CHARACTERISTICS OF THE TECHNOLOGICAL PROCESS

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Abstract

SPECIALIZATION IN MECHANICAL ENGINEERING GENERAL STUDY PURPOSE1 Educational. In this chapter, students will understand the concept of machine precision. methods of increasing accuracy, methods of checking and evaluating accuracy.

Keywords

At the stage of development of each item and its design in accordance with the tasks of the designer, he set the relevant geometric dimensions in their materials. accuracy. that is, it does not exceed the limit values of each dimension and the basic technical requirements. It seems.

In serial production, the standard time spent on processing or collecting a batch of carcasses is calculated by the following formula: - T'db' n + Tt ya, min. (1.6) Here: n is the number of animals in the party. The sum of the labor and preparation time spent on one detail. donabay is the calculation time, i.e. Tdb.k = T'db + (T'i.ya / n) , min. (1.7) Costs and productivity of operations performed on the basis of standard time are determined, the number of machine tools required to perform the task is calculated, and technological processes that are economically convenient are planned.

main factors affecting accuracy. to study the causes of their occurrence and methods of elimination. general knowledge on determining and calculating the sum and the errors that make it up. formation of skills and attitudes. Educational. A crowd of students. formation of abilities to work in small groups and individually, to increase their interest in the profession. Developmental. To develop students' ability to think freely about accuracy and work independently to improve it. 2.1-MAV/.U. ACCURACY TUSIIUNCIII Learning objective. To acquire knowledge about machine accuracy in students and to form knowledge and practical skills about the progress of development. 2.1.1. Functional, structural and technological requirements are defined as the degree of accuracy of the structure or details of their real components in the highest level of the working drawing. As a result of mechanical processing, various inaccuracies and shape errors appear due to the influence of various factors. For example. we can see such shape errors in cylindrical shaft type details. on a cylindrical surface in the direction of the longitudinal section:

conuslmon barrel-shaped, saddle-shaped and curved shape errors and in terms of cross-sectional size: oval-shaped, angular and polygonal shape errors occur. It seems. these errors are related to the geometric accuracy, one of the main quality indicators of the product. In the process of processing dctals, the true absolute values of its geometric dimensions can never be achieved. In view of this, the designer consciously sets boundary dimensions for each geometric dimension, i.e. lays out a layer. Some of the smallest and the smallest limit sizes are called sheep (dopusk) deh. Functional, constructional and technological allowances Functional allowances are established taking into account the permitted operational deviations of the machine or part. However, for non-bonding surfaces, this may be the deposits of the hydraulic cylinder, carburetor cylinder diameters, etc. Then the functional set 7} of this dimension is one of the largest and smallest allowed values of f T. This is determined depending on the change in the allowed operating performance of the item

The functional set 7} consists of the sum of the exponentiation T,t and the construction set 7\. The first - operating condition Ttk describes the accuracy reserve that satisfies the requirement of long-term operation of the part. The second is that the construction bet compensates for the 7-point error. In the cases where connecting surfaces are implemented, the design deposit details preparation errors, connections and machine assembly. takes into account their alignment errors and compensates for other errors. The construction cost is inextricably linked with the functional cost, and it is calculated by the designer based on the analysis (theoretical and research) of the costs of machine preparation and operation. Deposits assigned to intermediate sizes during the technological process (TI) are called technological deposits. It consists of a very complex process that depends on the errors that occur. It is necessary to minimize this error as much as possible in order for the technological investment to be smaller than the construction investment. Only in such conditions will the assembly process of the compound and machine become easier. Analyzing the ratio between design and technological investments allows to make a judgment about the improvement of TJ. 2.1.2. Accuracy of size, shape and location of surfaces. machining process with various devices and cutting tools

