

Rebuilding wheels — a black art?

Not at all, discovers Peter Watson.

Patience and perserverance can reap deeply satisfying reward

REBUILDING a wire-spoked motorcycle wheel is usually reckoned to be a job for the professionals. I've seen this advice repeated so often in motorcycle magazines that the fact that two friends of mine invariably re-spoke their own just didn't register as a warning to stop behaving like a 'Sun' reader and believing everything I read.

Enquiries revealed that the task requires the minimum of equipment and a lot more in the way of patience and perseverance. But it was in costing the exercise that I discovered why most folk take the easy way out.

My local wheel builder — Roy Thersby in Stockton — charges about £8 to build a wheel. This includes bead blasting an alloy hub. It's the rim (£17.32 for a 40-hole chromed steel 19in WM2 Radaelli) and the spoke set (£12-£20; add £6 for stainless spokes) which cost you, with the labour a far less significant expense.

So unlike the majority of DIY jobs, wheel-building doesn't offer massive savings. But it's very far from being a black art.

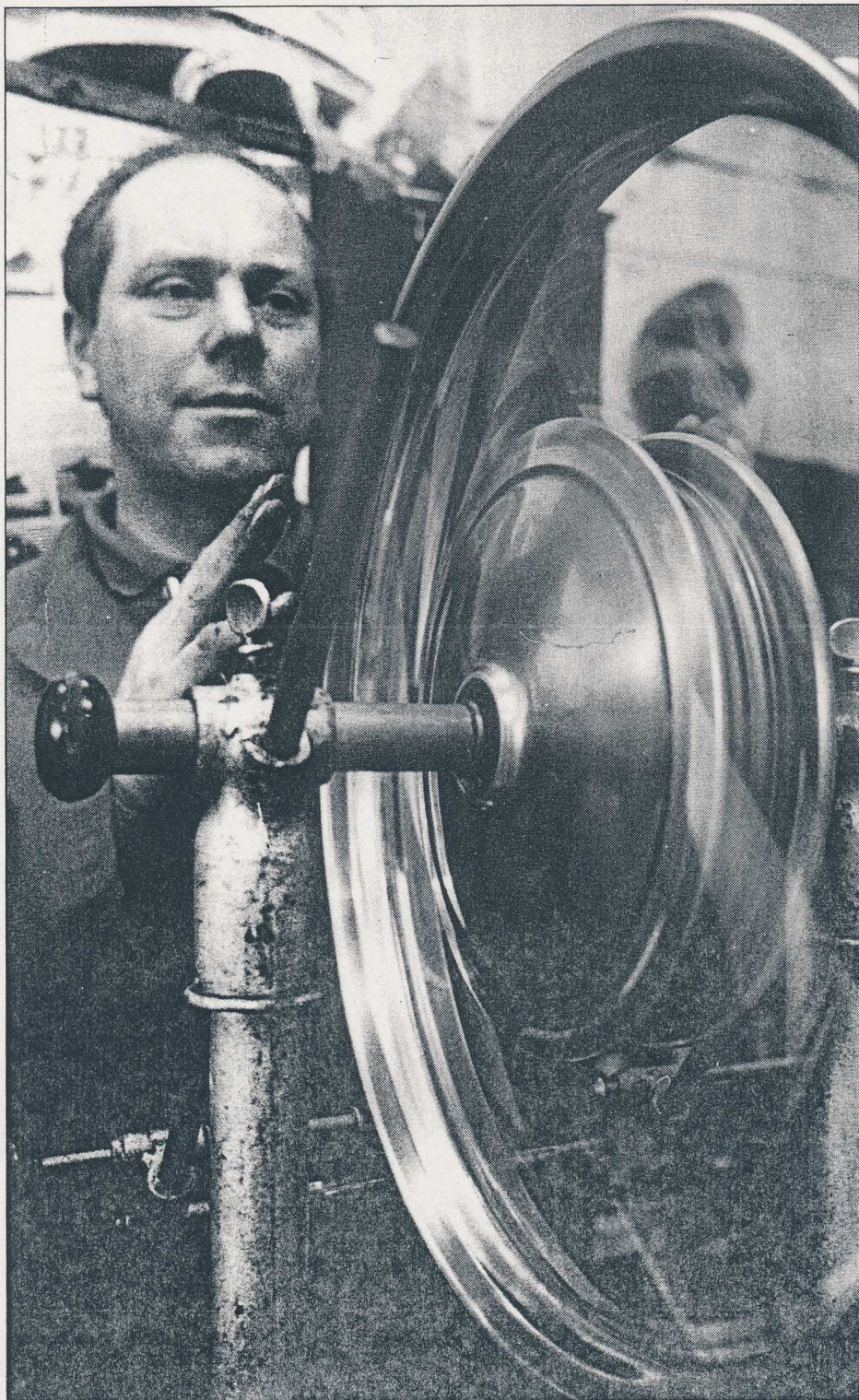
First, back to absolute basics. It's no good rebuilding a wheel if the brake drum is hopelessly scored and oval or the hub bearings worn out. Go over these points before you do anything else. Wheel-builders frequently have facilities for skimming scored drums and can check for ovality.

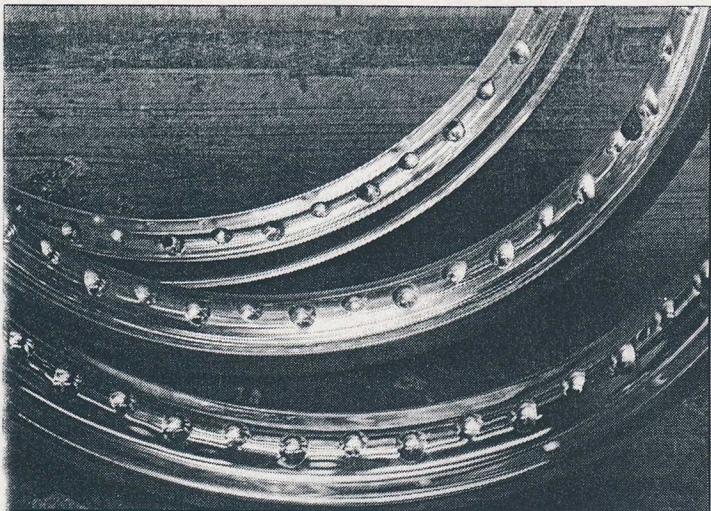
Next make a careful note of the way in which your wheels are laced and any offset between the outer edge of the wheel rim and that of the brake drum. This is often a feature of machines built before the advent of full width hub brakes.

