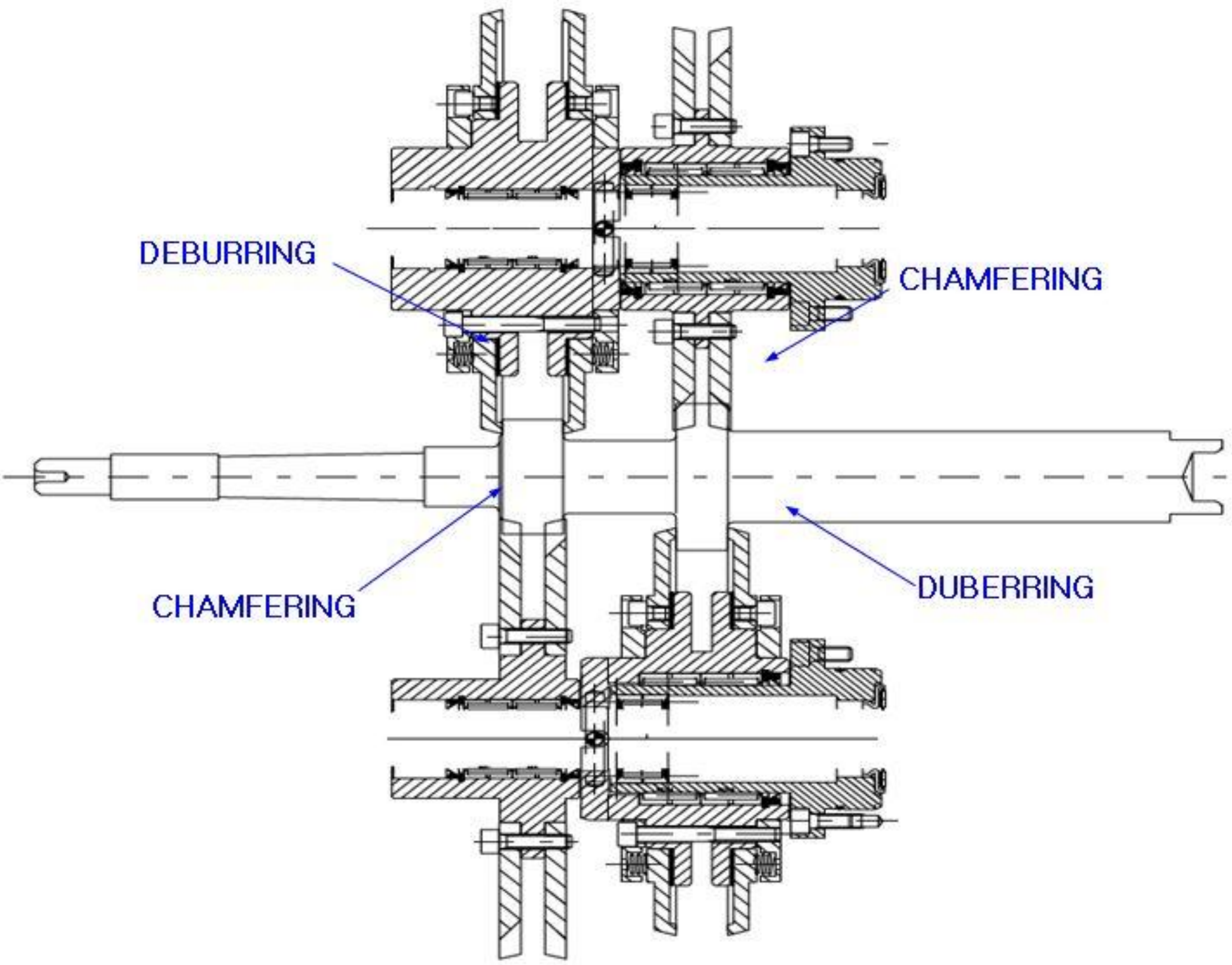
Gear chamfering, deburring and rolling (special application)

Special application for cluster gear

It's possible to chamfer and deburr more gears in the same time of cluster gear.

