THE UNIFICATION OF THE MECHANICAL PRESS DRIVING MECHANISM

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RESUME

The basic aim of this research is to find the possibilities of the unification of the mechanical press driving mechanism. There are certain directions and methodologies in the construction of the unified driving mechanisms in the group of mechanical presses having different pressure force and different press stroke number. A certain number of different applications are pointed considering huge number of various solutions of mechanical press driving mechanism.

The main words*: driving mechanism, mechanical press, and unification.*

1. THE INTRODUCTION

Considering well-known patterns and methods, we deal with the problem of finding the possibilities of application a certain driving mechanism in the group of mechanical presses whose pressure force and press stroke number are different. Selecting the flywheel and analyzing its power usage we specify the domain of its application at the presses of specified pressure force and different number of press stroke

Producing groups of presses differed by pressure force and the number of press strokes, as the main characteristics, it is possible to produce some sub-systems as unified.

The main purpose of this research is to find, through the familiar patterns, the possibility of the application of the same driving mechanism in a certain number of mechanical presses. Here, we will try to show some directions in construction of mechanical press so that the complete system (driving motor-lamella and brake-reduction gear-excentric sheave axle, and possibly presser) could be the same at a few presses of the same group (presses of different pressure force and different press stroke number).

It is obvious that this is impossible for the whole group as the range of pressure force and press stroke number is huge, but it is possible to include reasonable range (excentric sheave 63 to 100 mp pressure or excentric sheave 100 with press strokes 50-80) what gives a lot of advantages in such conditions.

This can be done if we don't stick to the principle of dimensioning machine elements considering hardness. This factor can't be completely denied or neglected, but it is just pointed that it is not always the only one and the most important, so it can be denied if other factors are economically and technically justified.

To satisfy the other factors influencing more deeply the production profitability, trying to solve this problem we had to be aware of the fact that certain press elements are more or less over capacitated.

There are some of these factors:

1. The possibility of driving system serial production for individual or small serial production directly influences the decrease of product cost..
2. Certain funds are necessary for the testing of press group as the testing of driving system and all connected with it is done only once.
3. It is easier to supply the substitute of elements and framework in usage meaning that maintenance is easier in the workshops with more presses of the same group constructed on this way.

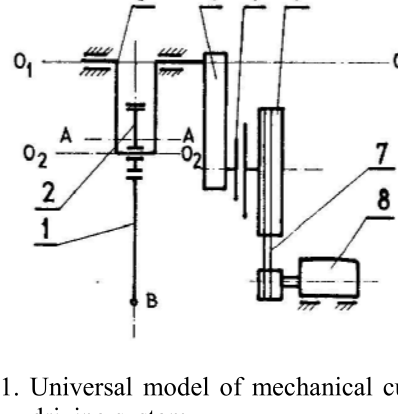

Figure 1. Universal model of mechanical curving press driving system

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2. THE DIRECTIONS FOR THE UNIFICATION OF DRIVING MECHANISM

To analyze this problem in details, we must set the scheme first consisting of elements: electric motor (8), flywheel (6), lamella and brake (5), reduction gear (4), shaft (4), connecting rod (1) and presser.
The application of certain driving system depends on the choice of flywheel.
The selection of flywheel: The selection of flywheel is made using the formula:

$$\left(GD^2\right)_m = \frac{7\cdot 10^6 \cdot P_m \cdot \lambda}{\beta \cdot n_{sm}^2 \cdot n_e \cdot S_k \cdot \left(2 - S_k\right)\cdot p} \quad [\text{daNm}^2] \quad (1)$$

where: $(GD^2)_m$ - GD^2 of flywheel is reduced on the axle of electric motor in $daNm^2$,

P_m - nominal power of driving motor in KW,

λ - Coefficient of motor overloading that is here from 1,7 to 2,2.

p - Coefficient representing the relation of real cycles to possible ones (for automatic work, p=1)

n_{sm} – Synchronized number of electric motor rotations per minute,

n_e – The press stroke number per minute,

S_k – Critical sliding of electro motor given in the formula:

$$S_k = S_H \cdot \left(\lambda + \sqrt{\lambda^2 - 1}\right) = S_H \cdot k \quad (2)$$

where:

$$S_H = \frac{n_{sm} - n_m}{n_{sm}} \quad (3)$$

- Nominal sliding of electric motor

n_m – Nominal number of electric motor rotations per minute

β - Coefficient that is the function of power coefficient γ and diagram coefficient of resistance moment α.
If we lack the data for β obtained by an experiment, we can get coefficient β by the formula:

$$\beta = 0{,}9 \cdot \sqrt{\frac{\gamma^2 - 1}{\alpha}} \quad (4)$$

where: γ - coefficient of engine power and it is usually from 1,1 to 1,3 and
α- coefficient of resistance moment which is usually from 0,5 to 1,0.

It is marked like this:

$$a = \frac{\lambda}{s_k \cdot \left(2 - s_k\right)\cdot p} \quad (5)$$

$$C_1 = a \cdot \frac{7\cdot 10^6}{n_{sn}^2} \quad (6)$$

$$C_2 = \frac{1}{\beta} = \frac{1}{0{,}9 \cdot \sqrt{\frac{\gamma^2 - 1}{\alpha}}} \quad (7)$$

equation (1) is now in following shape:

$$\left(GD^2\right)_m = C_1 \cdot C_2 \cdot \frac{P_m}{n_e} \quad [daNm^2] \quad (8)$$

Let's analyze, (5), (6) and (7):
1) The value of engine overloading coefficient (λ) is in relatively tight limits from 1,7 to 2,2 and it can be asserted that it has little influence (almost none) on the value of the formula (5), while the nominal sliding of electric motor makes the main influence (table. 1). For the burst work the value of coefficient a is given in the list T1 for, λ = 1,7 and λ = 2,2 with the practical average value.