introduces opin modifier. As a result, the errors of the drawing are large and, as a rule, its accuracy decreases. The expression of the combination of several surfaces of each machine. Despite the complexity of the details, the surface is machined. These are cylindrical, conical, flat and shaped surfaces. The accuracy of mechanical processing of bodies It is related to the existence of a tight contour of the elements of the technological system, manifested with three types of accuracy: size accuracy, shape accuracy, and the accuracy of the spatial location of the surface. Dimensioning significantly determines product quality. Dimensions can be assigned to different groups. .responsible surfaces.determining the service function of the detail.For example, flat surfaces are the typical surfaces of coffee-sliced details and holes for placing bearings. Coordinating dimensions connect the cylindrical and cylindrical surfaces of the casing. A cumulative dimension determines the position of one arm of the machine relative to another. These dimensions are those of the most common attachable surfaces. The mating surfaces of body parts are often flat surfaces. Technical dimensions other than those specified apply. They are necessary for the preparation of the details and for the analysis. Size depends on which group. its accuracy directly affects the quality of the machine and its ability to perform its function within specified limits. The solution to the accuracy problem requires solving another concept of "size". Sizes are divided into nominal (overall), marginal and actual size. Relative to nominal

limit sizes are determined. The nominal size serves as the starting point for calculating the deviations and is determined by the designer based on the detailing service. Therefore, the concept of real size is introduced because the technological system machine-tool-tool-machine (DM AT) cannot provide the function of constant (nominal) size due to the uniqueness of its continuity. It is determined by measurement with a permissible error. The actual size should not differ significantly from the nominal value. Therefore, there are two limit sizes - the largest and the smallest. The amount of the nominal size can be between the largest and smallest sizes or equal to one of them. The so-called actual size is important to evaluate the quality of the product. In the process of preparing the part, this size will be different at each instant of time. The physical essence of this is that in the process of processing and moving (breathing) the technological system on the body, several factors arise and affect the quality of detail output. These factors are divided into two types. Ririnchisi - factors related to the DMAT system, the following: - geometrical errors of the technological equipment; - errors that occur from shooting with tr. navorlami; — Errors caused by elastic deformation of the vehnological system; — errors resulting from dimensional erosion of cutting tools; — errors related to the adjustment of cutting tools: — errors related to temperature deformation of the technological system; — shape and spatial deviation errors caused by all the above factors. The second - errors not related to the DMAT system: - errors caused by copying of the template; — errors caused by the internal voltage of the device.

ACCURACY CROSSING METHODS Learning objective. Providing students with ideas about the method of increasing the accuracy of detail, forming knowledge and practical skills about the development of this method. There are basically two ways to increase accuracy. 1. "Processing and measuring until accuracy" method or "Test walking and measuring" method. 2. "Automatic increase in accuracy" method. 2.2.1. "Processing and cutting to precision" method. The essence of this method is that a cutting tool is inserted into the working surface of the machine tool, and pushed to the right, it is removed from the machine. the cutter is brought close to the body and a trial run is made at a short distance from the starting point, and the cutter is pushed back, and then the machine is stopped. The machined surface is inspected with a cutting tool, deviations from the dimensions in the drawing are determined, and the position of the cutting tool is corrected. Then again, this section of the body is treated, a test sample is taken and measured again. This is continued until the exact size is reached

in addition, the worker working on the body can lean on the support calmly and calmly: due to the reduction of rhythmic forces in the processing stage, the worker's body weight is reduced. achieve high productivity. If highly qualified workers are used rationally, even if the work on the set-up machines is assigned to apprentice operators: _ if later automation is developed, these tasks will be assigned to automatic machine tools and machine tools controlled by software; — highly qualified workers adjust the machine. 8-12 machines are occupied with control, as a result of which various costs are reduced. such as an increase in the efficiency of production, etc. The advantage of this method is that it is widely used in series, large series and mass production. This method is used in serial production. special machines do not give good results in terms of economy and do not pay for themselves because the number of parts in a batch is too small. the use of equipment and tools, as well as adjustment processes, cannot cover itself. the cost of prepared detailing will be very high; serious technological training. It is impossible to carefully create a technological process and apply detailed adjustment schemes in the conditions of small series production. In each considered method of achieving a given accuracy, there are systematic and random processing errors that appear due to various reasons. . This is the result of the influence of various factors on accuracy.