The figure N°1 shows an application of a cluster gear with two gears processed in the same time with a machine with only two heads.

It's possible also a more complex layout, for example to chamfer and deburr in the same time 4 gears of a cluster gear, but in order to simplify the set-up of this kind of multiple machine, it's better to share the single operation in to station where to process two gears in each station.



Chain sprocket deburring and rolling tool

These tools are developed exclusively to deburr chain sprocket; the special adapted form has exactly the same profile as the flank radius of the gear tooth and therefore any burrs from the lateral surfaces of the gear teeth.

The chain sprocket roller tool profile also correspond to he gear tooth profile.

The special tapered form of the tool tooth prevent material from building up along the gear tooth profile during the contemporary deburring operation.

In order to obtain the best result deburring and rolling operation must be proceed in the same time.

Because every chain sprocket normally have a different face radius, needs a different deburring tool for each gear.

Figure N°2- *Rolling operation of a chain sprocket*

Special profiles of gear teeth
There are many gears with not straight lateral face; the figure N°3 shows some examples.

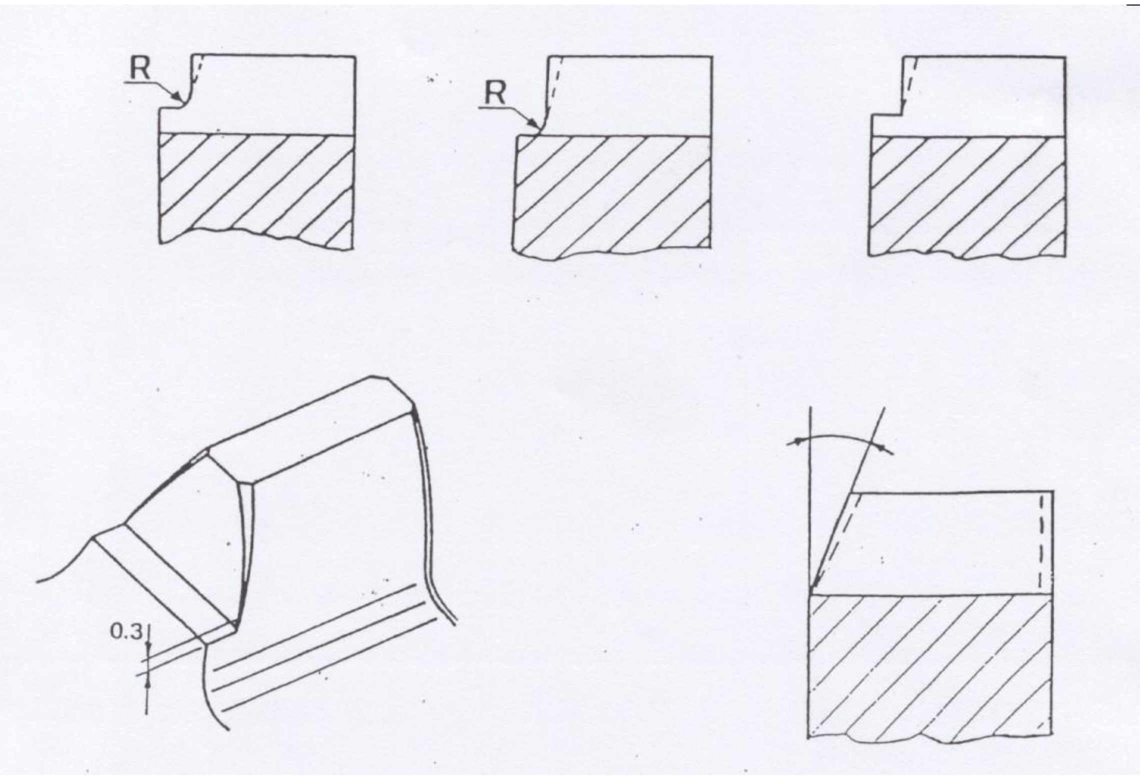


Figure N°3- *Some examples of special profile of the gears flanks*

In these cases it needs a special deburring tool, with a face inclined and with cutting edges. This tool must have a peripheral speed different then gear.
The figure N°4 shows the chamfering tool and the deburring tools for this type of gear.

