GEAR AND SHAFT INTRODUCTION

Abstract: The important position of the wheel gear and shaft can't falter in traditional machine and modern machines.The wheel gear and shafts mainly install the direction that delivers the dint at the principal axis box.The passing to process to make them can is divided into many model numbers, useding for many situations respectively.So we must be the multilayers to the understanding of the wheel gear and shaft in many ways .

Key words: Wheel gear;Shaft

In the force analysis of spur gears, the forces are assumed to act in a single plane. We shall study gears in which the forces have three dimensions. The reason for this, in the case of helical gears, is that the teeth are not parallel to the axis of rotation. And in the case of bevel gears, the rotational axes are not parallel to each other. There are also other reasons, as we shall learn.

Helical gears are used to transmit motion between parallel shafts. The helix angle is the same on each gear, but one gear must have a right-hand helix and the other a left-hand helix. The shape of the tooth is an involute helicoid. If a piece of paper cut in the shape of a parallelogram is wrapped around a cylinder, the angular edge of the paper becomes a helix. If we unwind this paper, each point on the angular edge generates an involute curve. The surface obtained when every point on the edge generates an involute is called an involute helicoid.

The initial contact of spur-gear teeth is a line extending all the way across the face of the tooth. The initial contact of helical gear teeth is a point, which changes into a line as the teeth come into more engagement. In spur gears the line of contact is parallel to the axis of the rotation; in helical gears, the line is diagonal across the face of the tooth. It is this gradual of the teeth and the smooth transfer of load from one tooth to another, which give helical gears the ability to transmit heavy loads at high speeds. Helical gears subject the shaft bearings to both radial and thrust loads. When the thrust loads become high or are objectionable for other reasons, it may be desirable to use double helical gears. A double helical gear (herringbone) is equivalent to two helical gears of opposite hand, mounted side by side on the same shaft. They develop opposite thrust reactions and thus cancel out the thrust load. When two or more single helical gears are mounted on the same shaft, the hand of the gears should be selected so as to produce the minimum thrust load.

Crossed-helical, or spiral, gears are those in which the shaft centerlines are neither parallel nor intersecting. The teeth of crossed-helical fears have point contact with each other, which changes to line contact as the gears wear in. For this reason they will carry out very small loads and are mainly for instrumental applications, and are definitely not recommended for use in the transmission of power. There is on difference between a crossed helical gear and a helical gear until they are mounted in mesh with each other. They are manufactured in the same way. A pair of meshed crossed helical gears usually have the same hand; that is ,a right-hand driver goes with a right-hand driven. In the design of crossed-helical gears, the minimum sliding velocity is obtained when the helix angle are equal. However, when the helix angle are not equal, the gear with the larger helix angle should be used as the driver if both gears have the same hand.

Worm gears are similar to crossed helical gears. The pinion or worm has a small number of teeth, usually one to four, and since they completely wrap around the pitch cylinder they are called threads. Its mating gear is called a worm gear, which is not a true helical gear. A worm and worm gear are used to provide a high angular-velocity reduction between nonintersecting shafts which are usually at right angle. The worm gear is not a helical gear because its face is made concave to fit the curvature of the worm in order to provide line contact instead of point contact. However, a disadvantage of worm gearing is the high sliding velocities across the teeth, the same as with crossed helical gears.

Worm gearing are either single or double enveloping. A single-enveloping gearing is one in which the gear wraps around or partially encloses the worm.. A gearing in which each element partially encloses the other is, of course, a double-enveloping worm gearing. The important difference between the two is that area contact exists between the teeth of double-enveloping gears while only line contact between those of single-enveloping gears. The worm and worm gear of a set have the same hand of helix as for crossed helical gears, but the helix angles are usually quite different. The helix angle on the worm is generally quite large, and that on the gear very small. Because of this, it is usual to specify the lead angle on the worm, which is the complement of the worm helix angle, and the helix angle on the gear; the two angles are equal for a 90-deg. Shaft angle.

