SECTION K

THE ROAD WHEELS and TYRES

THE ROADWHEEL

THE TYRES

THE ROADWHEEL

RIM TYPE

RUBERY OWEN 4J x 15" C.2546.

PRESSED STEEL WHEEL RIMS.

S.M.M. and T. standard tolerances are as follows:-

(a) WOBBLE

The lateral variation measured on a vertical inside face of the flange shall not exceed 0.080" (2.032 mm.).

(b) LIFT

On a truly mounted and revolving wheel the difference between the high and low spots, measured at any location on either tyre bead seat, shall not exceed 0.080" (2.032 mm.).

Lateral or radial eccentricity outside these limits contribute to dynamic and static unbalance respectively.

A roadwheel rim 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 but undue lateral eccentricity is undesirable as it effects dynamic balance.

Severe radial eccentricity also imposes intermittent loading on the tyre. Static balancing will not correct this condition which can be an aggravating factor in the development of tyre wear.

There is no effective method of truing eccentric pressed steel roadwheel rims economically and they must be replaced.

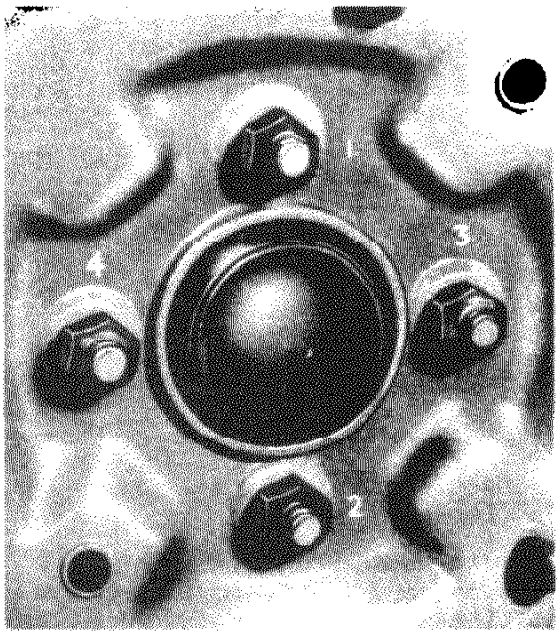

Figure K1.
The Roadwheel nut tightening sequence.

ROADWHEEL NUT TIGHTENING TORQUE

60-65 lbs.ft. (8.295 - 8.987 kgm.)
All nuts have right hand threads.

SECURITY OF ROADWHEELS Fig. K1.

The security of the roadwheels should be checked periodically. Ensure that the hand-brake is hard on and tighten the nuts by diagonal selection. All roadwheel nuts have right hand threads.

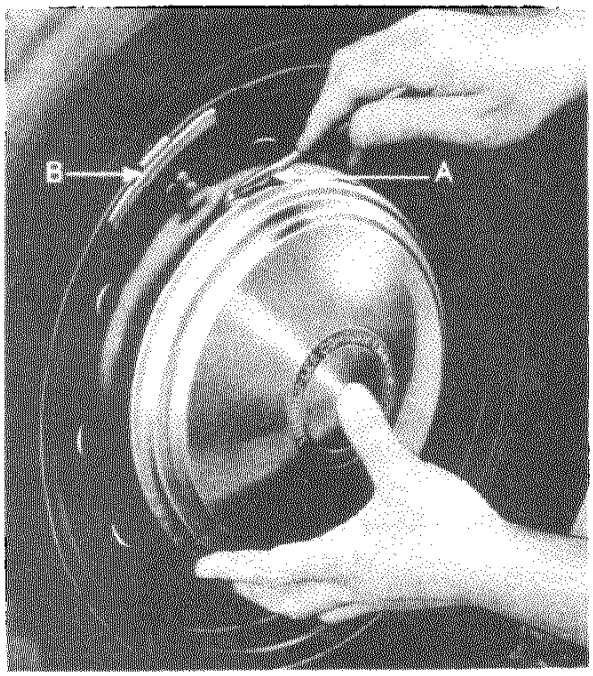

Figure K2.
The hub cap being removed.

