Oct '87

T.A.M.*2* Live axle bump-steer

'The Book' says that if trailing arms are equal, parallel and horizontal then for one wheel bump, the wheel will move forward on an arc determined precisely by the length of the trailing arms.

In roll, both wheels will move forward the same amount, so there will be nil roll-steer. With the help pf Mr Pythagoras, the sums are simple.

If the roll centre were at hub level and if the axle brackets were equal length above and below the axle and if the T.A.s were also parallel when viewed from above, then the foregoing is close to the truth.

In practice, none of the 'ifs' apply. Roll centres are way below hub level, so that in one wheel bump or roll, the top arm moves sideways much more than the bottom and the T.A. front pivots are often 4" or more closer together than the rear.

If the trailing arms are equally tapered together top and bottom, then a little plotting will show that the axle movement should follow the same one as if they were parallel and still determined by the arm length.

If this is done, then there will be a 'geometric quarrel' for one wheel bump or roll, as the two sides will want to move in different directions.

Up to a point, such a quarrel is of no great importance. It's severity can easily be checked by removing a spring, moving one wheel up and down and noting if resistance tightens up. At worst you have provided a free anti roll bar.

The only problem is that there is no way of telling what part of the system is flexing, so that the draughtsman will not be able to determine the wheel travel even if he is clever enough to think and draw in three planes

The solution must be found by experiment.

The rear bump steer of a Mk 27SG was very carefully measured and found to give a steer change of .08" over the full suspension travel. Remembering that both wheels steer this amount, the number would seem to be significant and always the wheel toed out in bump, i.e. an oversteer direction.

One simple change halved the error and two other changes halved and halved again, so eventually the error was 8 times better at .01" i.e. 10 thou.

It seems that with T.A.s tapered in the horizontal plane, the bump-steer can actually be better than simple prediction of arm arc would suggest i.e. As an arm moves above the horizontal, the rear pivot moves forward when viewed from the side, but backward when viewed from above. These two effects can be made to cancel to give almost pure straight line motion, even when T.A.s are unequal length and tapered to give anti squat.

Thinking about it, and ignoring geometric quarrel, the rear T.A. pick-up must follow an arc dictated by the perpendicular between it and the roll centre.

Future possibilities

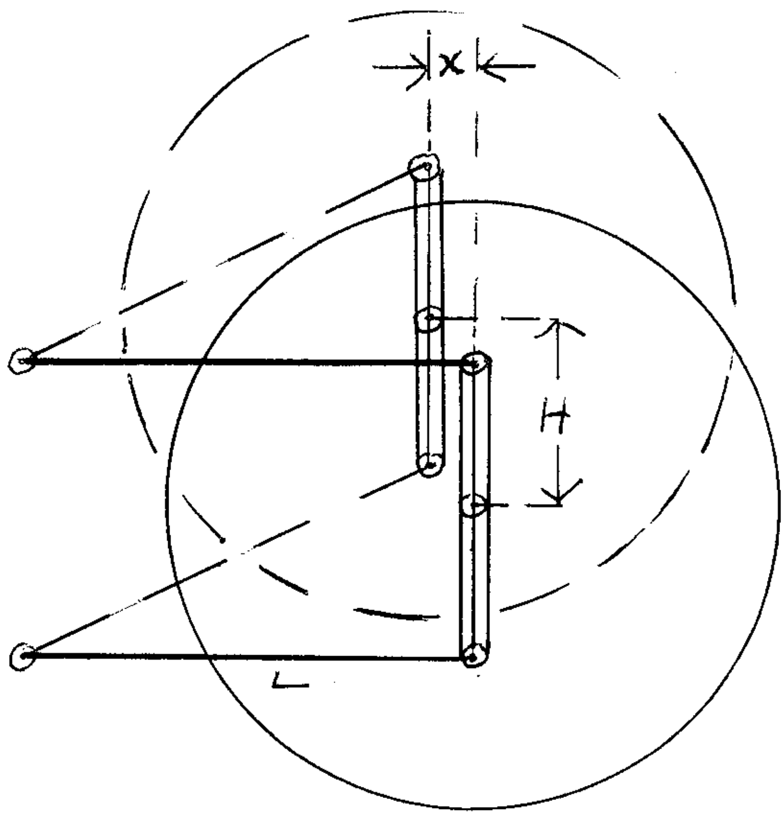
During the experiments an interesting theoretical point was confirmed:

If one top trailing arm is disconnected, the other top arm can play no part in axle steering. It can only cause the whole axle to rotate about the lower pivots, which then control entirely the bump steer.

This opens-up interesting possibilities for three arm control, possibly with torque canceling.

