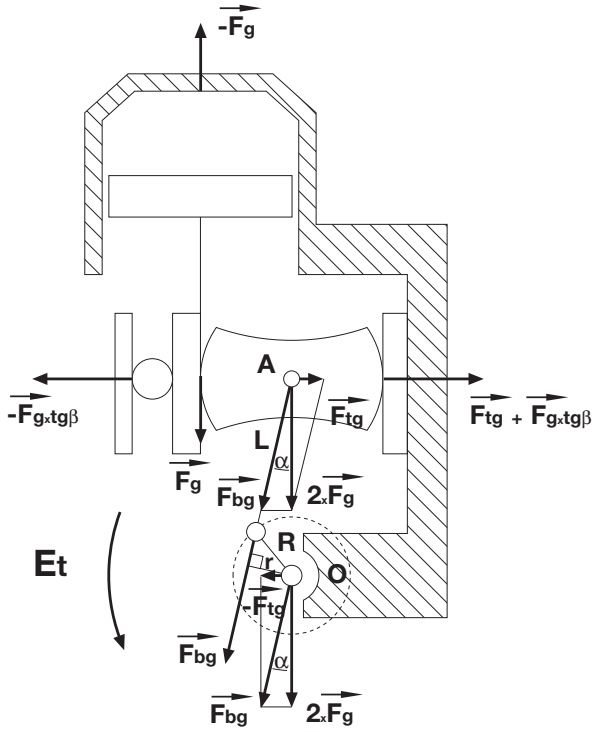
Combustion forces applied on the MCE-5 VCR engine block parts:

The MCE-5 engine also presents a rod-crank mechanism, but a gear wheel replaces the piston. The piston which position is shifted, comprises a rack on its lower part and operates under translation motion between the gear wheel and a synchronized roller.

It must be noticed that the crank radius is equal to a quarter stroke, contrary to that of a conventional engine which is equal to half the stroke.

The same method can be used to calculate the effects of gases pressure on the MCE-5 mechanism from which results the following scheme:



β= Gear teeth pressure angle

$$Et = 2 \times OA \times Ftg$$

In the case of MCE-5, the gases pressure force is directly applied by the piston rack to the gear wheel which can be compared to a lever. As a result, the force applied to the rod axis is twice the force applied by gases pressure to the piston.

The rest of the reasoning is identical to that permitting to calculate forces applied to a conventional engine except that the force applied to rod axis is equal to 2.Fg.

And: $Fbg = \frac{2 . Fg}{\cos \alpha}$ and $F_{tg} = - 2 . Fg . tg\alpha$

As a result:

- Forces momentum applied to the engine block (M_{comb} combustion momentum) is equal to:

$$M_{comb} = - 2.OA . F_{tg}$$

- Engine torque E_t applied to the crankshaft is equal to:

$$E_t = 2.OA . F_{tg}$$

Comments:

1. When an equivalent force is applied to the piston by the gases pressure, MCE-5 Engine torque is not twice that of a conventional engine. Indeed, despite the force applied to the rod which is doubled compared to a conventional engine presenting the same given rod/crank ratio, the OA distance is divided by two because the crank radius and the rod length are divided by two.

   The same Engine torque E_t is found in the two cases.

2. In the case of the MCE-5 VCR engine block, the horizontal force F_{tg} is no longer applied by the piston to the cylinder, but by the gear wheel on the synchronised roller.

   Thanks to the high efficiency of spur gears which is from 99 to 99.9 % depending on the instantaneous load (the lower the load, the higher the efficiency), engine friction losses are reduced.