

## THE ADVANTAGES OF A LIVE REAR AXLE

## Trailing Arm Magic

By ARTHUR MALLOCK

**T**here is a strong case for the live rear axle for racing applications, and it is backed up by the success of Mallock cars in categories which are popular in the UK, such as Vauxhall Supersports, Sports 1600 and Front-Engined Sports.

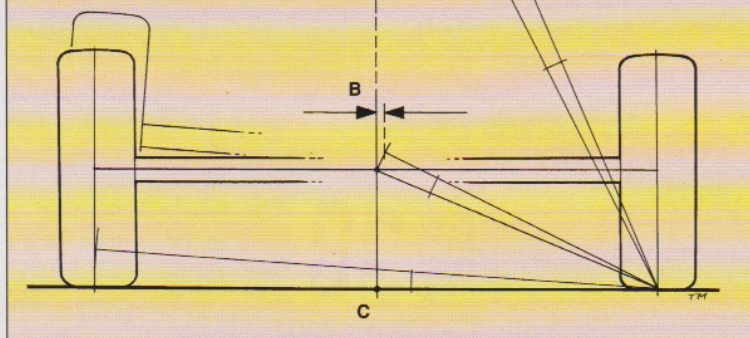
One authority has been quoted as saying that the only advantage of a live axle is that the wheels remain upright. I would add to that — "Under all important circumstances, such as braking, acceleration and cornering!"

This equates to far greater grip — surely a major contribution by itself. If there is a problem, it is getting an independent front suspension (IFS) to match this grip, and prevent excess understeer.

There is a school of thought which says that, in single wheel bump, the axle will tilt and, hence, the wheel is no longer upright. But, at worst, the tilt is no more than that of an independent rear suspension (IRS), with a swing axle length equal to track. In practice, any

FIG 1: THE STAGECOACH EFFECT

**A:** With rollcentre at track height (the stagecoach), the chassis moves sideways almost as much as bump. **B:** With rollcentre at hub level, the sideways movement is much smaller. **C:** With rollcentre at zero, the sideways movement is too small to see.



Major Arthur Mallock wrote this article for *Racecar Engineering* just a few weeks before he died, aged 75, on 2 December 1993. With the agreement of his family, we are proud to publish it as our tribute to his unique engineering expertise and infectious enthusiasm for the sport he loved.

bump is likely to have a rounded top, so that the deflected wheel can still be upright to the ground.

It is no coincidence that, when traction is a premium, such as in drag racing, sporting trials, short circuit, and US sprint cars and dirt track models, live axles are absolutely mandatory for performance.

For years, the startline speedtrap at the Prescott hillclimb showed that our Mallocks were state-of-the-art, with acceleration close to 1G. With our recent introduction of some torque-cancelling, our status has improved to "brand leaders".

However, upright wheels are by no means the only advantage. Good traction calls for anti-squat. With IRS, 20-25% is the practical limit. With live axles, there is no limit: in other words, 100% or even more is practical. Moreover, it is quite possible to keep the anti-squat percentage constant with ride height — it can even rise as ride height goes down. With IRS, as squat starts, the anti-squat is always reduced (see panel).

With downforce equal to sprung weight at 135mph, double wheel suspension rate needs to be stiff to preserve a stable aerodynamic platform, and to prevent the chassis being pushed into the ground.

For best ride, the single-wheel bump rate should be soft. With conventional IRS, the single-wheel rate is at best equal to the two-wheel rate and, with a stiff anti-roll bar, can be almost double. With a live axle, the single-wheel rate can be half the double (due to the narrow spring base) and, with a higher rollcentre, an anti-roll bar is often not needed.

This should not be over-emphasized because, while a narrow spring base can sometimes be good, a narrow damper base is not. With coil-over-damper suspension, we look for the widest possible base. Let's just say, the score is about 2 to 1 in favour of the live axle.

The range of practical rollcentre heights for IRS is very limited. Over 2in, scrub and jacking become excessive. With live axles, cars have been raced with rollcentre heights varying