When gears are to be used to transmit motion between intersecting shaft, some of bevel gear is required. Although bevel gear are usually made for a shaft angle of 90 deg. They may be produced for almost any shaft angle. The teeth may be cast, milled, or generated. Only the generated teeth may be classed as accurate. In a typical bevel gear mounting, one of the gear is often mounted outboard of the bearing. This means that shaft deflection can be more pronounced and have a greater effect on the contact of teeth. Another difficulty, which occurs in predicting the stress in bevel-gear teeth, is the fact the teeth are tapered.

Straight bevel gears are easy to design and simple to manufacture and give very good results in service if they are mounted accurately and positively. As in the case of squr gears, however, they become noisy at higher values of the pitch-line velocity. In these cases it is often good design practice to go to the spiral bevel gear, which is the bevel counterpart of the helical gear. As in the case of helical gears, spiral bevel gears give a much smoother tooth action than straight bevel gears, and hence are useful where high speed are encountered.

It is frequently desirable, as in the case of automotive differential applications, to have gearing similar to bevel gears but with the shaft offset. Such gears are called hypoid gears because their pitch surfaces are hyperboloids of revolution. The tooth action between such gears is a combination of rolling and sliding along a straight line and has much in common with that of worm gears.

A shaft is a rotating or stationary member, usually of circular cross section, having mounted upon it such elements as gears, pulleys, flywheels, cranks, sprockets, and other power-transmission elements. Shaft may be subjected to bending, tension, compression, or torsional loads, acting singly or in combination with one another. When they are combined, one may expect to find both static and fatigue strength to be important design considerations, since a single shaft may be subjected to static stresses, completely reversed, and repeated stresses, all acting at the same time.

The word “shaft” covers numerous variations, such as axles and spindles. Anaxle is a shaft, wither stationary or rotating, nor subjected to torsion load. A shirt rotating shaft is often called a spindle.

When either the lateral or the torsional deflection of a shaft must be held to close limits, the shaft must be sized on the basis of deflection before analyzing the stresses. The reason for this is that, if the shaft is made stiff enough so that the deflection is not too large, it is probable that the resulting stresses will be safe. But by no means should the designer assume that they are safe; it is almost always necessary to calculate them so that he knows they are within acceptable limits. Whenever possible, the power-transmission elements, such as gears or pullets, should be located close to the supporting bearings, This reduces the bending moment, and hence the deflection and bending stress.

Although the von Mises-Hencky-Goodman method is difficult to use in design of shaft, it probably comes closest to predicting actual failure. Thus it is a good way of checking a shaft that has already been designed or of discovering why a particular shaft has failed in service. Furthermore, there are a considerable number of shaft-design problems in which the dimension are pretty well limited by other considerations, such as rigidity, and it is only necessary for the designer to discover something about the fillet sizes, heat-treatment, and surface finish and whether or not shot peening is necessary in order to achieve the required life and reliability.

Because of the similarity of their functions, clutches and brakes are treated together. In a simplified dynamic representation of a friction clutch, or brake, two inertias I1 and I2 traveling at the respective angular velocities W1 and W2, one of which may be zero in the case of brake, are to be brought to the same speed by engaging the clutch or brake. Slippage occurs because the two elements are running at different speeds and energy is dissipated during actuation, resulting in a temperature rise. In analyzing the performance of these devices we shall be interested in the actuating force, the torque transmitted, the energy loss and the temperature rise. The torque transmitted is related to the actuating force, the coefficient of friction, and the geometry of the clutch or brake. This is problem in static, which will have to be studied separately for each geometric configuration. However, temperature rise is related to energy loss and can be studied without regard to the type of brake or clutch because the geometry of interest is the heat-dissipating surfaces. The various types of clutches and brakes may be classified as follows:

1. Rim type with internally expanding shoes

2. Rim type with externally contracting shoes

3. Band type

4. Disk or axial type

5. Cone type

6. Miscellaneous type

The analysis of all type of friction clutches and brakes use the same general procedure. The following step are necessary:

1. Assume or determine the distribution of pressure on the frictional surfaces.

2. Find a relation between the maximum pressure and the pressure at any point

3. Apply the condition of statical equilibrium to find (a) the actuating force, (b) the torque, and (c) the support reactions.

Miscellaneous clutches include several types, such as the positive-contact clutches, overload-release clutches, overrunning clutches, magnetic fluid clutches, and others.