British rims and hubs have 40 holes, while the Japanese make do with 36. Lacing patterns are described on the basis of how many other spokes an outer one crosses from hub to rim. Most are X2 or X3, but British makers used some curious-looking variations.

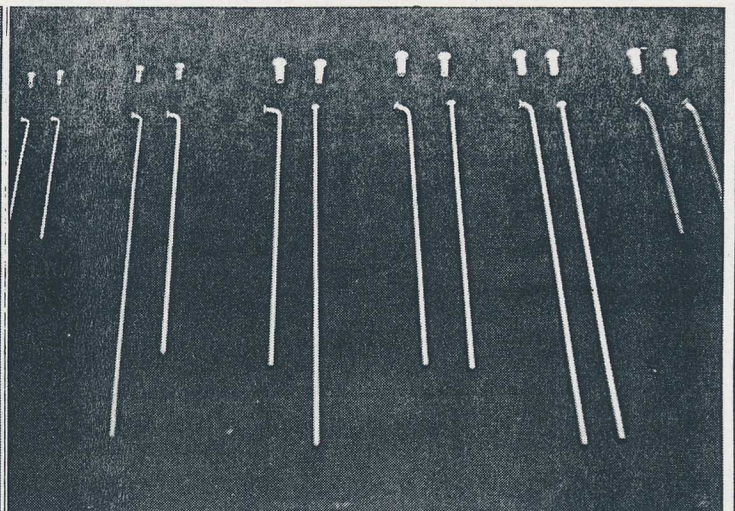
If you've just got a pair of hubs, or you possess hubs and rims separately, best get a professional to puzzle it out. Likewise, if this is a very quick bike, leave the wheel-building to someone who can get the run-out down to virtually zero.

Take the wheel to a wheelbuilder as it is — or send at least two sample spokes, one from each side — when ordering a set of spokes. Talk to him about the gauge of spoke — swaged or butted types just give you extra weight where you need it — and try to afford stainless steel spokes. They only cost a little extra. If yours were painted originally buy the ordinary 'rust-





Rim choice. Old-fashioned 'flanged' alloy type is still popular at £30 (back), with 'flangeless' alloy (centre) more expensive. Chromed steel rims are usually Italian (front).

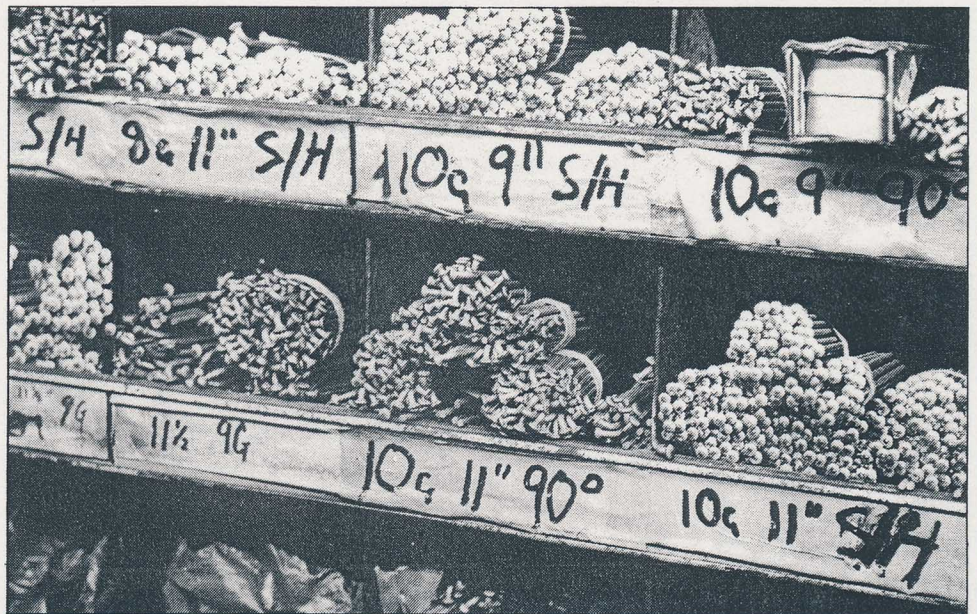


Variation in spoke gauge is enormous.

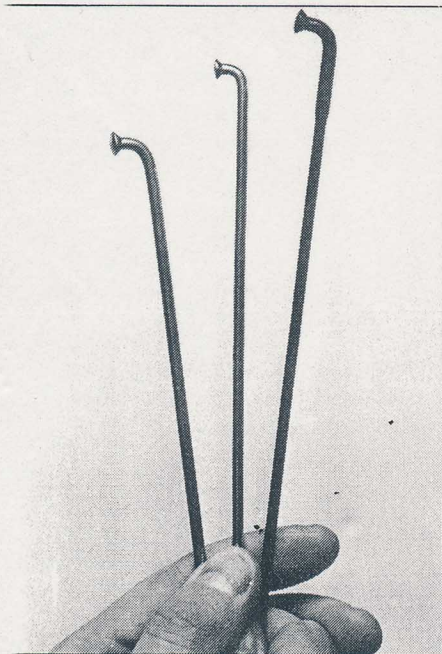
ess' spoke, degrease and spray paint.

Ask your supplier to fasten the 'inner' and 'outer' spokes together in clearly labelled bundles. You'll find this very handy later on.

The indispensable tool is a spoke key to turn the spoke nipples. Alf Hagon's costs £4.83. It's possible to lace up a wheel on a flat surface, while some people favour using a vice or Workmate to secure the hub on the wheel spindle.



