



**КОНСТРУКТИВНО-ТЕХНОЛОГИЧНИ ОСОБЕНОСТИ НА МАШИНИ  
ЗА БРИКЕТИРАНЕ НА ОСТАТЪЦИ ОТ ТЮТЮНОПРОИЗВОДСТВОТО  
STRUCTURAL AND TECHNOLOGICAL FEATURES OF MACHINES  
FOR BRIQUETTING OF TOBACCO RESIDUES**

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**Abstract**

Plant biomass is one of the most effective renewable energy sources of a great potential in the energy field. In the form of fuel it ensures one-seventh of the total fuel resources in the world.

One of the greatest sources of biogenic fuels is the lignite-cellulosic agricultural waste. The bulk of this biomass is used as animal feed and manure on arable land.

The briquettes from tobacco stems have a huge market potential as fuel. The potential exists due to the presence of accessible unused raw materials of high energy density.

The increasing production of biomass briquettes consists in developing new technologies and advanced installations of a technological challenge – delivering the highest quality with minimal production costs.

The paper treats the possibilities for briquetting tobacco stems under the conditions of single production by farmers who meet their own heating needs. Two fundamentally different technological schemes of briquetting machine development are presented.

**Key words:** bio-energy, biomass, tobacco residues, briquette, briquetting machines.

**INTRODUCTION**

Globally there is a separate energy crisis with highs and lows, which forces all countries to look for permanent solution in terms of energy balance. For meet basic energy needs many countries are planning more rational using of energy and exploitation of renewable energy (RE) for substituting of part from fossil fuels. To energy from RE include: bio-energy, hydro-power, geothermal, solar and wind energy (Josifov, 2005).

The term “biomass” means all substances with organic origin, containing plant or animal biomass (Josifov, 2005), i.e. residues from tobacco are classified as bio-energy.

Briquetting belongs to technology which compact biomass. Finished products are solid biogenic fuels, ready for burning in heating installations. With compaction of biomass aims to improve the quality and economic indicators of the output biomass as fuel in terms of compactness, calorific, keeping, etc.

**The aim of the development** is to show some characteristics of briquetting machines of residues from tobacco, with the possibility of utilization in heating systems of small farmers.

**TECHNICAL REQUIREMENTS  
FOR BRIQUETTING MACHINERY**

Designed to briquetting machines can make the following requirements:

1. Compactness and mobility;
2. Prepared briquettes to have the chance for direct combustion in heating systems, without the need of processing;
3. Ability to work with small quantities biomass;
4. Possess a simple construction, easy to operate and maintenance;
5. To operate with low pressure, temperature and degree of compaction;
6. To work with shredded stalks of tobacco, with relative humidity around 15%;
7. Obtained briquettes have a dimensions diameter 40-90 mm and length 30-60 mm.

### OPERATING PRINCIPLE

Proceeding from the above mentioned requirements for machinery and complying with characteristics similar to ones which were laid two kinematic schemes of machines for briquetting of residues from tobacco, shown in fig. 1 and 6 (<http://www.ekoeffect.com/briketmashini.html>; <http://spisanie.info/broj2>; <http://finansirane.eu/>; 2015).

Figure 1 shows kinematic scheme of piston press for briquette from tobacco residues. The essence of this press is applying pressure on arm 4 and the piston 2 on the biological waste (which is placed in the liner 1) to the shaping of the briquettes with a suitable form in press chamber 3. The speed of making briquettes is very small, therefore she is suitable for application in single production at farmers by about 2-3 dka tobacco plantations.