A. Hub cap removal lever.
B. Roadwheel balance weight.

REMOVAL AND REPLACEMENT
HUB CAP Fig. K2.

1. REMOVAL

Insert the short end of the "L" shaped lever provided under the rim of the hub cap at a point adjacent to the tyre valve and prise off the hub cap.

2. REPLACEMENT

Fit the hub cap by positioning the rim over two of its three studs. Give the hub cap a punch with a clenched fist adjacent to the third stud so that it springs over the remaining stud.

A smear of grease around its inside edge and on the three studs greatly facilitates its replacement.

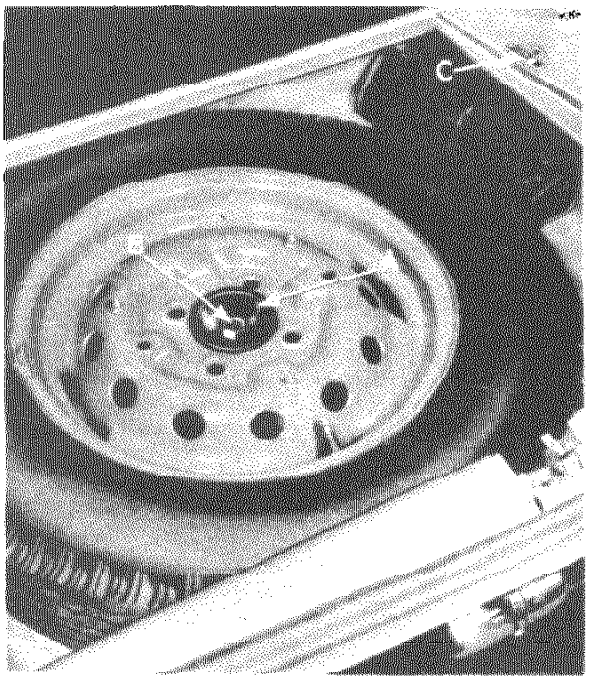

Figure K3.
The sparewheel stowage

A. Fixing bolt.
B. Cup washer.
C. Turn buckle.

REMOVAL AND REPLACEMENT
SPARE WHEEL Fig. K3.

1. REMOVAL

Open the luggage boot of the car and remove the false floor by releasing the turn buckles. Lift out the roadwheel by withdrawing the bolt and cup washer.

2. REPLACEMENT

The replacement of the roadwheel is the reversal of the removal sequence.

To facilitate the checking of the tyre pressure it is an advantage to position the valve to the rear of the compartment.

REMOVAL AND REPLACEMENT
ROADWHEEL Fig. K1.

1. REMOVAL

Fit the jack to the chassis frame and take the weight of the car without lifting the roadwheel from the ground, remove the hub cap and slacken the wheel nuts no more than half a turn. Raise the car so that the roadwheel is clear of the ground. remove the roadwheel by detaching the wheel nuts.

2. REPLACEMENT

Fit the replacement roadwheel and tighten the wheel nuts; lower the car to the ground and then tighten the wheel nuts for a second time by diagonal selection, replace the hub cap.

CHANGING THE STATION OF ROADWHEELS

Changing the station of the roadwheels will avoid undue wear falling on any one tyre and it is suggested that roadwheels and tyres are interchanged in the following sequence.

(i) Fit the spare wheel to the R.H. rear station.

(ii) Fit the R.H. rear wheel to the L.H. front station.

(iii) Fit the L.H. front wheel to the R.H. front station.

(iv) Fit the R.H. front wheel to the L.H. rear station.

(v) Place the L.H. rear wheel in the spare wheel compartment.

It will be noted that not only are the stations of the wheels and tyres interchanged but also the direction of rotation is reversed.

