Smiths Chronometric Speedometers

Most English motorcycles through the Classic period used the Smiths Chronometric Speedometer until the advent of the cheaper to produce, but less accurate Magnetic type used from the mid 1960's. How did the Chronometric operate and why was it considered so accurate?

This particularly neat and accurate design of speedometer uses the clock movement or chronometric principle, whereby speed indications are obtained at intervals of ¾ second, by means of an escapement mechanism.

Referring to Fig 1, 2 and 3, the driving shaft from the gearbox or front or rear wheel speedometer drive is shown at A. By means of the four gear wheels, 1, 2, 3 and 4, the drive is taken to the camshaft B. The camshaft is an intricate piece of work- and should be studied closely. Mounted on it are the gear wheel 4 and the escarpment wheel C, and three cams, 5, 6 and 7, which operate three leaf springs, the purpose of which will be described shortly.

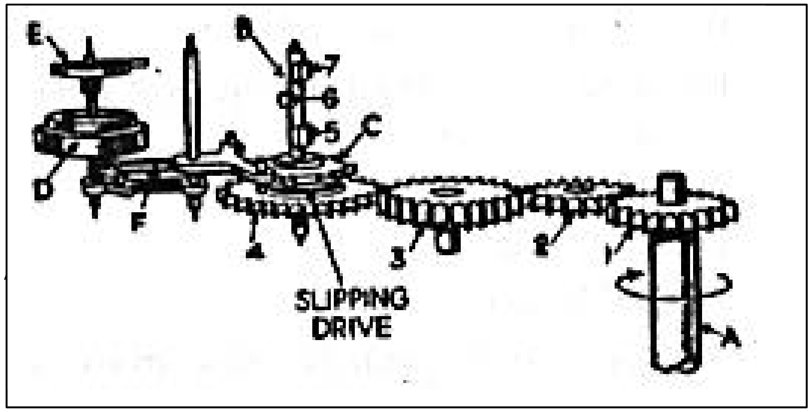

Fig 1. *Showing Gear-wheels and Camshaft of Smiths Chronometric Speedometer.*

The gear wheel 4 has a slipping drive on the camshaft (mounted on a sleeve, as it were) so that there is only a friction drive between it and the escarpment wheel C, which is keyed to the camshaft.

The rotation of the escapement wheel (and therefore of the camshaft) is governed by the balance wheel D with its hair-spring E, and by the escapement lever F, this part of the mechanism working exactly like a watch. No matter, therefore, at what speed the gear wheels are being driven by the driving shaft, the camshaft B will only rotate at the speed permitted by the escapement. In other words, the friction drive between the escapement wheel C and the gear wheel 4 allows the drive to overrun, and we have the camshaft B rotating at a constant speed, no matter at what rate the machine is traveling.

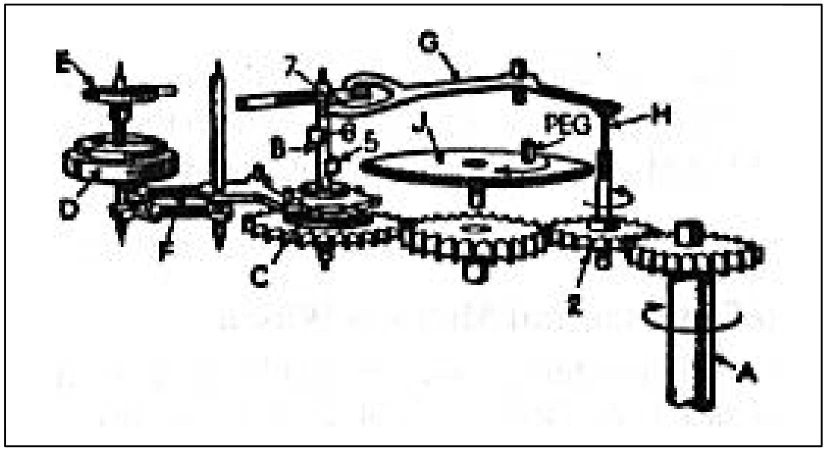

Fig2 *The Rocking Lever and its Leaf Spring, the Spindle and Ratchet Pinion added.*

Referring to Fig 2, held against cam 7 by its leaf spring is one end of a rocking lever G. The other end of the rocking lever is connected to the spindle H. whose central portion is finely gearcut to mesh with the ratchet pinion J. Owing to the action of the cam 7 the rocking lever G will be continually moving the teeth cut on the spindle H in and out of engagement at regular intervals. Now the spindle H is also being rotated by the gear wheel 2 at the speed of the driving shaft A and during the periods therefore, that its teeth are in engagement with the ratchet pinion it will turn the pinion a greater, or less degree, according to the speed at which it being driven by the driving shaft. In other words, if the driving shaft, and therefore the teeth cut on the spindle, are rotating at high speed, the ratchet pinion will be moved a greater distance in a fraction of a second while the teeth are in engagement with it than if the driving shaft were rotating at a slower speed.

