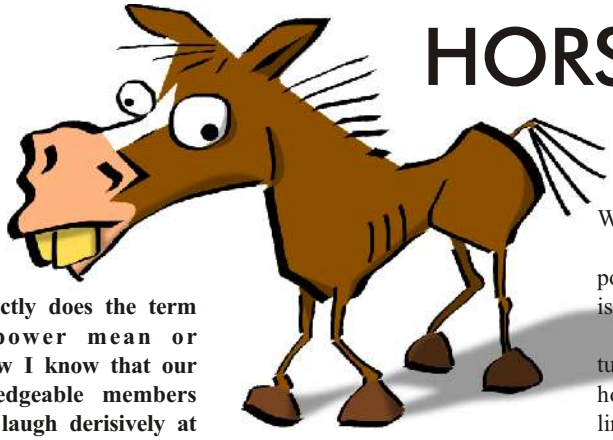
# HORSE POWER

by Fred Phillips



**What exactly does the term horsepower mean or describe? Now I know that our more knowledgeable members will perhaps laugh derisively at this question, but I readily admit that although I knew that the term describes a measurement of our car's potential "Oomph", I knew not how it was derived or calculated. That was, till I read a brief description in a motoring column penned by one Matt Prior. I found his words more than interesting and immediately set about, via the mighty Google, canvassing the thoughts of the Wikipedia intelligentsia. So now, as a freshly minted guru, I am able, to show off and share some pearls of lockdown wisdom with you.**

It turns out, (pun unintended) that in the UK, (mainly Wales) real horses were used as the motive force to drive the pumps used to keep water levels at a more, or less manageable level in the coal pits. It seems that old Dobbin would be harnessed to a wheel and walk around endlessly, turning a gear which provided power to the pumps.

James Watt, a Scottish engineer was producing steam engines for among other things, driving pumps at this time and, in order to market them to the canny mine bosses, he needed to draw comparisons with the work effort of the pit ponies. Hence, he coined the expression, HORSE POWER. It seems like a good thing that he did not opt for the more obvious pony power, as that may, on reflection, have sounded a bit effete when the boys at the bar were bragging about their car's performance.

Anyway, Watt determined that a decent horse could turn a mill wheel 144 times in an hour (or 2.4 times a minute). The wheel was 12 feet (3.7 m) in radius; therefore, the horse travelled 2.4 × 2ð × 12 feet in one minute. Watt also judged that the horse could pull with a force of 180 pounds.

Watt then defined and calculated the horsepower as 32,572 ft·lbf/min, which was rounded to an even 33,000 ft·lbf/min.

Various figures were being put forward at the time, but Watt found by experimentation in 1782 that a brewery horse could in fact produce his claimed 32,500 foot-pounds per minute power output. It is not recorded how many different horses were tried before the desired number was achieved. In any case, James Watt standardized that figure at 33,000 foot-pounds per minute the next year and that became the accepted figure.

Why did he opt for a brewery horse? Well, a common legend states that the unit was created when one of Watt's first customers, a brewer, specifically demanded an engine that would match a real horses performance.

The crafty brewer then chose the strongest horse he could find and driving it to the limit, established the bench mark that Watt needed to achieve in order to attain parity with his pump. Watt, while aware of the skulduggery, accepted the challenge and built a machine that, actually was even stronger than the figure achieved by the brewer, and it was the output of that machine which became the horsepower we know today.

How accurate was the figure that Watt came up with in 1782? Well, it is interesting to note that over 200 years later, in 1993, a R. D. Stevenson and R. J. Wassersug published correspondence in "NATURE MAGAZINE" USA, summarizing measurements and calculations of peak and sustained work rates of a horse. Using accurate measurements made at the 1929 IOWA STATE FAIR, they reported that the peak horse-power over a few seconds has been measured to be as high as 14.9 hp, but interestingly, they also observed that for sustained activity, a work rate of about 1 hp per horse is consistent with agricultural devices from both the 19th and 20th centuries. This showed both that horses have not become weaker, and Watt was absolutely right.

Now the most bewildering horse-power idea as far as I am concerned, is that of the RAC HP Rating.

All pre-war vehicles manufactured in Britain have an RAC horsepower rating, which was linked to the Vehicle Excise Duty or VED, aka Road Tax or Car Tax.

When the horsepower tax was introduced on 1 January 1910 a formula, known as the RAC Rating, was used to calculate the horse-power. It turns out that the formula was based on applied theory and derived from basic principles rather than from the results of a bench test. It made three basic assumptions which are: a mean effective cylinder pressure of 90 psi; a mechanical efficiency of 75% and a mean piston speed of 1000 ft/min.

**hp = ( D2 x n ) / 2.5**
*where D = the diameter of the cylinder in inches and n = the number of cylinders.*

The tax payable was: 0 to 6.5hp (£2.10) and all the way up to a maximum of 60hp (£22.05).

This tax encouraged an interest in light cars and effectively limited large engines to luxury cars but, was ideal for a car like the Austin Seven.

By 1930, engine developments meant that the effective cylinder pressure was up to 125 psi, and piston speed had doubled. Also, some performance engines were making much more power than the 60 hp upper limit. Some manufacturers, such as Rolls Royce, Rover and Wolseley, started to use a double rating system and designated a car as eg. 10/25, where the 10 was RAC horsepower and 25 was indicated real horsepower

The RAC Rating was used until 1947 at which time the government replaced it by a flat rate of £10 per year for all cars and the rather strange RAC system fell away. So now at last, I know why a Rolls Royce 20/25 is what it is.

I think.