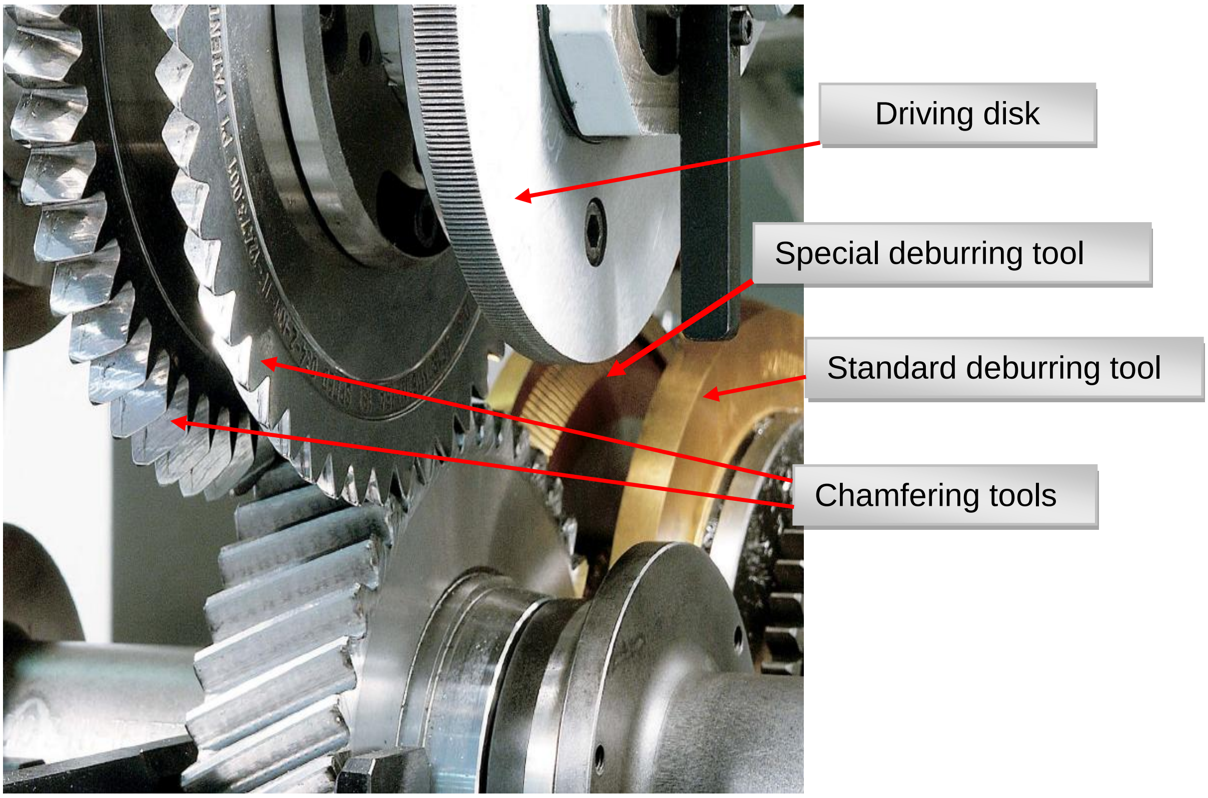


Figure N°4- *A special deburring tool*

Metallurgic Research into Chamfered and Rolled Tooth Edges

The use of chamfering tools causes a build-up of material along the profile.

