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## DESCRIPTION

All Volvo cars and vans are fitted with disc type wheels. These wheels are attached to their respective hubs by means of nuts and bolts.

The rims are of the recessed type, in that they have a channel in the centre. This channel eases the task of removing or fitting the tyres.

The tyres are of the bead type and are 4—6 ply. There are two types of tyres. Early production cars are fitted with tyres with inner tubes and late production cars have tubeless tyres. The tubeless tyres have an internal layer of butyl rubber.

Butyl rubber has greater resistance against leakage than rubber of the normal type, therefore it is not necessary to check the pressure of tubeless tyres as often as is done with ordinary tyres. Tubeless tyres maintain lower temperatures than the ordinary kind and so have a longer life. There is considerably lower risk of explosion with tubeless tyres than with the ordinary kind.

Wheel, tyre and inner tube dimensions are tabled in the Specifications of the vehicle concerned.

## Tyre wear

Tyre wear can vary considerably. The form taken by the wear can generally be used to trace the reason for abnormal wear. Details concerning characteristic damage and the causes of such damage is given here. Remember that a combination of several causes can produce a different result.

Fig. 1 gives some idea of the effect of certain factors on the life of a tyre.

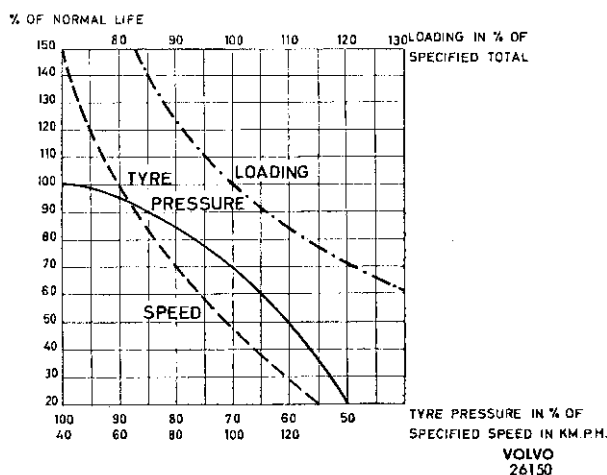


Fig. 1. Diagram of tyre wear.

## Air pressure and loading

One of the primary reasons for abnormal tyre wear is faulty air pressure and over-loading. See the specifications for the vehicle in question which include the correct air pressure. If the air pressure is correct, the whole tread will be in contact with the road surface (Fig. 2). Loading is distributed over the entire tread and the tyre air cushion evens out shocks from unevenness in the road surface in a natural way. If there are no mechanical faults there will be even wear (Fig. 5).

If the air pressure is too high, only the centre part of the tread will be in contact with the road (Fig. 3), this will cause abnormally severe wear on the centre section (Fig. 6) and risk for cracks in the bottom of the tread pattern.

to believe that the load-carrying capacity of a tyre is increased by increasing the air pressure above normal. If the air pressure is too high, the tyre cannot absorb unevenness in the road surface so that the cord in the tyre is subjected to abnormal stress with subsequent risk for breakage.

If the air pressure is too low, only the outer edges of the tyre are in contact with the road surface (Fig. 4) so that these are subjected to more severe wear than the centre section of the tread (Fig. 7). The sides of the tyre are also subjected to an abnormally great degree of bending which causes higher temperatures and weakened cord. This can result, for example, in cord breakage, as shown in Fig. 13, or worn patches in the tread.

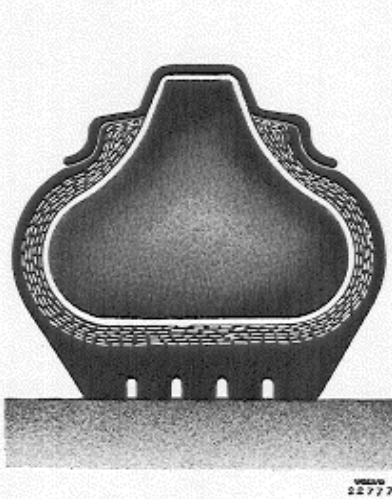


Fig. 2. Correct air pressure.

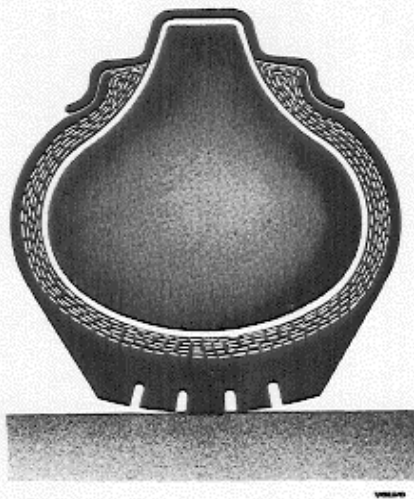


Fig. 3. Excessively high air pressure.