THE ROADWHEEL BALANCE

1. STATIC BALANCE

In the interests of smooth riding, precise steering and the avoidance of high speed "tramp" or "wheelhop" all the Dunlop Road Speed tyres are balance checked to pre-determined limits. To ensure the best degree of tyre balance the casings are marked with white spots on one bead and these indicate the lightest portion of the casing. The inner tube is marked on its base by green spots at its heaviest spot. By fitting the tyre so that both sets of marks coincide, a high degree of casing and inner tube balance is achieved. When using inner tubes which do not have the green spots it is advantageous to fit the valve assembly to the marks on the casing.

The original degree of balance can be lost during the life of the tyre when the latter is affected by uneven tread wear, by casing and inner tube repairs, by tyre removal and replacement or by wheel damage and eccentricity. The car may also become more sensitive to unbalance due to normal wear of moving parts. If roughness or high speed steering troubles develop and mechanical investigation fails to disclose a possible cause, the roadwheel must be balanced on a propriety fixture. Static unbalance is corrected by having the roadwheel freely mounted, whereupon the heaviest side will sink to the bottom and is corrected by clipping on a weight to the light side which is diagonally opposite.

2. DYNAMIC BALANCE

The second type of roadwheel unbalance is known as dynamic unbalance and it can only be detected when the roadwheel is revolving. There may be no heavy spot, i.e., there will be no tendency for the roadwheel to rotate about its own centre due to gravity; but the weight may be unevenly distributed each side of the tyres centre line, laterally eccentric rims will give the same effect. During rotation the offset weight distribution sets up a rotating couple which tends to steer the roadwheel alternately to left and to right. Dynamic balancing is usually carried out after the static unbalance has been corrected as in certain instances the addition of the "static balance weight" can produce dynamic unbalance. This balancing can only be effected by specialized equipment handled by a knowledgeable operator.

THE BALANCE WEIGHTS Fig. K2.

The fitting of one or more balance weights to the roadwheel is quite normal and to effect good balancing they may be fitted to either or both sides of the roadwheel rim. They should not in normal circumstances be removed as the balance of the roadwheel will be destroyed. The balance of the roadwheel can be largely preserved during a puncture repair by identifying the positions of the tyre, roadwheel rim and balance weights, after repair fitting all these components to their original positions.

BALANCING A ROADWHEEL
STATIC BALANCE ONLY.

Having returned from a journey is the most opportune time to statically balance the roadwheel as the whole assembly will be warm and assist the balancing operation.

Jack up the front roadwheel to be balanced and ensure that the roadwheel spins freely by pushing the brake pad off the brake disc. Spin the roadwheel and allow it to come to rest, mark the bottom most portion with chalk and fit a balance weight to the roadwheel rim diametrically opposite the chalk mark and make a further spin. When the same point sinks to the bottom, a heavier weight is required; if the weight sinks to the bottom it is too heavy and a lesser one must be fitted. Proceed until perfection is attained. When the weight added is greater than 2 ozs; two weights, each half the weight of the single original, are now selected and fitted to the roadwheel rim in the same relative position but one on the inside and one on the outside of the roadwheel rim.

THE TYRES

TYRE SIZE 5.90 - 15.

TYRE RUNNING PRESSURES (COLD)

	English	Metric
NORMAL MOTORING	FRONT 22.P.S.1.	1.547 k.s.cm.
	REAR 24.P.S.1.	1.687 k.s.cm.
HIGH SPEED MOTORING	FRONT 28.P.S.1.	1.969 k.s.cm.
	REAR 30.P.S.1.	2.109 k.s.cm.

NOTE: The tyre manufacturer or their representative should be consulted when entering high speed sporting events.

The importance of maintaining the correct tyre running pressure cannot be over emphasized and the check must be effected when the tyres are COLD, such as after standing overnight and NOT when they have attained their running temperature.

Tyres lose air pressure, even when in sound condition, due to chemical diffusion of the compressed air through the walls of the inner tube. This rate of loss in a sound car tyre is usually between 1 and 3 P.S.1 (0.211 k.s.cm.) per week, which averages more than 10% of the total initial pressure. For this reason and with the additional purpose of detecting punctures, tyre pressures should be checked with a reliable tyre gauge not less than once a week.

