Manufacturing engineering

Manufacturing engineering process for a small spur gear

According to Groover (2014), manufacturing means application of a physical and/or chemical process to make products given starting or raw material. In order to accomplish that machinery, tools, labour and power are needed. This particular report explains four manufacturing processes involved in production of a small mild steel spur gear used in a power transmission system. The context of this report is a typical production plant for fast moving consumer goods. The production line has been stopped because of a spoilt spur gear used in one of the machines. Consequently, a new spur gear has to be produced to ensure the breakdown is attended to. There are four manufacturing processes explained in this case study namely turning, milling, shaping, and annealing. Further, each of the process is accompanied by safety and health regulations and human factors that determine the efficiency of the said processes.

Turning

It is the first process and the machine used was a semi-automatic lathe machine. Once the workpiece had been cut into the right size, that is, in terms of the width, it was transferred to the lathe machine. Normally, this machine performs a turning and boring process so as to have the correct internal and external diameter. There is contact between the cutting tool and the surface of the workpiece which creates frictional forces with dissipation of heat. In addition to that, chippings and sparks are likely to jump off the turned section. It is the responsibility of the operator to ensure all occupational, safety and health requirements are adhered to. A precaution needs to

be taken because of potential health and safety hazards. Operators need to use work instructions and provided signs to protect themselves. Direct contact with moving parts such as levers, gears, motors, chucks, workpiece and cutting tool should be avoided. Lock-out procedures need to be used when operating the machine. There needs to have all the switches, wires, and plugs are in good condition before using the machine. Protective wear such as safety boots, overalls, safety glasses, and ear muffs is necessary to avoid injuries. They are referred to as personal protective equipment (PPE).

There was an observation that human factors play a role in operational efficiency of the machine. With the stoppage of the production line, pressure from supervisors is likely to affect the performance of the operator. More so, lack of tools such as lack of good cutting tools can undermine the efficiency of the process. It is unfortunate that some managers wanted to have the process quickened to minimise the downtime hence the said pressure. However, this can negatively affect the concentration and performance of operators. For instance, an operator may use an unsuitable federate to quicken the process but break the cutting tool or produce a very poor surface finish. Unless the team in charge of these operations works harmoniously with operators, the quality of the end product may be compromised. A good turning process guarantees quality workpiece surface finish and longevity of engineering tools. Figure 1 below shows a turning process.

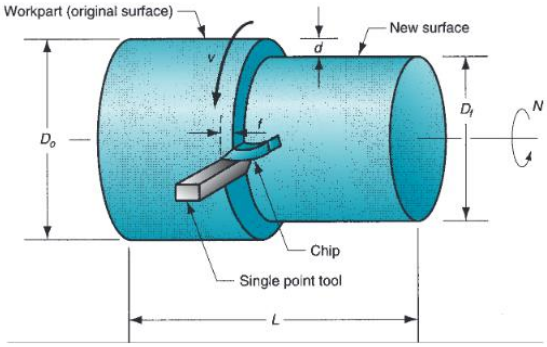

Fig. 1 shows a turning process (Groover, 2014)

Milling

Having performed the turning operation to obtain the correct internal and external diameters, the workpiece was taken to a semi-automatic horizontal milling machine for cutting of gear teeth. This means that the operator could intervene manually during the process. Here, the set-up is different and attention is paramount because the process involves determining the number, module, thickness, and depth of the teeth to be cut. It implies that this is the most important operation because an error in any of the said parameters would render the workpiece useless or defected. In addition to that, an appropriate milling tool is requisite to ensure an efficient process. An operator working under undue pressure from the supervisor or manager in charge may not perform optimally. Additionally, an appropriate cutting tool has to be appropriate based on the workpiece material (in this case mild steel). Occupational, safety and health measures are similar to those taken during the turning process. Operators need to follow work instructions as provided for in order to comply with safety and health requirements. Basically, milling uses a rotating cutting tool to remove metal portions from the workpiece as shown in Figure 2 below.

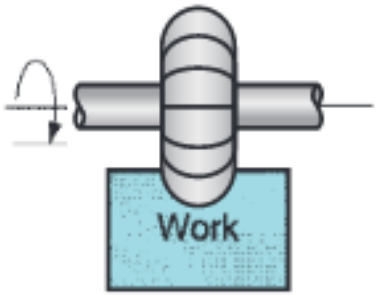

Fig. 2 shows a milling tool and workpiece (Groover, 2014)

Shaping

Transmission systems need a key-keyway assembly so as to transfer power from the input to the output. A shaping machine was used to produce the keyway on the internal section of the milled spur gear. Properly cut keyways ensure maximum transfer of power hence an efficient process. More so, technicians fitting the gear assembly back do not strain because of wrong geometry sections of the key and keyway. Shapers operate similarly to sawing machines though the tools may be different. Figure 3 below shows a spur gear with a keyway.

Fig.3 shows a spur gear

Annealing

It was the last process meant to improve material properties of the gear before use. Simply put, annealing is the process of heating the workpiece to an appropriate temperature, maintaining that temperature and allowing a slow cooling process (Goover, 2014). There are two key advantages of annealing compared to rapid cooling which causes a martensitic structure; i) reduction of brittleness and hardness and ii) attaining desirable mechanical properties by altering the microstructure. Besides, residual stresses from previous stresses are significantly relieved.

Reference

Mikell P. Groover (2010). Fundamentals of Modern Manufacturing, 5th Edition, John Wiley & Son, Inc.