Service Instruction Manual

Fourth Issue

STANDARD VANGUARD

SERIES I AND II
and
TRIUMPH "RENOWN" MODELS

WHEELS AND TYRES

SECTION L

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THE STANDARD MOTOR COMPANY LTD., COVENTRY

WHEELS AND TYRES

INDEX

ILLUSTRATIONS

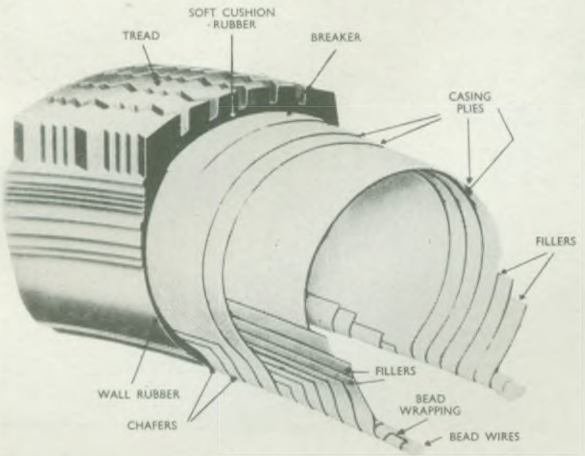

Fig. 1. Construction of tyre

One of the principal functions of the tyres fitted to a car 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 the 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 plies of cord fabric, secured at the rim position by wire bead cores, and adding a tough rubber tread (Fig. 1).

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 internal heat is not easily dissipated. Excessive temperature 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. All tyres are designed to run ~~at predetermined~~ deflections, depending upon their size and purpose.

Load and pressure schedules are published by all tyre makers and are based on the correct relationship between tyre deflection, tyre size, load carried and inflation pressure. By following the recommendations the owner will obtain the best results both from the tyres and the car.

Inflation pressures. (Fully laden condition.)

	Tyre Section	FRONT	REAR Lb./sq. in.	REAR Kg./sq. cm.
	5.50		28	1.95
Saloon	5.75	24	26	1.85
(as fitted)	6.00	Lb./sq.in.	26	1.85
	5.50		28	1.95
Estate Car	5.75	1.7	28	1.95
	6.00	Kg./sq.cm.	26	1.85
Pick-up Truck	6.00		30	2.1
Delivery Van	6.00		30	2.1

Note.—Pressures should be checked when the tyres are cold, such as after standing overnight, and not when they have attained normal running temperatures.

Tyres lose pressure, even when in good condition, due to a chemical diffusion of the compressed air through the tube walls. The rate of loss in a sound car tyre is usually between 1 lb. and 3 lb. per week, which may average 10% of the total initial pressure.

For this reason, and with the additional purpose of detecting slow punctures, *pressures should be checked with a tyre gauge applied to the valve not less often than once per week.*

Any unusual pressure loss should be investigated. After making sure that the valve is not leaking the tube should be removed for a water test.

Do not overinflate, and do not reduce pressures which have increased owing to increased temperature. (See Section "Factors Affecting Tyre Life and Performance.")