A diagram on figure 2 is drawn according to the values on the list T 1.
2) Driving machines used for the mechanical presses are asynchronies three-phase short-circuited motors with 2, 4, 6, and 8 ends, with synchronized rotating number n_{sm} = 3000, 1500, 1000, and 750(rev/min). According to this, for all the electric motors, the burst work, it is possible to calculate the value of coefficient C_1, which is shown on the diagram and figure 3.
In the formula (7) we can see that C_2 is the function of coefficient λ i γ. Changing γ to 1,1 — 1,3 and α from 0,5 — 1,0 we get the values for C_2 as shown on the diagram in figure 4.

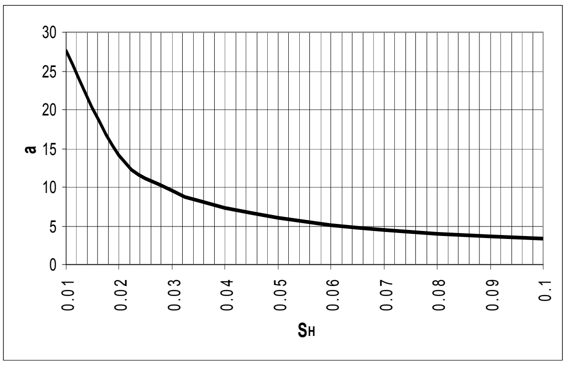

Figure 2.

It must be mentioned that nominal sliding for asynchronies three-phase short-circuited motor is not higher than 0,1.
As we defined the value of C_1 in function to S_H and C_2 in function to α and γ, we can easily define the and $(GD^2)_m$ of fly wheel using the formula (8) for the certain electric motor and press stroke number, with at first approximation supposed values for α and γ, define $(GD^2)_m$ of flywheel.

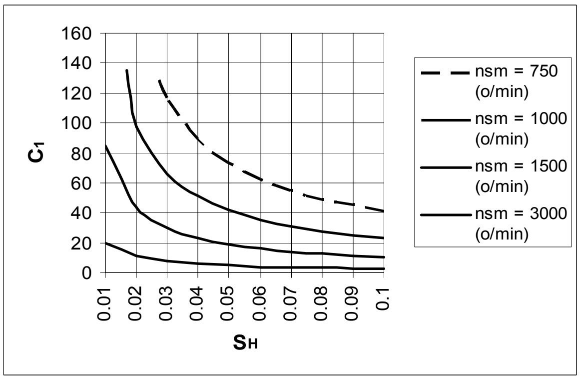

Figure 3.

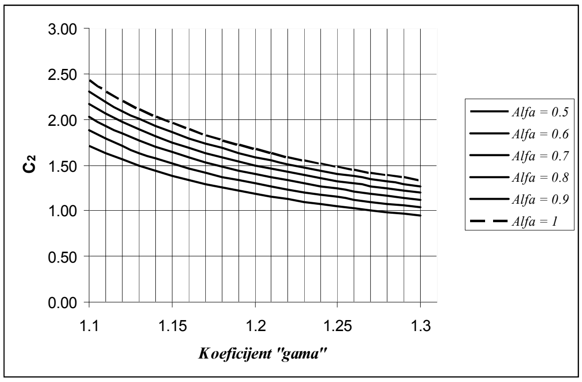

Figure 4.

Table T-1.

	a for S_H									
λ	0.10	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.02	0.01
1.7	3.28	3.57	3.95	4.43	5.10	6.00	7.40	9.65	14.3	28.1
2.2	3.34	3.61	3.97	4.44	5.04	5.91	7.23	9.40	13.8	27.0
	3.30	3.60	3.95	4.43	5.07	5.96	7.32	9.52	14.0	27.5

Defining the transmission ratio electric motor – flywheel we want, or which is suitable, considering lamella available and the dimensions we need to place the flywheel, we can easily define dimensions and weight of flywheel using the familiar formula:

$$\left(GD^2\right)_z = i_{mz}^2 \cdot \left(GD^2\right)_m \qquad (9)$$

As we defined the flywheel, we defined the lamella and the transmission ratio but reduction gear with transmission ratio, inlet and outlet rotating moments as well. In short, a mechanical press of certain possibilities is defined, and it represents a group of mechanical presses. Changing the pair of gear in redaction gear, or changing the press body and safety plates, we can get the other presses in the group with their characteristics, the presses with the other press stroke number or the other pressure force.

3. CONCLUSION

Analyzing the solution for the mechanical curving press of simple effect and analyzing its main functions we come up with a number of these machines that produce by deformation.
Analyzing the universal model of driving mechanism (without discussing its individual parts), we can identify possible concepts of variations and classify them.

We consider the solution by analyzing the laws of orbit changing and analyzing the number of work orbit cycles in working part of the machine, as these parameters are tightly connected with the solution for the driving mechanism.
The presented parameters show the complexity of finding the solution at the machines of static effect and wide range for the creativity of a constructor, which led to the large varieties of these machine types.
It is useful to consider the case of unified driving mechanism for the universal model of driving mechanism. Changing some of the components, the characteristics of the press inside the group are changed as well.

4. REFERENCES

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