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VACUUM PRESS WITH WORM

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ABSTRACT

This paper presents a constructive solution of extruded brick presses performed with Solid Edge software. This allows the implementation of virtual prototyping and the timely functionality verification. The diversity of molds allows for new types of brick.

KEYWORDS**:** extrusion, press, CAD, CAE

1. OVERVIEW

Bricks are the basic cells used for resistance structures, for interior walls, they are commonly used to decorate the interior or exterior surfaces, pavement and even the construction of modern art.

The classification of bricks consists of:

- Brick Classic
- Glass brick
- Face brick
- Special brick

Basically, the bricks are produced with a vacuum extrusion machine:

- vacuum brick extruder machines
- brick extruder screw machines.

2. VACUUM PRESS WITH WORM

The assembly vacuum press consists of:

- Vacuum press with worm
- Motor
- Reducer

The assembly press is made up from the base plate where the engine is placed. The transmission of the rotational movement from the engine to the press is executed by coupling, belt drives and reducer (fig.1).

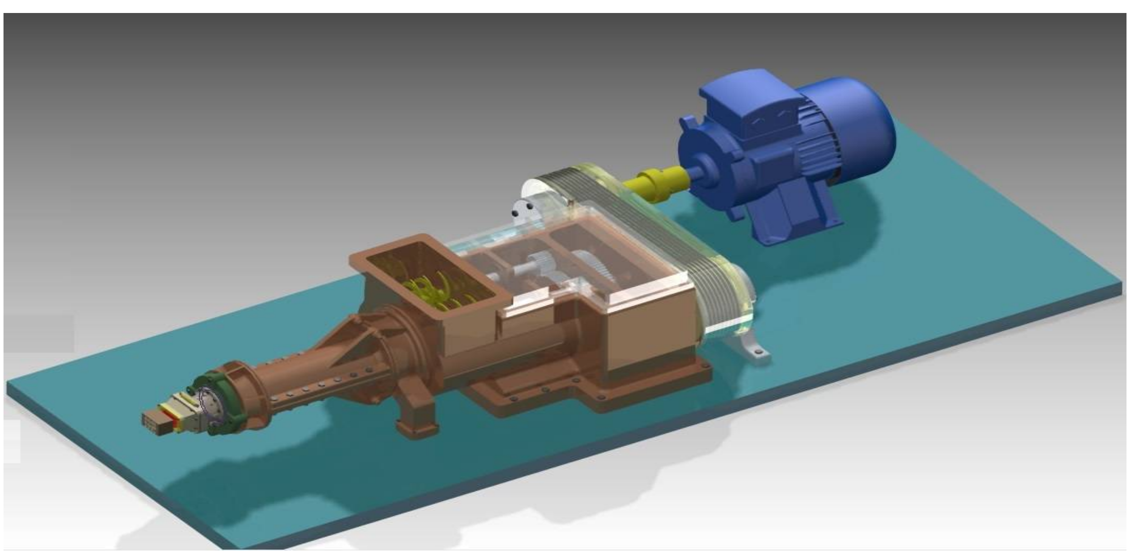

Fig.1 3D assembly of a vacuum press with worm

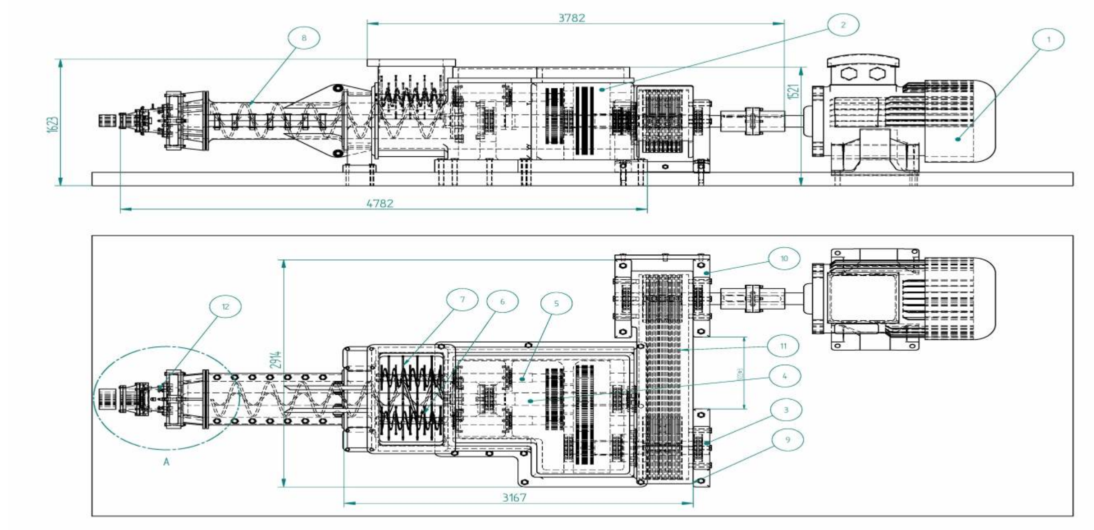