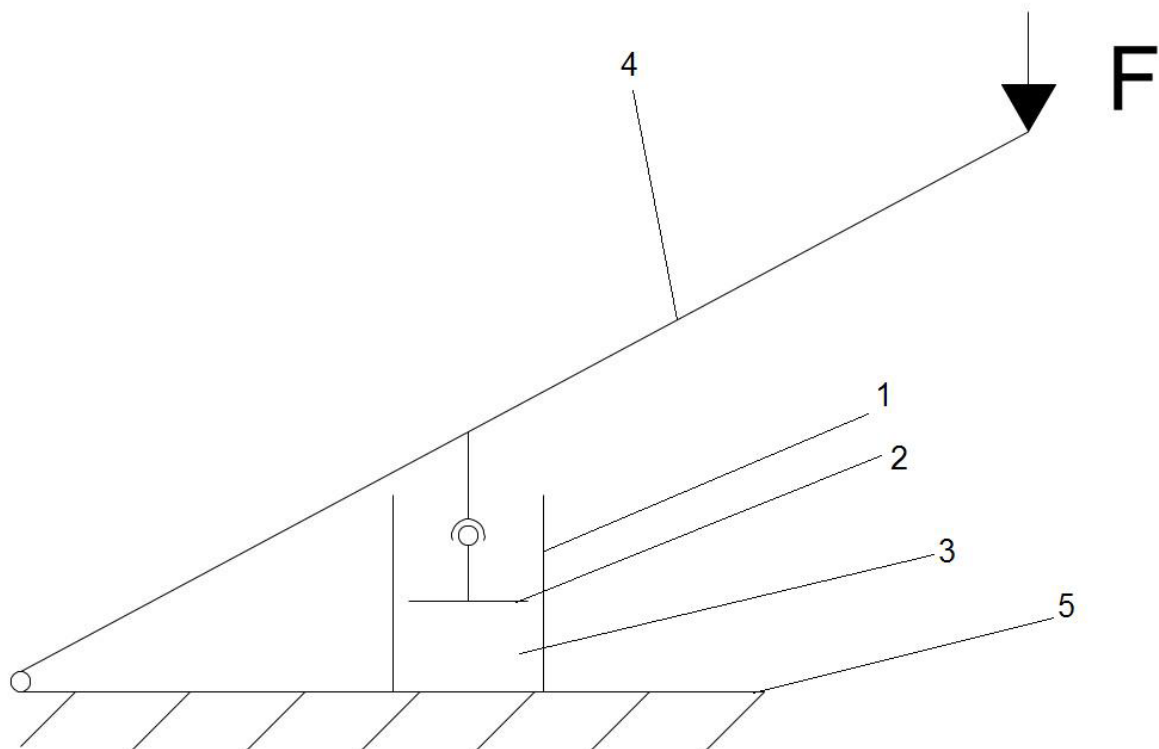
To increase in productivity able to work two or four presses simultaneously. Figure 2 shows a charging device to press with two pistons for briquettes from tobacco residues. The liners 1 are with diameter of 80 mm and height of 80 mm. They are connected together in a block through connecting link 5. The arm 6 by means of a hinge, provides a mobility of liners through their rotating.

This operation is required to release the already finished briquettes. The block with liner being locked between fixed support 2, which is connected to the plate and mobile support 3. The block is fixing between supports by pins 4.

