ISSN: 2394-3696, Website: www.ijiert.org, Organized on 24-25 April, 2020

THE METHODOLOGY FOR THE FORMATION OF THE COMPOSITION AND SEQUENCE OF OPERATIONS OF THE TECHNOLOGICAL PROCESS OF MANUFACTURING PARTS OF THE "SHAFT" TYPE OF AGRICULTURAL MACHINERY

Sh.A.Shoobidov, O.I.Drachev, Q.Q.Mirzayev

Abstract: The article is devoted to the methods of technological process of designing details of agricultural machinery in the copy "Shaft". The method of designing the technological process of machining, taking into account the curvature of the shafts, reduces the number of cycles through the use of new technical solutions, the use of analytical dependencies to determine the expected size of deformations, ultimately increasing machining accuracy and shape stability and also reduction of volume of labour are given in the article

Key words: shaft, billet, casting, technological base, deformation, internal stress, defect, bluntness, uneven hardness, outer surface, eccentricity, inheritance coefficient, residual stresses, impact force, compensation method; tilt of the shaft axis.

The generally accepted method of the technological process of designing the details of agricultural machinery in the copy "Shaft" provides: the choice and justification of the method of production; calculation of deposits for machining; selection of technological bases; determine the sequence of processing methods; calculation of accuracy taking into account defects of base and processing. Defects and shortcomings of machining include wear, bluntness (deformation) and deformation of cutters, uneven hardness, deformation of support and machine parts, deformation of tools and equipment as a result of temperature.

The results of our research [1, 2, 3] allow to control the formation of internal stresses and deformations on the surfaces of parts in the "shaft" version, but also to develop the basic principles of construction of technological processes that ensure minimal deformation of the outer surfaces.

The following conditions are taken into account in these principles, in addition to the generally accepted methods:

- the value of the subsequent deformation of the part in the case of shear loss of unevenly distributed joints:

$$f = \frac{\sigma_0 \cdot L^2 \cdot a}{2R^2 \cdot E}, \tag{1}$$

where σ_0 - the stress in the centre of part of the detail, MPa; R – the radius of the body, mm; a – eccentricity, mm; E – module of elasticity, MPa.

(1) The expression allows you to choose the method of centralization, which provides a permissible design defect (eccentricity) in the development of the technological process, based on the permissible defects in the location of the surfaces obtained during cutting and machining;

- the optimal sequence of operations, referring to the number of cycles of machining, taking into account the succession of defects.

It is proposed to calculate the coefficients of technological succession in machining of details by the following dependencies (1):

$$c_1 = \frac{y_2}{y_1} = \frac{\sigma_2 \cdot R_1^2}{\sigma_1 \cdot R_2^2}, \tag{2}$$

respectively

$$c_i = \frac{y_{i+1}}{y_i} = \frac{\sigma_{i+1} \cdot R_i^2}{\sigma_i \cdot R_{i+1}^2}. \tag{3}$$

where σ_i - residual stresses in phase i ; c_i - coefficient of deformation in phase i .

$$K_i = \frac{\left(C_{F\beta} \cdot S \cdot HB^n\right)^i}{J_c^2}. \tag{4}$$

where K_i - the reduction coefficient of the initial defect after the i transition; $C_{F\beta}$ - a constant coefficient for certain processing conditions; S – signal in i transition; HB – surface hardness; J_c - developed recommendations for reducing deformations in technical processing: method of stabilization (compensation) of unbalanced stresses in processing; optimal placement of the keyhole and other structural elements, depending on the characteristics of the deflection of the shaft axis; calculation of defects in the permissible location of centering holes; load the body with the force directed along the following axis:

$$\left(\frac{\pi^2 \cdot E \cdot J}{L^2} - \frac{P \cdot C_{01} \cdot \theta}{2}\right) \le N \le \left(\frac{\pi^2 \cdot E \cdot J}{L^2} + \frac{P \cdot C_{01} \cdot \theta}{2}\right). \qquad (5)$$

where θ – the angle of inclination of the tangent to the curved axis of the workpiece.

- the effect of the tempering rhythm on the value of the residual stresses on the surface of the shaft, which assess the surface quality.