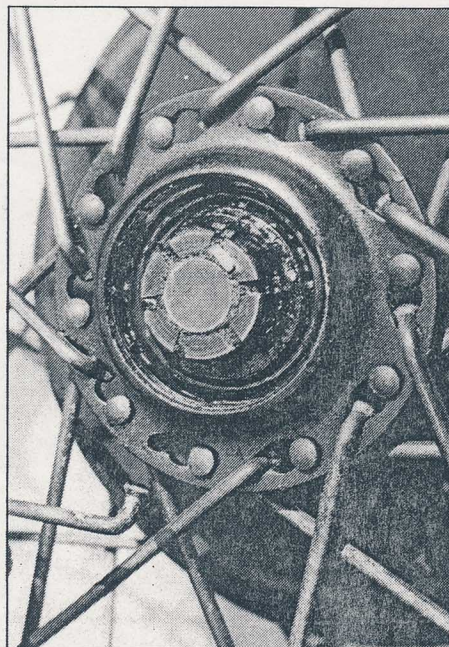
A fraction of the typical wheelbuilder's spoke stock shows that they have to be prepared for anything.



Finish and construction varies, too. Tapered or butted type (far right) puts stress only where it's required.

Now you can true a wheel in this position, but it's far, far easier to knock together a jig which will allow you to do it with the wheel upright. An old swinging arm clamped in a vice is perfect, but you could simply employ two lengths of 2 x 2in timber notched to accept the wheel spindle as advocated by Radco in his excellent *Vintage Motorcyclists' Workshop*.

At each side you'll need to mount a pointer, just as on a professional £200 truing jig. These can just be pieces of chalk or pencil secured by rubber bands or pipe clips. The idea is that they'll show you where the rim is running out of true from front to side.



'Keyhole' type hub means that you have to start truing wheel with all spokes in place.

Underneath the rim you need to fix a rod or plate that will indicate radial eccentricity. This is best done across the bead seats of the rim – inside the well – although you can usually sight the eccentricity at the top as you spin the wheel.

In truing up a wheel you're trying to get it running true laterally (side to side) and radially (up and down) with the correct offset and spoke tension. 'Think twice and turn once,' advises Roy Thersby. Work slowly, turning nipples a couple of flats at a time.

If you want to correct lateral truth at one point on the wheel, tighten up the spoke or spokes opposite. The same goes for eccentricity top to bottom, remembering that if all the spokes are tight, you'll need to slacken one slightly before you tighten up its opposite number.

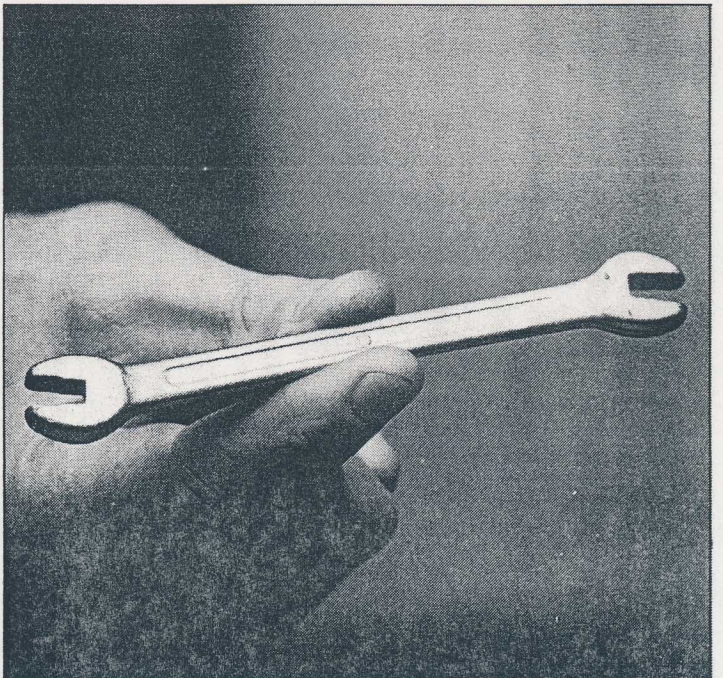
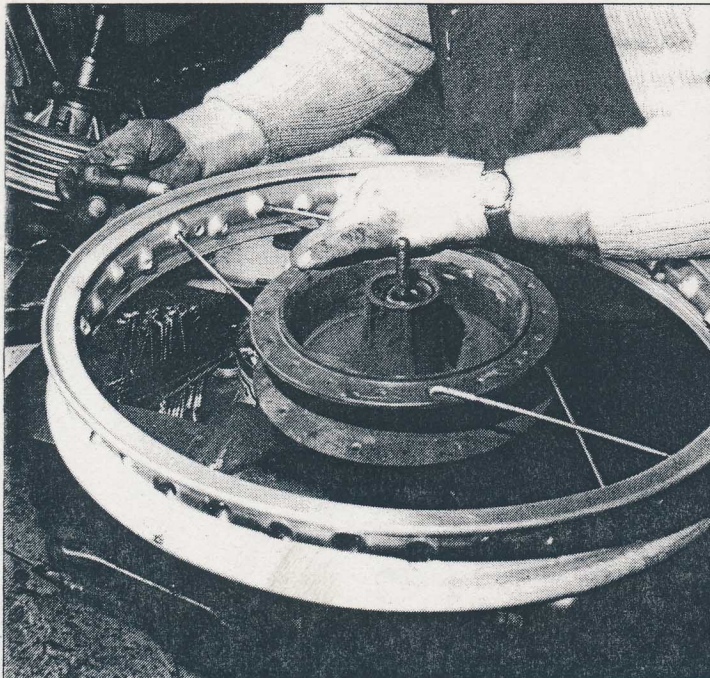
Correct lacing without truing should see you almost there with the offset. If it doesn't, then something's gone wrong. Correct radial eccentricity first and then work on lateral truth.

A good time-saving dodge with a full-width brake hub is to build the wheel and complete truing just using the inner 20 or 18 spokes. Then you can simply lace up and



1 Chop the hub out after you've made a careful note of the lacing pattern and any offset.

2 A flat surface is all you need to begin with. Insert 'inner' spokes in alternate holes.



One method of working at home: use a vice or a Workmate. Truing is far easier with wheel spinning upright, however.

Vital tool. Spoke key capable of handling four nipple sizes.

tighten the outers very rapidly. It's not possible with a 'keyhole' type hub, however.