It also seems likely that the top T.A.s could be still further shortned, to give more T.A.M. or even be put inside the chassis, as on the Mk 2

Figure 1

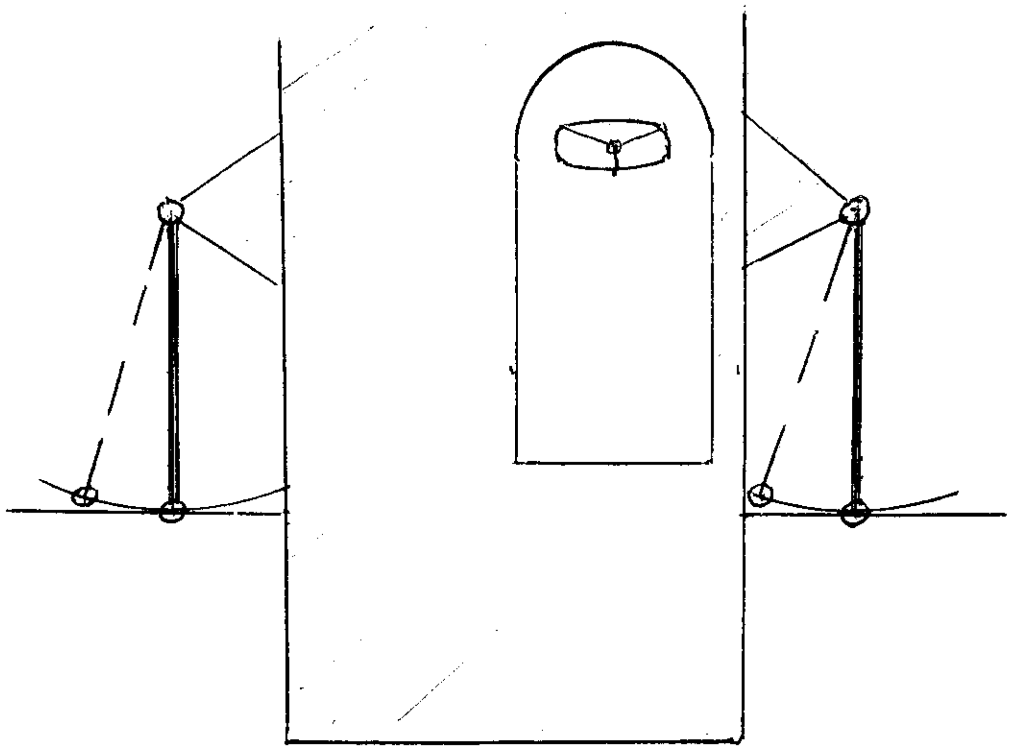


The 'Book' says that steer is related to 'X' where $X = L - \sqrt{L^2 - H^2}$

If 'K' is the distance between diamonds the toe change measured at 14" wheel diameter is $\frac{14X}{K}$

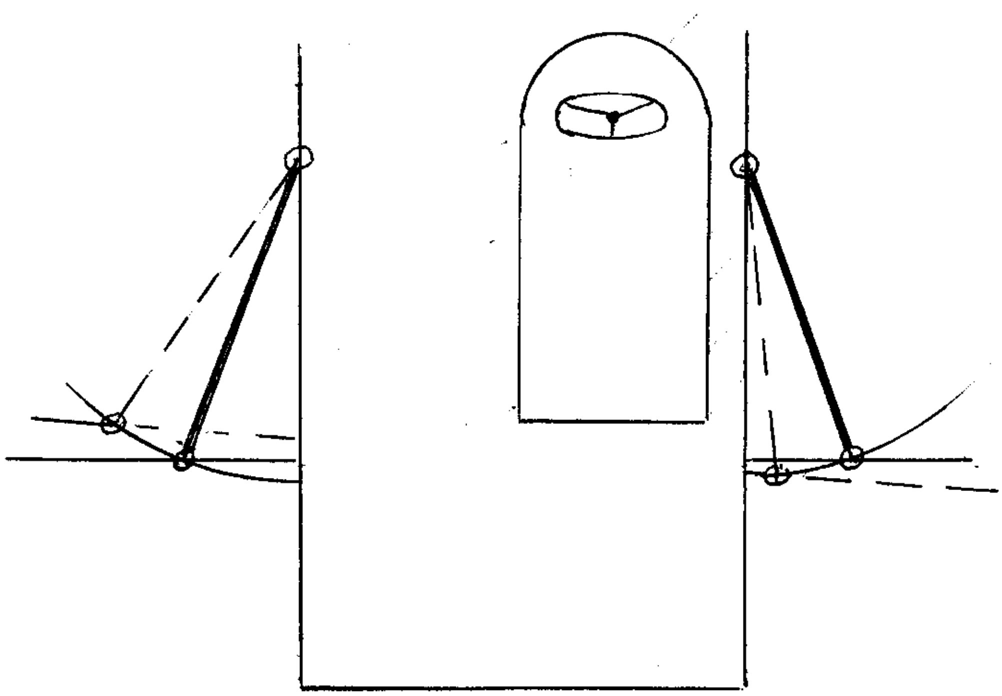
e.g. If K = 40" and L = 35" then for H = 1", X = 5 thou, for H = 2", X = 20 thou and H = 4", X = 80 thou. In practice however, the change is never as simple as this.

Figure 2.



If T.A.s are parallel when viewed from above, rear pivots will appear to move forward on both bump and droop. This will often aggravate the situation in Figure 1.

Figure 3.



If the T.A.s are tapered, the resultant skew can be used to counteract the steer resulting from Figure 1. The effect is greater on the top arms as they are further from the Roll Centre.