This is usually in the range of 50 μm to 70 μm and can shorten the life-span of ceramic and galvanic bonded tools, which are used in the finishing process.

In some cases it is therefore necessary to use a third tool in order to even out this build-up of excess material.

The rolling operation allows to eliminate the "burrs" that chamfering operations form by plastic deformation on the flank of the gears. These burrs, usually in the region of 5-7/100, cause problems in subsequent grinding phases and actually put the grinding wheel at risk; at this point a rolling operation on the gears becomes necessary.

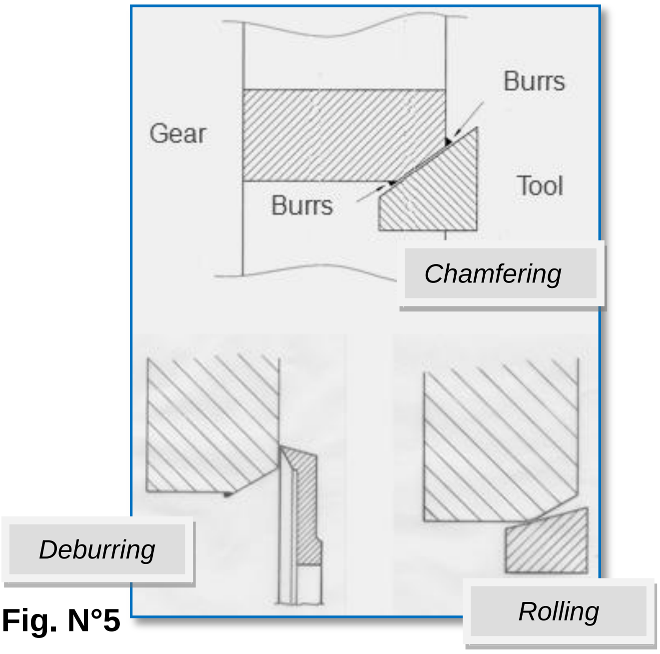


Fig. N°5

The diagram of the figure N° 6 shows the profile of hardness of a gear after heat treatment.