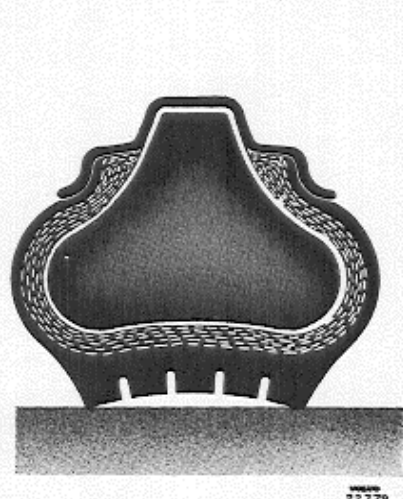


Fig. 4. Excessively low air pressure.



Fig. 5. Normal tyre wear.



Fig. 6. Tyre wear, air pressure too high.

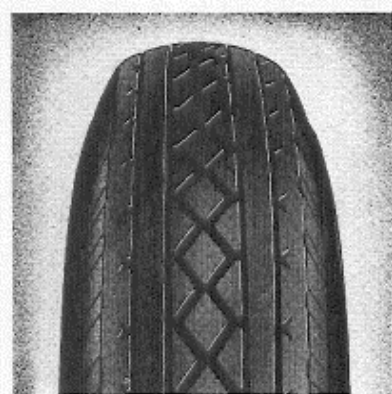


Fig. 7. Tyre wear, air pressure too low.



Fig. 8. Tyre wear, faulty camber.

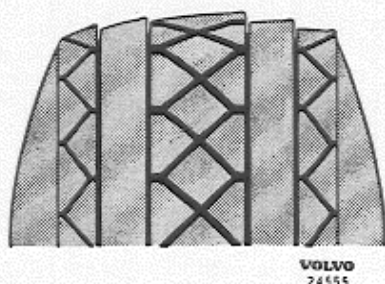


Fig. 9. Toe-in wear,  
(right-hand front wheel  
seen from the front).

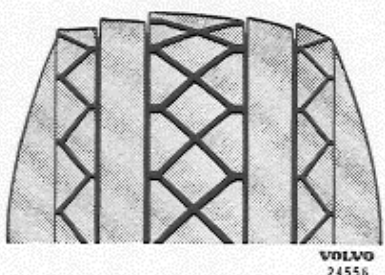


Fig. 10. Toe-out wear,  
(right-hand front wheel  
seen from the front).

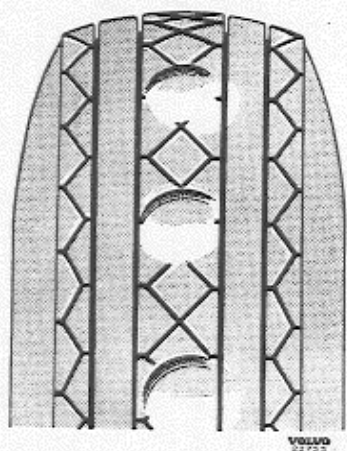


Fig. 11. Patchy tyre wear.

## Mechanical faults

### Front wheel alignment

If toe-in is too large, tyre wear will be abnormal with sharp edges on the inner side of the tread (Fig. 9).

Toe-out faults result in similar wear but with sharp edges on the outer side of the tread (Fig. 10).

Faulty camber results in more wear on one side of the tyre (Fig. 8).

### Unbalanced wheels

Badly balanced wheels give rise to patchy wear which gradually results in pits in the tread (Fig. 11). Badly balanced front wheels are recognised by "jazzing" on the steering.

### Other mechanical faults

Loose wheels and worn wheel bearings, ball joints or bearing bushings can produce uneven wear as shown in Fig. 12. Out-of-round brake drums and faultily adjusted brakes wear the tyres in patches, see Fig. 11 for example.

Faulty fitting or repair work on tyres means abnormal wear.

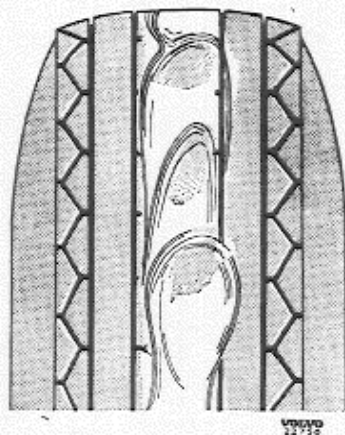


Fig. 12. Tyre wear, mechanical fault.

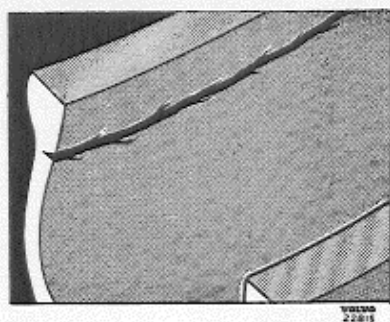


Fig. 13. Cord breakage.

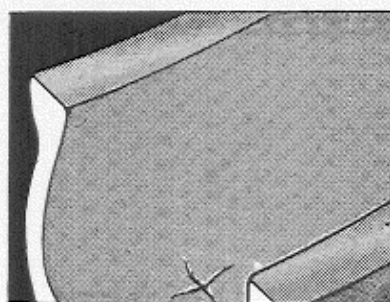


Fig. 14. Cord breakage.