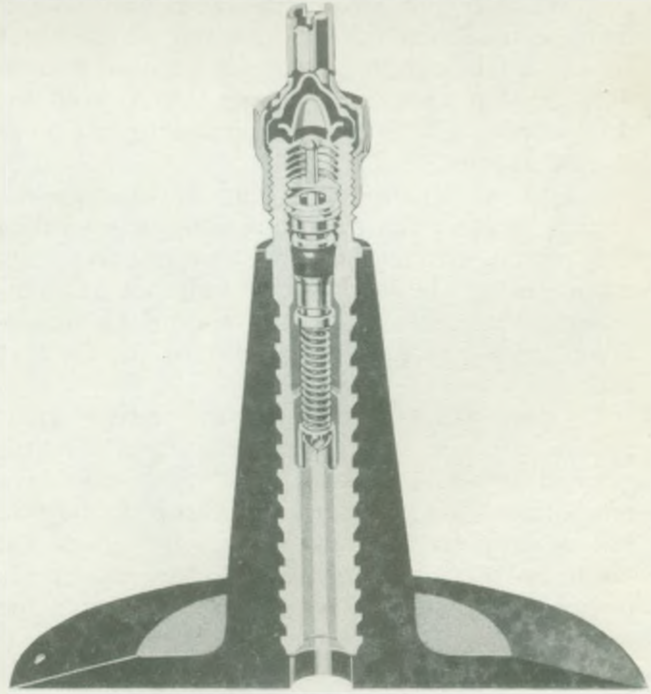

Fig. 2 Valve and cap in section

Valve cores and caps. (Fig. 2)

Valve cores are inexpensive and it is a wise precaution to renew them periodically.

Valve caps should always be fitted, and renewed when the rubber seatings have become damaged after constant use.

Tyre examination.

Tyres on cars submitted for servicing should be examined for :—

Inflation pressures.
Degree and regularity of tread wear.
Misalignment.
Cuts and penetrations.
Small objects embedded in the treads, such as flints and nails.
Impact bruises.
Kerb damage on walls and shoulders.
Oil and grease.
Contact with the car.

Oil and grease should be removed by using petrol sparingly. Paraffin is not sufficiently volatile and is not recommended.

If oil or grease on the tyres results from over-lubrication or defective oil seals suitable correction should be made.

Repair of injuries.

Minor injuries confined to the tread rubber, such as from small pieces of glass or road dressing material, require no attention other than the removal of the objects. Cold filling compound or " stopping " is unnecessary in such cases.

More severe tread cuts and wall rubber damage, particularly if they penetrate to the outer ply of the fabric casing, require vulcanized repairs. The Dunlop Spot Vulcanizing Unit is sold for this purpose and it is also suitable for all types of tube repairs.

Injuries which extend into or through the casing, except clean nail holes, seriously weaken the tyre. Satisfactory repair necessitates new fabric being built in and vulcanized. This requires expensive plant and should be undertaken by a tyre repair specialist or by the tyre maker.

Loose gaiters and " stick-in " fabric repair patches are not satisfactory substitutes for vulcanized repairs and should be used only as a temporary " get-you-home " measure if the tyre has any appreciable tread remaining. They can often be used successfully in tyres which are nearly worn out and which are not worth the cost of vulcanized repairs.

Clean nail holes do not necessitate cover

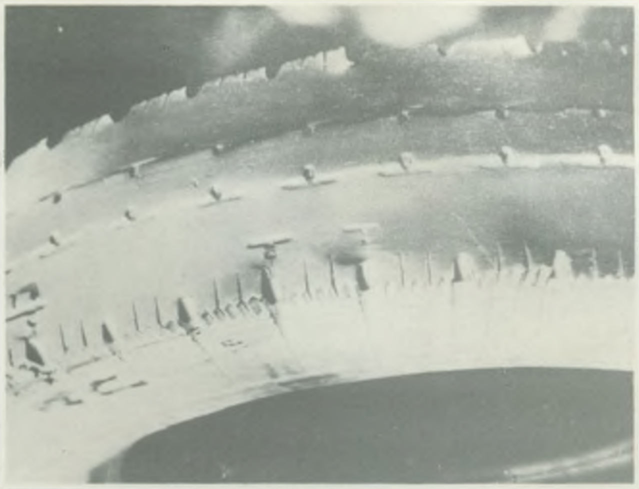

Fig. 3. The effect of persistent under-inflation on tyre tread

repairs. If a nail has penetrated the cover the hole should be sealed by a tube patch attached to the inside of the casing. This will protect the tube from possible chafing at that point.

If nail holes are not clean, and particularly if frayed or fractured cords are visible inside the tyre, expert advice should be sought.

FACTORS AFFECTING TYRE LIFE AND PERFORMANCE

Inflation pressures.