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ANIQL1KN1 INSPECTION METHODS Learning objective. It is important to develop the skills and competence of students to understand the methods of checking the accuracy of the details, to learn about the application and results of these methods, and to perform practical and experimental exercises. 2.3.1. Methods of correcting systematic errors in statistics It is known that all errors occurring in technological systems according to mathematical statistics are combined into three groups of errors. These are: system constants, system variable errors and random errors. Systematic constant errors can include: geometric, kinematic and tool sizing errors of the technological system. Systematic variable errors: temperature deformation of the technological system and dimensional erosion of cutting tools, etc. Random errors: arrival of different sizes of cut layers of a batch of working bodies. the variability of the deformation of the elements of the technological system due to the different hardness along the surface of each body. the presence of unknown inner strength in bodies. It is possible to enter a translation error and other errors.

Checking the accuracy on the curve distribution As a result of random errors during processing on machines configured for a set (batch) of parts, the actual size of each part is randomly large and can take a different value within certain intervals. . The sum of the values of the actual dimensions of the parts processed under different conditions is shown in table 54 in order of increasing size, and the distribution of the dimensions of the parts with the repetition of this size m (relative repetition m /n) is shown. A. Tabular distribution of parts sizes The size distribution of a set of parts can be presented in a tabular or graphical form. In practice, detailing is divided into actual size ranges or dimensions in such a way that In order to compensate for the measurement error, the value of the intermediate part is taken to be somewhat larger than the value of the part of the measuring instrument. For example. After calculating the actual dimensions of 100 parts heated on the machine, it should be between 30.00 mm and 30.35 mm.

B. The distribution of the sizes of the details by the graft k method, it is possible to construct a graphical distribution of the size according to the data presented in Table 2.1. If we place the measurement intervals along the abscissa, then along the ordinate we place the corresponding w-thick ro rlan cases or /m/l-relative repetitions, resulting in a stairwell called a histogram distribution. square columns are formed

in the batch; At - the actual values of the usual details in the direction; D,., — the average arithmetical value of the actual dimensions of the details in the given batch; e is the base of natural logarithms. The average value of the sum of

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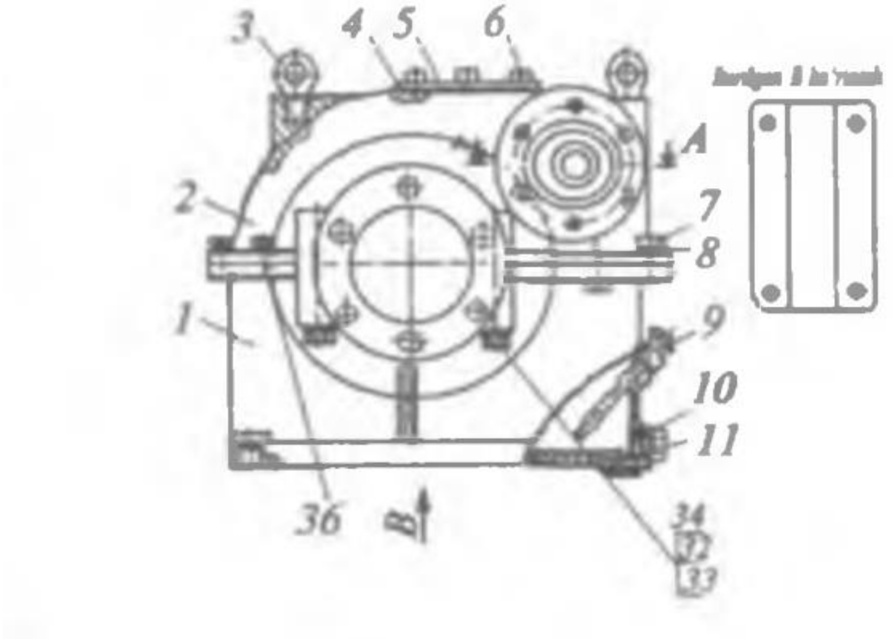
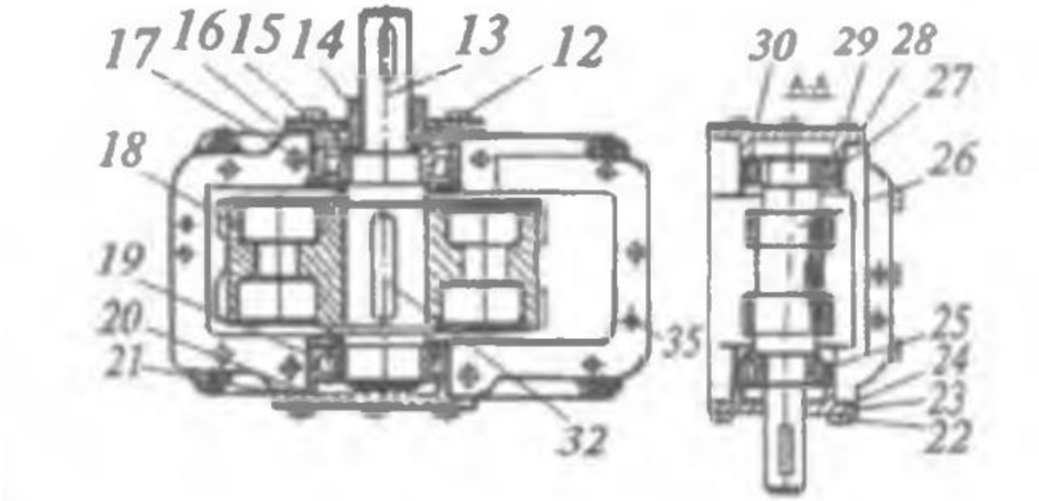
measurements (D,.g) is expressed by the following formula: The curve chi/iq representing the differential law of natural distribution is shown in Figure 2.5. Ao.r is the average arithmetical value of the actual dimensions of the details in the given batch, which describes the condition of the size grouping mark/i (location) a = ^ (Ai - A c/r) +(A2 - A 0>) +. .. + (A„ - A0*r)2 j/iV or