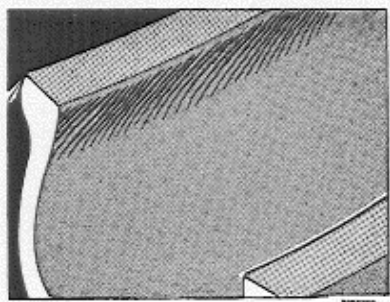


Fig. 15. Cord breakage.

## Driving technique

High-speed driving means high tyre temperatures and increased wear. The consequence of high speed in connection with low air pressure is over-heating of the tyre. Careless cornering under such conditions can ruin the best tyres. Skidding resulting from such driving produces the wear shown in Figs. 9 and 10.

If a tyre is subjected to severe impact while the car is driven (so that the tyre "bottoms"), the damage shown in Fig. 14 can sometimes result.

If the car is driven with abnormally low air pressure in a tyre, for example with a puncture, the tyre is crushed against the road and its temperature becomes very high. The result is loose internal cord strands along the sides of the tyre (Fig. 15).

Rapid acceleration or braking with subsequent tyre skid subjects the tyre tread to abnormally great wear.

## Inter-changing the wheels

If even wear is noted on all tyres during normal driving the same direction of rotation should be maintained and nothing is gained by inter-changing the wheels. If the wheels have been balanced together with their respective hubs and brake drums, balance is also disturbed if wheels are inter-changed and new balancing must be carried out. In order to maintain such balance after the individual wheels have been removed and are to be re-fitted, the position of the rim relative to the brake drum should be marked before removing.

If the wheels are inter-changed for some reason, wear should first be studied in order to detect any faults. Mechanical faults should be rectified and not concealed by inter-changing the wheels.

Concerning the order to be maintained when inter-changing wheels, follow the instructions issued by the tyre manufacturers.

## REPAIR INSTRUCTIONS

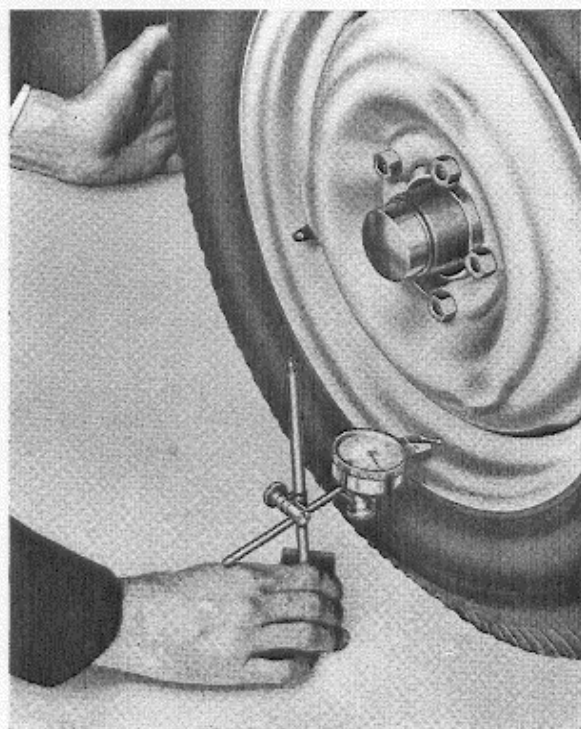
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Fig. 16. Measuring runout (vertical).

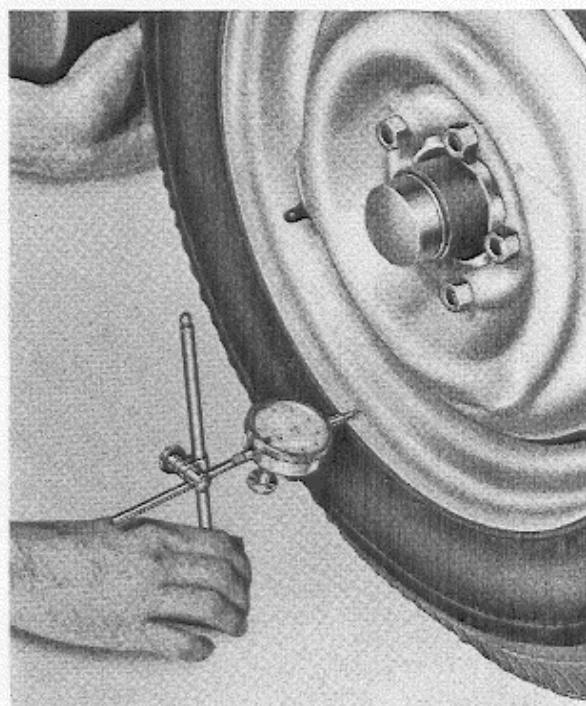
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Fig. 17. Measuring runout (horizontal).

### Wheel change

See the instructions for the model concerned.

### Checking the wheel rim

Runout on the wheel rim may not exceed 2.5 mm (0.10") and is measured as follows:

1. Remove one of the front wheels.
2. Clean the contact surfaces between the wheel to be measured and the hub.
3. Fit the wheel in position and tighten the wheel nuts evenly to the correct torque. Check that there is no abnormal looseness.
4. With the tyre fitted, measure the runout as shown in Fig. 16. Then turn the dial indicator and carry out a further measurement as shown in Fig. 17 which, however, shows another type of dial indicator.