Final spoke tensioning is completed by tapping each spoke to see if it produces the same note. Too sharp and that's over-tight, too flat and it's loose. You can use this method to detect accidentally over-tightened spokes during the initial true-up.

Whatever you do on one side of the rim

affects the other. This is where the patience comes in. And don't worry if you always get a slight 'kick' on the rim at the weld. Even the professionals expect that.

It's sad that British rim makers Dunlop and Jones no longer produce chromed steel wheels. But the weld quality and chroming of the Italian Radaellis has improved greatly even if they fail to match the standard set by those British firms. Rechroming old rims

isn't normally a viable option.

Doing the job yourself can be deeply satisfying, not least because of all that advice to the contrary. And if you do fail first time around, there's no disgrace in turning up at the local wheel-builder's shop with a half-finished job.

'Can you just true this up for me, mate?' They'll have heard it all before.



3 A twist of the hub will show you just how the spokes are supposed to line up.



4 Once you've got a few nipples on, twisting the hub round will show you how it goes.

Bearing up under the strain

YOU'LL encounter three basic types of wheel bearing: cup-and-cone, tapered-roller and ball-journal.

The first is simply an old-fashioned bicycle wheel bearing which British manufacturers continued to specify on their 98, 25 and 150cc lightweight models even in the 1960s. Like the infinitely preferable tapered-roller bearing, cup-and-cone designs are adjustable.

Ball-journal types don't feature adjustable elements, and it's for this reason that they have largely ousted the other designs. Your average mechanic is simply too hurried and ham-fisted to adjust them correctly.

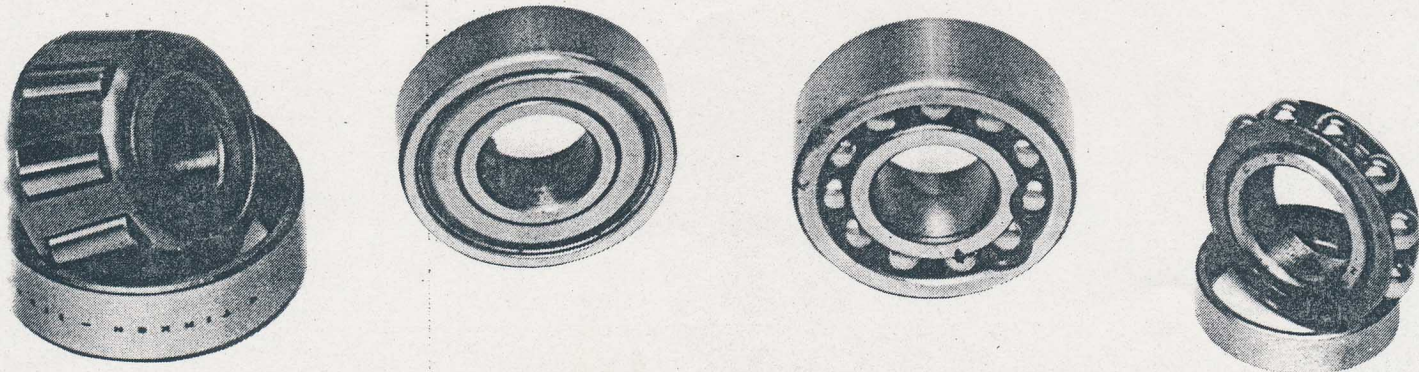
If you need to replace cup-and-cone types – with either freely assembled ball bearings or the caged design – try to find some way of substituting ball-journals. Grooved or pitted tracks, as well as dam-

aged balls or rollers, indicate that a bearing of the adjustable kind is shot.

In adjusting cup-and-cone or tapered-roller wheel bearings, aim for about $\frac{1}{16}$ in movement at the rim when you rock it from side to side. There must be some discernible shake at the rim or you have a tight bearing that will soon fail.

Do not take up all the adjustment and then back off the adjusting nut. This will almost certainly indent the track as the hard balls or rollers dig in under considerable pressure. Instead take up the slack very gradually, pausing to see if you've got it spot on after each adjustment.

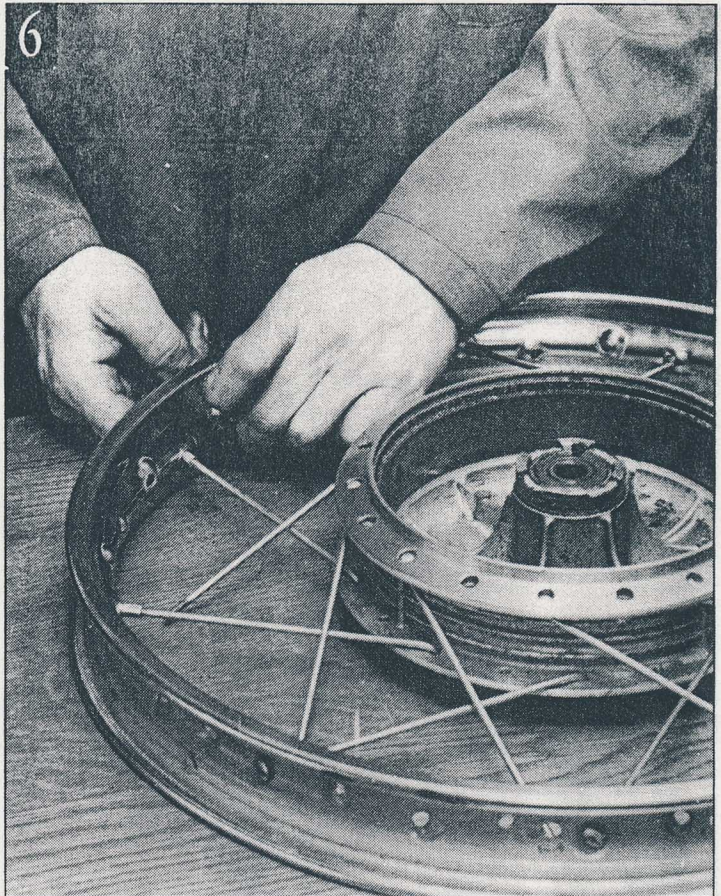
Since none of these bearings requires much in the way of lubrication beyond light oiling, you might wonder why we advised to pack them with high melting point (HMP) grease. This is really there to keep grit and moisture out.