The law of distribution of natural distributions (Gauss law). From the graph, it is blue. the curve approaches asymptotically to the abscissa axis, and in the distance D A0.r is inclined to the abscissa axis in such a way. in this limit, it is 99.73% of the total area of the area enclosed by the curve, therefore, it is considered that its branches (tips) intersect with the abscissa axis from the peak of the curve. The magnitude «.-1* indicates the clustering center of the random variable. The "st" value indicates how dense this grouping is and is a measure of accuracy applied to

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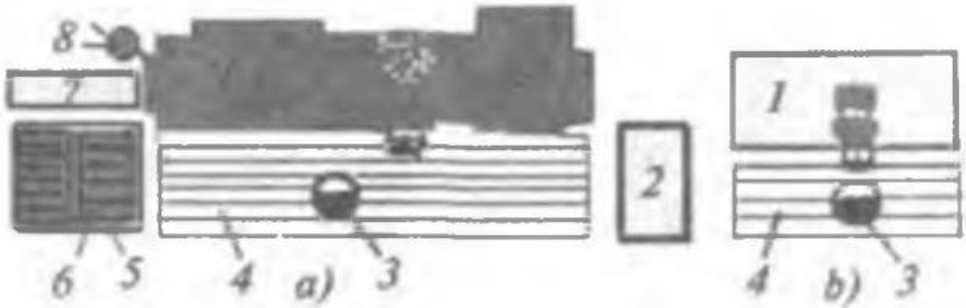
the accuracy of the detail set. Determining the accuracy of a set of machine-made parts according to mathematical statistics. size distribution area (n) of the detail set.