Other things being equal there is an average loss of 13% tread mileage for every 10% reduction in inflation pressure below the recommended figure.

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

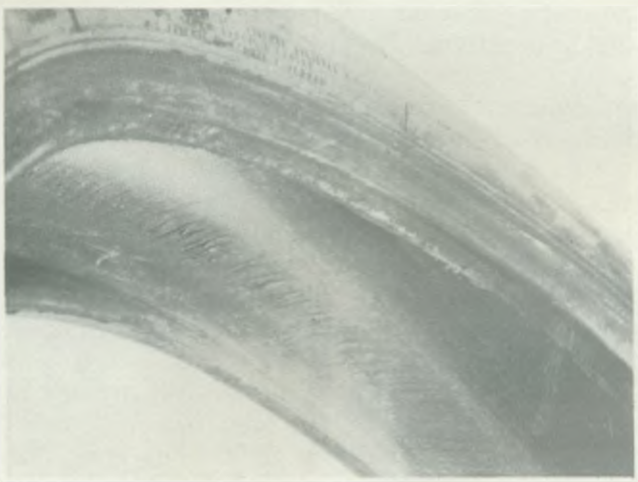

Fig. 4. Internal view showing the partial destruction of the ply body due to under-inflation

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 (Fig. 3). It also causes structural failure due to excessive friction and temperature within the casing (Figs. 4 and 5).

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. In any event cold tyres should not be inflated to pressures higher than the maximum figure shown on standard Load and Pressure Schedules for the size of tyre involved. Excessive pressures overstrain the casing cords, in addition to causing rapid wear, and the tyres are more susceptible to impact fractures and cuts.

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 the result of high speed. These factors are taken into account when designing the tyre and in preparing Load and Pressure Schedules.

Pressures in warm tyres should not be reduced to standard pressures 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 in 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. 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 unsuitable 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. 6). The braking varies during each wheel revolution as the minor and major axes 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 rate 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. Also the resistance of the tread to abrasion decreases with increase in temperature. Increased abrasion on dry roads, plus increased temperatures of tyres and roads cause faster tyre

Fig. 5. Showing the result of running on a deflated tube. The tube in question was completely destroyed

wear during summer periods. For the same reasons tyre wear is faster during dry years, with comparatively 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, 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 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.

The extent to which road surfaces affect tyre mileage is not always realized.

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 areas the surface dressing is coarser or of larger " mesh " than in 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.

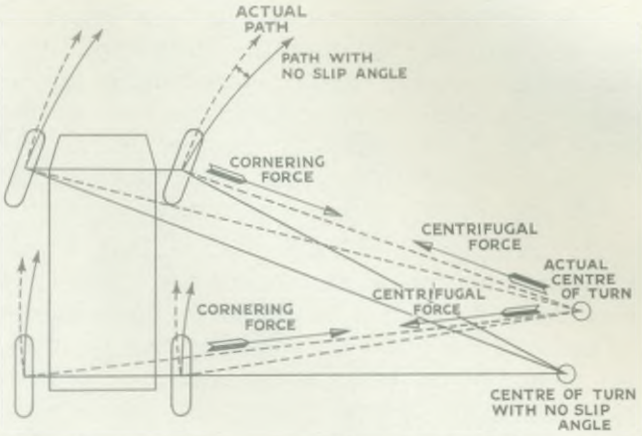

Fig. 7. Diagrammatical illustration of slip angles

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 to the front tyres. The resulting tyre slip and distortion increase the rate of wear according to speed, load, road camber and other factors (Fig. 7).

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

Road camber is a serious factor in tyre wear and the subject is discussed on page 7.

An analysis of tyre performance *must* include road conditions.

Impact fractures.