A positive-contact clutch consists of a shift lever and two jaws. The greatest differences between the various types of positive clutches are concerned with the design of the jaws. To provide a longer period of time for shift action during engagement, the jaws may be ratchet-shaped, or gear-tooth-shaped. Sometimes a great many teeth or jaws are used, and they may be cut either circumferentially, so that they engage by cylindrical mating, or on the faces of the mating elements.

Although positive clutches are not used to the extent of the frictional-contact type, they do have important applications where synchronous operation is required.

Devices such as linear drives or motor-operated screw drivers must run to definite limit and then come to a stop. An overload-release type of clutch is required for these applications. These clutches are usually spring-loaded so as to release at a predetermined toque. The clicking sound which is heard when the overload point is reached is considered to be a desirable signal.

An overrunning clutch or coupling permits the driven member of a machine to "freewheel" or "overrun" because the driver is stopped or because another source of power increase the speed of the driven. This type of clutch usually uses rollers or balls mounted between an outer sleeve and an inner member having flats machined around the periphery. Driving action is obtained by wedging the rollers between the sleeve and the flats. The clutch is therefore equivalent to a pawl and ratchet with an infinite number of teeth.

Magnetic fluid clutch or brake is a relatively new development which has two parallel magnetic plates. Between these plates is a lubricated magnetic powder mixture. An electromagnetic coil is inserted somewhere in the magnetic circuit. By varying the excitation to this coil, the shearing strength of the magnetic fluid mixture may be accurately controlled. Thus any condition from a full slip to a frozen lockup may be obtained.

Introduction of Machining

Have a shape as a processing method, all machining process for the production of the most commonly used and most important method. Machining process is a process generated shape, in this process, Drivers device on the workpiece material to be in the form of chip removal. Although in some occasions, the workpiece under no circumstances, the use of mobile equipment to the processing, However, the majority of the machining is not only supporting the workpiece also supporting tools and equipment to complete.

Machining know the process has two aspects. Small group of low-cost production. For casting, forging and machining pressure, every production of a specific shape of the workpiece, even a spare parts, almost have to spend the high cost of processing. Welding to rely on the shape of the structure, to a large extent, depend on effective in the form of raw materials. In general, through the use of expensive equipment and without special processing conditions, can be almost any type of raw materials, mechanical processing to convert the raw materials processed into the arbitrary shape of the structure, as long as the external dimensions large enough, it is possible. Because of a production of spare parts, even when the parts and structure of the production batch sizes are suitable for the original casting, Forging or pressure processing to produce, but usually prefer machining.

Strict precision and good surface finish, Machining the second purpose is the establishment of the high precision and surface finish possible on the basis of. Many parts, if any other means of production belonging to the large-scale production, Well Machining is a low-tolerance and can meet the requirements of small batch production. Besides, many parts on the production and processing of coarse process to improve its general shape of the surface. It is only necessary precision and choose only the surface machining. For instance, thread, in addition to mechanical processing, almost no other processing method for processing. Another example is the blacksmith pieces keyhole processing, as well as training to be conducted immediately after the mechanical completion of the processing.

Primary Cutting Parameters

Cutting the work piece and tool based on the basic relationship between the following four elements to fully describe : the tool geometry, cutting speed, feed rate, depth and penetration of a cutting tool.

Cutting Tools must be of a suitable material to manufacture, it must be strong, tough, hard and wear-resistant. Tool geometry -- to the tip plane and cutter angle characteristics -- for each cutting process must be correct.

Cutting speed is the cutting edge of work piece surface rate, it is inches per minute to show. In order to effectively processing, and cutting speed must adapt to the level of specific parts -- with knives. Generally, the more hard work piece material, the lower the rate.

Progressive Tool to speed is cut into the work piece speed. If the work piece or tool for rotating movement, feed rate per round over the number of inches to the measurement. When the work piece or tool for reciprocating movement and feed rate on each trip through the measurement of inches. Generally, in other conditions, feed rate and cutting speed is inversely proportional to。

Depth of penetration of a cutting tool -- to inches dollars -- is the tool to the work piece distance. Rotary cutting it to the chip or equal to the width of the linear cutting chip thickness. Rough than finishing, deeper penetration of a cutting tool depth.

