9.3 Gear grinder

Gear grinder

Machine taking grinding wheel as cutting tool to process precise gear is called gear grinder. It is also called gear-grinding machine. The working principle of gear grinder can be divided into two types, fractal method and generating method.

Gear grinder is mainly used in processing hard tooth surface gear in a precise way. Most of them are half automatic machine, they can divide tooth, dress grinding wheel, compensate for grinding wheel abrasion, count and stop, all automatically. The grinding precision can reach Class 6~3 (GB10095-88) and the surface roughness is R_a 0.63~0.32 μ_m.

Wheel gear grinder of large plane grinding

Wheel gear grinder of large plane grinding is a kind of gear grinder that takes large plane grinding wheel as its cutting tool. It is a kind of gear grinder that utilizes rack pair engagement principle to process precisely gear tooth based on generating method. There are mainly two types: one adopts steel belts and rolling disc to make generating motion. For example, China Y7432, Germany Carl Hurth SRS400 and Japan T-842 type gear grinder. The other makes generating motion by using involute cam and baffle block, such as China Y7125, United States National Tool, Soviet Union 5892 and 5891 gear grinder.

This kind of machine has short transmission chain, simple structure and high precision grinding tooth. It is widely used in cutting standard precision gear and gear shaper cutter, shaving cutter etc. The tooth grinding precision can reach Class 3 or more (JB17983) and the surface roughness is R_a 0.63~0.32 μ_m.

For made-in-China Y7432 type wheel gear grinder of large plane grinding, the adjustable range of grinding wheel carrier angle is $6^\circ \sim 23^\circ$; the diameter of the used grinding wheel is 800mm. The range of grinding module is m=1～12mm, tooth number is z=12～120, the diameter is d=50～320mm and the helix angle is $\beta = 0^\circ \sim \pm 45^\circ$.

Gear grinder with cone grinding wheel

It takes cone grinding wheel as tool. The main characteristics of this kind of gear grinder are: this type of gear grinding machine has simple structure and it is easy to process and repair. The precision of gear grinding can reach Class 5 with high production efficiency. It is adaptable for single or batch production.