In order to provide adequate strength, resistance to wear, stability, road grip and other necessary qualities, a tyre has a certain thickness

Fig. 6. Local excessive wear due to brake drum eccentricity

Fig. 8. Impact fracture caused by striking a sharp object such as a brick-end or pavement kerb

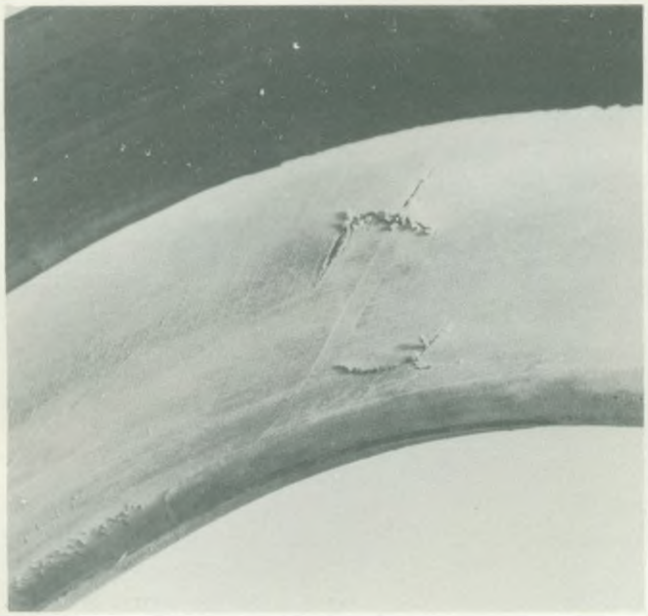

Fig. 9. Typical double fracture

and stiffness. Excessive and sudden local distortion such as might result from striking a kerb, a large stone or brick, an upstanding manhole cover, or a deep pothole may fracture the casing cords (Figs. 8 and 9).

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 ; there is usually 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 or parking against one.

SPECIAL TYPES OF IRREGULAR TREAD WEAR

" Heel and toe " or " saw tooth " wear.

This is the condition where one end of each pattern segment or stud is more worn than the other (Fig. 10). To some extent it is latent in any non-skid pattern design and severe service conditions may cause it to develop.

When each successive portion of a running tyre comes under load the tread is flattened and there is limited pattern distortion and shuffle on the road surface. Additional movement is caused by braking, driving and the tyre's own rolling resistance,which acts as a constant retarding force.

On rear wheels the effects of braking and rolling resistance are offset by the effects of driving. Rear tyres usually wear evenly if they are properly maintained. Front tyres are at a disadvantage in this respect and their pattern displacement tends to be always in the same direction.

Fig. 11 illustrates the basic cause of " heel and toe " wear. If the tyre is assumed to be on a locked wheel and sliding forward, the abrasive road surface may be likened to a file passing across the tread. The manner in which the flexible rubber studs will be worn is clear. There is a similar but less marked effect when the tyre is revolving but trying to " hang back " under the forces of braking and rolling resistance.