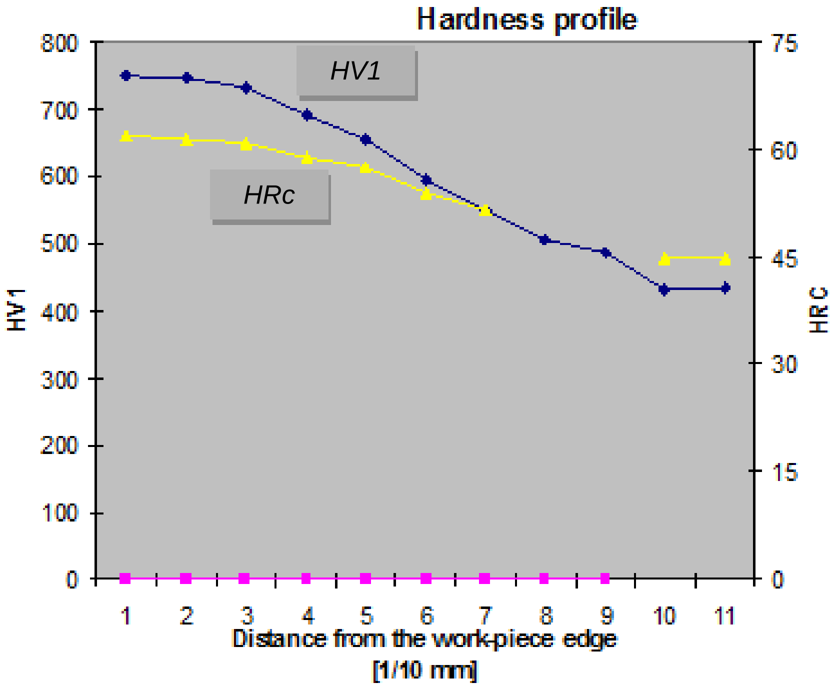


Figure N°6-

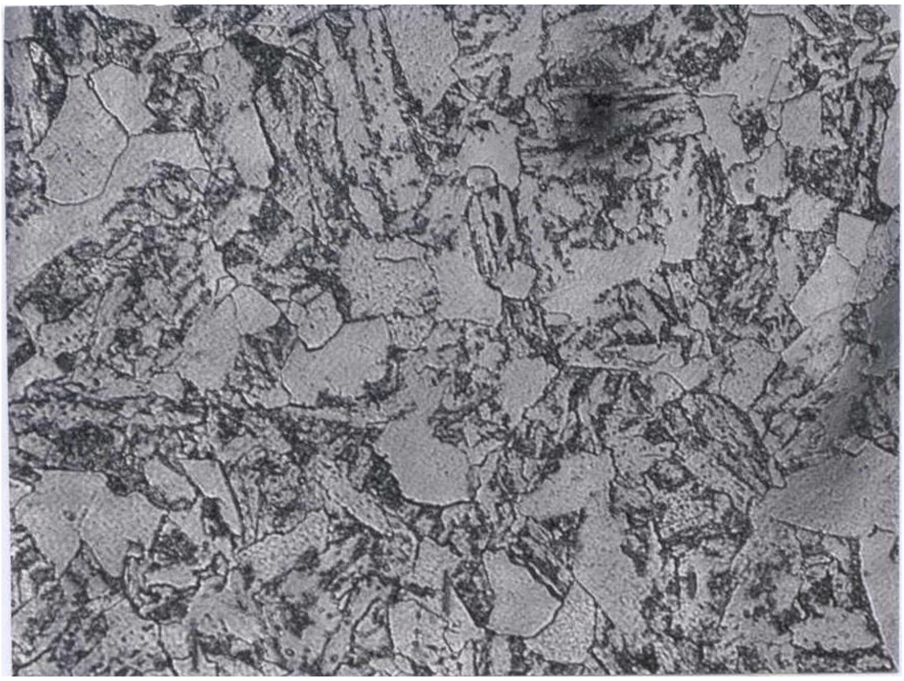


Figure N°7- *Analysis of the softness of gears*

Without heat treatment

Corroded by 2% Nital

Structure: ferritic structure - Pearlite content: 25%