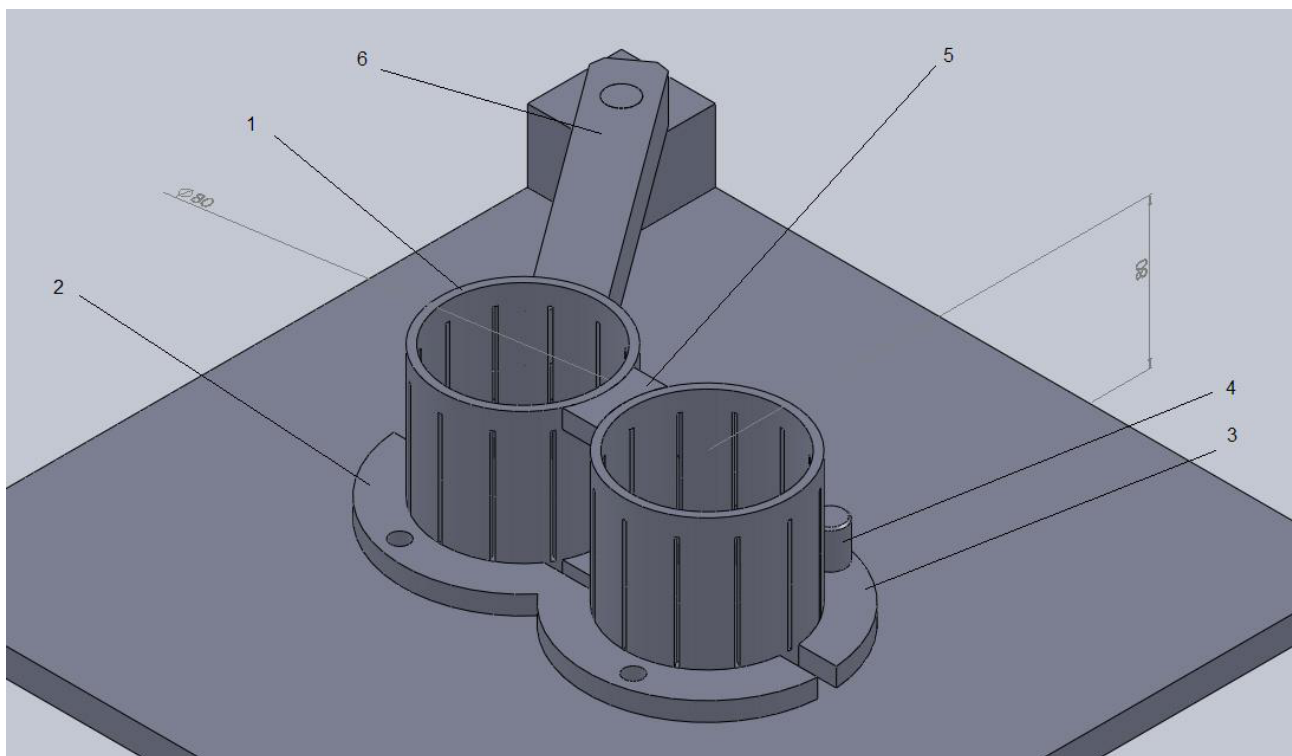
For implementation of the pressing of the residues from tobacco are used pistons 1. (figure 3). To these are attached arms 2 by means of hinge joint 3. The arms in other side are attached to retainer 4. They guarantee the final position of the pistons in the liners (through spherical shape cutout at the top profile surface and the end position of contact between retainer and liner) and the same height of all briquettes.

For convenient charging and cleaning of the press from the already finished briquettes the pistons with retainers are rotating around supports 5.

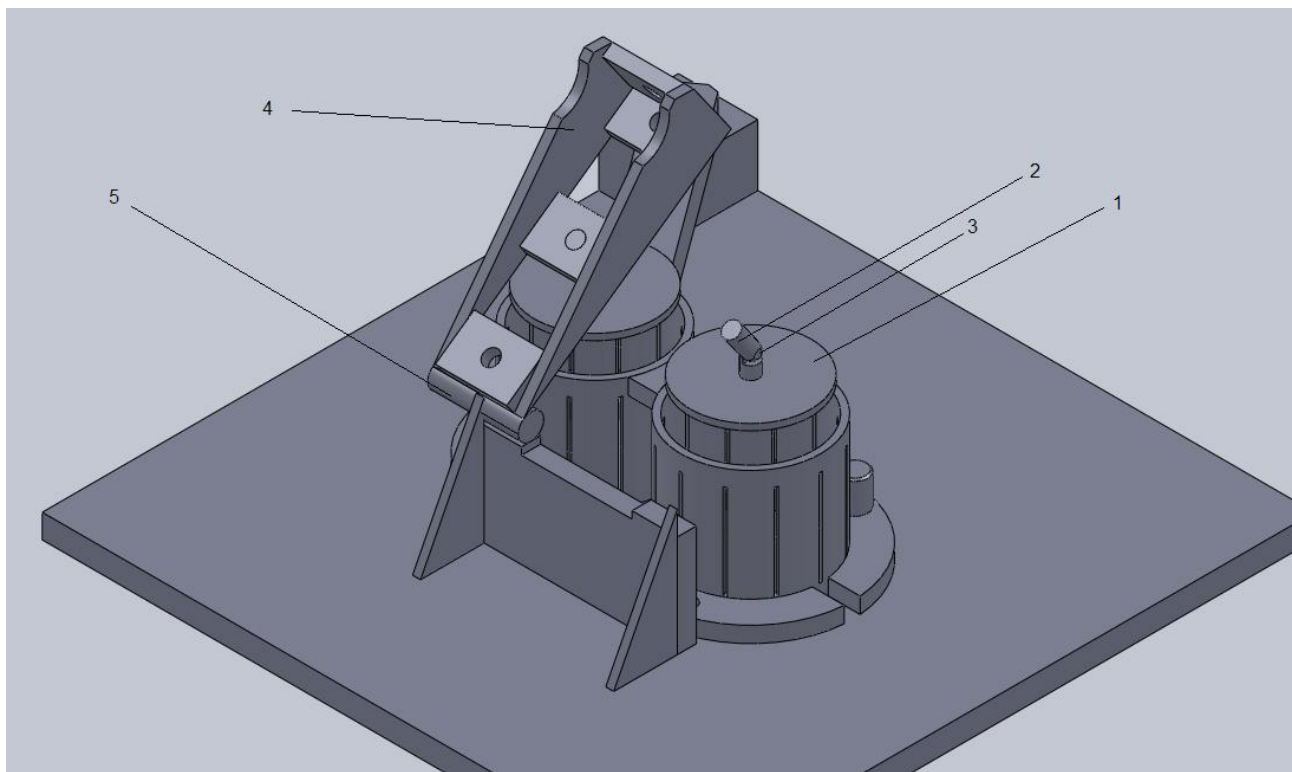
The actual pressing is done manually, through application of force on the lever with support 3 (figure 4). Carry out the rotation movement of the support and the sleeve 1 starts rotating around guide 2 of lever with support, in contact with the shaped surface of retainer from figure 3.