TYPE OF TYRE

Owing to the high speed and fast acceleration of the car, Dunlop Road Speed Tyres are fitted as original standard equipment. No change of tyre type should be made when replacements are being chosen.

CARE OF TYRES

The following precautions should always be observed:

(i) Avoid over or under inflation.

(ii) Avoid striking kerbs or similarly defined obstructions.

(iii) Remove promptly any object embedded in the tyre.

(iv) Have tyre damage repaired immediately.

(v) Regularly change the stations of roadwheel and tyres.

(vi) Check the front suspension geometry, steering and front hub assemblies for mechanical irregularities.

THE VALVE CORES AND CAPS

It is a wise precaution to renew the valve cores and caps, particularly when their rubber seals have become damaged after constant use as this is the valves second seal.

CONSTRUCTION OF THE TYRE

One of the principal functions of the tyre is to eliminate high frequency vibrations. They do this by virtue of the fact that the unsprung mass of each tyre, the part of the tyre in contact with the ground, is very small.

Tyres must be flexible and responsive. They must also be strong and tough to contain air pressure, resist damage, give long mileage, transmit driving and braking forces and at the same time provide road grip, stability and good steering properties.

Strength and resistance to wear are achieved by building the casing from several layers of fabric, secured at the rim position by wire bead cores and then adding a tough rubber tread.

Part of the work done in deflecting the tyres on a moving car is converted into heat within the tyres. Rubber and fabric are poor conductors and so internal heat is not easily dissipated. Excessive heat weakens the tyre structure and reduces the resistance of the tread to abrasion by the road surface.

Heat generation, comfort, stability, power consumption, rate of tread wear, steering properties and other factors affecting the performance of the tyres and car are associated with the degree of tyre deflection. By observing the tyre pressure recommendations, the owner will obtain the best results from both his tyres and the car.

TYRE EXAMINATION

Tyres submitted for servicing should be examined for:-

Inflation pressures.
Misalignment.
Cuts and penetrations.
Small objects embedded in the tread.
Impact bruises.
Oil or grease.
Contact with steering rods, body or chassis parts.

Oil and grease should be removed with the sparing use of petrol, and then washed with soap and water.

When oil or grease on the tyres are the results of over or defective lubrication the cause of the inconvenience must be stopped.

REPAIR OF CASING INJURIES

Minor injuries confined to the rubber tread, such as from small pieces of glass or road dressing material, require no attention after the removal of the object.

More severe tread cuts and wall damage particularly when penetrating to the outer ply of the fabric casing require vulcanised repairs.

Injuries which extend into or through the fabric casing, seriously weaken the tyre. A satisfactory repair necessitates new fabric being built in and vulcanised by a tyre repair specialist or by the tyre manufacturer.

Clean nail holes do not necessitate any cover repairs. When the nail has penetrated the cover the hole should be sealed by a tube patch adhered to the inside of the casing, this will protect the inner tube from chafing.

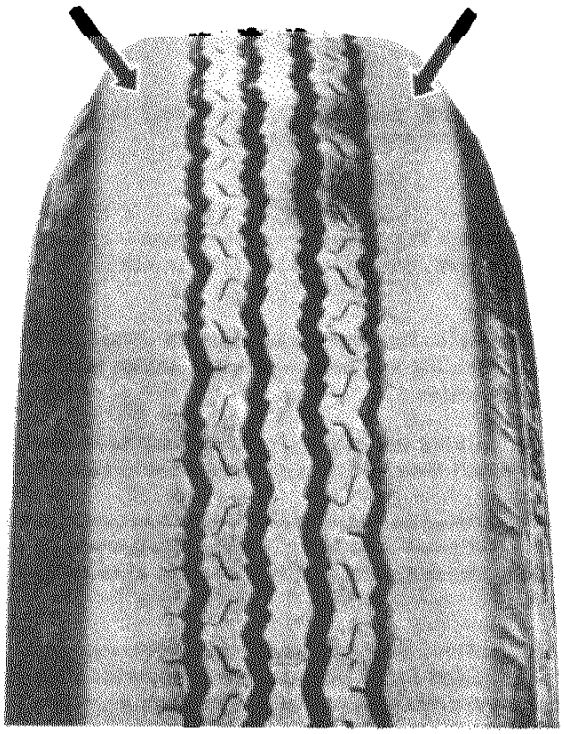

Figure K4.
The tread wear due to under-inflation.