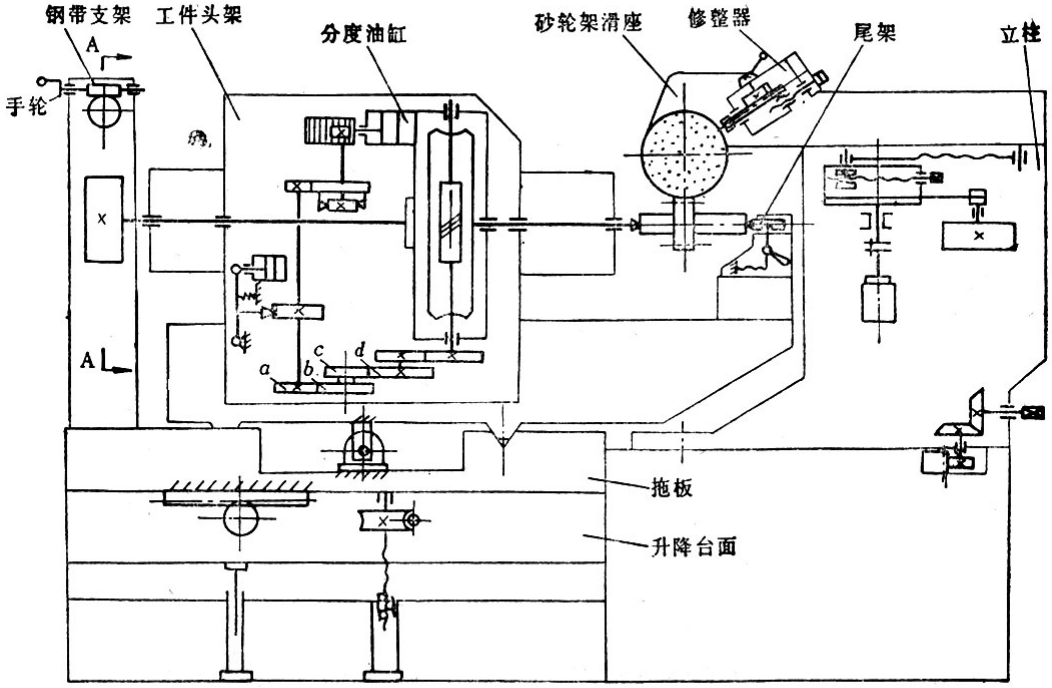

图 9-5

Y7132 type gear grinding machine, shown in Figure 9-5 is a typical type of cone grinding wheel gear grinding machine made in China. The application range of it is module m=l～6mm, tooth number z=9～120, helix angle $\beta = 0^\circ \sim \pm 45^\circ$, diameter d_a ＝35～320mm. The largest tooth surface width is b=100mm.

Gear grinder with cone grinding wheel

It is machine tool taking worm grinding wheel as cutting tool to shave the tooth surface of gear. The machine tool belongs to gear grinding machine under the guidance of generating method. The principle of taking worm grinding wheel to grind involute gear is as same as the processing principle of hob cutting gear. Generally, the grinding wheel of worm is single-end. Every round the grinding wheel rotates, the workpiece will pass a tooth. When grinding gear, the set helix angle can be achieved by adding movement on the workpiece through differential device. In order to grind the whole length of gear tooth of workpiece, the workpiece also need to feed along its axial direction. There is a lateral feeding mechanism on the machine to control grinding times. As the worm grinding wheel indexes continuously, the rotate speed is quite fast, the production efficiency is very high. It is suitable to launch mass production. The grinding precision can be Class 4. The surface roughness is $R_a 0.63\mu_m$.

Figure 9-6 shows Y7215 type gear grinding, which can be used appropriately in grinding precise small module spur gear. The size of grinding wheel: outside diameter

200mm, width 25mm and aperture 75mm.

The processing range: module m=0.125～1.5mm, the minimum tooth number z=12, the maximum outside diameter d_a=150mm, the largest tooth width b=75mm. Gears whose module is less than 0.3～0.5mm can grind directly on the machine without gear grinding process.

Cycloidal gear grinder

It is machine tool taking grinding wheel as cutting tool to shave the tooth surface of cycloid gear. It grinds workpiece under the engagement principle of pin-teeth internal gear (shortly, pin gear) and cycloid gear. This kind of gear grinding machine has simple structure. It is easy to operate with high productivity and stable precision, which is suitable for grinding various cycloid gears.

The application range of domestically produced Y7654 cycloidal gear grinder: outer diameter of gear d_a=70～532mm, eccentricity e=0.65～8mm, the largest width b=74mm and the tooth number z=9～87.

Gear grinder of formed grinding wheel

Gear grinder of formed grinding wheel is a kind of machine taking formed grinding wheel as its grinding tool. It belongs to duplicating gear grinder. It grinds the two side edges of grind wheel into the shape that is similar to the flank of tooth space of the ground gear, then it grinds gear tooth under duplicating method.

Gear grinder of formed grinding wheel has simple structure and its grinding precision is quite stable (Class 5) with high production efficiency. It is versatile and the only type of machine that can grind internal gear. Gear grinder of formed grinding wheel can be widely used in batch production, especially for gear with few tooth number. It is also adaptable in gears with non-involute tooth profile and the grinding of edge-blade gear.

