tubeless tyre can also be re-treaded.

To Prepare the rim before Fitting the Tyre

(1) Examine the condition of the wheel and renew if cracked, or if the attachment holes are elongated.

(2) Check for loose rivets in the base of the wheel rim and fit oversize rivets if necessary, ensuring that they do not protrude the beyond height of the original rivets. An airtight seat must be maintained.

(3) Clean off all rust, rubber, etc., from the wheel flange and rim seat, using steel wool, emery or similar cleaning medium. In extreme cases of rusty rims it may be necessary to use a wire brush or even a file.

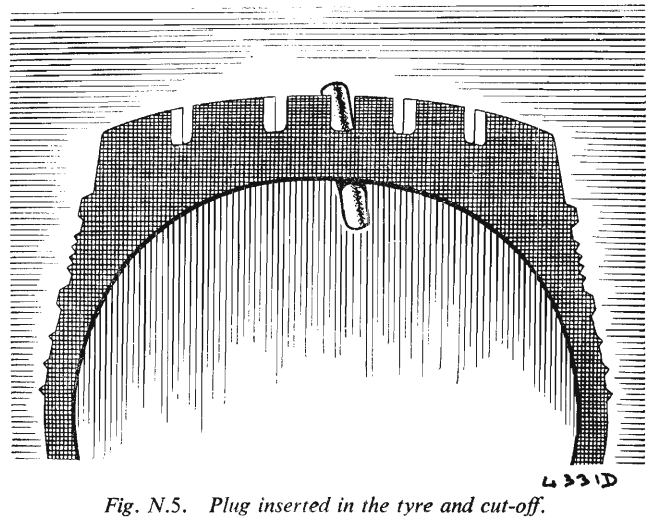


Fig. N.5. Plug inserted in the tyre and cut-off.

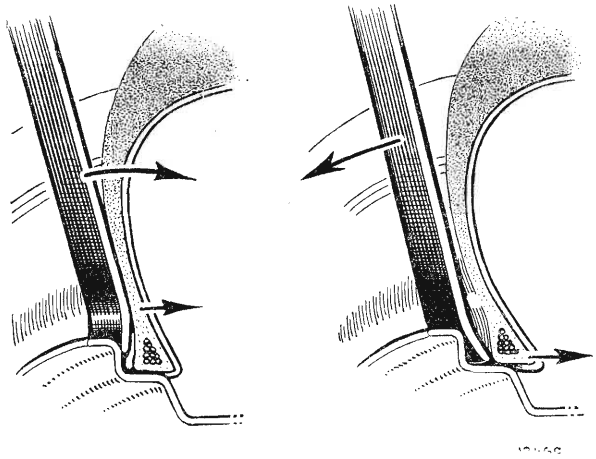


Fig. N.6. Removing a tyre bead off the rim.

(4) Remove any dents in the flange by hammering out carefully to maintain an airtight seat.
(5) High spots in the welded joint of the rim must be filed or buffed away.

To Renew a Valve

A valve should never be refitted once it has been removed from the rim, and it should be renewed every time a new tyre is fitted.

Cut out or pull outwardly the old valve from the rim.

Lubricate a new valve with soap solution and pull it through the rim hole from the inside. The valve should be pulled until the flange on the rubber base of the valve is in full contact with the inner rim surface. If the valve is pulled too far, the base will be damaged and another new valve will have to be fitted.

The use of the Schrader valve mounting Tool No. 553 is recommended, so as to avoid damage.

To Reassemble

When replacing the tubeless tyre a similar technique has to be employed to that used for removal, first fitting the tyre into the base of the rim at a point opposite the valve. Make sure the valve interior is removed and that the balance spots near the tyre bead are at the valve position. Wipe clean and moisten the beads of the tyre, rim flanges and tyre levers with clean water. Do not use petrol. Carry out the final fitting of the tyre, using levers which are in good condition and free from burrs. Take small "bites" with the levers.

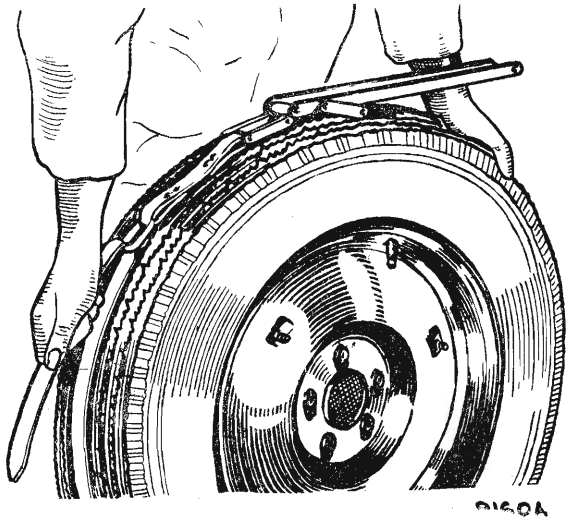


Fig. N.7. The use of a tourniquet to seal the beads.