FACTORS AFFECTING TYRE LIFE AND PERFORMANCE

1. INFLATION PRESSURES
Figs. K4 and K5.

There is an average loss of 13% tread mileage for every 10% reduction in inflation pressures below the recommended figure. Moderate under-inflation causes an increased rate of tyre wear although the tyres appearance seems to remain unchanged. Severe and persistent under-inflation produces unmistakable evidence on the tread, i.e., increased wear on the two outside edges; it causes over heating structural failure due to excessive friction within the casing.

Inflation pressures which are higher than those recommended often 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.

2. EFFECT OF TEMPERATURE

Air expands with heating so tyre pressures will increase as they warm up, they increase more in hot weather than in cold. Inflation pressures of warm tyres must NOT be reduced to the standard pressures specified for cold tyres.

3. SPEED AND BRAKING

Rapid acceleration and harsh braking causing the roadwheels to spin or to become locked and "scruffing" or "thrash" from irregular road surfaces are more pronounced during these two conditions.

4. CLIMATIC CONDITIONS

The rate of tread wear during a reasonably dry and warm period can be twice as great as during a wet and cool period. Water is a rubber lubricant and tread abrasion is much less on a wet road than on dry roads. Also the resistance of the tread to abrasion decreases with a rise in temperature. Increased abrasion on dry roads plus the increased temperatures of both the tyres and roads cause faster tyre wear during hot periods. For the same reasons tyre wear is faster during dry years with little rainfall than during wet years. 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, accelerating and braking are greater than when the tyre is part worn. High tyre mileage will no doubt, result if new tyres could be fitted when the wet and cooler period approaches rather than when the dry and hot period approaches. As mentioned earlier, water is a rubber lubricant and it would be an advantage to have the thicker tread in order to offer more resistance to penetrations.

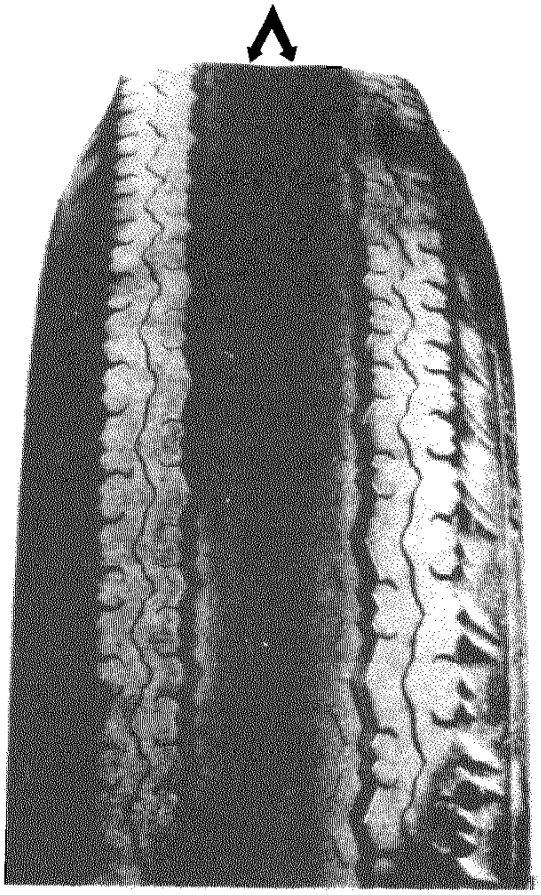

Figure K5. (Left).
Tread wear due to over-inflation.