) as can be seen from the formula. o — as the average square deviation increases, the value of the ordinate decreases, and the area of distribution « = 6 0 increases; as a result, the curve becomes slightly wider and lower, which means that the location of the dimensions is larger and the accuracy is lower. In this sense, α serves as a measure of the distribution of the mean square deviation or precision. Figure 2.6 shows the effect of ct on the shape of the natural distribution curve. The factual (real) distribution area of the dimensions of details is expressed as follows: c o = b a . (16) In practice, due to various systematic variables and random reasons, the height of the distribution curve shifts from the center of the distribution area to one side or the other. the shape of the curve may change. as a result, the actual curve of the natural distribution may not be symmetrical. In this case, the dimensions are not equal to the coordinate of the grouping center \ and the coordinate of the center of the distribution area „D



The shift of the grouping center is described by the amount of the relative asymmetry coefficient, which is determined from the following formula. a -(EnvAj - wAf)/(w/ 2) or a = (£ m. i - E cw.4i) / (T / 2). (2.8) In this. w A i— 7 is the coordinate of the center of the deposit field. The value α is in the range from 0 to -0.5. determined by experience or from relevant tables. When designing, if the processing conditions are unknown. distribution curve is calculated symmetrically, α = 0 is obtained. To avoid the formation of unusable detail, using the formula (2.6), the following equation can be adopted: st = P A S. (2.9) where \ S is the mean squared deviation. it is determined according to the formula (2.2) based on

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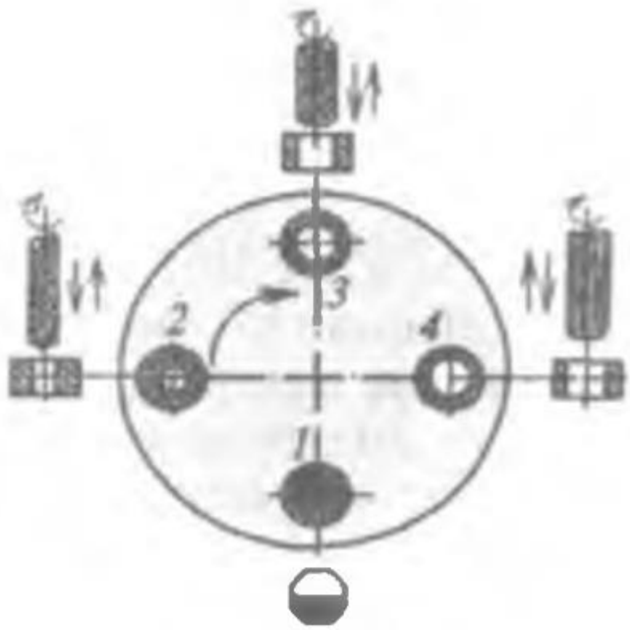

Detailed information on distributions according to Siiapson (a) and Tcng probability laws (b, d). .?. The Law of Equal Probability If the size distribution depends only on variable systematic errors (for example, the wear of a cutting tool, Fig. 2.8-b), the distribution of the actual sizes of the processed parts obeys the law of equal probability of distribution (Fig. 2.8- Figure d). For example, the reduction of the size of the cutting tool during the stabilization of the cutting tool in the work of the shafts is subject to a straight line law. that is, the diameters of the working bodies are increased accordingly. The natural, i.e. working body dimensions change by the amount T — 7', time 2 L = b — a is a straight line law

compare the machining accuracy of bodies in different conditions of lubrication coolant and so on.