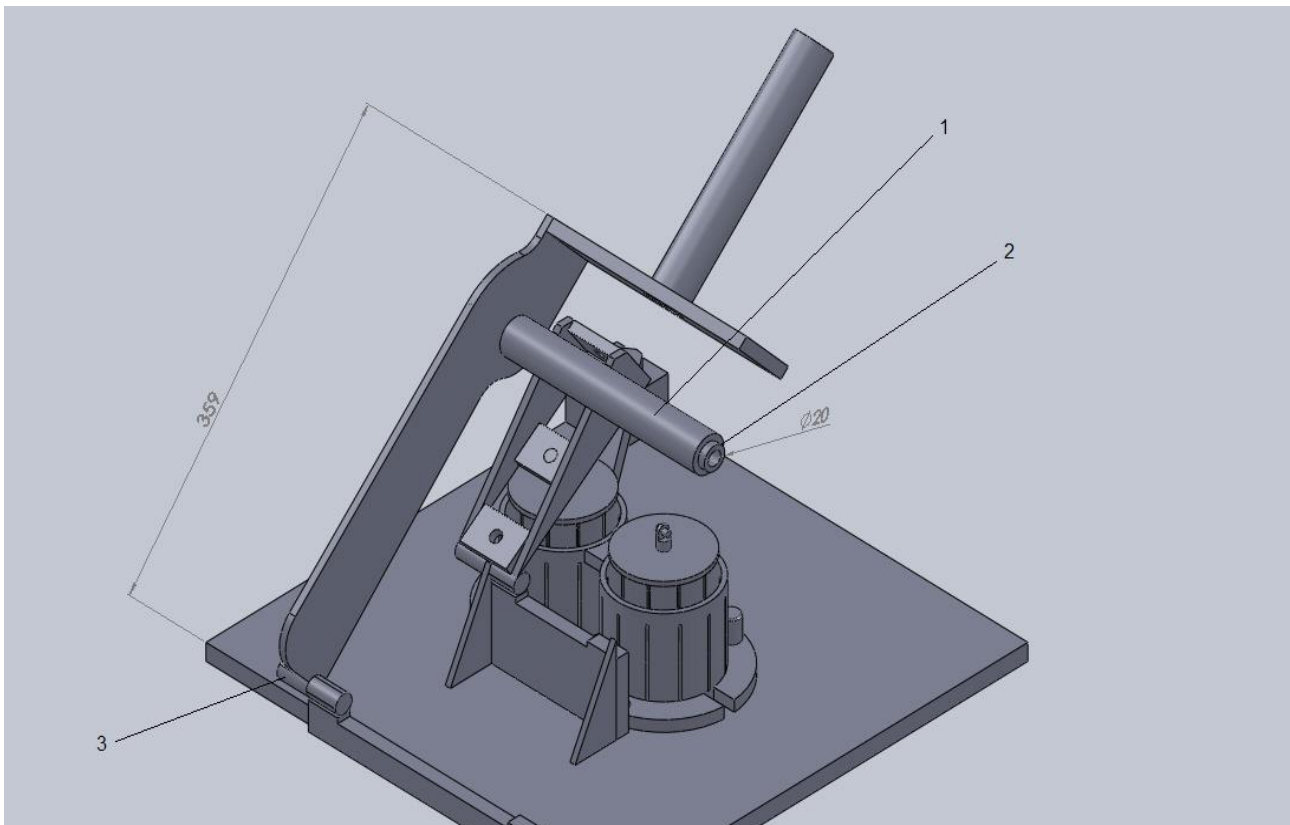
**Fig. 1.** Kinematic scheme of piston press for briquettes from tobacco residues:  
1 - liner; 2 - piston; 3 - sealing chamber; 4 - arm; 5 - anchor



