WORKSHOP

Wheel balance.

Steve Denner

Recently my casual attitude to this mundane and infrequently undertaken task suffered a rude awakening. In the course of swapping some wheels and tyres around I noticed that a front brake drum, left to its own devices, persisted in settling at its favourite spot; a sure indication that it was out of balance. Investigation with bits of scrap steel taped to the rim of the drum determined that it needs a correction of 30 grams, a piece of steel bar about 3/4" dia by 3/4" long. I confess this alarmed me a little and I could see no reason for imbalance of this magnitude. On reflection I think the reason is that vintage Alvis drums are fully machined only on the inside and with minimal machining on the outside. Despite the high quality of Alvis foundry work it would be impossible to guarantee patterns and cores would deliver a perfectly consistent wall thickness out of the mould In this case an error of 30 grams would require an "off centre" of the order of 0.015" - 0.020". Therefore I expect this is a quite typical balance error in our drums.

There is no simple or even elegant way of fastening a weight of this size to the rim of the drum, and the alternative, drilling lightening holes in the diametrically opposite side, is an equally unwelcome notion.

The solution of course is to balance the drum and wheel together, but to ensure that having balanced them, each wheel and tyre is marked to identify its corner of the chassis (Front/LH, Rear/RH, etc) and is also indexed to its unique mounted position on the 5 studs. I use a blob of paint on the face of the drum and a corresponding blob on the wheel centre to ensure the wheel is always returned to the same position. Without this procedure it is possible to refit the wheel so that the balance is worse than it was before you started.

In summary what is required is to determine the heavy point of each drum, mark it, and then separately find and mark the heavy point of each wheel and tyre. Each wheel and tyre is then mounted on its hub such that the heavy point of the drum and the heavy point of the wheel and tyre are opposite each other to the maximum extent possible using the five mounting studs. This will minimise the weights that have to be added by you to achieve balance. The whole assembly of drum, wheel and tyre is then balanced as per The Vintage Alvis Manual. It is not necessary to know the out of balance value for each drum. Vintage Alvis owners are lucky in that the drive shaft in the rear axle can easily be withdrawn by an inch and thus allow the rear drum to rotate without drag such that its heavy point will always fall to the bottom. It is necessary to temporarily balance a front drum by taping bits of scrap to its rim. This hub is then used to determine the heavy point for each wheel and tyre in turn.

Does it matter? After all 30 grams is not much in a car weighing around a ton. Most of the physics from school days has long since escaped my brain and at times like this I wish I had spent more time listening to Mr James in double physics period on Wednesday afternoons. Nevertheless, with what I could dredge from the abyss of memory, together with the notes in Prof. D A Low's Pocket Book for Mechanical Engineers, (publ. Longman's 1931, price 13/6d.) the centrifugal force is

F = MV(squared)/gR , where

M= mass in grams
V= velocity in centimetres per sec g=
gravity (981 cms/sec/sec)
R= radius (approx 6.25" on vintage Alvis drum)

A further point to remember is that the drum is rolling, as well as revolving. That is, at a road speed of say, 100km/h although the wheel moves at 100 its bottom is stationary where the tyre contacts the road. If it is not you are in a terminal skid and about to cause some damage to yourself and the streetscape. Logically therefore, the instantaneous maximum velocity of the drum periphery is at its top and is 200km/h.

I welcome any check of the numbers, but my scribbles suggest that the maximum centrifugal force is 57kg, and that this cycles between zero at the bottom (stationary) point of rolling, and 57kg at the top twelve times per second, and a staggering G force of 1,923. That sounds to me like an awful lot of flapping up and down on the ends of the axles! Apart from anything else it uses a lot of energy for which I have other uses, such as shaving the lap times at Winton.

It would be interesting to collect and record data taken from a population of cars to see what the average and extremes are for the out of balance value on these vintage drums. Perhaps Hon. Eds. will oblige by publishing any data sent to them?