CONSTRUCTIVE SOLUTIONS OF THE MECHANISMS OF SOME PRESSES

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ABSTRACT: *The paper present a construction and structural solutions the mechanisms mechanical pressures. Finally the paper presents a calculation of forces from sliding rod mechanisms used mechanical presses***.**

Keywords: presses, maxipresse, the mechanism piston rod cra

INTRODUCTION

Mechanical presses, like most of machines used to process metals by pressing, have certain specifically features. The functional features of the mechanical presses are:
-the nominal force F_N, measured in kN;
- the nominal run (stroke) of both the minimum and maximum executor- organ, S_{max}=H and S_{min}=H_1, in mm;
-the amount of double runs "n" executed in the time unit, in min^{-1};
-the available training class L, in the installed power, in kw.
Among the features of both double and triple action presses, one should also consider the available force for the exterior slide mechanism, while in the case of the presses equipped with mechanisms for doing away with machine parts, their force is indicated. For the triple action presses, one should also indicate the lengths of the executor elements' runs of both the second and the third effect. The rigidly of the press is to be considered too, since it is an important functional feature. The most important geometrical features [1] are:
-the sizes of clearance diagram (length- breadth-height) in mm;
-the distance from the press mass to the inferior surface of the executor organ (tool), when it is situated on the superior extreme surface, in mm;
-the available sizes, in order to fix the mobile part of the punching machine or the pressing stencil on the executor tool (length- breadth), in mm;
-the available size (length- breadth);
-the thickness of the oversizing board h, in mm;
-the adjustment limit of the adjustment limit of the execution tool position, in mm;
-the maximum space H can be assembled, in mm;

The distance from the executor tool to the nearest point of the frame, in mm;
In the forging section, one can find the mechanical presses with simple effect for the warm molding, since they are proficient, they are more economical and more advantageous than mechanical presses for warm molding and the maxipresses have a high precession (0,5…0,1 mm). The cranck press fig.1 is a mechanic press for the alternative movement of the wither is achieved via a cranck-piston rod mechanism. It is also known as a maxipress.

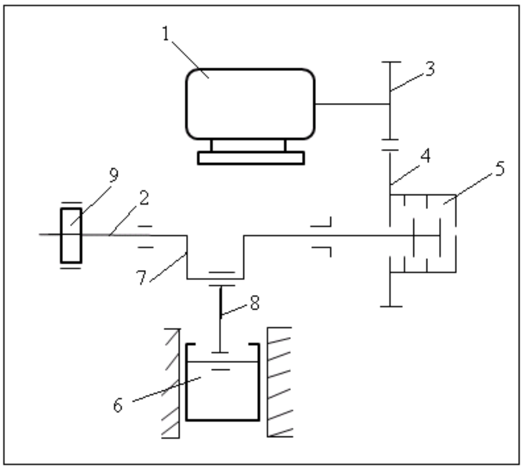


Figure.1 The chart of cranck-press

From the electric engine 1, the movement is transmitted to the shaft 2 via the cogged wheel 3, the loose 4 and the coupling5. From the shaft 2 the movement is transmitted to the wither 6 via the cranck 7 and the piston rod 8. In order to stop the wither to the superior dead point, the coupling 5 is actuated. The acting of the equipment is carried out electrically in most of the cases with the help of electrical engines, the movement and the power being transmitted from the engine to the equipment via a mechanic transmission. In order to choose the electric engine, one must know the conditions of exploitation (the working chart, the temperature and the humidity of the environment, etc). The necessary power and the rotation of the engine shaft, being dependent on the power and the rotation to the main shaft of the working machine, as well as on the kinematic elements of the mechanic transmission.

1. MECHANIC PRESSES WITH A SIMPLE ACTION

The open type presses, with a passage space towards the frame, allow for the light harming from 4 directions while the inclinable ones due to their possible inclination, allow for the light evacuation of the pressed pieces. The closed type presses with two or four levels, own executor tools of the main movement, having wide working surfaces, which allow for their use to the pressing of the pieces with large sizes of the clearance diagram.