If the tyre is not fitted, measure the runout internally on the rim contact surfaces (inside of rim corners). While carrying out both runout measurements, check that the measuring point is not in contact with the fillets in the corners of the wheel rim so this will, naturally cause faulty readings.

### Tyres (with inner tubes)

#### Changing a tyre and inner tube

##### Removing the tyre from the wheel

1. Deflate the tyre by unscrewing the valve needle.
2. Press, opposite the valve, both sides of the tyre into the channel.
3. Force off the tyre at the valve side with the aid of two tyre levers (Fig. 18).

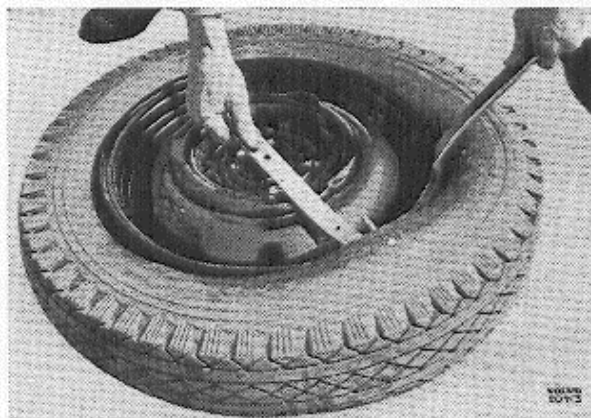
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Fig. 18. Removing the tyre.

4. Press in the valve and pull it out between the rim and the tyre (Fig. 19). Remove the inner tube and screw on the valve needle and cap.

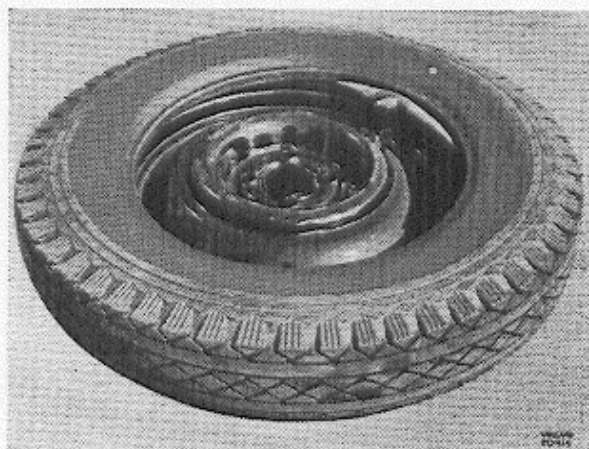


Fig. 19. Removing the valve.

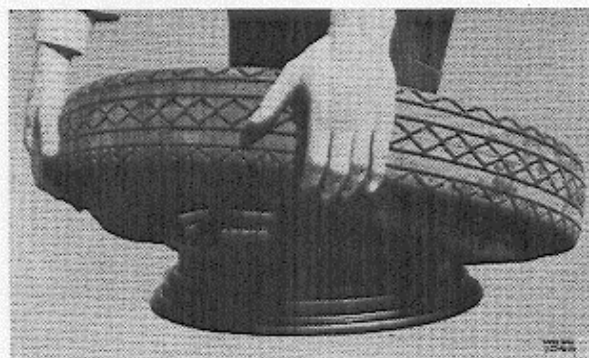


Fig. 20. Removing the tyre.

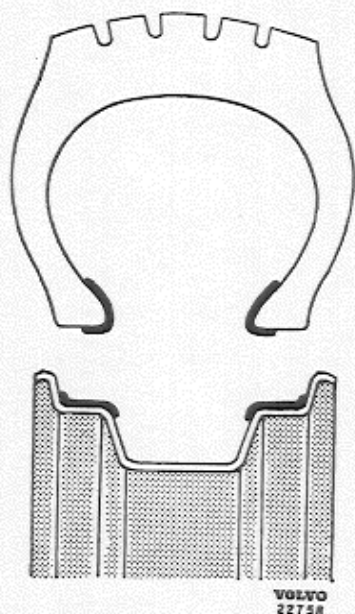


Fig. 21. Application of paste.

5. Grip the tyre, near the valve, with both hands and pull it off the rim (Fig. 20).

### Fitting the tyre onto the wheel

1. Clean the wheel rim and then smear the rim and tyre with a thin layer of special paste at the points shown in Fig. 21.
2. Lay the wheel on the floor with the outside, upwards and then lay the tyre with its size designation upwards. Force on the lower side of the tyre with the assembly tools, (Fig. 22).
3. Pump a little air into the tube and put the tube into the tyre. Check that the valve is opposite the balancing mark on the tyre, should there be one, and on the same side

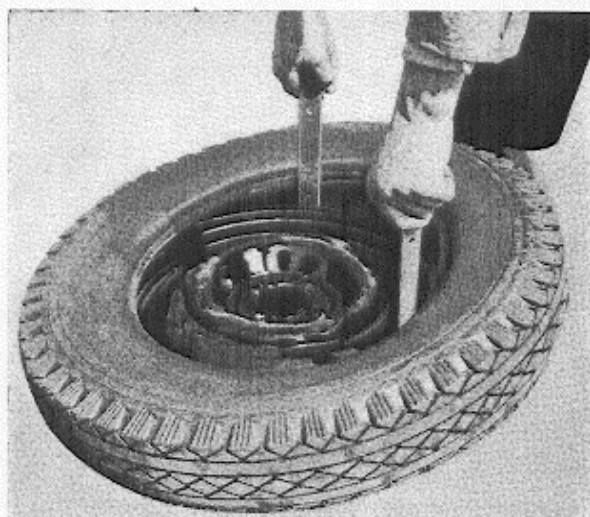


Fig. 22. Fitting the tyre, lower part.