Figure 1 shows the general block history of the shaft machining algorithm, and figure 2 describes the design of the technological process, taking into account the approximate deflection of the shaft axis based on the introduction of the proposed method.

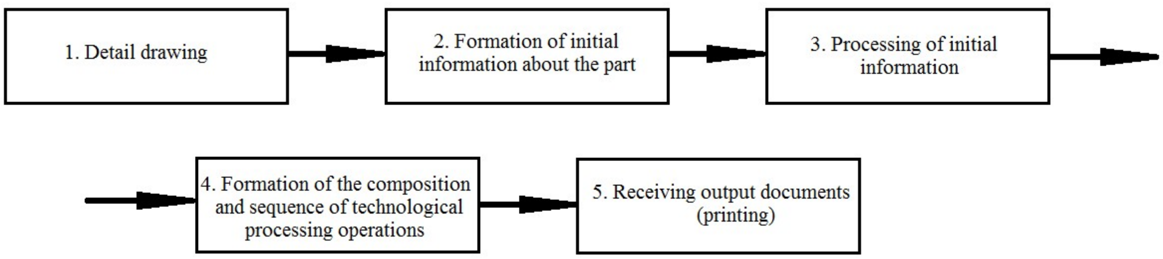


Figure 1. Block-history of processing formation algorithm.

1. Detail drawing:
Labelling of drawing - LabD
Mass of detail - MD
Length of detail - LenD
Accuracy quality - AQ
Type of production:
Small type - ST
Middle type - MT
Large category - LK

2. Initial information about the detail
Allowed kick AK -0,02...0,04
material steel 45, 40X
$\beta = 12 \cdot 10^6\, t/K; E = 2 \cdot 10^5\, MPa; T_0 = 250 - 300\ ^0C$
amount of eccentricity a
the radius of body R
maximum processing capacity δ
readability limit σ_T
contact length of roller detail b
cutting depth t_p
cutting speed v
transition S
load on axis P_f=500...2000 N
residual stress in grinding σ

3. The calculations in the processing of primary information are obtained by expressions in the following form:
- dimension of residual stresses

$$\sigma_0 = \frac{\beta \cdot E \cdot T_0}{3};$$

- Value of deformation

$$y = \frac{\sigma_0 \cdot \pi \cdot a \cdot L^2}{2R^2 \cdot E};$$

- inheritance coefficient

$$c_i = \frac{y_{i+1}}{y_1(c_{i-1}) \cdot t};$$

- impact force

$$P = \frac{D \cdot \delta \cdot \sigma_T}{m \cdot E \cdot \left(\frac{D}{b} + 1\right)};$$

- equation of regression (grinding)

$$\sigma = 20{,}64 + 6{,}2t_p + 14{,}4255 - 6{,}9t_p \cdot v_c - 11{,}916t_p \cdot S - 11{,}052v_c \cdot S + 19{,}725t_p \cdot v_c \cdot S$$

In the proposed option (b), the following are taken into account for operations:

3-in cutting practice P_f=2000 N; P=1500 N;

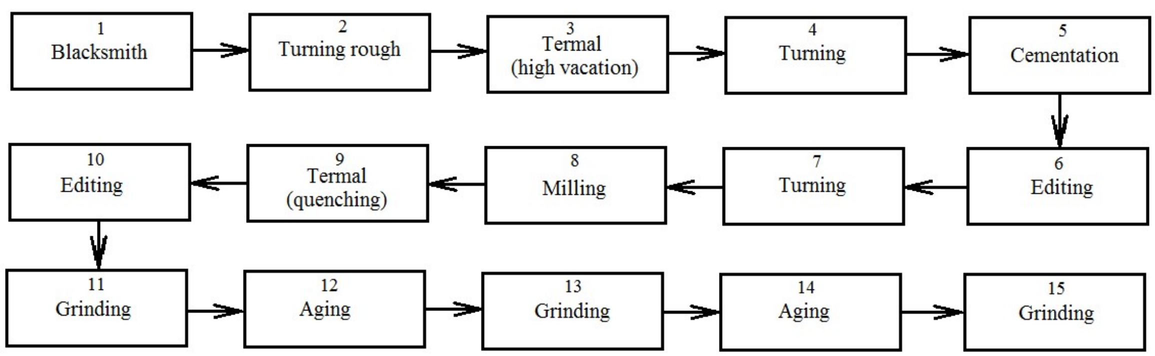
5- in cutting practice P_f=1800 N; P=1000 N;