Wears of Cutting Tool

We already have been processed and the rattle of the countless cracks edge tool, we learn that tool wear are basically three forms : flank wear, the former flank wear and V-Notch wear. Flank wear occurred in both the main blade occurred vice blade. On the main blade, shoulder removed because most metal chip mandate, which resulted in an increase cutting force and cutting temperature increase, If not allowed to check, That could lead to the work piece and the tool vibration and provide for efficient cutting conditions may no longer exist.

Vice-bladed on, it is determined work piece dimensions and surface finish. Flank wear size of the possible failure of the product and surface finish are also inferior. In most actual cutting conditions, as the principal in the former first deputy flank before flank wear, wear arrival enough, Tool will be effective, the results are made unqualified parts.

As Tool stress on the surface uneven, chip and flank before sliding contact zone between stress, in sliding contact the start of the largest, and in contact with the tail of zero, so abrasive wear in the region occurred. This is because the card cutting edge than the nearby settlements near the more serious wear, and bladed chip due to the vicinity of the former flank and lost contact wear lighter. This results from a certain distance from the cutting edge of the surface formed before the knife point Ma pit, which is usually considered before wear. Under normal circumstances, this is wear cross-sectional shape of an arc. In many instances and for the actual cutting conditions, the former flank wear compared to flank wear light, Therefore flank wear more generally as a tool failure of scale signs. But because many authors have said in the cutting speed of the increase, Mae to surface temperature than the knife surface temperatures have risen faster. but because any form of wear rate is essentially temperature changes by the significant impact. Therefore, the former usually wear in high-speed cutting happen.

The main tool flank wear the tail is not processed with the work piece surface in contact, Therefore flank wear than wear along with the ends more visible, which is the most common. This is because the local effect, which is as rough on the surface has hardened layer, This effect is by cutting in front of the hardening of the work piece. Not just cutting, and as oxidation skin, the blade local high temperature will also cause this effect. This partial wear normally referred to as pit sexual wear, but occasionally it is very serious. Despite the emergence of the pits on the Cutting Tool nature is not meaningful impact, but often pits gradually become darker If cutting continued the case, then there cutter fracture crisis.

If any form of sexual allowed to wear, eventually wear rate increase obviously will be a tool to destroy failure destruction, that will no longer tool for cutting, cause the work piece scrapped, it is good, can cause serious damage machine. For various carbide cutting tools and for the various types of wear, in the event of a serious lapse, on the tool that has reached the end of the life cycle. But for various high-speed steel cutting tools and wear belonging to the non-uniformity of wear, has been found : When the wear and even to allow for a serious lapse, the most meaningful is that the tool can re-mill use, of course, In practice, cutting the time to use than the short time lapse. Several phenomena are one tool serious lapse began features : the most common is the sudden increase cutting force, appeared on the work piece burning ring patterns and an increase in noise.

The Effect of Changes in Cutting Parameters on Cutting Temperatures

In metal cutting operations heat is generated in the primary and secondary deformation zones and this results in a complex temperature distribution throughout the tool, workpiece and chip. A typical set of isotherms is shown in figure where it can be seen that, as could be expected, there is a very large temperature gradient throughout the width of the chip as the workpiece material is sheared in primary deformation and there is a further large temperature in the chip adjacent to the face as the chip is sheared in secondary deformation. This leads to a maximum cutting temperature a short distance up the face from the cutting edge and a small distance into the chip.

Since virtually all the work done in metal cutting is converted into heat, it could be expected that factors which increase the power consumed per unit volume of metal removed will increase the cutting temperature. Thus an increase in the rake angle, all other parameters remaining constant, will reduce the power per unit volume of metal removed and cutting temperatures will reduce. When considering increase in undeformed chip thickness and cutting speed the situation is more compels. An increase in undeformed chip thickness and cutting speed the situation is more complex. An increase in undeformed chip thickness tends to be a scale effect where the amounts of heat which pass to the workpiece, the tool and chip remain in fixed proportions and the changes in cutting temperature tend to be small. Increase in cutting speed, however, reduce the amount of heat which passes into the workpiece and this increase the temperature rise of the chip in primary deformation. Further, the secondary deformation zone tends to be smaller and this has the effect of increasing the temperatures in this zone. Other changes in cutting parameters have virtually no effect on the power consumed per unit volume of metal removed and consequently have virtually no effect on the power consumed per unit volume of metal removed and consequently have virtually no effect on the cutting temperatures. Since it has been shown that even small changes in cutting temperature have a significant effect on tool wear rate, it is appropriate to indicate how cutting temperatures can be assessed from cutting data.