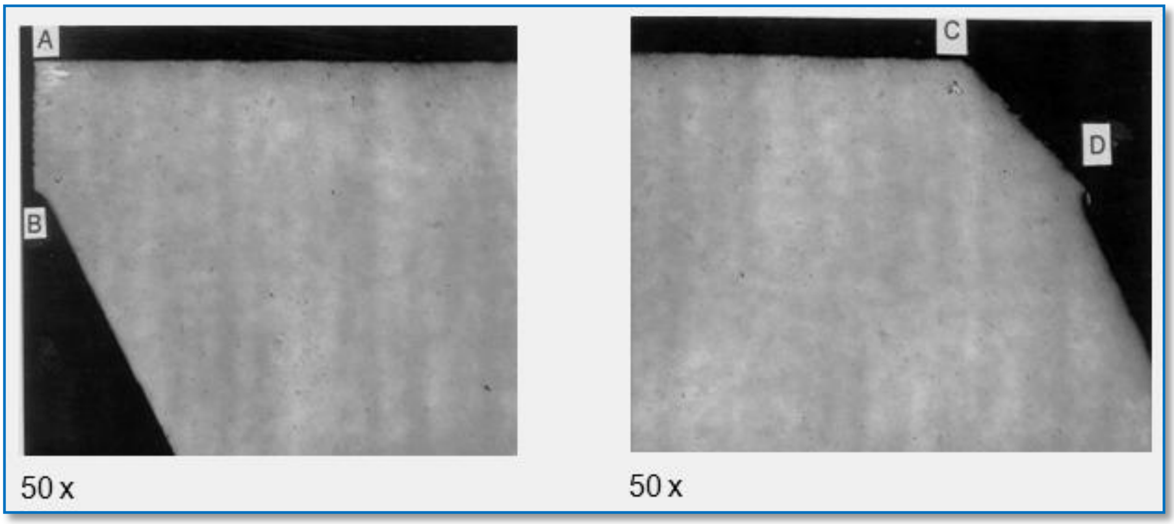


Figure N°8- *Gear hobbed and chamfered*

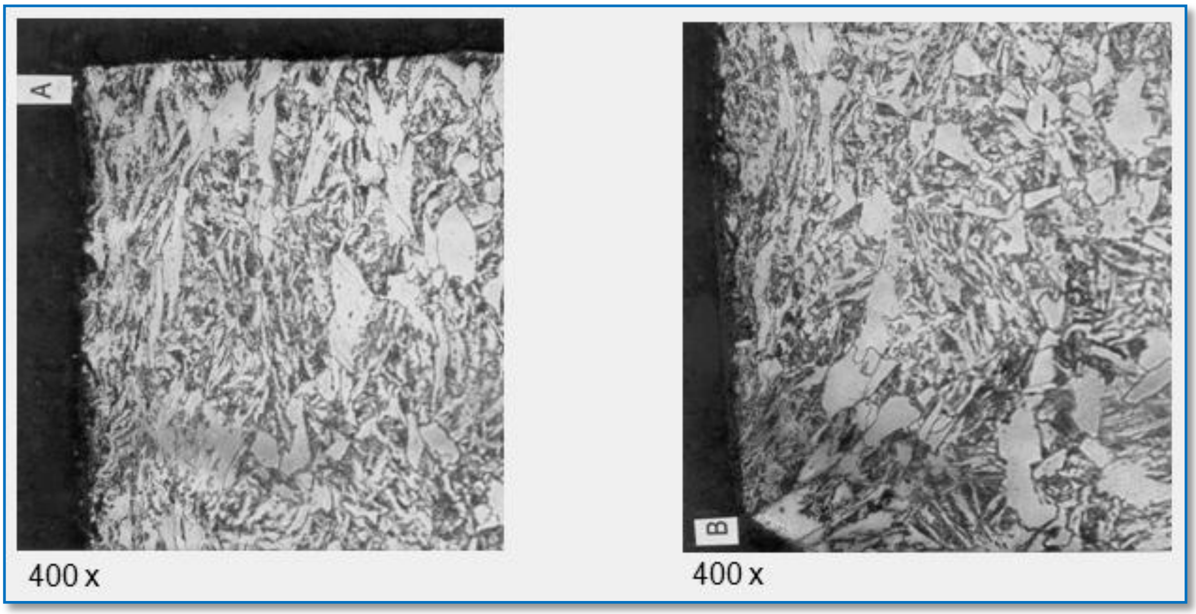


Figure N°9- *The tooth edges after chamfering and rolling are corroded and deformed and they have a ferritic structure with a pearlite quota of about 25%*