To Inflate the Tyre

(1) Before inflating the tyre, bounce the crown of the tyre on the ground at various points round its circumference, to snap the beads home against the rim. This will provide a partial seal.

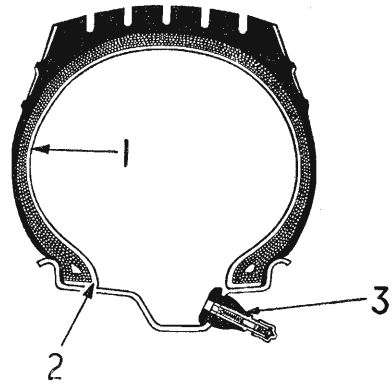


Fig. N.8. A section through the rim, tyre and valve.
1. *Air retainer liner.*
2. *Rubber air seal.*
3. *Rubber-sealed valve.*

(2) Connect an air line to the valve, with its interior plunger omitted, and inflate the tyre with the wheel in an upright position. If a seal cannot be effected by the first rush of air, bounce the tyre on its crown at various points round the circumference with the air line still attached. In cases of difficulty apply the special tourniquet consisting of a strap incorporating a lever, but a suitably strong cord or rope around the circumference of the tread and a twisting bar or stick will also serve. If no air line is available and the tyre has to be inflated by a foot- or hand-pump, then the use of a tourniquet is essential to force the beads outwards against the rim flanges to effect a seal. Remove the air line, insert the valve interior and re-inflate, for test purposes, to 50 lb./sq. in. (3·5 kg./cm.^{2}).
(3) Allow the tyre to stand for a few minutes so that any free air trapped between the flange and the bead clinch can escape. Test the complete assembly in a water tank to check for leaks, special attention being paid to the areas at the beads, valve and wheel rivets. Should leakage occur

at the valve base, this can only be rectified by renewing the valve. Loss of air around the bead seat and flange is generally due to a high spot on the rim (foreign matter, rust, weld, etc.) and in most cases this can be cured by holding the tyre bead away from the rim, with the tyre deflated, in order to effect further cleaning of the rim bead seat with emery, steel wool, etc. Air leakage at the rivets can be remedied by peening over the rivet head with a ball-pane hammer. The rivet should be backed up with another, and preferably larger, hammer. In extreme cases where major leaks occur at the flanges or rivets, mark off the position of the leaks on the tyre and the rim before removing the tyre for inspection and rectification.

(4) When satisfied that there are no air leaks, and that the tyre is correctly fitted, adjust the tyre to the recommended working pressure.

To Replace

(1) Install the wheel and tyre assembly on the hub.

(2) Screw on the wheel nuts, which have right-hand threads, *i.e.* turn in a clockwise direction, and tighten them in diagonal sequence.

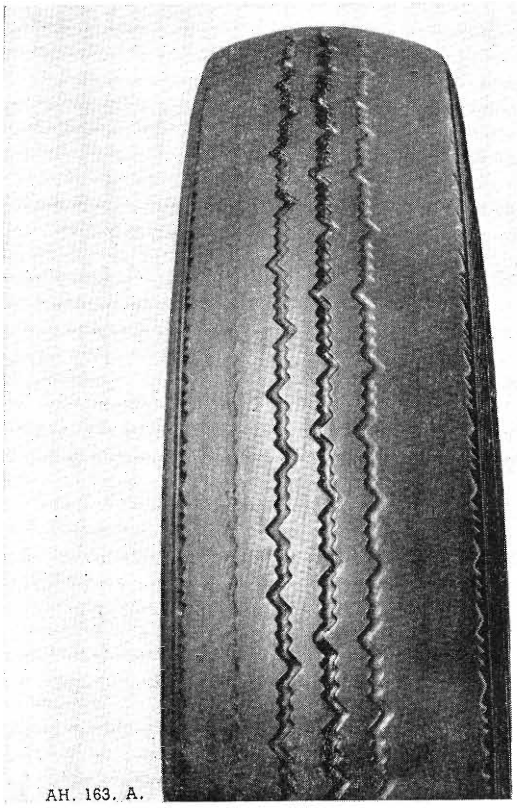


Fig. N.9. Excessive tyre distortion from persistent underinflation causes rapid wear on the shoulders and leaves the centres standing proud. If the effects of underinflation are aggravated by other factors, such as camber and excessive braking, the irregular and rapid wear is more pronounced.