Modern tyre patterns designed for use on

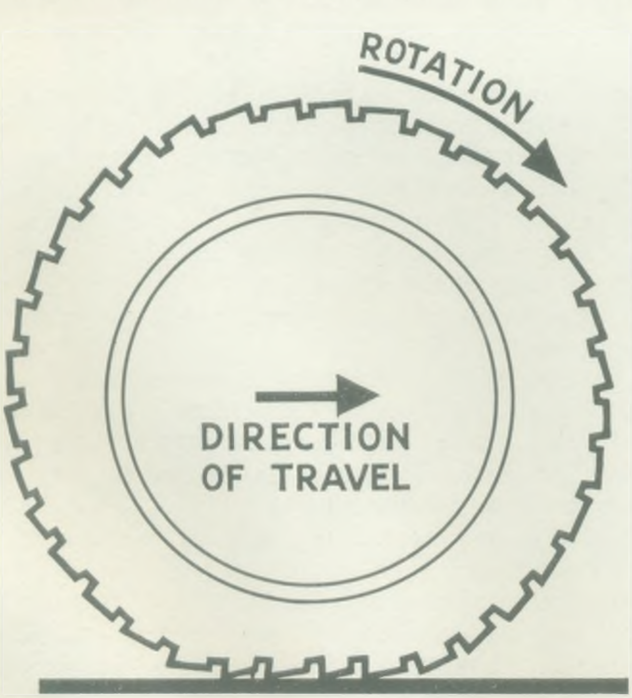

Fig. 10. " Heel and toe " wear

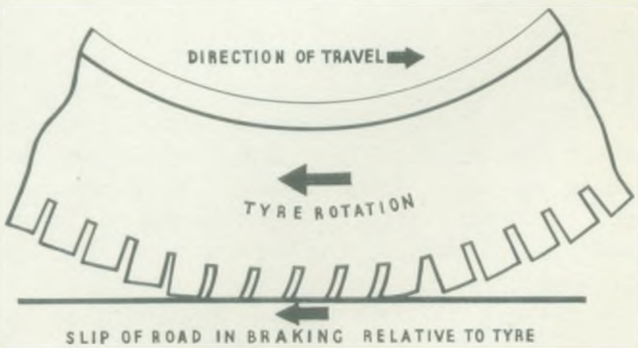

Fig. 11. Showing the effect of braking and rolling resistance on tyre tread

hard road surfaces are very stable. They do not consist of separate unsupported studs or blocks such as are shown in the diagram. In normal conditions " heel and toe " wear should be absent or barely noticeable but any localized forces such as from eccentric brake drums, fierce or binding brakes, incorrect brake balance and severe front braking will usually cause this type of wear to appear amongst other evidence of these troubles. An unsuitable tyre contact area and distribution of load, resulting from road camber, wheel camber, or excessive deflection, will also produce " heel and toe " wear.

Regular interchanging of tyres will prevent or reduce irregular wear (see page 10).

Fig. 12. Irregular spotty wear due to a variety of causes

" Spotty " wear.

Fig. 12 shows a type of irregular wear which sometimes develops on front tyres and particularly on near front tyres. The causes are difficult to diagnose although evidence of camber wear, misalignment, underinflation, or braking troubles may be present.

It has been explained that 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 tyre's circumference more worn than the other half. Unbalance alone does not cause the type of " spotty " wear illustrated 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 spacing round the circumference—indicates an alternating " slip-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 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 :—

(a) Inflation pressures and the consistency with which the pressures are maintained.
(b) Brake freedom and balance, shoe settings, lining condition, drum condition and truth.
(c) Wheel alignment.
(d) Camber or similarity of camber of the front wheels.
(e) Play in hub bearings, king pin bearings, suspension bearings, and steering joints.
(f) Wheel concentricity at the tyre bead seats. S.M.M. & T. tolerances provide for a radial throw not exceeding 0.1", but this may be affected by impact or other damage.
(g) Balance of the wheel and tyre assemblies.
(h) Condition 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.

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 ITS ASSOCIATION WITH 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 sharp " 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 (Fig. 13).

" Fins " on the inside edges of the pattern ribs—nearest to the car—and particularly on the near-side tyre indicate " toe in." " Fins " on the outside edges, particularly on the offside tyre, indicate " toe out."

With minor misalignment the evidence is less noticeable and 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 towards the near side. This is instinctively corrected by steering towards the road centre.

As a result the car runs crab-wise, diagrammatically illustrated in an exaggerated form in Fig. 14. The diagram shows why near-side tyres are very sensitive to too much toe in and offside tyres to toe out. It also shows why sharp " fins " may appear on one tyre, but not on the other, and

Fig. 13. Fin or feathers caused by severe misalignment. This condition is usually associated with " heel and toe " wear across the tread pattern