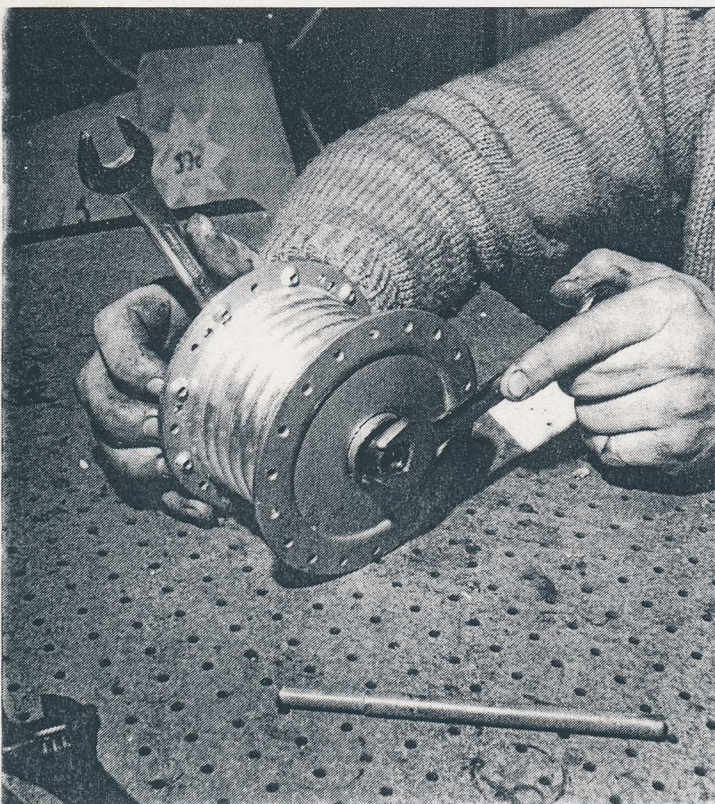
Bearing types. From the left: tapered-roller, sealed ball-journal, ordinary ball-journal and cup-and-cone.



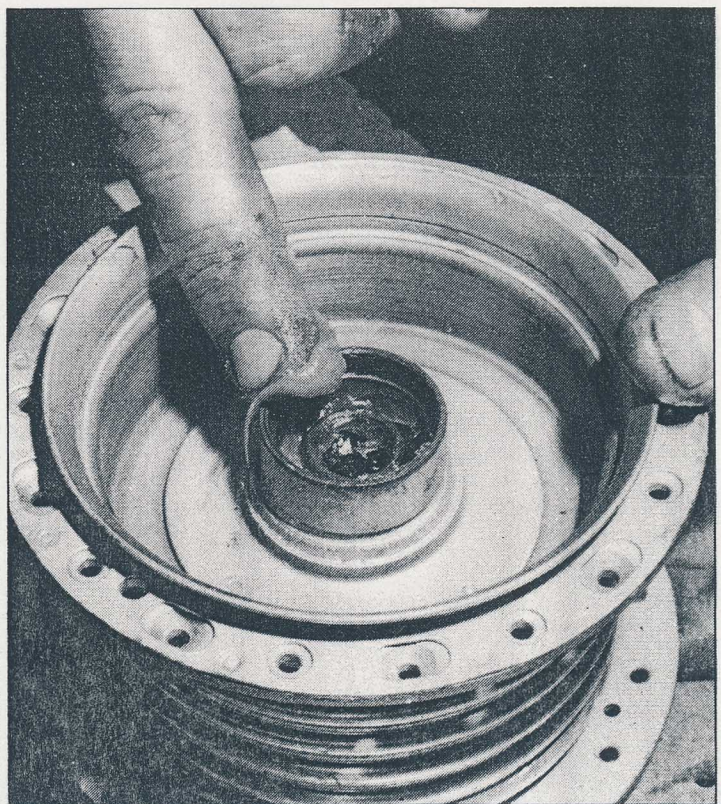
5 Turn over to insert the 'inner' spokes on the other side of the rim and then ...



6 ... finger-tighten the nipples. On a 36-hole full-width hub wheel you can now true up ...



7 Cup-and-cone bearing adjustment demonstrated on a typical British lightweight hub.



8 Packing the hub with fresh grease. Don't overdo it.

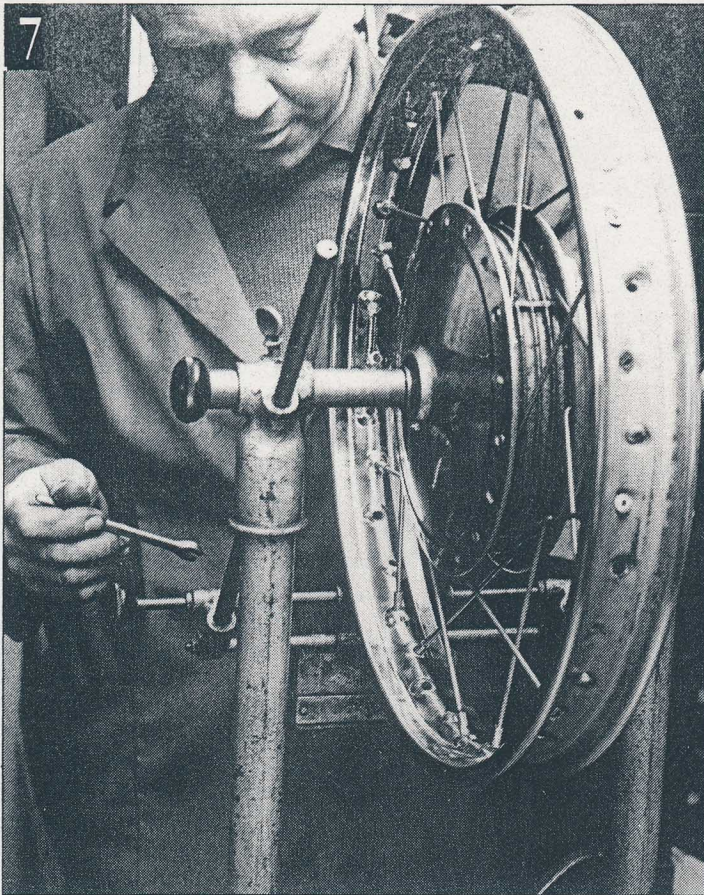
Don't overdo the grease and don't – on older models – pump grease in to the bearings via a hub nipple. It's bound to reach your brake shoes.