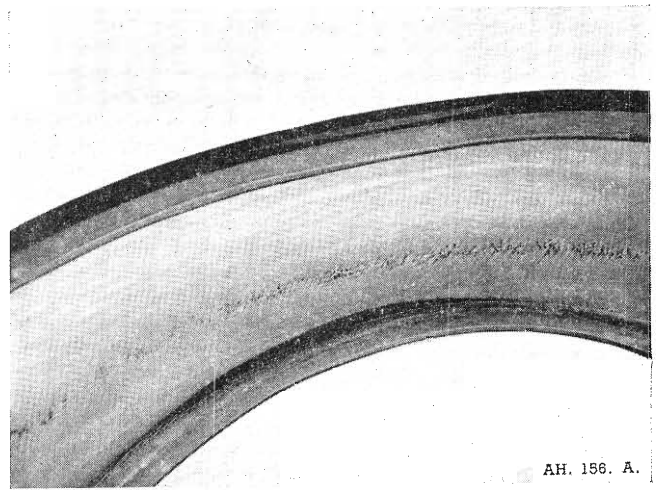


Fig. N.10. This casing is breaking up due to over-flexing and heat generation.

(3) Release the jack and scotch; check the wheel nuts again, using a torque wrench such as Service Tool 18G 372, to a tightness of 37 to 39 lb. ft. (5·02 to 5·4 kg. m.). **Do not overtighten.**

(4) Place the rim of the hub cover over two of the buttons on the wheel centre and give the outer face a sharp blow of the fist over the third button.

Section N.4

FACTORS AFFECTING TYRE LIFE AND PERFORMANCE

Inflation Pressures

All other conditions being favourable there is an average loss of 13% tread mileage for every 10% reduction in inflation pressure below the recommended figure.

A tyre is designed so that there is a minimum pattern shuffle on the road surface and a suitable distribution of load over the tyres contact area when deflection is correct.

Moderate underinflation causes an increased rate of tread wear although the tyre's appearance may remain normal. Severe and persistent underinflation produces unmistakable evidence on the tread, see Fig. N.9. It also causes structural failure due to excessive friction and temperature within the casing, Figs. N.10 and N.11.

Pressures which are higher than those recommended for the car reduce comfort. They may also reduce tread life due to a concentration of the load and wear on a smaller area of tread, aggravated by increased wheel bounce on uneven road surfaces. Excessive pressures overstrain the casing cords, in addition to causing rapid wear, and the tyres are more susceptible to impact fractures and cuts.

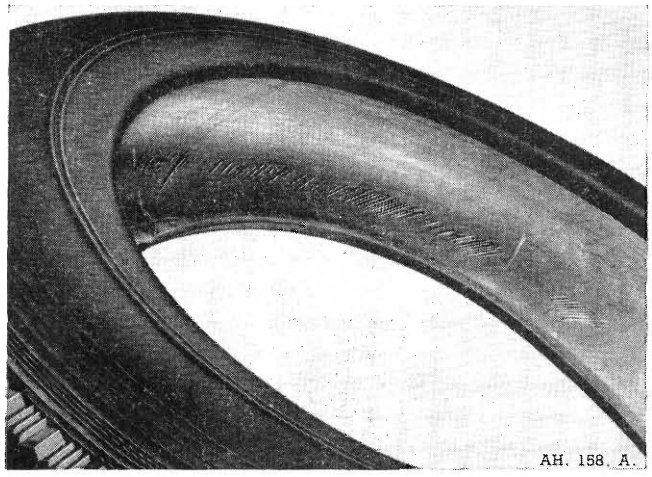


Fig. N.11. Running deflated has destroyed this tyre.

Effect of Temperature

Air expands with heating and tyre pressures increase as the tyres warm up. Pressures increase more in hot weather than in cold weather and as a result of high speed. These factors are taken into account when designing the tyre and in preparing Load Pressure schedules.

Pressures in warm tyres should not be reduced to standard pressure for cold tyres. "Bleeding" the tyres increases their deflections and causes their temperatures to climb still higher. The tyres will also be underinflated when they have cooled.