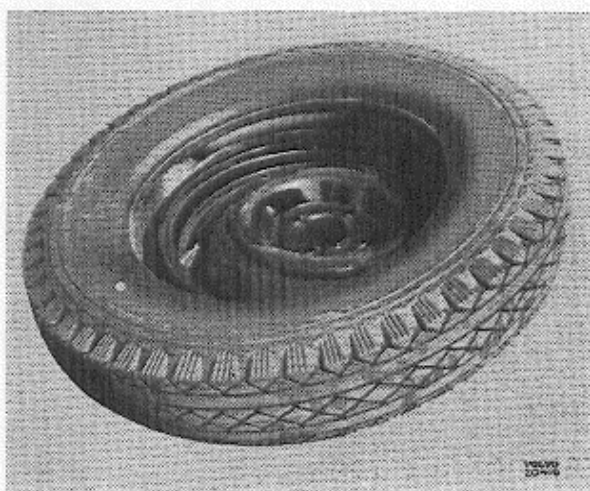


Fig. 23. Fitting the valve.



Fig. 24. Fitting the tyre, upper part.

as the tyre dimension designation and that the tube lies evenly. Fit the valve in place in the rim, (Fig. 23).

4. Force on the upper part of the tyre.
5. Inflate the tyre until the edges are in the correct positions. Deflate the tyre and then inflate it to the correct value. By deflating the tyre and then inflating it again, the inner tube comes into its correct position.

## Tubeless tyres

### Changing a tyre

#### Removing the tyre from the wheel

1. Deflate the tyre by unscrewing the valve needle.
2. Press in both sides of the tyre into the channel with a special tool as shown in Fig. 25. It is not permissible to use a hammer.
3. Force off the tyre on the valve side with the aid of two tyre levers. Always start near the valve. The tyre levers must be completely smooth, as otherwise the sealing rubber will be damaged.
4. Grip the tyre with both hands and pull it off the wheel.

#### Fitting the tyre on the wheel

1. Check that the rim is free from faults. With wheels that have not been fitted with rimless tyres before, check that all welds on the rim are even and that there are no loose rivets. Correct all unevenness. Carefully



Fig. 25. Removing the tyre.

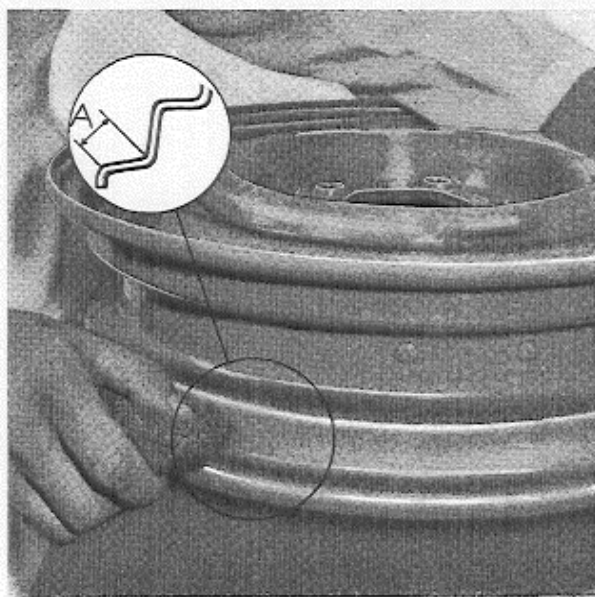


Fig. 26. Cleaning the rim.

clean the rim edges with steel wool or a steel brush, so that all dirt, rust and rubber deposits disappear. If the rim is very rusted, use a file. The diagram in Fig. 26 shows that part (A) of the rim that must be cleaned extra carefully. Fit the valve in the rim valve hole.

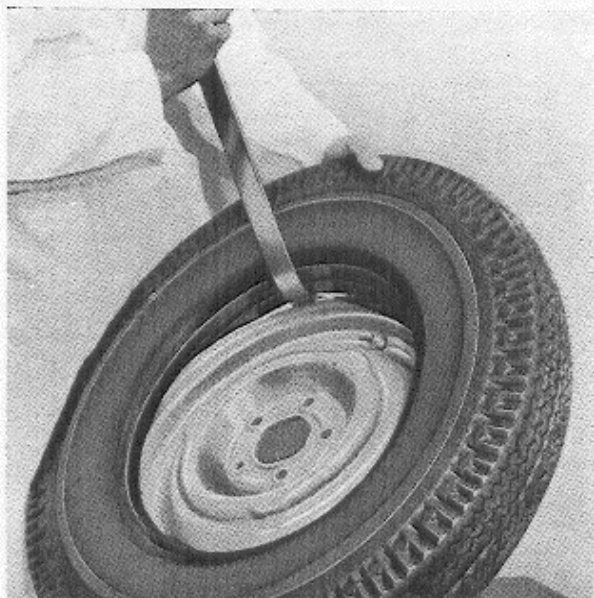
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Fig. 27. Fitting a tubeless tyre.