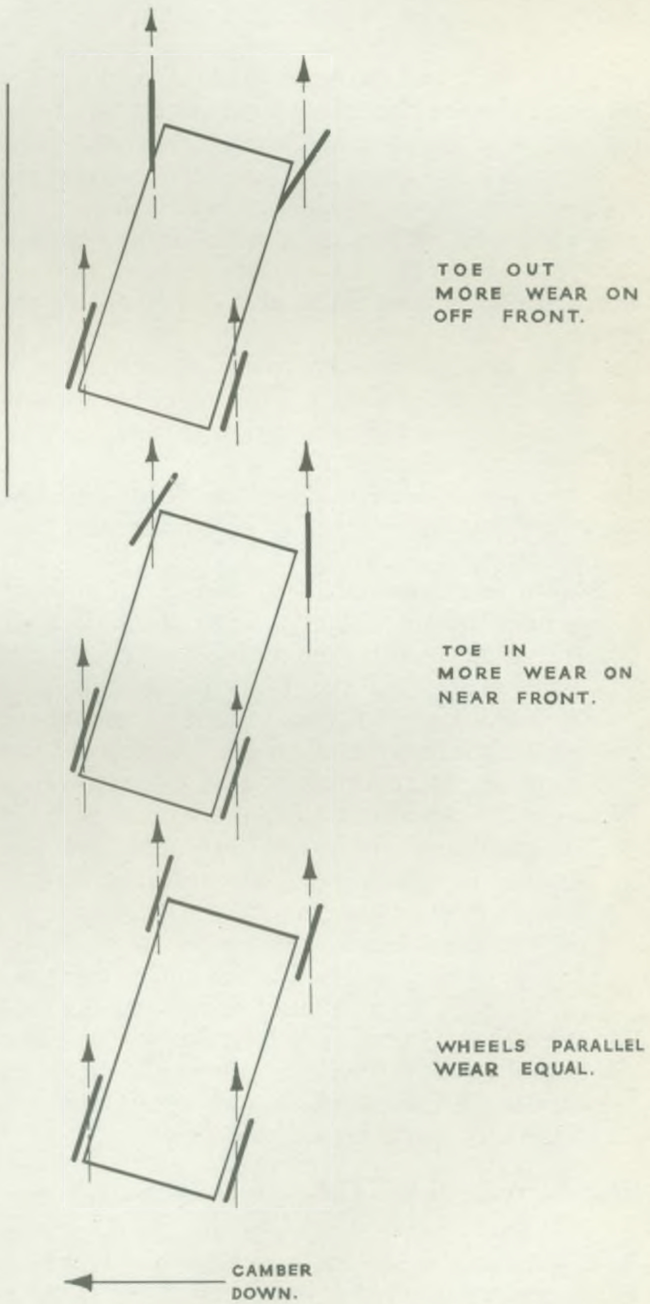

Fig. 14. Exaggerated diagram showing effect of road camber on a car's progress

why the direction of misalignment can be determined by noting the position of the "fins." Severe misalignment produces clear evidence on both tyres.

The front wheels on a moving car should be parallel. Tyre wear can be affected noticeably by quite small variations from this condition. It will be noted from the diagram that even with parallel wheels the car is still out of line with its direction of movement, but there is less tendency for the wear to be concentrated on any one tyre.

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 interchanging of tyres.

Precautions when measuring wheel alignment.

1. The car should have come to rest from a forward movement. This ensures as far as possible that the wheels are in their natural running positions.
2. It is preferable for alignment to be checked with the car laden. (The driver and one passenger.)
3. With conventional base-bar type alignment gauges measurements in front of and behind the wheel centres should be taken at the same points on the tyres or rim flanges. This is achieved by marking the tyres where the first reading is taken and moving the car forwards approximately half a road wheel revolution before taking the second reading at the same points. With the Dunlop Optical Gauge two or three readings should be taken with the car moved forwards to different positions—180° road wheel turn for two readings and 120° for three readings. An average figure should then be calculated. Wheels and tyres vary laterally within their manufacturing tolerances, or as the result of service, and alignment figures obtained without moving the car are unreliable.

