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INVESTIGATION OF THE OPTIMAL MODEL OF MARKING OBJECTS IN PRODUCTION SYSTEMS

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ABSTRACT
Identification marking of objects is not the subject of necessary attention in the manufacture. In this paper will be presented the model of identification marking of objects who allows simple choose of optimal identification marking system by Index of identification mark's clearness. Model of identification marking of objects with smaller Index of identification mark's clearness will be chosen and can be implemented for marking of all objects in production system.
Keywords: Production system, identification marking of objects, Index of identification mark's clearness

1. INTRODUCTION
Different systems of object's identification marking are practiced in the manufacture. Objects are products, machines, tools, raw materials, technical and business documents etc.
Identification marking problem have not necessary attention, today. In the manufactures which produce same or similar products different approaches to object's identification marking exist as result of low level of attention. Researches shown that approaches to object's identification marking depend about knowledge of individual and this poor paid persons work in development or standardization department, usually. Managers are not educated to realize the importance of object's identification marking as base for introducing of total normalization in enterprise [1].
In this paper possible approach in resolving and choosing of optimal model of object's identification marking in manufacture will be shown. Knowledge of the basic approaches to object's identification marking are necessary to understand why is some model pick up and offered.

2. TYPES OF IDETIFICATION MARKS
Three types of identification marks are known from bibliography [2]:
1. *Classification's identification mark*, are based on characteristics of objects and items with permanent nature (quality, shape, materijal, purpose)
2. *Informatisation's identification mark*, are based on new, created characteristics of objects and items (price, measure etc.)
3. *Identification's identification mark*, are based on description of object or items and have purpose to define the same.

The above types of identification marks can be used, single or in combination, bounded by different techniques.

3. TECHNIQUES OF BOUND OF IDENTIFICATION MARKS
There are three techniques of bounding of identification marks [2]:
1. Integrated technique
2. Parallel technique
3. Modified technique.

Integrated technique of bounding of identification marks is presented on Figure 1. It's basic characteristics are:

- the left side is classification part and right side is identification part of identification marks
- the identification marks cann't be divided and cann't be used separatel
- the identification marks cann't be wide extent
- if the sstem of identification marks will be overcapacity, it has to be settled.

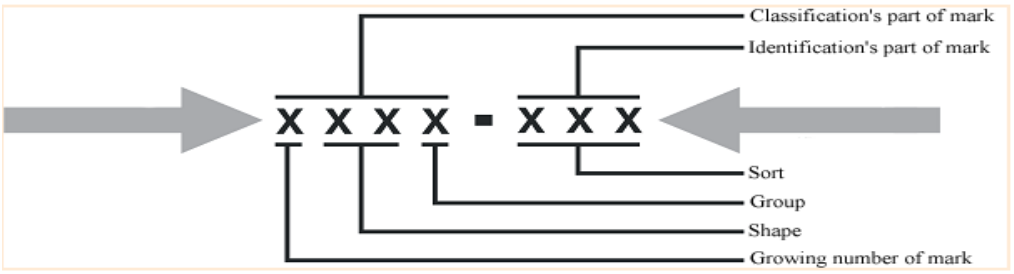

Figure 1. Scheme of Integrated technique

Parallel technique of bounding of identification marks is presented on Figure 2. It's basic characteristics are:

- the left side is identification part and right side is classification part of identification marks
- the identification marks can be used as single or in combination
- size of the identification marks depend about number of objects which will be marked and have unlimited capacity
- size of the identification marks depend about number of characteristics, number of classification levels and choosed criterion
- very convinient for computer utilization
- system of object's identification marking of objects is unlimited and stable
- marking of objects is decentralized beside necessary control on system's level.

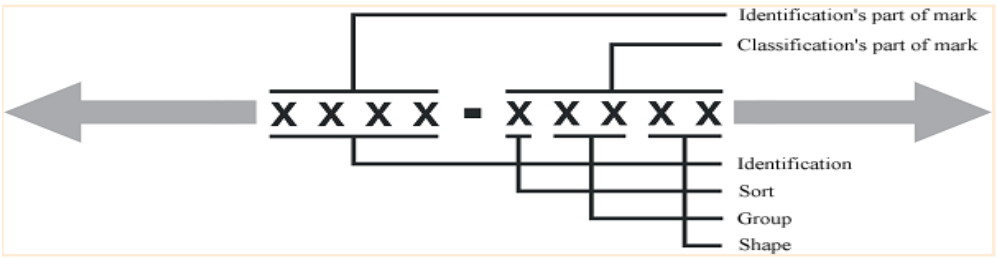

Figure 2. Scheme of Parallel technique

Modified technique of bounding of identification marks is combination of integrated and parallel technique. It's application in manufacture is not practicable. Theoretical base are given by V. Ferišak [2].

4. TYPE OF MARKS

To marking the objects three types of symbols are used:

- numbers (numerical marks)
- letters (alphabetical marks)
- combination of letters and numbers (alphanumerical marks).