The mechanism of the main movement of the simple action presses is composed of devious shaft, a piston rod and an executor tool called a slide. According to the type of the press and the constructive variant chosen, the training of the slide can be executed through either one, two or three piston rods. The carrying out of the rectilinear trajectory of the main movement is achieved with the help one or four guiding's fixed by the frame along which the slide of the press is moving. The mechanism piston rod cranck it's most general sense, can be represented according to fig.1, in which:

-R represents the ray of the cranck, the length of the piston rod;

-e eccentricity.

For a certain position of the cranck the run of the slide can be expressed via relation:

$$S=\sqrt{(R+L)^2-e^2}-(R\cos\propto+L\cos\beta), \quad (1)$$

In which:

$\propto$ -is the angle of the position of the cranck;

β-is the angle of the position of the piston rod;

This relation can also be written under the form:

$$S=R\left[1-\cos\alpha+\frac{\gamma}{4}(1-\cos 2\alpha)+k\gamma\sin\alpha+\frac{k^2}{2(1+\gamma)}\right] \quad (2)$$

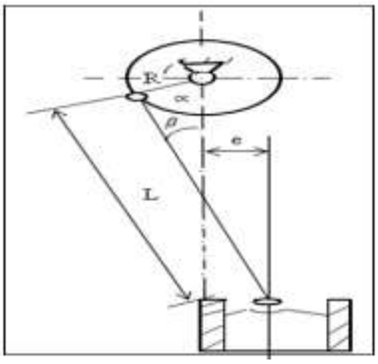


Fig. 2. The chart of the mechanism piston rod crank used for mechanic presses.

In relation 2, there were used the notations and the substitutions

$\frac{R}{L}=\gamma$; $\frac{e}{R}$=k; $\sin\beta=\gamma*(\sin\alpha+k)$ şi

$\cos\beta=\sqrt{1-\gamma^2}(\sin\alpha+k)^2$=1-$\frac{\gamma^2}{2}(\sin\alpha+k)^2$;

$\sqrt{(R+L)^2}-e^2=(R+L)\sqrt{1-\frac{e}{R+L}^2}$=R+L - $\frac{e^2}{2(R+L)^2}$.

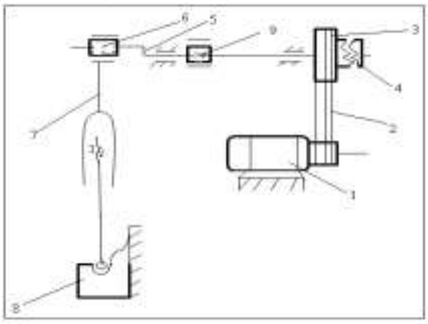
Out of the relation (2) it follows the for the mechanisms in which the slide is moving according to the axis that goes through 0, eccentricity e=0, the expression of the run becomes:

$$S=R\left[(1-\cos\alpha)+\frac{\gamma}{4}(1-\cos 2\alpha)\right];\quad (3)$$

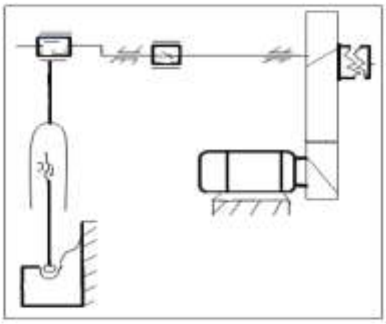
We infer that a rotation of the cranck for which e=0, it follows H=2*R. From a functional poent of view, the mechanism piston rod cranck demands as a limit of the ratio $\frac{R}{L}$ the value $\gamma\leq\frac{1}{4}$ in the case of mechanic presses the field of their use is $\frac{1}{20}\leq\gamma\leq\frac{1}{4}$.