CAMBER, CASTOR, AND KING PIN INCLINATION

These angles normally require no attention unless they have been disturbed by a severe impact or abnormal wear of front end bearings. It is always advisable to check them if steering irregularities develop.

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 still faster tread wear.

When tyre wear associated with camber results from road conditions and not from car condition little can be done except to interchange or reverse the tyres. This will prevent one-sided wear, irregular wear, and fast wear from developing to a maximum degree on any one tyre, usually the near front tyre.

Castor and king pin inclination by themselves have no direct bearing on tyre wear but their measurement is often useful for providing a general indication of the condition of the front end geometry and suspension.

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 Dunlop 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. Tubes are marked on the base with black spots at the heaviest point. By fitting the tyre so that the marks on the cover bead exactly coincide with the marks on the tube a high degree of tyre balance is achieved (Fig. 15). When using tubes which do not have the coloured spots it is usually advantageous to fit the covers so that the white spots are 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

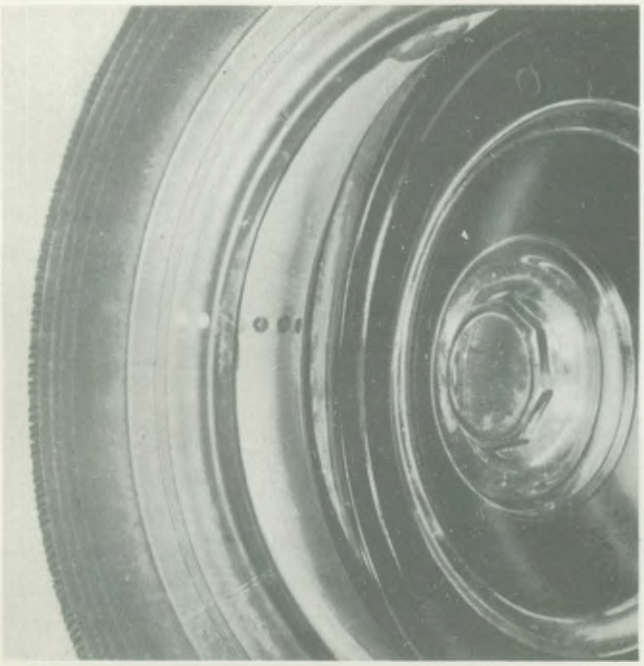

Fig. 15. Showing the correct relation of tyre and cover

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.

If 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. This is shown in Fig. 16.

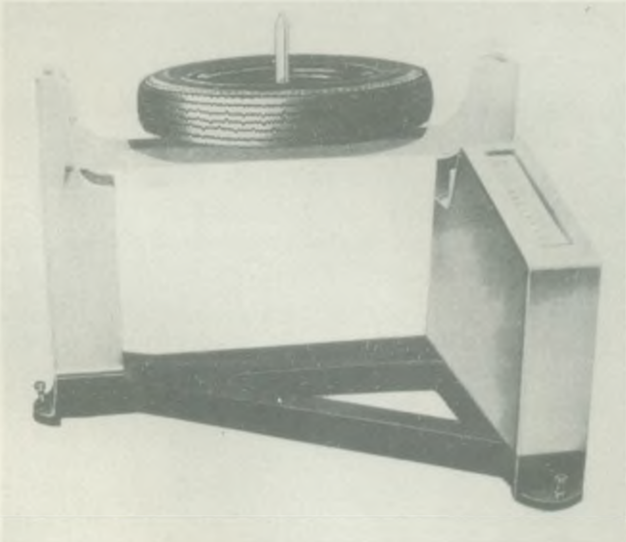

Fig. 16. Dunlop tyre balancing machine

Dynamic balance.