From total number of letters (A-Z) 21 letters are used (O, I ,Z ,S ,G are not used for the reson of similarity with numbers), and 10 numbers are used (0-9). Theoretical possibilities for types of marks variation can be presented in the next way:

- numerical marks $K_b = n^r = 10^r$, ... (1)
- alphabetical marks $K_s = n^r = 21^r$, ... (2)
- alphanumerical marks $K_{sb} = n^r = 31^r$, ... (3)

Whereas: K - capacity of mark

n - number of mark

r - space number in mark.

5. CLEARANCE INDEX OF MARK

Clearance of information is one of three most important characteristics of information (clearance, volume and quality). There are quantitative relations for measuring the gradient of text clearance (writen text primary). According to K. R. London, next relation is given for measuring of writen text clearance [3]:

$$IJ = \frac{PBR + 2 \cdot PBR_3}{5} + 3, \qquad \text{... (4)}$$

Whereas: *IJ* - text clearance index
PBR - average number of words in sentence
PBR_3 - average number of words with three or more syllables in sample of one hundred words.

The bigger clearance index means smaller text clearance and contrary.

In this case the subject is classification of objects in manufacture. Question is, how the equation (4) will be applied on the marks of objects. The answer is not simple and demand to take in consideration enormous research. Some authors said will be enough to mark of object has to be translated in descriptive, technically understandable text and measure his clearance regarding equation (4). In this case next rule will be valid:

The smaller clearance index mean biger clearance of object's mark and contrary.

6. ACCOUNTING OF CLEARANCE INDEX OF OBJECT'S MARK

Accounting of text clearance index is performed on marks of five group of objects. The marks of each relevant objects are in accordance with above mentioned system of marking and are translated on technically understandable text for someones who receive the informations. On this technically understandable text are performed accounting of *PBR* i PBR_3. Objects are analysed within groups, to ensured sample of minimum of 100 words, as condition of equation (4). Relations for five groups of objects are shown in Table 1. Table 2. presents the accounting of clearance index of object's marks.
Analyse of results from table 1 and table 2 give the possibility to compare the different models of object's marking. Accounting the average values of mark's clearance index has to be taken in consideration during designing of new model of marking the objects in manufacture.

Table 1. Relations for five groups of objects

Mark of group of object	***Name***	***Object's mark (standard)***	***Text of mark***	***PBR -IJ***
72	Elements for connecting by coil	72.1101.0212.80	Standard of elements for connecting by coil, screw, metrical coil M2x12, material steel for screws.	$PBR = 16$ $PBR_3 = 54$ $IJ = 27.8$
74	Elements for connecting without coil	74.1101.0308.04	Standard of elements for connecting without coil, rivets ϕ 3 mm, long 8mm, material-aluminum	$PBR = 16$ $PBR_3 = 54$ $IJ = 27.8$
76	Pipes	76.1301.5701.10	Standard of pipes, pipe's arch 180^0, ϕ57mm, depth of pipe 2.9 mm, material-steel	$PBR = 15$ $PBR_3 = 28$ $IJ = 17.2$
78	Tools	78.1202.1213.12	Standard of tools, lathe boring tool, hard material lathe boring tool P 30, cross section of tool 12x12mm. right angle $\gamma = 12^0$	$PBR = 23$ $PBR_3 = 36$ $IJ = 22$
79	Materials	79.1106.4020.15	Standard of materials, steel, without thermo processing, hot rolled, quality of surface depend about technology of shaping, depth 15 mm	$PBR = 18$ $PBR_3 = 60$ $IJ = 30.6$

Table 2. Accounting of clearance index of object's marks

Model / Objects	Model decade classification			Model X			Model Y		
	PBR	***PBR_3***	***IJ***	***PBR***	***PBR_3***	***IJ***	***PBR***	***PBR_3***	***IJ***
Screw 72.1101.0212.80	16	54	27.8		X			Y	
Rivets 74.1101.0308.04	16	54	27.8		X			Y	
Pipes arch 76.1301.5701.10	15	28	17.2		X			Y	
Lathe boring tool 78.1202.1213.12	23	36	22		X			Y	
Steel Č.0361 79.1106.4020.15	18	60	30.6		X			Y	
Average values of mark's clearance index	17.6	46.4	25.1		X			Y	
$\overline{IJ}$		*	25.1	*	*			*	

The next methodology is obligatory:

1. To pick out the appropriate model of object's marking within new project
2. To pick out the appropriate number of objects and marks them in accordance with accepted model
3. For chosen objects account the text clearance index and accepted mark to be translated on technically understandable written text
4. Compare the text clearance index. Accounting of average values of mark's clearance index is recommended and their comparing. With this wider picture of model of object's marking is ensured.
5. In accordance with the recommendations of theory to mark of objects, whit smallest average value of text clearance index has to be given the priority.

This methodology gives the possibility to account clearance index of object's marking in the manufacture.

7. CONCLUSION

System of object's marking is base which has to have every manufacture if he want to introduce the computerised system of management (CAD, CAM, CIM, CAP, QA), [4].

Research to find out the optimal model of object's marking is performed by accounting of clearance index of marks, for five groups of objects, equation (4). In tables 1 and 2 show how the results of analysecan be presented. between few models of object's marking analyses give the posibility to pick up one with smaller average value of clearance index. This means technically more understandable marks.

8. REFERENCE

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