Speed

High speed is expensive and the rate of tread wear may be twice as fast at 50 m.p.h. as at 30 m.p.h.

High speed involves:

(1) Increased tyre temperatures due to more deflections per minute and a faster rate of deflection and recovery. The resistance of the tread to abrasion decreases with increase of temperature.
(2) Fierce acceleration and braking.
(3) More tyre distortion and slip when negotiating bends and corners.
(4) More "thrash" and "scuffing" from road surface irregularities.

Braking

"Driving on the brakes" increases the rate of tyre wear, apart from being generally undesirable. It is not necessary for wheels to be locked for an abnormal amount of tread rubber to be worn away.

Other braking factors not directly connected with the method of driving can affect tyre wear, for instance correct balance and lining clearances, and freedom from binding, are very important. Braking may vary between one wheel position and another due to oil or foreign matter on the shoes even when the brake mechanism is free and correctly balanced.

Brakes should be relined and drums reconditioned in complete sets. Tyre wear may be affected if shoes are relined with non-standard material having suitable characteristics or dimensions, especially if the linings differ between one wheel position and another in such a way as to upset the brake balance. Front tyres, and particularly near front tyres, are very sensitive to any condition which adds to the severity of front braking in relation to the rear.

"Picking-up" of shoe lining leading edges can cause grab and reduce tyre life. Local "pulling-up" or flats on the tread pattern can often be traced to brake drum eccentricity, Fig. N.12. The braking varies during each wheel revolution as the minor and major axis of the eccentric drum pass alternately over the shoes. Drums should be free from excessive scoring and be true when mounted on their hubs with the road wheels attached.

Climatic Conditions

The fate of tread wear during a reasonably dry and warm summer can be twice as great as during an average winter.

Water is a rubber lubricant and tread abrasion is much less on wet roads than on dry roads. In addition resistance of the tread to abrasion decreases with increase in temperature.

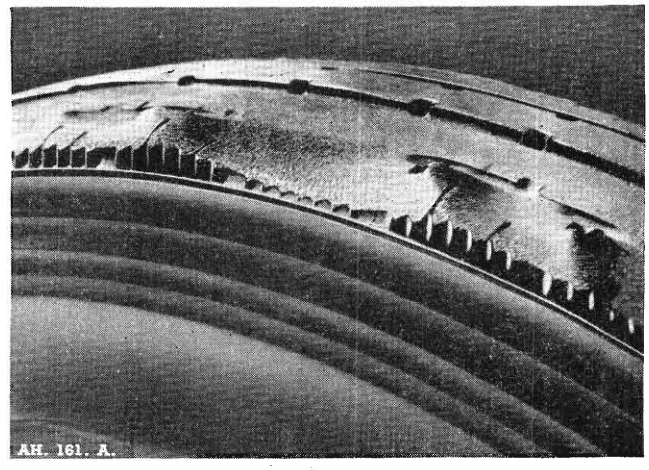


Fig. N.12. Local excessive wear due to brake drum eccentricity.

When a tyre is new its thickness and pattern depth are at their greatest. It follows that heat generation and pattern distortion due to flexing, cornering, driving and braking are greater than when the tyre is part worn.

Higher tread mileages will usually be obtained if new tyres are fitted in the autumn or winter rather than in the spring or summer. This practice also tends to

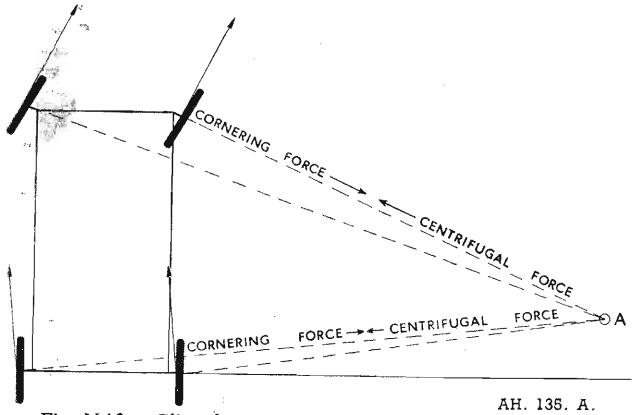


Fig. N.13. Slip when cornering causes increased tyre wear.

reduce the risk of road delays because tyres are more easily cut and penetrated when they are wet than when they are dry. It is, therefore, advantageous to have maximum tread thickness during wet seasons of the year.