5. ROAD SURFACE

The extent to which road surfaces affect tyre wear is not always realised. Road surfaces vary widely between one part of the country and another, often due to surfacing with local material. The material can be comparatively harmless rounded gravel, more abrasive crushed granite or knife edge flint, sometimes of small mesh and often of large mesh. Examples of surfaces providing slow tyre wear are smooth stone setts and wooden block, long since disappeared because of their non-skid properties are very low. Road camber is a serious factor in tyre wear and is detailed later. An analysis of tyre wear must include road conditions.

6. IMPACT FRACTURES

In order to provide all the necessities of a good tyre, it must have a certain thickness and stiffness. Excessive and local distortion such as might result from striking a kerb or brick, an upstanding manhole cover or a deep pothole may fracture the casing cords. Impact fractures often puzzle the car owner because the tyre and road spring may absorb the impact without him being aware of anything unusual. Only one or two casing cords may have been fractured by the blow but the tyre may not fail until some time later and there is usually no clear evidence on the outside of the tyre unless the object was sharp enough to cut it. This damage is not associated with speed and care should be exercised at all times, particularly when drawing up to the kerbside or parking against one.

SPECIAL TYPES OF IRREGULAR TREAD WEAR

1. SPOTTY WEAR Fig. K6.

Spotty wear is where a small area of the tyre has worn away and develops more often on front tyres and particularly the front tyre on the opposite side to the driver's seat. The causes are difficult to diagnose although evidence of camber wear, wheel misalignment, under-inflation or brake troubles may be present. Front tyres are at a disadvantage due to their fore and aft slip and distortion being in one direction. Front tyres are connected to the car through swivelling stub axles and jointed steering linkage and they are subjected to complicated movements resulting from steering, spring deflection, braking and camber. Load transference during braking causes increased loading and pattern displacement on front tyres and adds to the severity of front tyre operation. Unbalance of the rotating assembly may also contribute to a special form of irregular wear with one half of the tyres circumference more worn than the other half. Unbalance alone does not cause "Spotty" wear but the unbalance usually becomes progressively worse as the irregular or unequal wear develops. The nature of "Spotty" wear ; the pattern being much worn and little worn at irregular spacings round the circumference - indicates an alternating "strip-grip" phenomenon but it is seldom possible to associate its origin and development with any single cause. It is preferable to check all points which may be contributory factors. The front tyre and front 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.

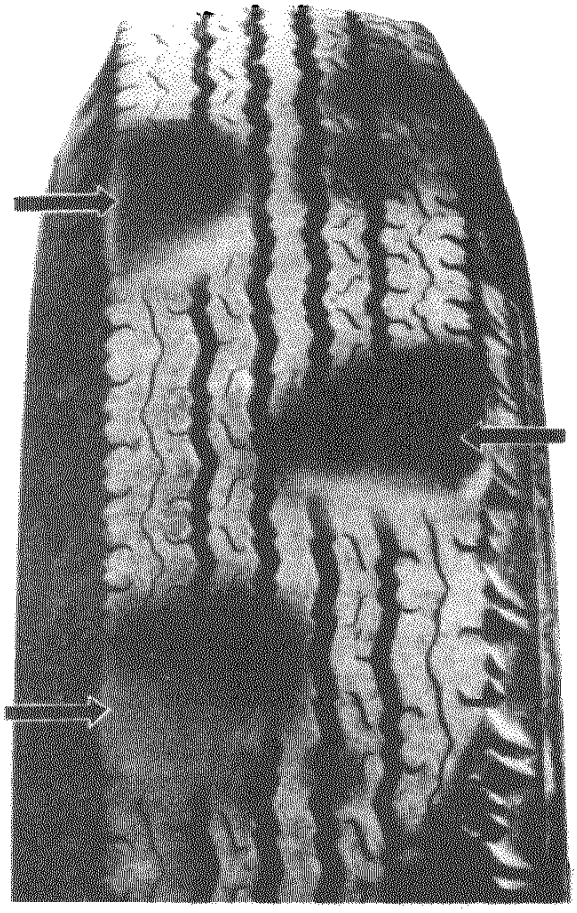

Figure K6
Spotty type tread wear.