Fig.2 2D drawing of press assembly

1- group entrainment; 2- assembly housing 3- input shaft; 4- intermediate shaft; 5-shaft; 6- left stirrer shaft; 7- right stirrer shaft; 8- assembly worm; 9- defender belts; 10- bearing ; 11- V belts; 12-mold

The special building reducer has one entrance and three exits (fig.2):

- An output for press worm
- Two upper levels for driving axles and rollers stirrer (sense right and left) (pos. 6, 7).

The vacuum press with worm is fed with mass clay through the bowl. The stirrer shaft makes the mass clay be brought in the worm area which has variable pitch and actually creates pressure.

Depending on the molds used (fig.3 and fig.4) various forms of brick are obtained.

Dimensional bricks are obtained through an auxiliary cutting process.

Mold clamping system allows quick fitting of the press.

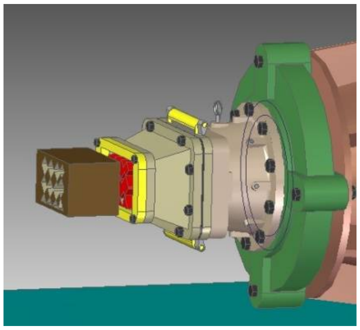

Fig.3 Extruded brick

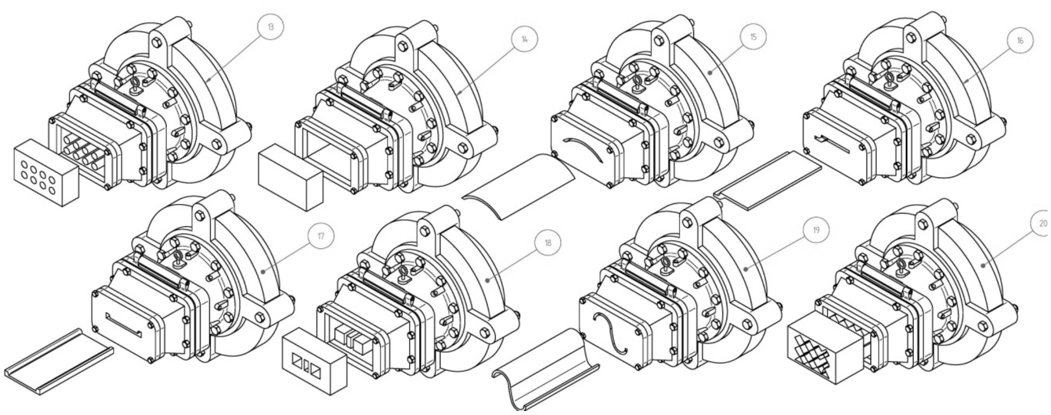

Fig.4 Various types of molds performed in 3D

13- For brick mold with holes; 14- For filled brick mold; 15- for brick mold for semi-round tile; 16-for brick mold with flat tile; 17- for brick mold with floor tiles; 18- for brick mold with square holes; 19-for brick mold of S type; 20- for brick mold of star type

The power room of press is presented in fig.5.