Road Surface

Present day roads generally have better non-skid surfaces than formerly. This factor, combined with improved car performance, has tended to cause faster tyre wear, although developments in tread compounds and patterns have done much to offset the full effects.

Road surfaces vary widely between one part of the country and another, often due to surfacing with local material. In some area the surface dressing is coarser than others; the material may be comparatively harmless rounded gravel, or more abrasive crushed granite, or knife-edged flint. Examples of surfaces producing very slow tyre wear are smooth stone setts and wood blocks, but their non-skid properties are poor.

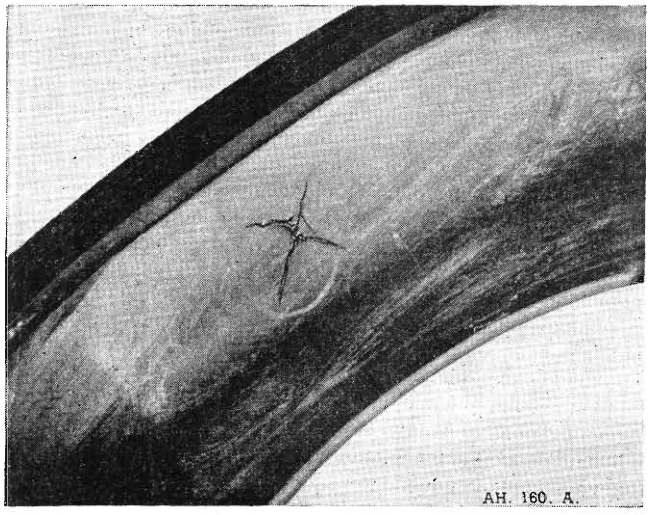


Fig. N.14. Severe impact has fractured the casing.

Bends and corners are severe on tyres because a car can be steered only by misaligning its wheels relative to the direction of the car. This condition applies to the rear tyres as well as the front tyres. The resulting tyre slip and distortion increase the rate of wear according to speed, load, road camber and other factors, Fig. N.13.

The effect of hills, causing increased driving and braking torques with which the tyres must cope, needs no elaboration.

Impact Fractures

In order to provide adequate strength, resistance to wear, stability, road grip and other necessary qualities, a tyre has a certain thickness and stiffness. Excessive and sudden local distortion, such as may result from striking a kerb, a large stone or brick, an upstanding manhole cover, or deep pothole may fracture the casing cords; Figs. N.14 and N.15.

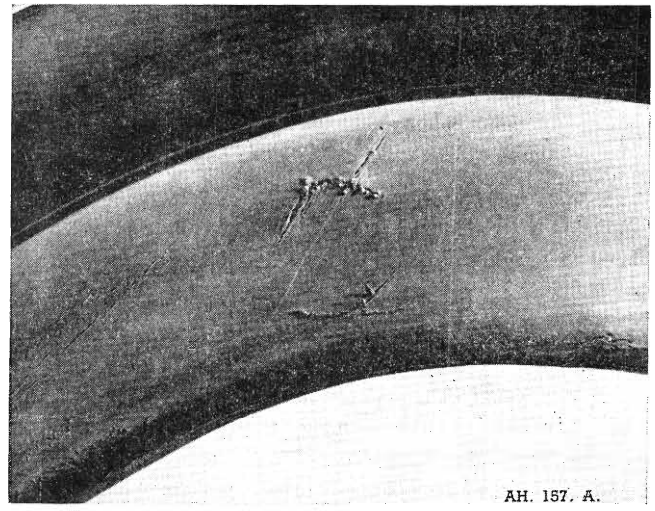


Fig. N.15. A double fracture caused by the tyre being crushed between the rim and an obstacle, such as the edge of a kerb.

Impact fractures often puzzle the car owner because the tyre and road spring may have absorbed the impact without his being aware of anything unusual. Only one or two casing cords may be fractured by the blow and the weakened tyre fails some time later. Generally there is no clear evidence on the outside of the tyre unless the object has been sufficiently sharp to cut it.

This damage is not associated solely with speed, and care should be exercised at all times, particularly when drawing up to a kerb.

"Spotty Wear"

Fig. N.16 shows a type of irregular wear which sometimes develops on front tyres and particularly on near-side front tyres.

The nature of "spotty" wear—the pattern being much worn and little worn at irregular spacings round the circumference—indicates an alternating "slip grip" phenomenon, but it is seldom possible to associate its origin and development with any single cause. There is evidence of camber wear, misalignment, underinflation, or braking troubles.