7- in cutting practice P_f=1000 N; P=700 N;

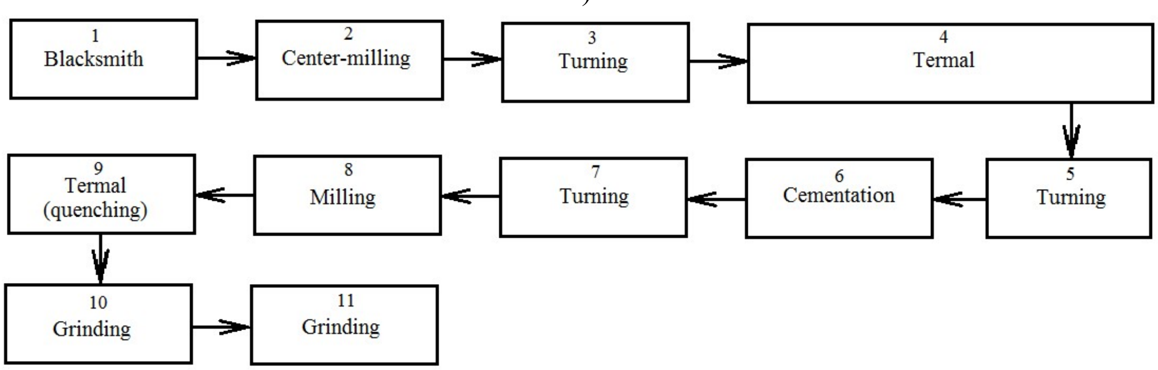
2-milling- Permissible values of permissible kicks and centering defects in the practice of centering are 0.02; 0,05; 0,08 and 0,25; 0,45; 0,85; for every 1000 mm, respectively;

8- in milling practice, the structural elements of the shaft are placed, taking into account the direction of the residual stresses;

11-grinding are made under the temp of t_p=0,05 mm; v_c=0,833 m/s; S=150 mm/min.



a)



b)

Figure 2. Current (a) and recommended (b) options for technological process design

The current variant consists of 15 operations and includes 5 thermal treatments. This technology does not involve the reduction of shaft deformation, as each machining cycle generates new values of shaft deformation.

In the proposed option (a), the number of operations is reduced to 11 in exchange for the loss of 2 aging and 2 correction operations. The method of designing the technological process of machining taking into account the curvature of the shafts allows reduce the number of cycles through the use of new technical solutions, the use of analytical dependencies to determine the expected deformations, ultimately increase machining accuracy and shape stability, as well as reduce labor and surface quality.

References

1. Drachev O.I., Taranenko V.A., Shaabidov Sh.A., Martirosov K.A. Management of technological inheritance in the manufacture of non-rigid shafts. - Tashkent .: "Fan va texnologiya", 2010 -200 p.

2. Drachev O.I. Manufacturing technology of low-rigidity axisymmetric parts. - S. Petersburg: Polytechnic, 2005.228 p.

3. Shoobidov Sh.A., Irgashev A., Mirzaev K.K. Improving the operational properties of the surface layers of machine parts: Monograph. –T .: Tashkent State Technical University, 2012. -176 p.

4. Shoobidov Sh.A., Ishmuratov X.K., Irgashev B.A. Methods of restoration of parts of tractors and agricultural machinery. Textbook. –Tashkent: "GOLD PRINT NASHR", 2019. -215 p.

5. Shoobidov Sh.A., Egamnazarov A.Sh., Bakhtiyorov D.B. A look at the theoretical foundations for achieving operational reliability of shafts. "Modern materials, techniques and technologies in mechanical engineering." Proceedings of the III International Scientific and Technical Conference. Section II, pp. 138-141. Andijon, 19-26 April 2016 y.

6. Shoobidov Sh.A., Mirzaev K.K. Modeling the manufacturing process of shafts by turning. Materials of the international scientific and technical conference "Current State and Prospects for the Development of Building Mechanics Based on Computer Technologies and Modeling" June 16-17, 2017. Samarkand. with. 365-368.