The most direct and accurate method for measuring temperatures in high-speed-steel cutting tools is that of Wright&Trent which also yields detailed information on temperature distributions in high-speed-steel tools which relates microstructural changes to thermal history.

Trent has described measurements of cutting temperatures and temperature distributions for high-speed-steel tools when machining a wide range of workpiece materials. This technique has been further developed by using scanning electron microscopy to study fine-scale microstructural changes rising from over tempering of the tempered martensitic matrix of various high-speed-steels. This technique has also been used to study temperature distributions in both high-speed-steel single point turning tools and twist drills.

Automatic Fixture Design

Assembly equipment used in the traditional synchronous fixture put parts of the fixture mobile center, to ensure that components from transmission from the plane or equipment plate placed after removal has been scheduled for position. However, in certain applications, mobile mandatory parts of the center line, it may cause parts or equipment damage. When parts vulnerability and may lead to a small vibration abandoned, or when their location is by machine spindle or specific to die, Tolerance again or when the request is a sophisticated, it would rather let the fixture to adapt to the location of parts, and not the contrary. For these tasks, Elyria, Ohio, the company has developed Zaytran a general non-functional data synchronization West category FLEXIBILITY fixture. Fixture because of the interaction and synchronization devices is independent, The synchronous device can use sophisticated equipment to replace the slip without affecting the fixture force. Fixture specification range from 0.2 inches itinerary, 5 pounds clamping force of the six-inch trip, 400-inch clamping force.

The characteristics of modern production is becoming smaller and smaller quantities and product specifications biggest changes. Therefore, in the final stages of production, assembly of production, quantity and product design changes appear to be particularly vulnerable. This situation is forcing many companies to make greater efforts to rationalize the extensive reform and the previously mentioned case of assembly automation. Despite flexible fixture behind the rapid development of flexible transport and handling devices, such as backward in the development of industrial robots, it is still expected to increase the flexibility fixture. In fact the important fixture devices -- the production of the devices to strengthen investment on the fixture so that more flexibility in economic support holders.

According to their flexibility and fixture can be divided into : special fixture, the fixture combinations, the standard fixture, high flexible fixture. Flexible fixture on different parts of their high adaptability and the few low-cost replacement for the characteristic.

Forms can transform the structure of the flexible fixture can be installed with the change of structure components (such as needle cheek plate, Multi-chip components and flake cheek plate), a non-standard work piece gripper or clamping elements (for example : commencement standard with a clamping fixture and mobile components fixture supporting documents), or with ceramic or hardening of the intermediary substances (such as : Mobile particle bed fixture and heat fixture tight fixture). To production, the parts were secured fixture, the need to generate clamping function, its fixture with a few unrelated to the sexual submissive steps :

According to the processing was part of that foundation and working characteristics to determine the work piece fixture in the required position, then need to select some stability flat combination, These constitute a stable plane was fixed in the work piece fixture set position on the clamp-profile structure, all balanced and torque, it has also ensured that the work features close to the work piece. Finally, it must be calculated and adjusted, assembly or disassembly be standard fixture components required for the position, so that the work piece firmly by clamping fixture in China. In accordance with this procedure, the outline fixture structure and equipped with the planning and recording process can be automated control.

Structural modeling task is to produce some stable flat combination, Thus, these plane of the work pieces clamping force and will fixture stability. According to usual practice, this task can be human-machine dialogue that is almost completely automated way to completion. A man-machine dialogue that is automated fixture structure modeling to determine the merits can be conducted in an organized and planning fixture design, reduce the amount of the design, shortening the study period and better distribution of work conditions. In short, can be successfully achieved significantly improve fixture efficiency and effectiveness.

Fully prepared to structure programs and the number of material circumstances, the completion of the first successful assembly can save up to 60% of the time.

Therefore fixture process modeling agencies is the purpose of the program have appropriate documents.