It is preferable to check all points which may be contributory factors. The front tyres and wheel assemblies may then be interchanged, which will also reverse their direction of rotation, or better still the front tyres may be interchanged with the rear tyres.

Points for checking are :

(1) Inflation pressures and the consistency with which the pressures are maintained.

(2) Brake freedom and balance, shoe settings, lining condition, drum condition and truth.

(3) Wheel alignment.



Fig. N.16. Irregular 'Spotty' wear, to which a variety of causes may contribute.

(4) Camber and similarity of camber of the front wheels.

(5) Play in hub bearings, swivel pin bearings, suspension bearings, and steering joints.

(6) Wheel concentricity at the tyre bead seats.

(7) Balance of the wheel and tyre assemblies.

(8) Conditions of road springs and shock absorbers.

Corrections which may follow a check of these points will not always effect a complete cure and it may be necessary to continue to interchange wheel positions and reverse directions of rotation at suitable intervals.

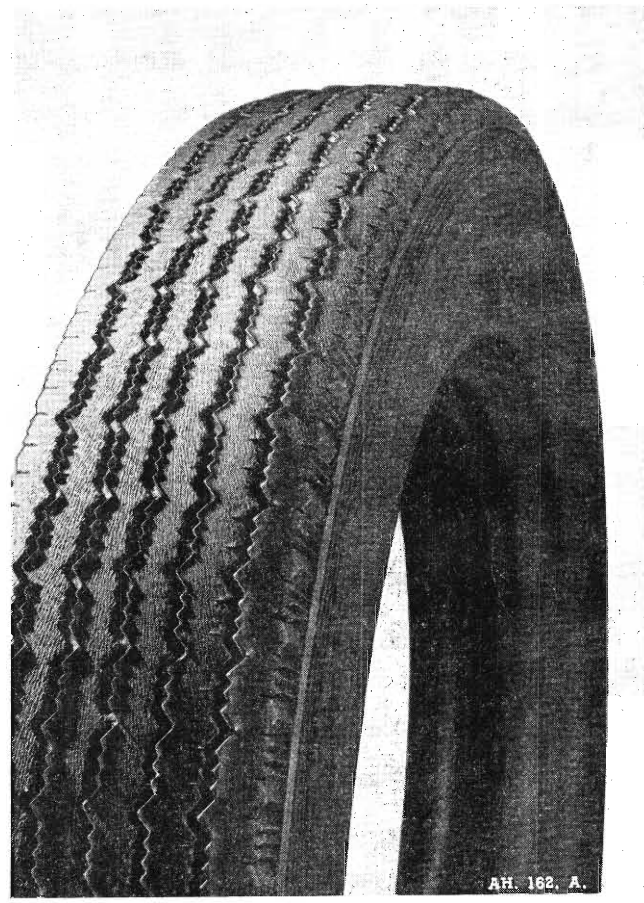


Fig. N.17. Fins or feathers caused by severe misalignment. With minor misalignment, probably aggravated by road camber, the ribs may have sharp edges instead of upstanding fins. The conditions will usually be accompanied by heel and toe wear across the tread due to its being distorted and worn away laterally instead of in a true rolling direction.

Irregular wear may be inherent in the local road conditions such as from a combination of steep camber, abrasive surfaces, and frequent hills and bends. Driving methods may also be involved. Irregular wear is likely to be more prevalent in summer than in winter, particularly on new or little worn tyres.

Wheel Alignment and Road Camber

It is very important that correct wheel alignment should be maintained. Misalignment causes a tyre tread to be scrubbed off laterally because the natural direction of the wheel differs from that of the car.

An upstanding fin on the edge of each pattern rib is a sure sign of misalignment and it is possible to determine from the position of the "fins" whether the wheels are toed in or toed out, see Fig. N.17. Fins on the inside edges of the pattern ribs—nearest to the car—and particularly on the off-side tyre, indicate toe-out.

With minor misalignment the evidence is less noticeable and the sharp pattern edges may be caused by road camber even when wheel alignment is correct. In such cases it is better to make sure by checking with an alignment gauge.

Road camber affects the direction of the car by imposing a side thrust and if left to follow its natural course the car will drift to the near side. This is instinctively corrected by steering towards the road centre. As a result the car runs crab-wise. Fig. N.18 shows, in exaggerated form, the effect this has upon the tyres.