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Fig. 28. Fitting a tubeless tyre.

2. Fit on the tyre as shown in Figs. 27 and 28. Use tyre levers that have no sharp edges or unevenness. Fit the tyre step by step, with only small steps of about 5—10 cm (2"—4") at a time. Start with the side that is opposite the valve. Fit the part that is nearest the valve last. Check that the balancing mark on the tyre comes precisely opposite the valve.
3. Soak a rag or some cotton waste in clean water. Squeeze out the water and let it run between the edges of the rim and the tyre,

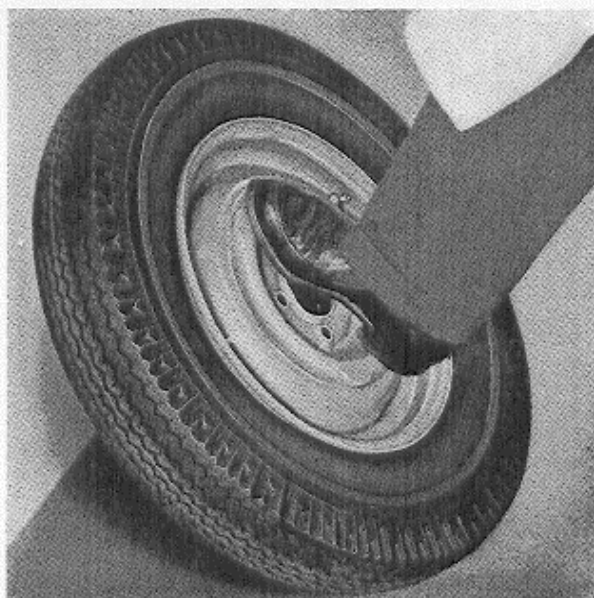
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Fig. 29. Adjusting the position of the tyre.

so that the tyre slides easily into the correct position.

4. Hold the wheel in a vertical position and bounce it on the floor. Revolve it whilst bouncing so that it bounces on its whole perimeter, this ensures that the sealing ridges assume their correct positions on the edge of the rim. Keep the wheel in the vertical position and inflate the tyre to a pressure of 3 kg/cm<sup>2</sup> (43 p.s.i.) to press the tyre hard against the rim. Fit the valve ring. Another method is to stretch a cord in a loop round the tread and thus force out the tyre edges at the same time as the tyre is inflated. Make sure that the cord is loosened as soon as the tyre settles against the rim edges since otherwise the air pressure can burst the cord.
5. If it is not possible to fit the tyre into the correct position in the manner stated above, try pressing in the edges onto the ridges by placing the wheel at an angle of 45° against a wall and then pressing the rim with your foot. When the edges are in the correct position, reverse the wheel and do the same to the other side. See Fig. 29.
6. Check that the tyre is correctly fitted by immersing the wheel in a tank of water. After removing the wheel from the tank, reduce the tyre pressure to its normal value, which is tabled in the Specifications for the vehicle concerned. Do not forget to replace the valve cap.

## Tracing leaks

Carefully examine the tyre for the object that has caused the leak.

If the tyre is completely deflated, inflate it and listen for any sounds of escaping air. If the leakage still cannot be traced, remove the wheel and immerse it in a tank of water. Mark the position of the leak. If the air seeps out between the tyre and rim, mark both the tyre and the rim.

## Fitting the valve

Tubeless tyre valves should be fitted into place before the tyre is fitted on. There are several different makes of this type of valve, so it is therefore impossible to give any general instructions for fitting them. Follow the instructions given by the manufacturer concerned.

## Storing tubeless tyres

If a tubeless tyre has been subject to pressure it can be extremely difficult to fit onto the wheel. It is therefore most important that these tyres should be stored so that they are not subjected to pressure. Do not remove the paper ring from the tyre until it is to be fitted onto the wheel.

## Balancing the wheel

Vibration in the front of the car or uneven wear on the front wheel tyres are often caused by unbalanced wheels. There are two types of unbalance, static and dynamic.

A wheel is statically unbalanced if cannot be stopped in any one position, when revolved on a perpendicular plane, without the wheel always returning to a certain point.

Dynamic balance is when a wheel is rotated rapidly and does not correspond to the normal rotation plane of the wheel, e. g. at right-angles to the axle. This means that the wheel attempts to throw in the same way as if it were twisted, especially with the front wheels, as they transmit their abnormal power to the front section of the vehicle. This causes many faults, e. g. a "kick" in the steering wheel, vibration in the front section, increased wear on the steering knuckles, excessive wear on the tyres, etc.