We also steel that for the ratio $\frac{e}{r}$ =k, one can adopt values k=0….∓1,3,but the recommended field is k=0……∓ 0,5. If the rotation axis is situated in front of the guiding's axis in the rotation direction of the crank then we consider the dezaxation e to be positive, consequently the ratio having a plus sign on the sign minus ,since the influence of the movement of the guiding's axis on the whole run is negligible, then we can refer that this actually corresponds of the kinematic variant. The influence of the movement of the guiding axis can't be neglected in the determination of the position of the slide during the run, because significant errors could occur otherwise. Generally while projecting, one must check the position of the slide as contrasted to the return points for various values of the angle. Consider the fact that for the mechanisms for which e=0, the maximum run corresponds to a rotation of the cranck between the limits 0….180^0, consequently the movement of the slide in both directions is carried out to the same rotation angles. In figure 3 we have the following notations:

1-training engine; 2-transmission belts; 3-loose; 4- coupling; 5 -main shaft (with an eccentric or a cranck); 6-eccentric jack; 7-piston rod; 8-slide; 9- brake;



a)

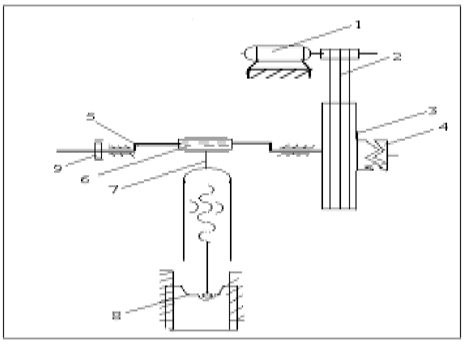


b)

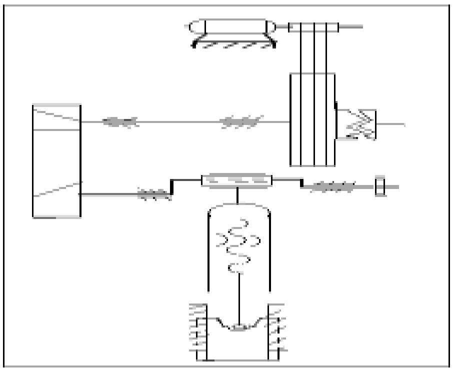
Figure 3.The kinematic chart of the mechanic presses with simple action having the main shaft perpendicular on the frontal face a) with transmission through belts; b) with transmission with cogged wheels;

Since the mechanic presses with a simple action having the main shaft perpendicular on the frontal face have a low nominal force R_N =1000kN and a great amount of double runs per minute the kinematic charts are simple including in the main kinematic chain several elements the function of which consist in transmitting the movement from engine 1 via the rotation of the shaft with eccentric the piston rod 7 is being moved which trains the slide 8 of the press. Break 9 is mounted on the main shaft instead of the transmission with belts, some construction are endowed with transmission via cogged wheels (figure 3, b). The open –type presses having the main shaft situated along the frontal face, (figure 4, a and b), have kinematic charts that mainly contain the same elements as those from the mechanic presses with a sample action having the main shaft perpendicular on the frontal face (1-training engine; 2- transmission belts; 3 - loose, 4- coupling; 5- devious shaft; 6-

eccentric jack; 7- piston rod; 8- slide; 9- brake).



a)



b)

Figure 4. The kinematic chart of the mechanic presses having the main shaft along the frontal face, a)with a reduction step; b) with two reduction steps;

In order to ensure the functional conditions determined by the possibility of execution of a wider scale of pressing operations, the kinematic assembly of these machines is endowed with systems for length adjustment and of the position of the run. The variation of the length of the run is obtained through the adjustment of the cranck ray or of that the eccentric –according to the functional characteristics imposed on the machine. The maximum length of the run is $S_{max}=H=2R$, while the minimum one of the cranck or the eccentric. The amount of the adjusted steps of lengths is different, depending on the construction of the adjustment mechanism and on the nominal force of the press. The increase of the technological possibilities of the open type presses is also related to the run execution in various areas of the space between the table and the slide of the press. The space in which the runs are carried out and the field of their adjustment is an important features of the presses the adjustment of the position of the presses can be carried out in two ways: by adjusting the length of the piston rod or by adjusting the position of the slide as contrasted to the connecting joint between the later and the piston rod. The kinematic assembly of the closed type presses is located either in their superior part or the inferior one. Situating the training system in the superior part brings about the planar sizes of the construction, it ensures an easy demounting of the oversizing boards from the table, it allows for a confortable access to the main movement chain in the view of mending damages and they have a good stability. The latest four levels construction presses have the training system located in the inferior part. These constructions mainly have the following advantages: they ensure a noise free level, have a high rigidity in the conditions of a small weight of the construction and due to the inferior port of the press, the oscillations are much lower as compared to those in the case of the superior part transmissions. The main disadvantage of the inferior transmission constructions is that their mounting in section is done on deep ground foundations when calculating the forces from the mechanisms cranck slide used in slow mechanic presses (n<120 double runs /min) with a cranck, the speeds of the working tools are low, the inertness forces are neglected because they do not surpass 10% from the value of the nominal force. In the ideal conditions of the presses owed to the articulation were neglected. Due to the pressing force overtaken by the slide, in the connecting articulation of the piston rod with the slide, there occur the elements:

$$F_b=\frac{F_d}{\cos\beta}=\frac{F_d}{[1-\gamma^2(\sin\alpha+k)^2]^{\frac{1}{2}}} \quad (4)$$

Which challenge the piston rod axially, and:

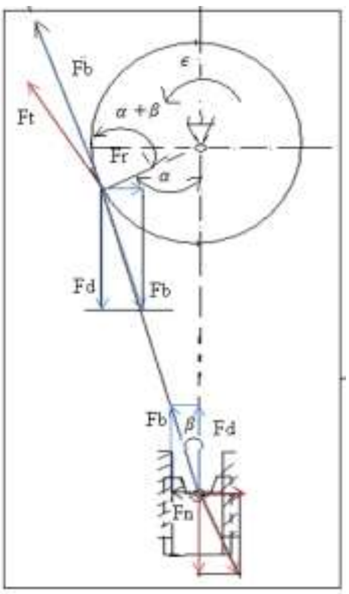
$$F_n=F_d\tan\beta=F_d\frac{\gamma(\sin\alpha+k)}{[1-\gamma^2(\sin\alpha+k)^2]^{\frac{1}{2}}} \quad (5)$$

Which action perpendicularly on the guiding's of the press (fig. 5 a). The torsion moment determined by of the press can be expressed under the form:

$$M_t = F_d \frac{\vartheta}{\omega} = F_d m_t \qquad (6)$$

In the projection calculations it is but necessary to take into consideration the fact that the deforming force $F_d \neq$const., generally has a void value when the parameter $m_t = \frac{\vartheta max}{\omega}$, and it increases during the work according to a parabolic variation. For a position of the cranck a=0 the deforming force usually amounts to the value F_{dmax} but the torsion moment will be $M_t=0$ since in this position $m_t=0$ too. The force F_b doesn't act according to the axis of the piston rod as it appears in the ideal case as it oriented after the mutual tangent to the friction circles corresponding to the articulation bearings of the piston rod. In order to determine the real requirements from the piston rod (fig. 6), there are represented the friction circles equivalent to the two articulations, their rays being:

$\rho_a = \mu R_a$ şi $\rho_b = \mu R_b$.



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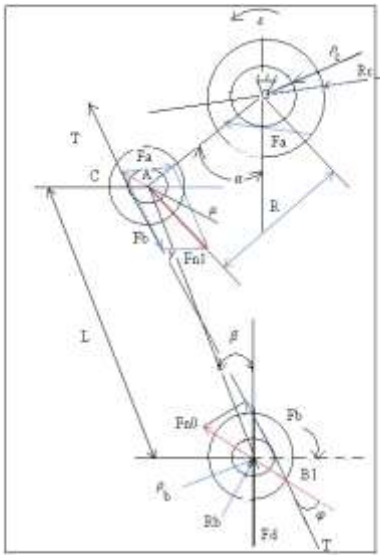

b)

Figure5. The action of the forces in the mechanism piston rod cranck

Where:

- $\mu - \tan\rho$ is the friction coefficient in the articulation;

R_a-is the ray of the bearing of the piston rod to the crank;

R_b-is the ray of the connecting articulation to the slide.

3.CONCLUSIONS

In the construction of the presses with a double action, with two or four crancks, we both situate the main shafts along the frontal face, and perpendicular on it. In order to decrease the total height of the presses with a double action, there have been projected and carried out presses with a training system situated under the inferior cross piece. Decreasing the height of the presses with a double action has a major importance since the construction having a training system situated in the superior cross piece are much higher than all the other machines in the technological field.

4. REFERENCES

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