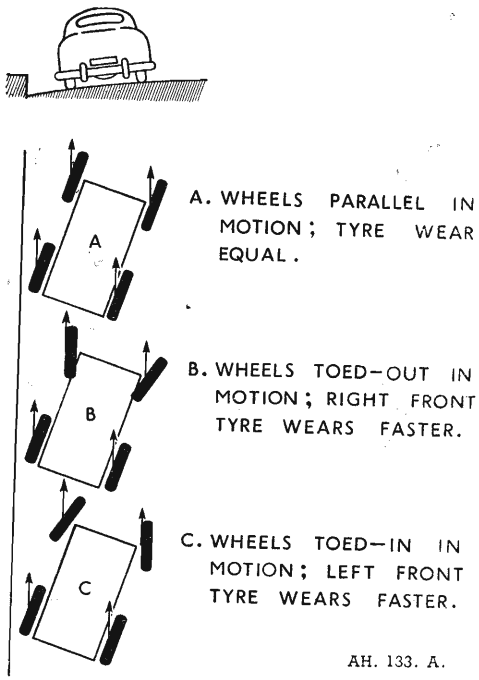


Fig. N.18. Exaggerated diagram of the way in which road camber affects a car's progress.

The near front tyre sometimes persists in wearing faster and more unevenly than the other tyres even when the mechanical condition of the car and tyre maintenance are satisfactory. The more severe the average road camber the more marked will this tendency be. This is an additional reason for the regular interchange of tyres.

Camber Angle

This angle normally requires no attention unless disturbed by a severe impact, however, it is always advisable to check this angle if steering irregularities develop, see K6.

Wheel camber usually combined with road camber, causes a wheel to try to turn in the direction of lean, due to one side of the tread attempting to make more revolutions per mile than the other side. The resulting increased tread shuffle on the road and the off centre tyre loading tend to cause rapid and one sided wear. If wheel camber is excessive for any reason the rapid and one sided tyre wear will be correspondingly greater. Unequal cambers introduce unbalanced forces which try to steer the car one way or the other. This must be countered by steering in the opposite direction which results in faster tread wear.

Section N.5

TYRE AND WHEEL BALANCE

Static Balance

In the interests of smooth riding, precise steering and the avoidance of high speed "tramp" or "wheel hop," all tyres are balance checked to predetermined limits.

To ensure the best degree of tyre balance the covers are marked with white spots on one bead and these indicate the lightest part of the cover. The white balance spots near the tyre bead should be at the valve position.

Some tyres are slightly outside standard balance limits and are corrected before issue by attaching special loaded patches to the inside of the covers at the crown. These patches contain no fabric, they do not affect the local stiffness of the tyre and should not be mistaken for repair patches—they are embossed "Balance Adjustment Rubber".

The original degree of balance is not necessarily maintained and it may be affected by uneven tread wear, by cover and tube repairs, by tyre removal and refitting or by wheel damage and eccentricity. The car may also become more sensitive to unbalance due to normal wear of moving parts.

Should roughness or high speed steering troubles develop, and mechanical investigation fails to disclose a possible cause, wheel and tyre balance should be suspected.

A tyre balancing machine is marketed by the Dunlop Company to enable service stations to deal with such cases.

Dynamic Balance

Static unbalance, as its name implies, can be measured when the tyre and wheel assembly is stationary. There is, however, another form known as dynamic unbalance which can be detected only when the assembly is revolving.

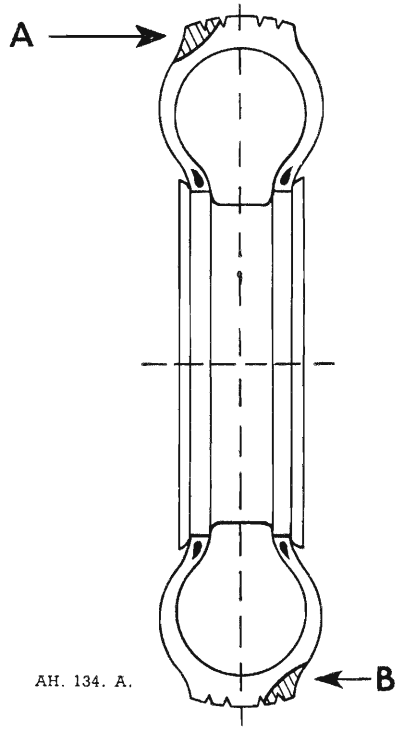


Fig. N.19. Dynamic or couple unbalance, produces wear at 'A' and 'B'.