Before starting to balance the wheel, clean it well.

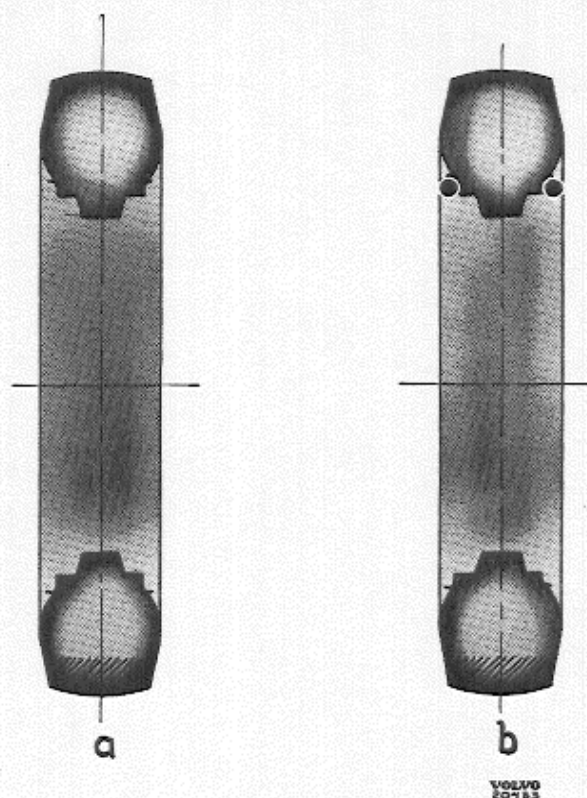


Fig. 30. Static balance.

a. Static unbalance. b. Static balance.

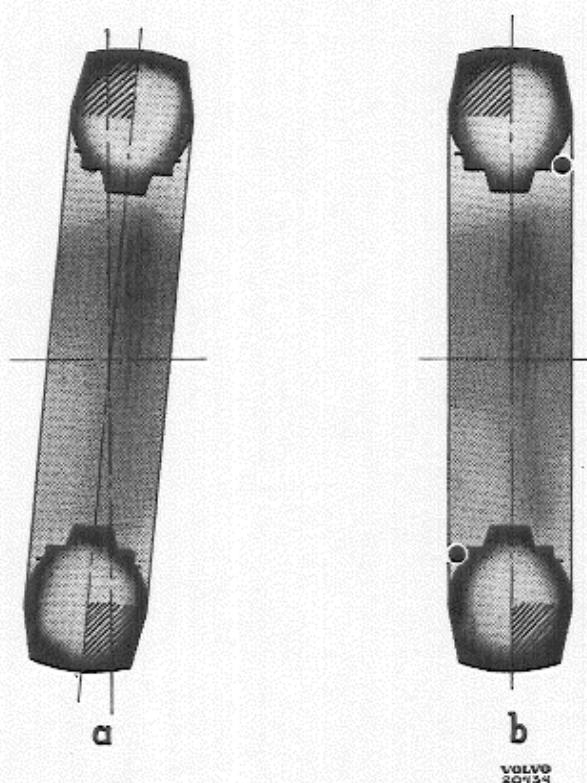


Fig. 31. Dynamic balance.

a. Dynamic unbalance. b. Dynamic balance.

Check that the tyre has the correct pressure and that the balancing mark, if there is one, is opposite the valve. The tyre must be in good condition and fitted correctly on the wheel.

## Balancing

Before it is possible to state that a wheel is correctly balanced, it must be balanced both statically and dynamically. This means that, before the required result is obtained, the operation must be carried out on a special balancing device. This device is shown in Fig. 32.

By just balancing the wheel statically (e. g. by rolling it slowly on the spindle and using this as a basis for fitting weights) the static power can be evened out. The existing dynamic unbalance may remain and become even worse. We will give an example (see a Fig. 33). This wheel is statically unbalanced in that it has an excess of weight on the lower part. The wheel is also dynamically unbalanced in that the centre of gravity of this excess weight is not on the wheel centre line, when the wheel is in the vertical plane. This unbalance cannot be traced by revolving the wheel. We balance the wheel statically by placing counter-weights diametrically opposite the centre of gravity of the excess weight in such quantities so that the wheel can be rotated and stopped in any position in the vertical plane, and remain stationary in this position (static balance). Now the question arises, should the counter-weights be placed on the inside or outside of the wheel? If the counter-weights are placed on the outside of the wheel (we take b Fig. 33 as an example) it balances the wheel statically. The dynamic balance is opposed but we do not know if it is completely eliminated.

If we place the counter-weights onto the other side of the wheel, the static balance is retained but the dynamic unbalance is increased (see a, Fig. 31) by the counter-weights, since the weight increases the existing dynamic unbalance.

Distribution of counter-weights on both sides of the wheel retains static balance, but the dyna-

mic balance is opposed by the counter-weights on the one side and assisted by the counter-weights on the other. If both sides are equally counter-weighted the dynamic balance remains unaltered.

This shows that static balance alone is not sufficient but the wheel must be spun rapidly and the dynamic unbalance measured and remedied.