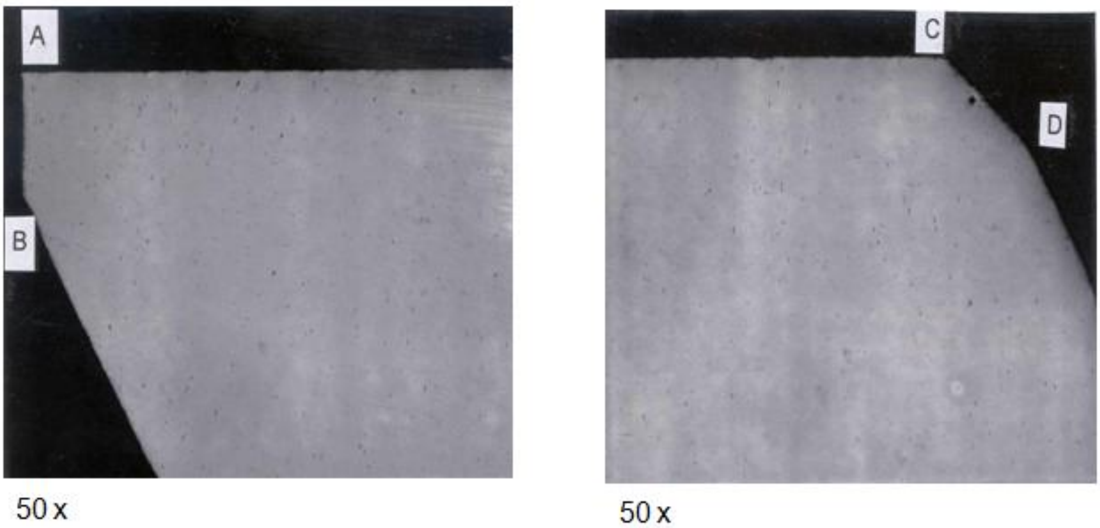
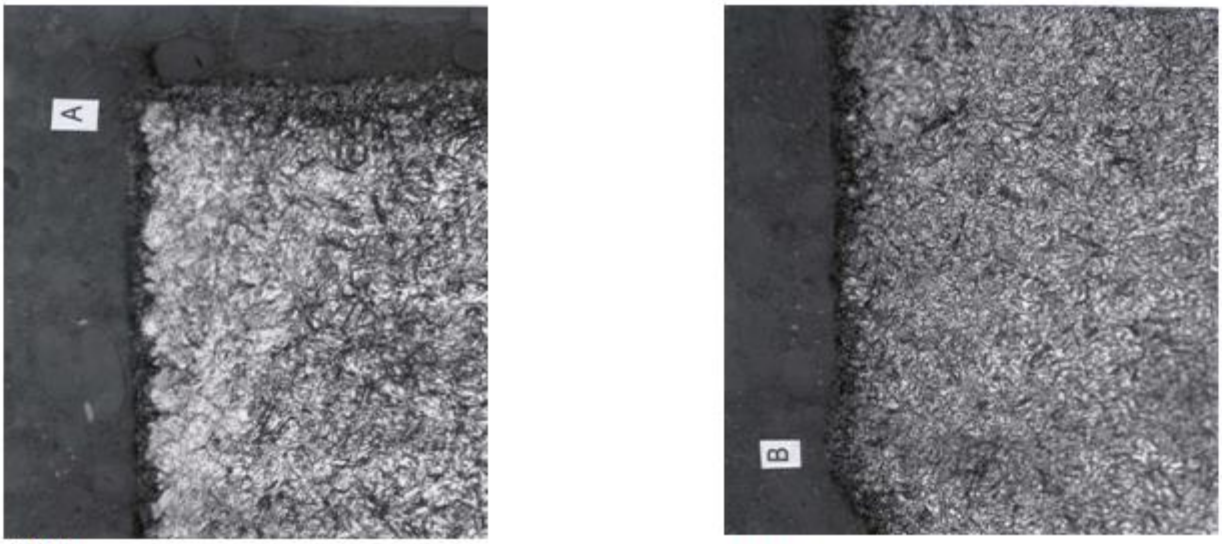


Figure N°10- *The tooth edges after chamfering and rolling*



500 x 400 x

Figure N°11- *The tooth edges after chamfering and rolling, heat treatment and straightening are corroded, they have a martensite structure with residual austenite (about 6% - 7%)*

Results

- *Before hardening chamfering and rolling cause structural deformations in that they render the structure more compact.*
- *Chamfering causes a build-up of excess material along the profile.*
- *Rolling is necessary in order to smooth over this material and it causes the material to become more compact.*
- *After heat treatment*
  - *cracks do not form in the rolled area.*
  - *The structure is normal and corresponds to all the structural characteristics of the material.*
  - *Cracks do not form in the area of material build-up*