Side-play on a wheel supported by ball-

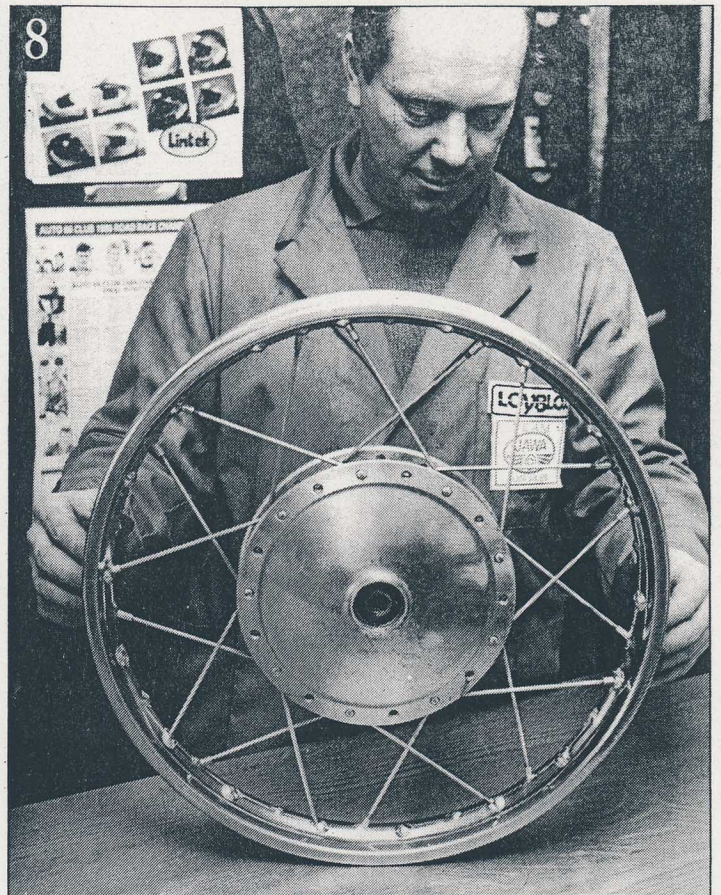
journal bearings indicates wear. Crunching noises and a rough feeling when you turn the wheel also reveal the need for replacement.

Be careful when removing the circlips,

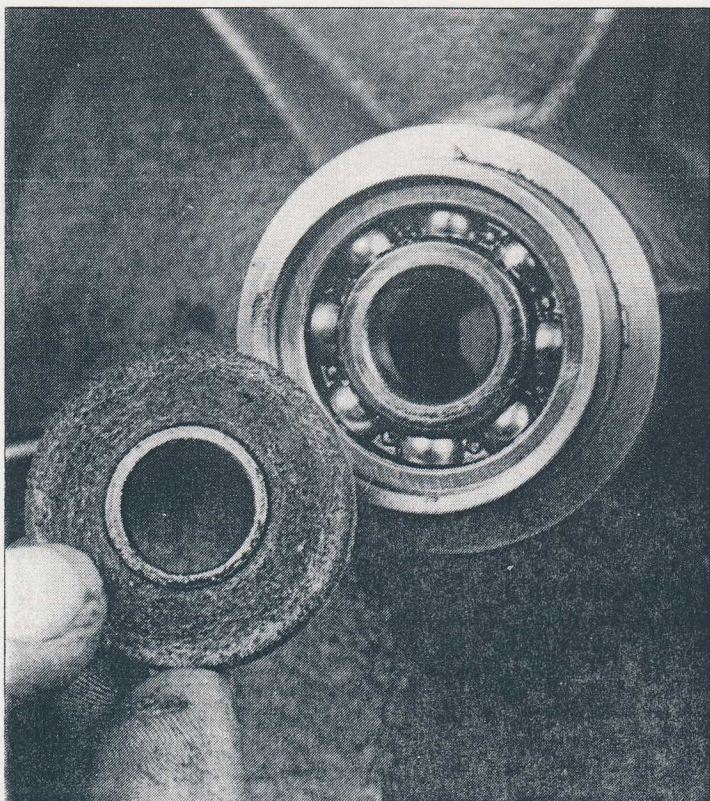
shims and seals above the bearing and jar it free with a tubular drift – a box spanner is usually handy – that bears on the outer race. Wash the bearings out in petrol and spin to feel and listen for roughness.



... with only 18 spokes, which saves time. A home-brewed truing jib is easy to make.



Now insert the two sets of 'outer' spokes. You can't use this dodge with a 'keyhole' hub.

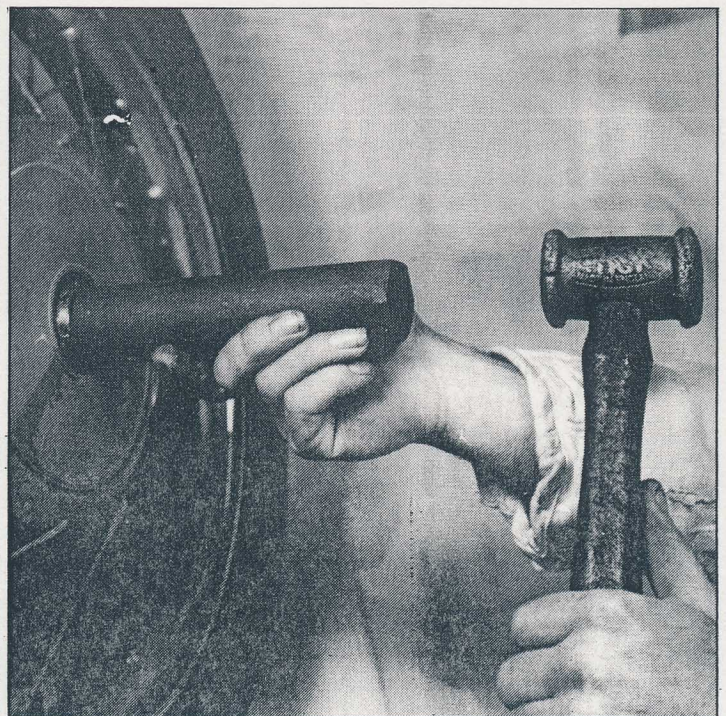


Typical British felt ring dust seal. Replace all seals and fit sealed-type ball-journal bearings.