Points for checking are:-

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

(b) Brake freedom, disc condition and truth.

(c) Front wheel alignment.

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

(e) Side play in hub bearings, vertical link bearings, suspension bearings and steering joints.

(f) Wheel concentricity at the tyre bead seats S.M.M. & T. tolerances provide a radial throw not exceeding 0.080" but this may be affected by impact or other damage.

(g) Static and dynamic balance of wheel and tyre assemblies.

(h) Condition of road springs and shock absorbers.

Corrections that may follow a check of these points will not always effect a complete cure and it may be necessary to continue to interchange wheel stations and reverse directions of rotations at suitable time intervals. Irregular wear may be inherent in local road conditions such as from a combination of steep camber, abrasive surfaces, frequent hills and bends. Driving methods may also be involved and irregular wear is more likely to be more prevalent in hot-dry weather than cold wet weather, particularly on new or little worn tyres.

2. WHEEL ALIGNMENT AND ITS ASSOCIATION WITH ROAD CAMBER CONDITIONS

It is very important that the correct wheel alignment should be maintained. Misalignment causes the tread to be scrubbed off laterally because the natural direction of the wheel differs from that of the car. An upstanding sharp "fin" on the edge of each rib pattern is a positive sign of misalignment and it is possible to determine from the position of the "fins" whether the wheels are "toed in" or "toed out". "Fins" on the inside of the pattern ribs, nearest the centre line of the car and particularly on the tyre opposite to the driver, indicate "toe in" and "fins" on the outside edge of the pattern ribs, particularly on the tyre on the driver's side, indicate "toe out". The "finning" is less noticeable with minor misalignment and the sharp pattern edges may be caused by roadwheel camber even when the wheel alignment is correct. In such instances it is better to check the wheel alignment with an alignment gauge.

Road camber affects the direction of the car by imposing a side thrust and if left to follow its natural cause the car will drift down the camber, this is of course corrected by

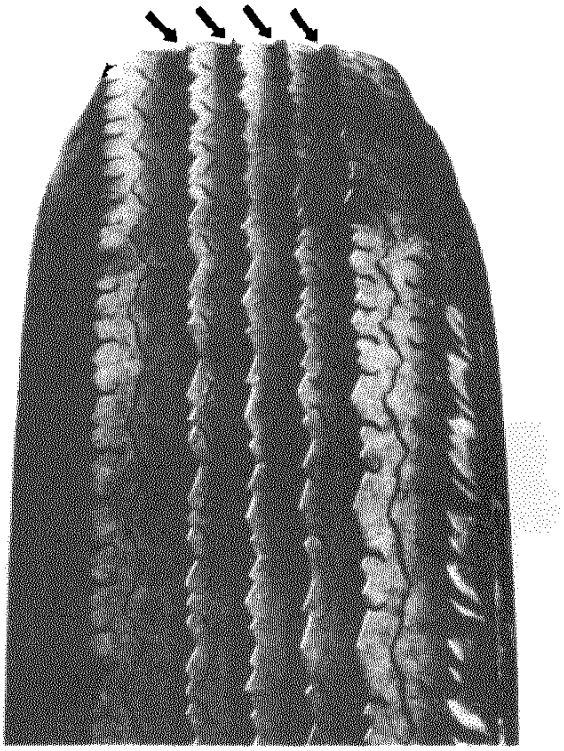

Figure K7 (Left)
The tread wear of a R.H. front casing due to excessive "toe out".

steering toward the road centre and as a result the car travels crabwise. By observing the diaphragm it will be realised why the front tyre away from the road centre line is very sensitive to too much "toe in" and the tyres nearer the road centre line to too much "toe out". It will also be seen why sharp "fins" may only appear on one tyre and why the direction of misalignment can be determined by noting the position of the "fins". Naturally very severe misalignment will produce unmistakable evidence on both tyres.