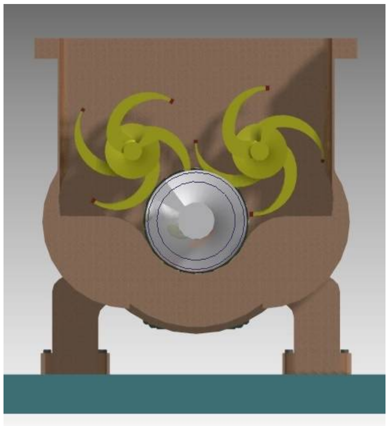

Fig.5 The power room

Wrapper rollers allow feeding the worm with argillaceous material.

The roll angle of attack must be smaller than the angle worm.

The roll diameter is recommended:

Droll = (0,7 ÷ 0,75) *Dworm. (1)

In fig.6 is shown the 3D assembly of a shaft worm.

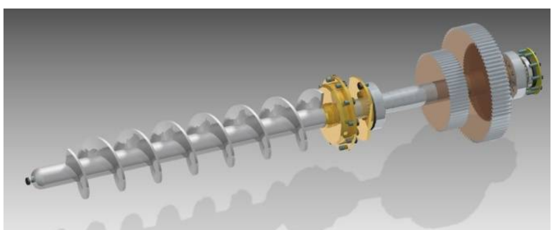

Fig.6 3D assembly of a shaft worm

The variable pitch construction of worm ensures better compaction ceramic paste.

The following parameters can be considered.

- the coefficient of friction between the clay and the metal is f = 0,2 ÷ 0,46,
- angle of friction φ=11° ÷ 25°.
- to avoid slipping on the clay paste on the worm shall be adopted α < φ (α being the helix angle of the worm). In fact, it has been adopted α =12°÷ 17°
- The coefficient of compression.

$$\varepsilon = (V_i - V_f)/V_i \qquad (2)$$

- The flow chopping machine can be evaluated with the following relation

$$Q = Ve(1-\varepsilon)nKM \times 60 \quad [m^2/h], \qquad (3)$$

- The power needed to act the press

$$N_{mas}=(N_{tr}+N_{pres}+N_{fr}+N_{cap}) \qquad (4)$$

3. CAE SIMULATION

The piece simulation was performed with Solid Edge software.

In fig.7 and fig.8 is shown the simulation sketch of the tensions on the spiral worm.