The method of balancing is wholly dependent upon the type of device that one is using. Carefully follow the instructions that accompany the balancing device. When balancing wheels with tubeless tyres, the lugs on the lead weights must be designed so that they do not go so far in between the tyre and the rim.

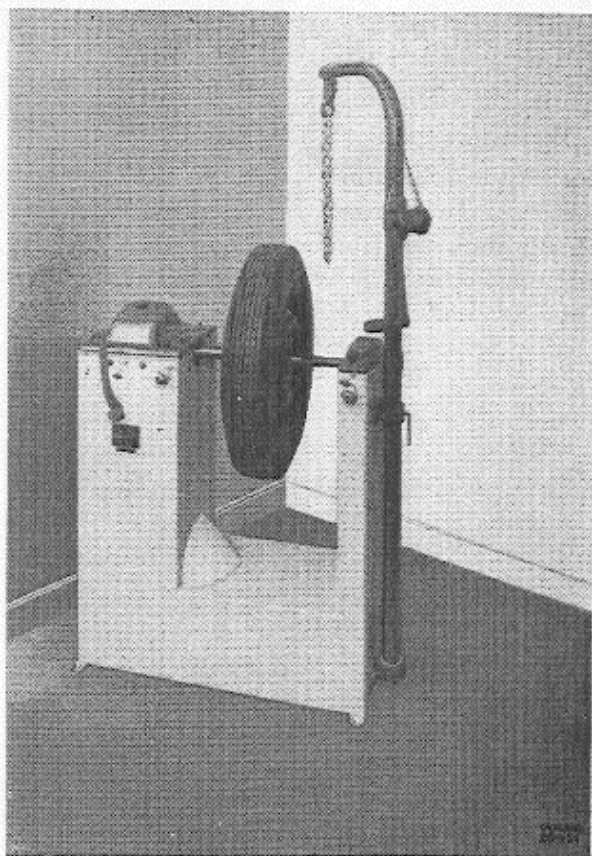
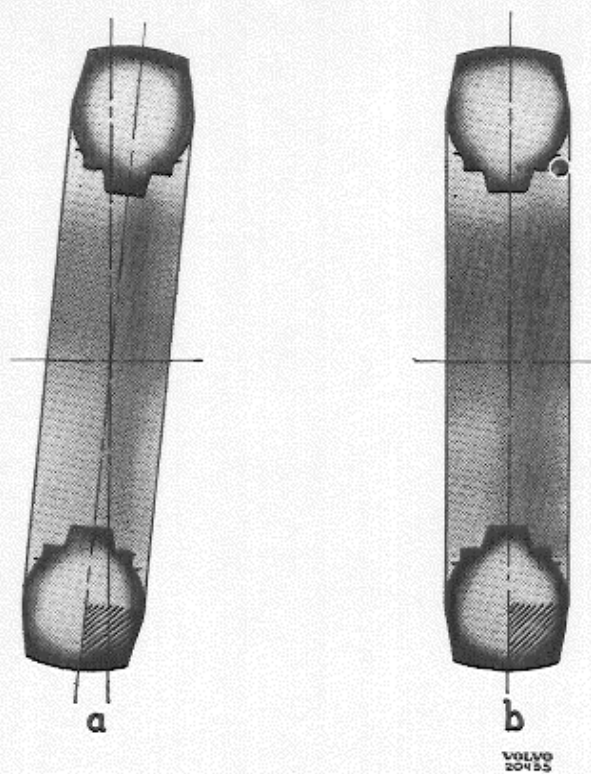


Fig. 32. Balancing machine.



*Fig. 33.*

- a. Static and dynamic unbalance.
- b. Static and dynamic balance.

## FAULT TRACING

| REASON  | REMEDY   |
|---|--|
| Continuous driving with excessively high tyre air pressure.         | Adjust air pressure.   |
| Continuous driving with excessively low tyre air pressure.          |  |
| Unbalanced wheels.  | Change tyres, balance wheels.  |
| Distorted wheel.  | Replace wheel.   |
| Excessive bearing clearance or worn bearings.                       | Check (replace) front wheel bearings.<br>Adjust bearing clearance.   |
| Loose king-pins.  | Recondition front wheel spindles.  |
| Brake drum out-of-round.  | Lathe-turn (replace) brake drum.   |
| Fierce acceleration or braking.                                     | Recommend more careful driving.  |
| Faulty camber. Twisted car body.                                    | Check control arms and attachments.<br>Check (adjust) wheel alignment.<br>Check alignment of body. Straighten (replace) damaged parts. |
| Faulty toe-in. Fierce cornering.                                    | Check (adjust) toe-in.<br>Recommend more careful driving.  |
| Car driven normally with driver alone or on heavily cambered roads. | Inter-change front wheels, adjust wheel camber with respect to driving conditions.   |
| Distorted wheel.  | Measure run-out on wheel and replace if runout exceeds 2.5 mm (0.10").   |
| Loose hub.  | Check that hub is properly tightened and that key is correctly in position.  |
| Distorted rear axle housing.  | Check (replace) axle shaft.<br>Check (replace) rear axle housing.  |
| Very fierce cornering.  | Recommend more careful driving.  |