While you're checking any type of wheel bearing make a point of examining the wheel spindle on which they turn. Any obvious damage requires replacement.

British manufacturers often fitted hope-

less dust seals over their wheel bearings: felt pads under a pressed-steel cover. Sealed ball-journal bearings will help to keep the muck at bay here, but always buy new dust seals if they're available.

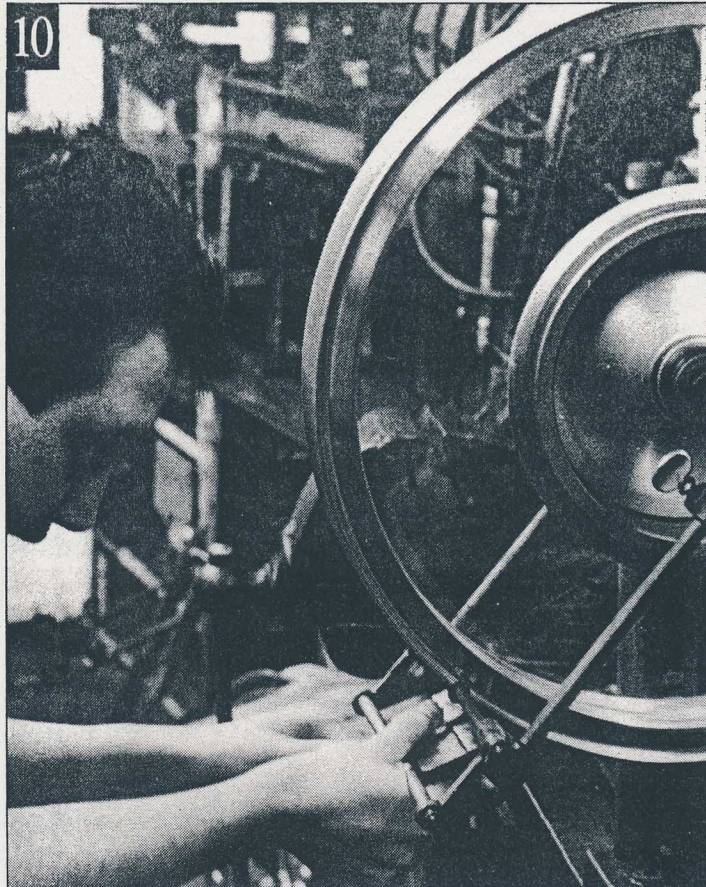


Biff. How to remove - and replace - ball-journal wheel bearings.

I buy my new bearings with the help of a friend who can get me a trade order form from his firm. Presenting this at the local bearing supplier means a discount of up to 70 per cent on the normal retail price. Check out your acquaintances now ...



Outer spokes will be curved around the hub unless you gently knock 'em straight.



Eccentricity is indicated by rim contact with movable plate. Side pointers show runout.

JAMES Starley, the father of the British cycle industry whose Ariel penny-farthing went on sale in 1871, is sometimes credited with the invention of the wire spoked wheel. In fact he merely developed an improved method of spoke tensioning.

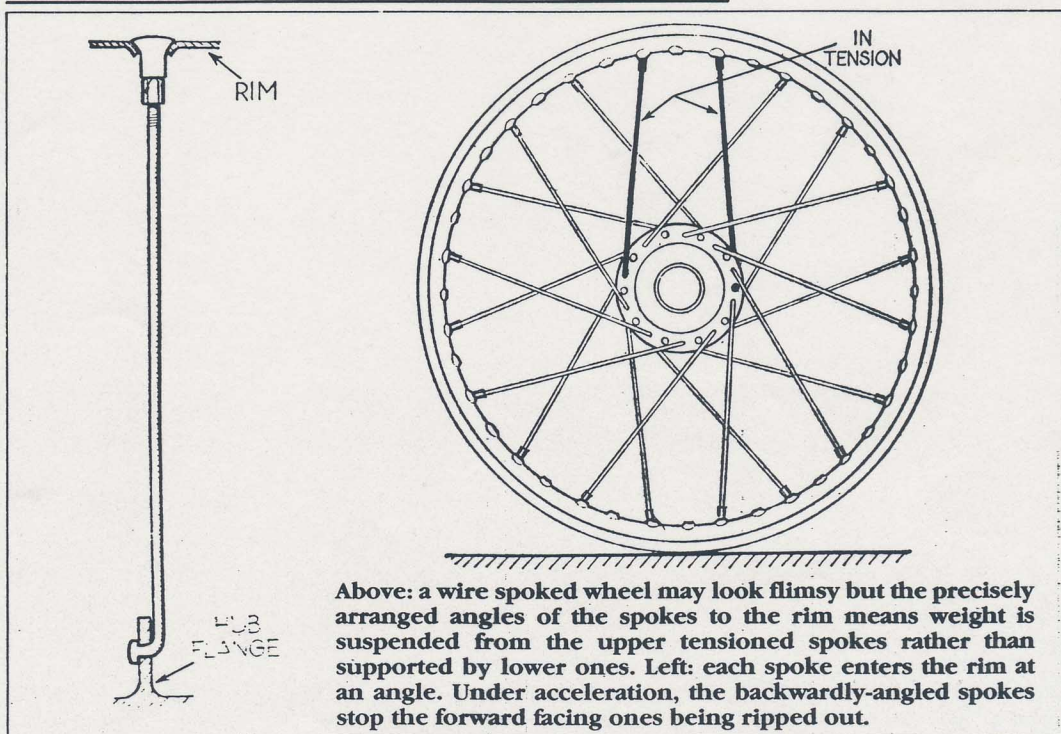
The idea of the suspension wheel is much older. And this name is far more descriptive of its construction. It is derived from the fact that the weight is suspended from the uppermost spokes, which are in tension, rather than pressing on the lowest spokes in compression.