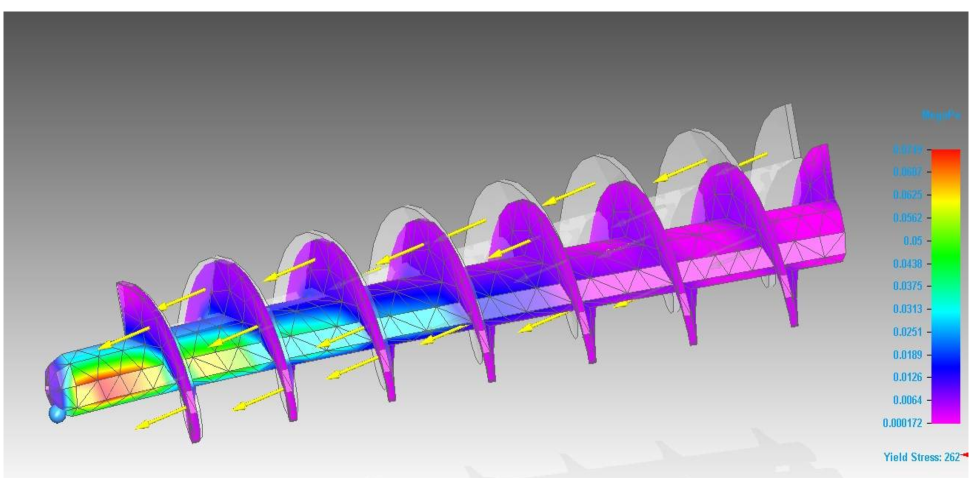

Fig.7 Simulation sketch of tension on spiral worm

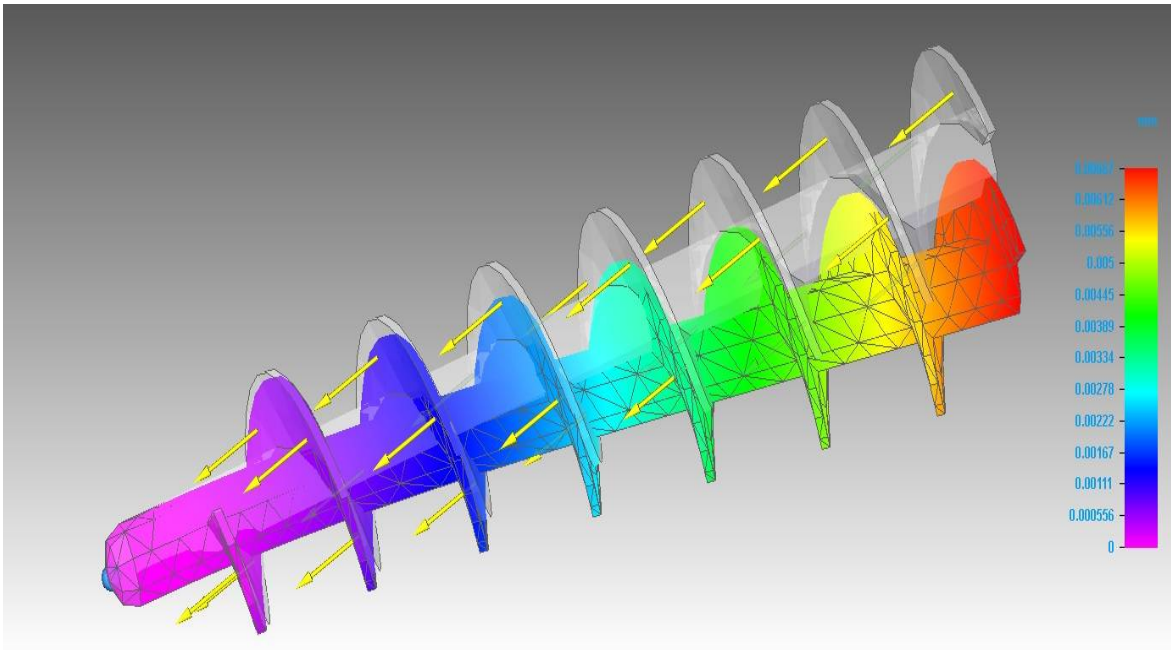

Fig.8 Resulted deformation following the simulation

A static analysis was performed.

It has meshed on piece with a number of nodes and elements.

It was applied the constraint on the area screw fastening and then a torque of 10^5 N was applied and oriented in the direction of the working pressure.

The simulation shows that maximum deformation occurs at the end of the worm where ceramic paste comes in contact with it and has the value of 6.67 * 10^{-3} mm and the maximum tension is 74900 N / m^2 and occurs in the constraint area of the worm.

4. Conclusions

Due to the calculation method presented, constructive solutions of presses can be optimized in order to obtain superior quality bricks.

The software used allows shortening the manufacturing cycle.

References

[1] Lăzărescu, I., Sînjoan, I., Vesa, E.- Equipment and technology of construction materials, Editura Didactică şi Pedagogică Bucureşti, 1985

[2] Dinescu A.,Surdeanu L, .Gagea l. Equipment and technology ceramic products – manual, Editura Didactică şi Pedagogică Bucureşti, 1982

[**3**] Simion Ionel: ,,*AutoCAD 2010 for Engineers*” –Editura TEORA, Bucuresti 2010.

[**4**] Mircea Badut: ,,*Basis of design with Solid Edge*” – Editura Albastra..