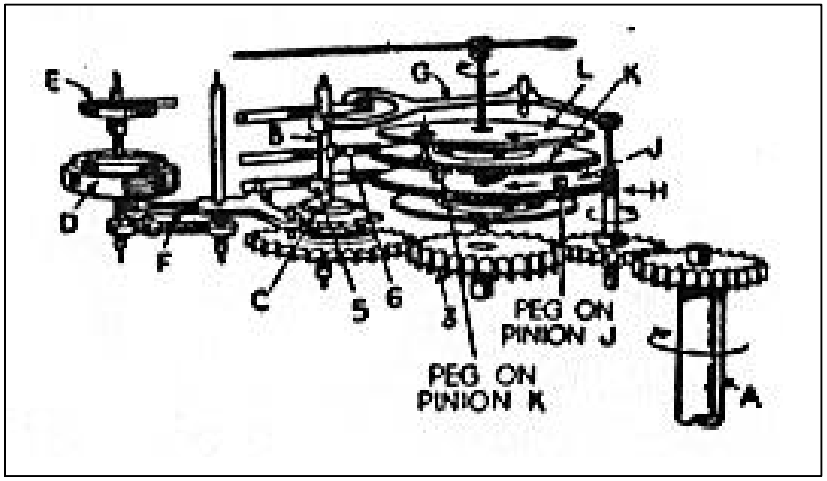

Fig 3 *The complete Smith Chronometric Speedometer Mechanism.*

Mounted on the ratchet pinion J is a peg, and when the pinion is driven round, this peg butts up against a similar peg (inverted) on the recorder wheel K (seen in Fig 3). Both these pinions, it should be understood, are a loose fit on their shaft and are not driven by the gear wheel 3. The recorder wheel is connected by a short link- to a third “damping wheel” L, upon whose spindle the speed recording hand is mounted. The damping wheel L is damped by the friction of a fourth leaf spring (not shown) bearing on it which rests lightly against the camshaft but is not operated by a cam.
As a speed indication arrives from H the ratchet pinion is driven around a certain distance, and its peg butts up against the peg on the recorder wheel and the recorder wheel is pushed around. Both the ratchet pinion and the recorder wheel are equipped with hair springs which tend to return them to zero, but they are checked alternately by leaf springs operated at regular intervals by the cams 5 arid 6, the ends of the leaf springs engaging with the teeth of the pinions J and K.

When the teeth cut on H come out of mesh with J, J's leaf spring has just come into engagement and holds it fast: meanwhile K's leaf spring is *out* of engagement, but K is held in position by the two pegs, which are still butting against one another. The next movement is that cam 5 lifts J’s leaf spring and J flies back to zero, but just prior to this cam 6 has engaged K’s leaf spring so that K still stands where it is, holding the wheel L locked in position registering the speed. Then the teeth cut on H come back into mesh and commence to drive J, and after a slight pause K's leaf spring lifts, releasing it.

Now if the speed has remained *unaltered* during this period of operations (which, remember, has only taken ¾ second) the peg onthe ratchet pinion J will catch up with the peg on the recorder wheel K and hold it in position, another cycle being repeated. If the speed has *increased*, J’s peg will carry- its opposite number farther on

If the speed has *decreased*, J’s peg will not be driven so far as the position occupied by the peg on K, and the hair spring will cause K to fly back till the two pegs meet once more.

The operation of the whole mechanism is thus governed entirely by the escarpment, and as the teeth cut on the spindle H are drawn in and out of engagement at regular intervals, the indicating hand connected to L is moved at those periods only, at all other times being locked in position, and when it does move it moves only the difference to correspond with any variation in speed that has taken place during the last ¾ second.

The Smiths Chronometric Tachometer operates in precisely the same manner, the only difference being the absence of the odometer and a suitably engraved dial, see photo below.