In 1808 Sir George Cayley designed a pyramidal suspension wheel for his unsuccessful ornithopter, a flapping-wing aircraft. The rims were wooden, the spokes made of cord tensioned at the hub and the design as light, strong and satisfactory as the ornithopter was not.

At the beginning of the 1830s the suspension wheel was re-invented for railway use with adjustable iron rods for spokes. It was a failure in this application.

The simple radially-spoked

Tension and suspension – the method of absorbing the load



Above: a wire spoked wheel may look flimsy but the precisely arranged angles of the spokes to the rim means weight is suspended from the upper tensioned spokes rather than supported by lower ones. Left: each spoke enters the rim at an angle. Under acceleration, the backwardly-angled spokes stop the forward facing ones being ripped out.

wire wheel – in which each spoke meets the rim at a right angle – cannot cope adequately with power transmission and heavy braking forces. Tangential

spoking, pioneered by Dr Fred Lanchester before the turn of the century, made the cycle wheel suitable for car and motorcycle applications.

In a tangential pattern the spokes are arranged at alternate tangents to the hub, entering the rim at an angle. When you accelerate and the hub tries to rip



Final spoke tension is checked by ear. Each spoke should give off the same note when tapped.



If spokes have been cut to right length, few will protrude past nipple and require filing.

Spokes protrude out of the rim, those angled backwards from the hub in the direction of rotation are precisely arranged to take the strain in tension. On braking, the opposing spokes take the load.

It should be clear from this description that you must have a rim with the spoke holes drilled at the right angle.

Wire spoked wheels may look flimsy, but when properly built and tensioned are amazingly strong. In a crash they can dissipate a certain amount of energy as they crumple. A cast wheel tends to transmit the whole force of an impact directly to the forks and frame.

Helping hands

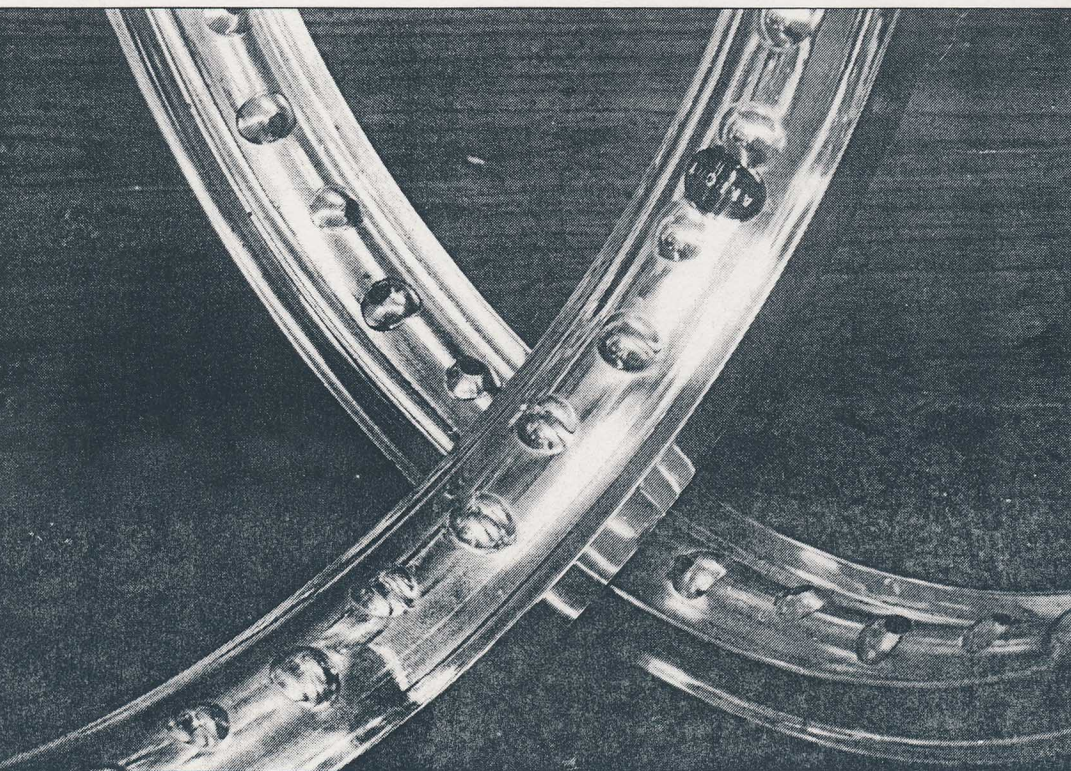
EC Booth, c/o 3 Copperfield Road, Coventry (0203 454148)

The Central Wheel Co, Copperfield Road (A446), Watlington, Birmingham B46 1NU (21 747 5175)

Derby Wheelbuilding Services, 87 Peel Street, Derby DE3 3GJ (0332 369085)

Essex Wheels, Wethersfield Road, Sible Hedingham, Malden, Essex (0787 60230)

Friendberry Engineering, 1 Linden Grove, Taunton TA1



1EF (0823 85065)
 • Alf Hagon, 350 High Road, Leyton, London E10 6QQ (01-556 4447)
 • John Hughes, Lower Road, Hammer Hill, Shrewsbury (0939 290606)
 • W Lomas, 183 Lees Road, Oldham, Lancs (061 633 0966)

• Reg Mills Wire Wheels, Wareham Road, Lychett Maltravers, Poole, Dorset PH16 6DS (0202 623126)
 • Molray, Unit C2, Dover Street, Maidstone, Kent ME16 8LE (0622 20012)
 • Motor Wheel Service & Repair, 65 Jeddo Road,

London W12 9ED (01-743 3532)
 • Rossendale Wheels, Grange Works, Burnley Road, Rawtenstall, Rossendale, Lancs BB4 8HY (0706 226127)
 • Roy Thersby, 26 Bowsfield Lane, Stockton-on-Tees, Cleveland (0642 6044768)