**Fig. 2.** Charging device of piston press for briquettes from tobacco residues:  
 1 - liner; 2 - fixed support; 3 - mobile support; 4 - pin; 5 - connecting link; 6 - arm



**Fig. 3.** Filling device of piston press for briquettes from tobacco residues:  
 1 - piston; 2 - arm; 3 - hinge joint; 4 - retainer; 5 - support



**Fig. 4.** Loading device of piston press for briquettes from tobacco residues:  
1 - sleeve; 2 - guide; 3 - lever with support

General view of piston press is shown in figure 5. As already explained above, to drive the press is necessary be accomplished pressure on drive lever 2 and the lever with support 3 carried a rotational movement around the support of plate 1. The gauge dimensions of the designed press are 400 x 400 x ~360 mm.

The other scheme of the machine for briquetting of tobacco residues are given on figure 6. Biomass for briquetting is fed through hole for charge and enters the body of extruder 2. She get around in body through screw conveyor with variable pitch 1, maintained by bearing 6. For compacting of biomass serve pressure chamber 4 and guideway part 5 imparts the exact form of briquettes.

General view of extruder press for briquettes from tobacco residues is shown on figure 7. The material which to pressed is fed through hole for charge 3 with diameter 56 mm. The finished briquettes comes out in funnel 1, which is at extruder through nut 2.

The extruder is consists of screw conveyor with variable pitch 1 (figure 8), which is driven by an electric motor with appropriate speed and torque by

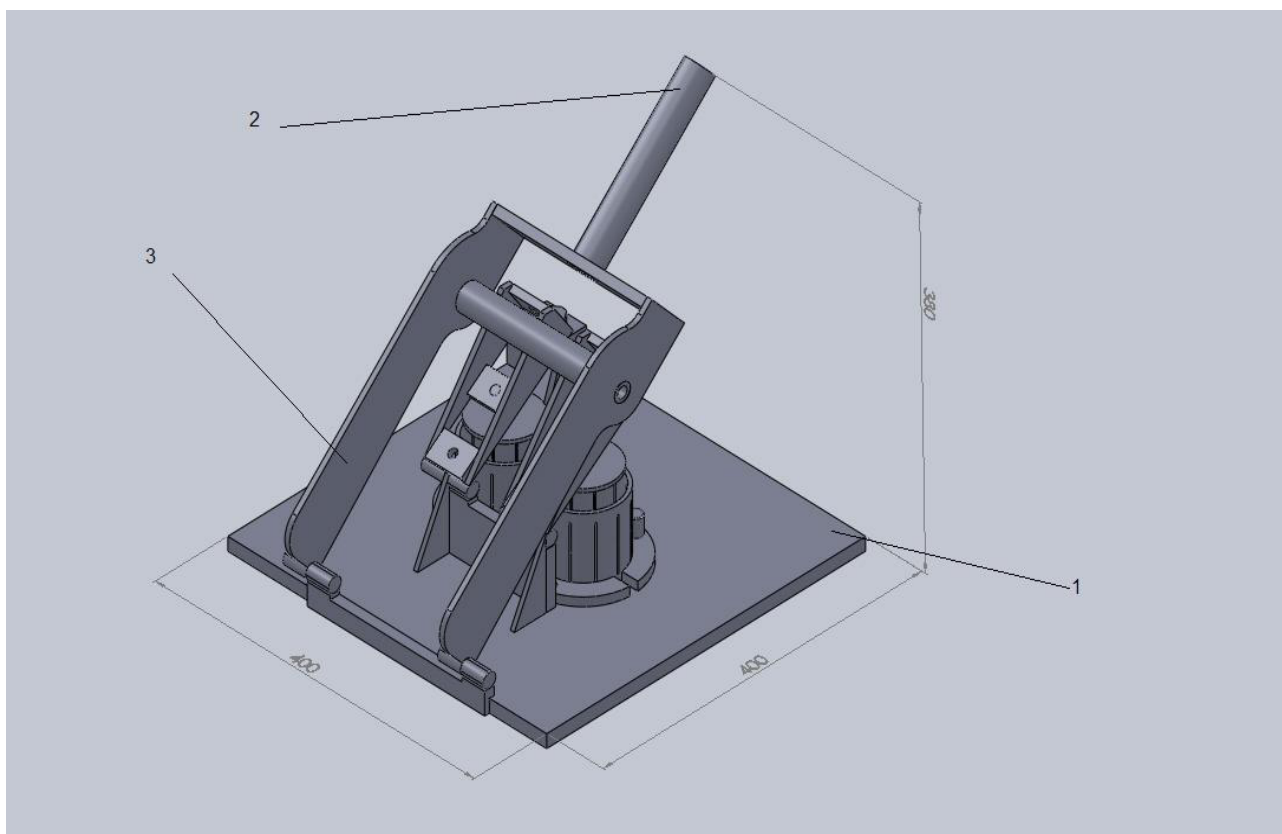
means of belt and drive pulley 4. In the extruder the screw carried a rotational movement as is supported by the legs 2 and 3.