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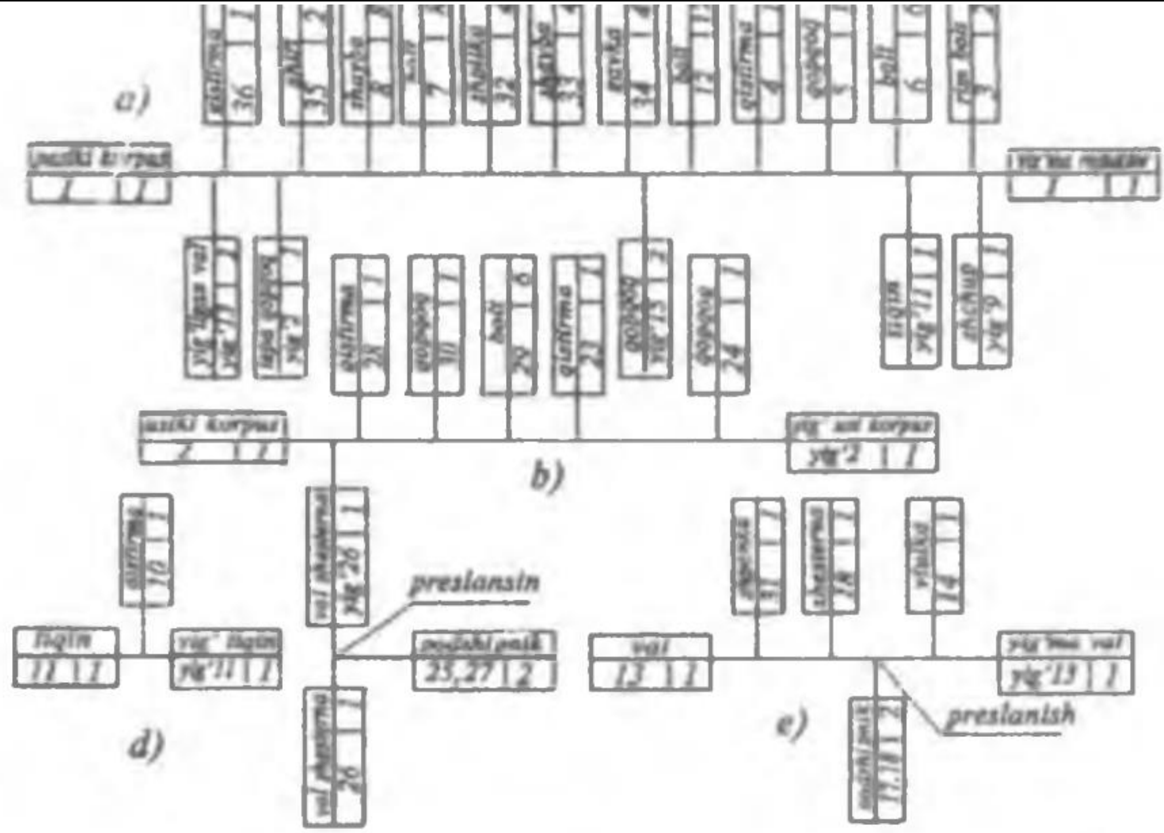

Designate the reliability of handling the bodies to make them fit for work; when the margin of accuracy / > 1.0, there is no unusable condition in the processing of bodies. i< 1.0 there is a probability of having unusable details. Only if /> 1.2. The application process is reliable. For all the laws of size distribution, the condition for preparing the body for work is calculated by the following expression: w< T , (2.17) where. The original is equal to the adjustment error. i.e. AUJ, = . In order to calculate the number of parts with a probability of being unworkable, the

as a result of the continuous transition of cutting edge and periodic adjustment of the machine. The characteristics of dot charts have been studied in detail in connection with the development of the method of static control of products in industry. The essence of the method leads to this conclusion. that is, in the process of preparing a given product, two to ten details are obtained periodically. The results of the measurement of these details, which are measured in universal instruments. is calculated at speed and included in a special (contrast) diagram. In this diagram, two parallel a-a determine the boundaries of the plot area, and b-b straight lines determine the distribution area of group averages, and the lines are called control straight lines. held in '/ (Fig. 2.12). This is according to the diagram. the initial operation is normal without changes and the broken line does not deviate from the control lines. When group A is controlled, the deviation of the broken line from the control line is observed. It serves as a signal for adjustment of the machine tool by adjustment and replacement or by checking the condition of the support. In control charts, not only the daily averages are shown. perhaps. Other parameters describing the stability of the machining process can also be included.

Nowadays, the methods of statistical analysis are constantly improved as a result of the widespread use of computers and avionics. In automated production, automatic process control and statistical measuring, analysis, and instant corrections are used. When using statistical methods, the number of controls is significantly reduced. because only 5-10 9r details are reported. In addition to the above mentioned methods in technical literature. There is also a method of constructing a diagram, called an accuracy diagram, which determines the effect of variable errors on the parameters of the curve distribution of the detail sizes in the sets. Their disadvantage is to measure a large number of details and perform complex processes that depend on the basis of statistical data collection. But these things are considered more productive because EHM and computer tools do it faster.

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