There may be no heavy spot—that is, there may be no natural tendency for the assembly to rotate about its centre due to gravity—but the weight may be unevenly distributed each side of the tyre centre line, see Fig. N.19.

Laterally eccentric wheels give the same effect. During rotation the offset weight distribution sets up a rotating couple which tends to steer the wheel to right and left alternately.

Dynamic unbalance of tyre and wheel assemblies can be measured on the Dunlop tyre balancing machine and suitable corrections made when a car shows sensitivity to this form of unbalance. Where it is clear that a damaged wheel is the primary cause of severe unbalance it is advisable for the wheel to be replaced.

Changing Position of Tyres

Reference has already been made to irregular tread wear which is confined almost entirely to front tyres and there may be different rates of wear between one tyre and another.

It is, therefore, recommended that front tyres be interchanged with rear tyres at least every 3,000 miles. Diagonal interchanging between near-side front and off-side rear and between off-side front and near-side rear provides the most satisfactory first change because it reverses the direction of rotation.

Subsequent interchanging of front and rear tyres should be as indicated by the appearance of the tyres, with the object of keeping the wear of all tyres even and uniform.

Wheel Wobble: The lateral variation measured on the vertical inside face of a flange should not exceed $\frac{3}{32}$ in. (2·3812 mm.).

Wheel Lift: On a truly mounted and revolving wheel the difference between the high and low points, measured at any location on either tyre bead seat, should not exceed $\frac{3}{32}$ in. (2·3812 mm.).

Radial and lateral eccentricity outside these limits contribute to static and dynamic unbalance respectively. Severe radial eccentricity also imposes intermittent loading on the tyre. Static balancing does not correct this condition which can be an aggravating factor in the development of irregular wear.

A wheel which is eccentric laterally will cause the tyre to snake on the road, but this in itself has no effect on the rate of tread wear.

At the same time undue lateral eccentricity is undesirable and it affects dynamic balance.

Rim seatings and flanges in contact with the tyre beads should be free from rust and dirt.

Section N.6

LIFTING GEAR

Car Jack

A Smith's "Steadylift" jack (Fig. N.20) is supplied with the car, which can be operated from either side, thus enabling either right or left side to be raised completely.

Before jacking up the car first apply the handbrake and if necessary (car on a gradient) chock one of the

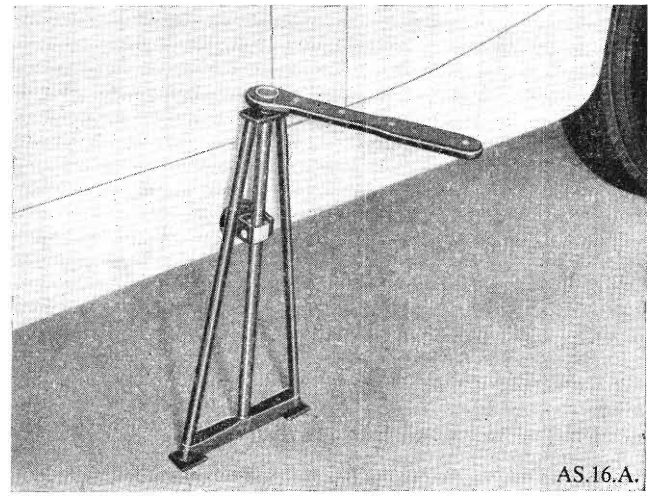


Fig. N.20 The Car Jack.

wheels on the opposite side to that requiring attention. Insert the jack lug into the socket provided under the car.

Ensure that the lug is fully engaged in the socket and that the base has a firm footing on the ground, before commencing to wind the screw clockwise with the aid of the ratchet spanner.

Immediately the car is felt to lift, recheck that the lug is correctly located within its socket.

Naturally, to lower the car the jack screw must be turned in an anti-clockwise direction.

Section N.7 FAULT DIAGNOSIS

Symptom	No.	Possible Fault
(a) Wheel and tyre noises	1	Wheel nuts loose or drawn up unevenly
	2	Variation in tyre tread surface (due to repaired section or break in the tyre)
	3	Foreign object embedded in the tyre tread
	4	Tyres under-inflated
(b) Abnormal tyre wear	1	Tyres consistently under-inflated
	2	Wheel nuts drawn up unevenly
	3	Front and rear axles not parallel, resulting from a broken spring centre bolt, or 'U' bolt, allowing the axle to move on the spring
	4	Misalignment of the front wheels
	5	Brakes improperly adjusted