The front tyres on a moving car should run parallel but even in this condition the tyres are misaligned with the cars direction but there is less tendency for the wear to be concentrated on any one tyre. The front tyre on the opposite side to the driver sometimes persists in wearing faster and more unevenly than the remainder even when the mechanical condition of the car and its tyre maintenance are satisfactory. The more severe the road camber the more marked this tendency will become and the necessity of regular changing of the roadwheel stations.

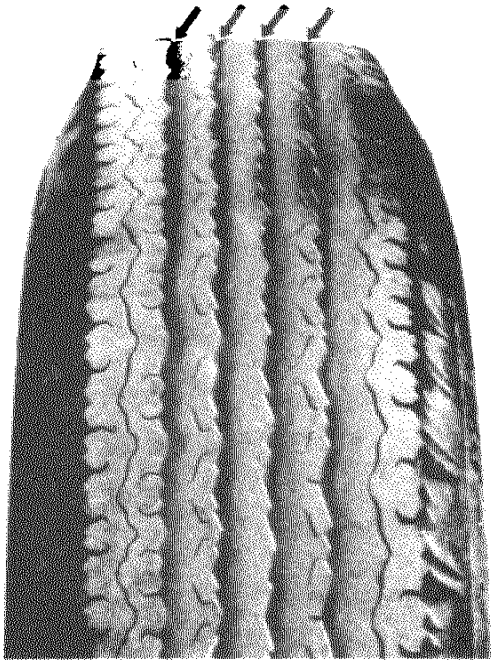

Figure K8 (Left)
Tread wear of a R.H. front casing due to excessive "toe in".

3. CAMBER, CASTOR AND KING PIN INCLINATION ANGLES. Fig. K9.

Roadwheel camber, usually combined with road camber, cause the roadwheel to attempt to turn toward the direction of lean, due to one side of the tyre tread attempting to make more revolutions per mile or kilometre than the other side of the tread. The resulting increased tread shuffle on the road surface and the off centre tyre loading tend to cause rapid and one sided wear; and if the road wheel camber is excessive for any reason, the rapid and one sided tyre wear will be correspondingly greater. Unequal camber of the two road wheels introduces unbalanced forces which try to steer the car one way or the other and this must be

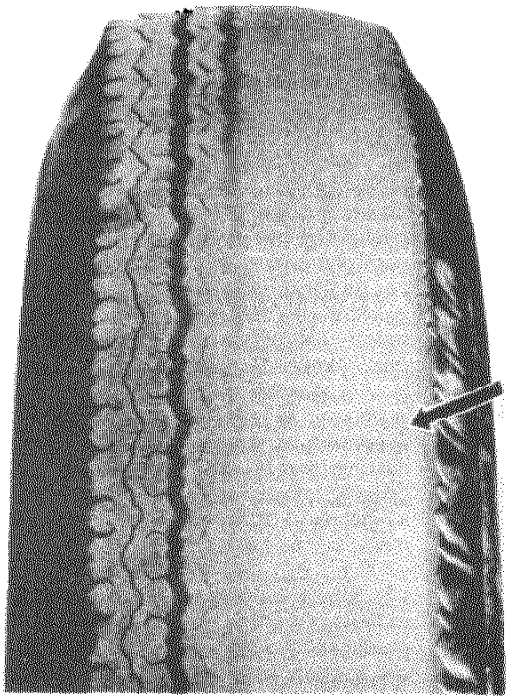

Figure K9 (Left)
The tread wear of a R.H. front casing due to excessive camber.

corrected by steering in the opposite direction which results in still faster tyre wear. If the tyre wear results from too much camber due solely to road conditions little can be done apart from interchanging or removing the tyres from the rim and reversing them. This action will prevent one sided wear, irregular wear and fast wear from developing to a maximum degree on any one tyre, usually the front tyre on the opposite side of the driver.

Castor and king pin inclination have no direct relationship with tyre wear.