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

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 (Fig. 17). Laterally eccentric

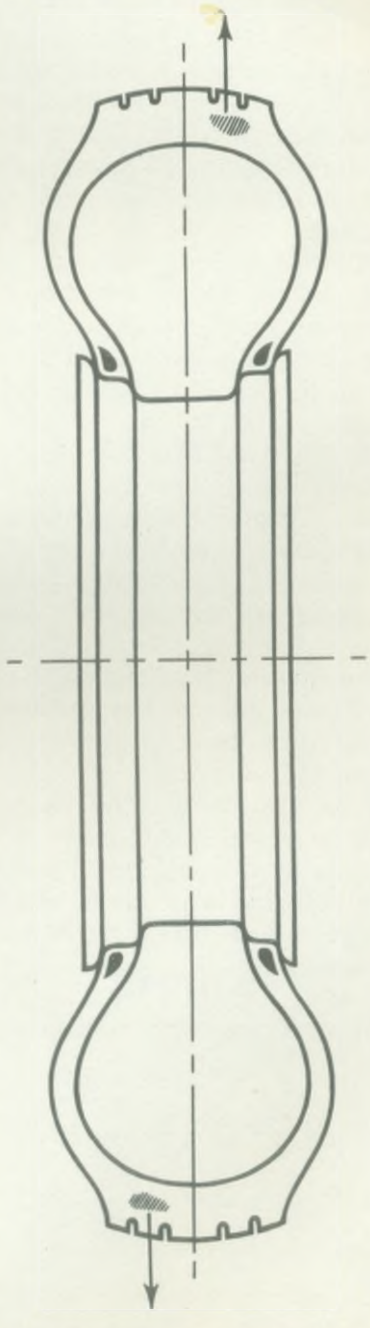

Fig. 17. Dynamic or couple unbalance

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 cars show 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

There have been references to irregular tread wear and different rates of wear between one tyre and another. It has also been stated that irregular wear is confined almost entirely to front tyres and that near front tyres are likely to be more affected than off front tyres.

The causes may lie in road conditions, traffic conditions, driving methods and certain features of design which are essential to the control, steering, and driving of a car. Close attention to inflation pressures and the mechanical condition of the car will not always prevent irregular wear.

It is therefore recommended that front tyres be interchanged with rear tyres at least every 2,000 miles. Diagonal interchanging between near front and off rear and between off front and near rear provides the most satisfactory first change because it reverses the directions 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.

When the car owner undertakes his own interchanging he can avoid moving the whole set at one time by carrying out a series of single exchanges at suitable intervals between the spare wheel and the various running wheels.

WHEELS

S.M.M. & T. standard tolerances are—

Wobble.

The lateral variation measured on the vertical inside face of a flange shall not exceed 0.10″.

Lift.

On a truly mounted and revolving wheel the difference between the high and low points, measured at any location on either tyre seat, shall not exceed 0.10″.

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.

There is no effective method of truing eccentric pressed steel wheels economically and they should be replaced.

Wheel nuts should be free on their studs. When fitting a wheel all the nuts should be screwed up very lightly, making sure that their seatings register with the seatings in the wheel.

Final tightening should be done progressively and alternately by short turns of opposite nuts to ensure correct seating and to avoid distortion.

Wheels with damaged or elongated stud holes, resulting from slack nuts, should be replaced.

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

Checking Wheel and Tyre Balance *in situ.*

Fig. 18 shows the component parts of the Churchill 120 electronic wheel balancer.

With this machine, the wheels and tyres are checked for balance *in situ.* Any correction of unbalance can be made without removing the wheels from the car.

The Electronic Wheel Balancer is marketed by Messrs. V. L. Churchill & Co. Ltd., 27-34, Walnut Tree Walk, Kennington, London, S.E.11.

Fig. 18. Churchill 120 Electronic Wheel Balancer

"VANGUARD"—SERIES II

WHEELS AND TYRES

SUPPLEMENT

Tyre sizes are standardized on Series II cars at 6.00—16 for all models.

The correct tyre pressure when fully laden and with the tyres cold should be :—

Front.	*Rear.*	*Lbs. sq. in.*
All Models	Saloon . .	26
24 lbs. sq. in.	Estate car Pick-up	28
	Delivery van . .	30