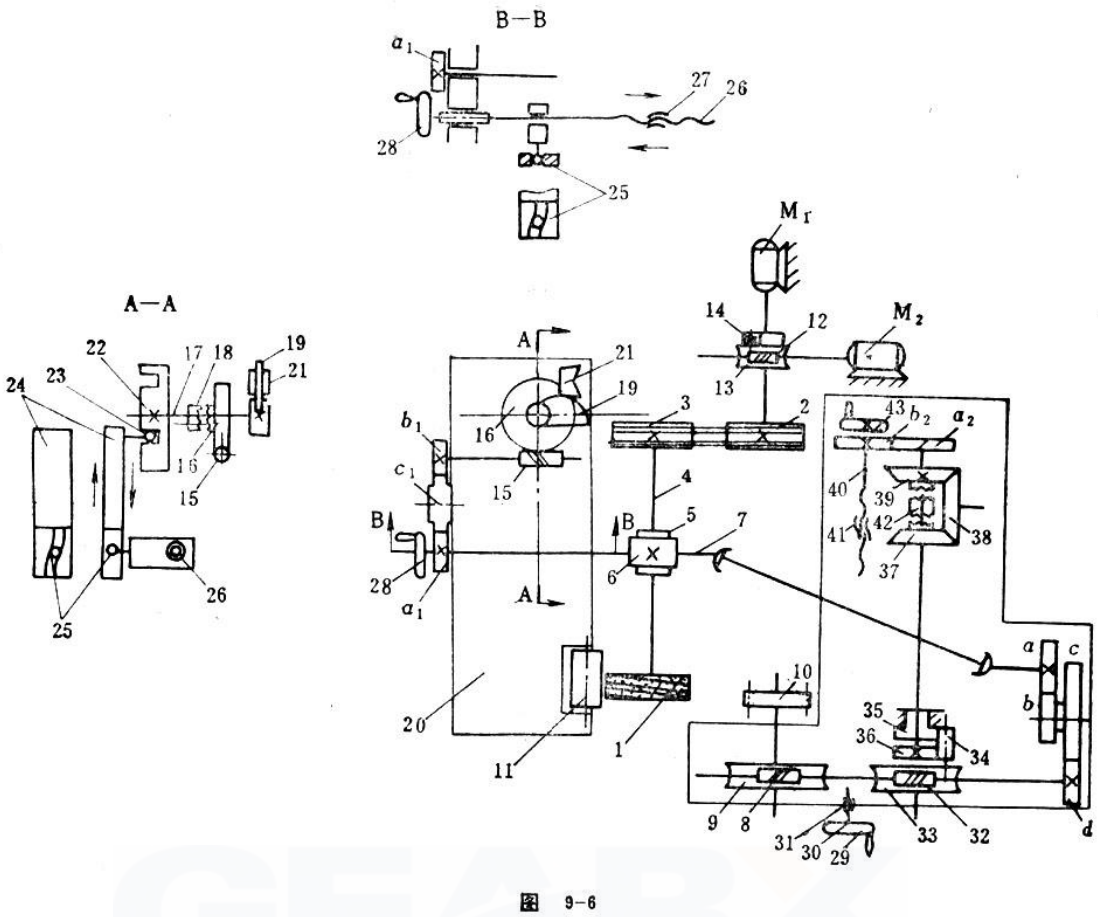

图 9-6

Spiral bevel gear grinder

Spiral bevel gear grinder is a kind of gear grinder made under generating method. It is used to grind spiral bevel gear and the tooth surface of hyperboloid gear. Its structure is similar to spiral bevel gear milling machine. In spiral bevel gear grinder, the milling cutter facer is replaced by grinding wheel movement facer and grinding wheel dresser is also installed. The process precision can reach Class 5 and the surface roughness is R_a 0.63~0.32 μ_m.

Gear grinder with dished double grinding wheel

Gear grinder with dished double grinding wheel takes a pair of dish wheel as its cutting tool. The machine is working under generating principle with steel belt and rolling circle disk applied. It utilizes the working edge of two grinding wheels to grind the involute surface of formed wheel at the same time. When grinding helical gear, the helix angle of gear can be secured just by adding an additional movement. The main character of this kind of gear grinding machine: large range of processing, good versatility and high precision (it can reach Class 4).It is suitable to be used in single and batch production.

