

Dry hobbing and carbide hobs

Nowadays, surely, the most current matter, in the field of gear production, is the dry hobbing with hob carbide hobs.

In fact, this is the goal of a slow, but constant, planning and use of the hobs development.

There has been, started 40 years ago, when were used hobs of standard dimension, with 3,5 inch of diameter, 3,5 inch of length ad 12 teeth.

The steel used, usually, was the M2 steel.

Of old, and the hobbing machines and hobs evolution proceeded together, especially, with the spur of the automotive industry, which required shorter times and smaller costs.

The modern hobs, nowadays, are built with very alloyed steels, with high cobalt percentage (M35) to hold out to the high temperatures caused during the hobbing with high cut speed.

The steels technology, also, resulted with ASP30 had a big progress, and now there are in the market, the steel of the last generation, like ASP60 and ASP80 or CPMREX76, which keep the hardness with temperature near to the 800 °C, too.

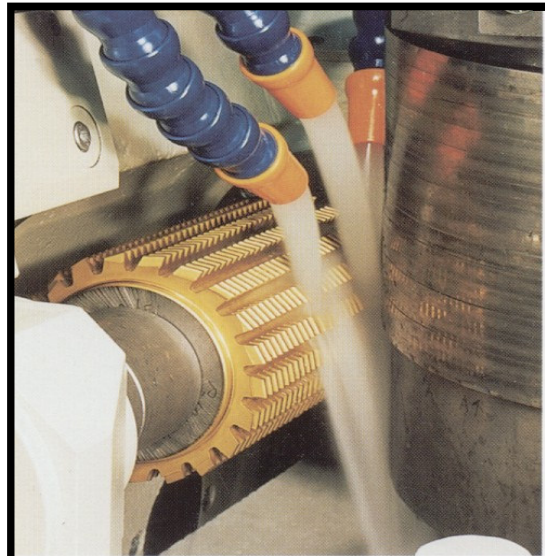
The techniques of TIN coating is developing and, at this moment it's showing the TiAlN coating hobs, which are coated with many different composition micro-coats (multilayer technology).

At the same time, at the steel development are followed the experimentations with carbide hobs and, also in this field there are been considerable improvements, especially in the carbide technology which, now, uses dusts "Micro-Grain" and "Ultra Micro Grain".

The hobs finishing has produced new dimensions, for example, the reduction of the diameter outer to 65 mm, the increase of the length at 250 mm, the increase of the number of starts to 5-7 and the increase of the gashes numbers over 20.

These hobs, which we could call the new generation hobs, are built with CNC machines and so have a higher precision than the old hobs.

This incredible evolution has been possible for the contemporary huge improvement of the hobbing machines, that now work with a cut speed and feeds which were not imaginable a few years ago.



Dry hobbing

The modern carbide hobs and the modern hobbing machines can, nowadays, work dry, that is without the use of the refrigerant oil.

Many technicians think that this work-system is more convenient than the normal hobbing with oil.

For these technicians “convenient” means to execute the gear with shorter times and lesser costs.

It is necessary specify that this s never true.

The dry cut has, always, a technical output lower than that at oil, this means that cutting without oil do not improve the hob times and the performances, his life.

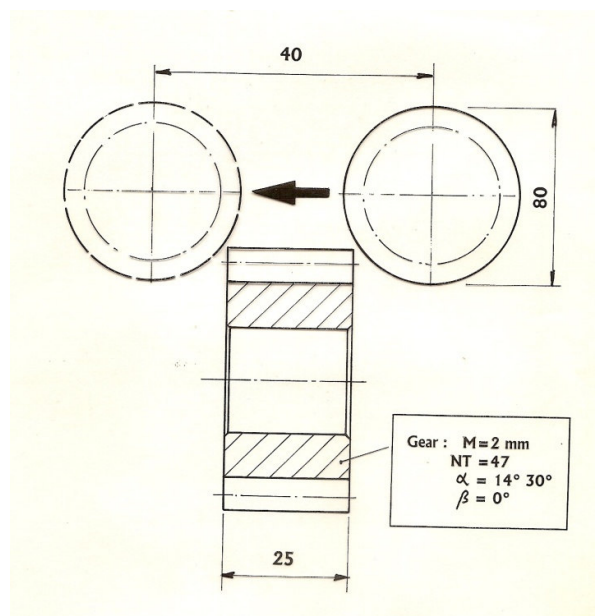
We can say that using the same carbide hob in the same machine and with the same work condition, with refrigerant oil, we can increase 2-4 times the pieces number that can be carried out for each resharpening.

The modern hobs in very alloyed steel coating with TiAlN (or similar) can work with a cut speeds very close at 200 m/min.

These hobs can be longer than the carbide hobs and have a number of starts more bigger (5-7), instead the carbide hobs usually, are at 1 start, but never more than 2-3.

Nowadays, the carbide hobs can cut at 250-300 m/min, and it's clear that the time cannot be lesser than those of an advanced HSS hob.

Gear: $m = 2 \text{ mm}$; $NT = 47$; $\alpha = 14^{\circ}30'$; $\beta = 0^{\circ}$; Width = 25 mm			
Hob material		HSS – ASP60	Carbide- TiAlN
Outside diameter	mm	80	80
Length	mm	230	180
N° of gashes		24	18
N° of starts		5	2
Cutting speed	m/min	190	280
Feed per gear revolution	mm	2	3
Stroke's length	mm	40	40
Hob's revolution per minute		756	1115
Gear's revolution per minute		80,42	47,44
Feed	mm/mm	160,84	142,32
Cutting time	(minute)	0,249	0,281



The carbide hob has some serious disadvantage:

- *High cost: 3-5 times more than the steel hobs.*
- *Ease breakages or causal splintering.*
- *Difficulty of the resharpening.*
- *Necessity taking away the TiN coating before to re-coat it again.*

Thus, we can know that the choice using a carbide hob instead a steel hob cannot be founded only on this element, because the carbide hob should be appear inferior.

The relevant element to consider is what involves the use of the refrigerant oil considering costs and environmental pollution.

This is the new and decisive element that will be conclusive in the choice of the working way and so in the choice of the kind hob.

The oil cost and in the future will cost more. The oil costs to buy itself, costs to avoid that the oil vapors strew in the air, costs because it is necessary rid of the drips sodden with oil (special waste), costs because it is necessary rid the oil when it is worn out.

In many countries the regulation about the oil use, about his elimination and about the presence of his vapors in the air ecc... is very rigid, in fact if in the budget we put the sum of the costs of, the advantage which there was using the HSS hobs disappears.

Conclusions

1)- With the current technology the use of carbide hobs is not profitable as regards as the most advanced steel hobs, if we compared only the costs of the tools and the hobbing times.

2)- The use of the refrigerant improves the life of the carbide hob.

3)- The use of carbide hob cab be thought, only, for production of big series. For little series the hobs storage cost would be too high.

4)- The oil cost, in all, is growing. In each Country and Company this cost must be remarked to understand how far it is profitable work t damp.

5)- Another relevant question is the difficulty with which a good carbide hob can be bought. How many makers, nowadays, are be able to supply, regularly and with a constant quality the carbide hobs?

6)- The hob grinding and the following covering with TiAlN is for many a big problem.

The carbide hobs test just since many years, there are been relevant progresses, but for a big diffusion of these hobs it is necessary wait a little time, still.

For dry hobbing, maybe, the substantial boost will came, not from automotive industry, but from the authority which keep the environment livable.

During the last few years the refrigerant oil has improved the characteristic. Now we can use special vegetable oil.

This type of oil haven't any dangerous impact in the environment.

The most important problem maybe found the solution.