Figure 9-7 shows domestically produced Y7032 gear grinder. The range of grinding module is m=1.5～10mm, tooth number is z=10～120, the diameter is d_a =

35～320mm and the helix angle is $\beta = 0^\circ \sim \pm 45^\circ$. The grinding wheel diameter of this machine is 220～170mm and the grinding angle is $0^\circ \sim 20^\circ$. Besides, MMAG, a company in Switzerland, produces SD-32-X, a new type gear grinder, which works in 0° grinding method. It takes double cranks universal rolling disc mechanism.

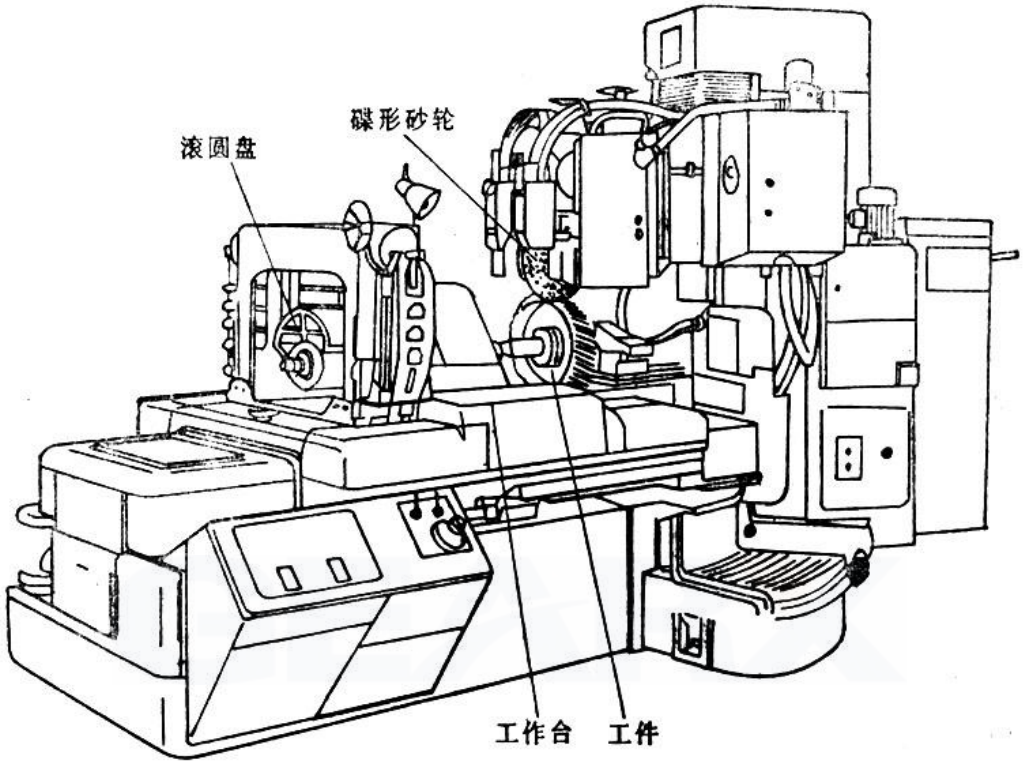

图 9-7

Worm grinder

Worm grinder is a special machine used in grinding the tooth surface of worm. It is equipped with tooth pitch straightening mechanism. Worm grinder can grind worm with single-sided sharpening method or double-sided grinding method.

Internal gear grinder

Internal gear grinder begins its grinding on the tooth surface of internal gear by sending the grinding wheel into the internal gear through universal grinding wheel. Internal gear grinder belongs to duplicating gear grinder. It is mainly used in grinding internal gear with spur tooth or helical tooth.

Y7550 internal gear grinder, made in Qin Chuan Machine Tool Plant, located in Shaanxi province, China, can be used to process internal gear with module m=2～6mm, tooth number z=32～170, helix angle $\beta = 0^\circ \sim \pm 25^\circ$ and tip circle diameter d_a =200～500mm and the maximum tooth width b=100mm.