The rear leg is with the same diameter as extruder housing and is fastened to it by means the nut from figure 7.

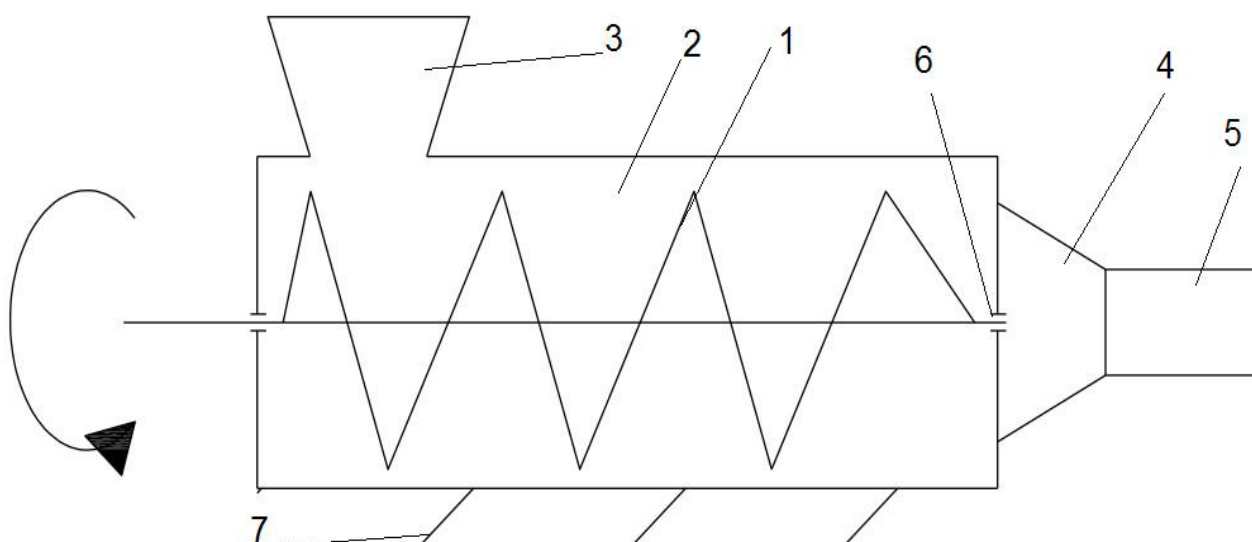
Figure 9 shows attachment of extruder to machine frame. It is does by means of fixings plates 2, that have drilled in two holes with diameter 10 mm and distance between the holes of the plate 70 mm. The distance between holes of the two plates is 102 mm.

With designed extruder may be compressed briquettes with diameter of 48 mm. The length of the briquettes is infinite, so as necessary an additional knife to cut briquettes with needed length. That knife can be executed with mechanical connection to belt drive or hydraulic control. At present that knife not shown. In the construction of machine can be envisages special loading device, to move the biomass to charging hole. The control again can be a mechanical connection or hydraulics.

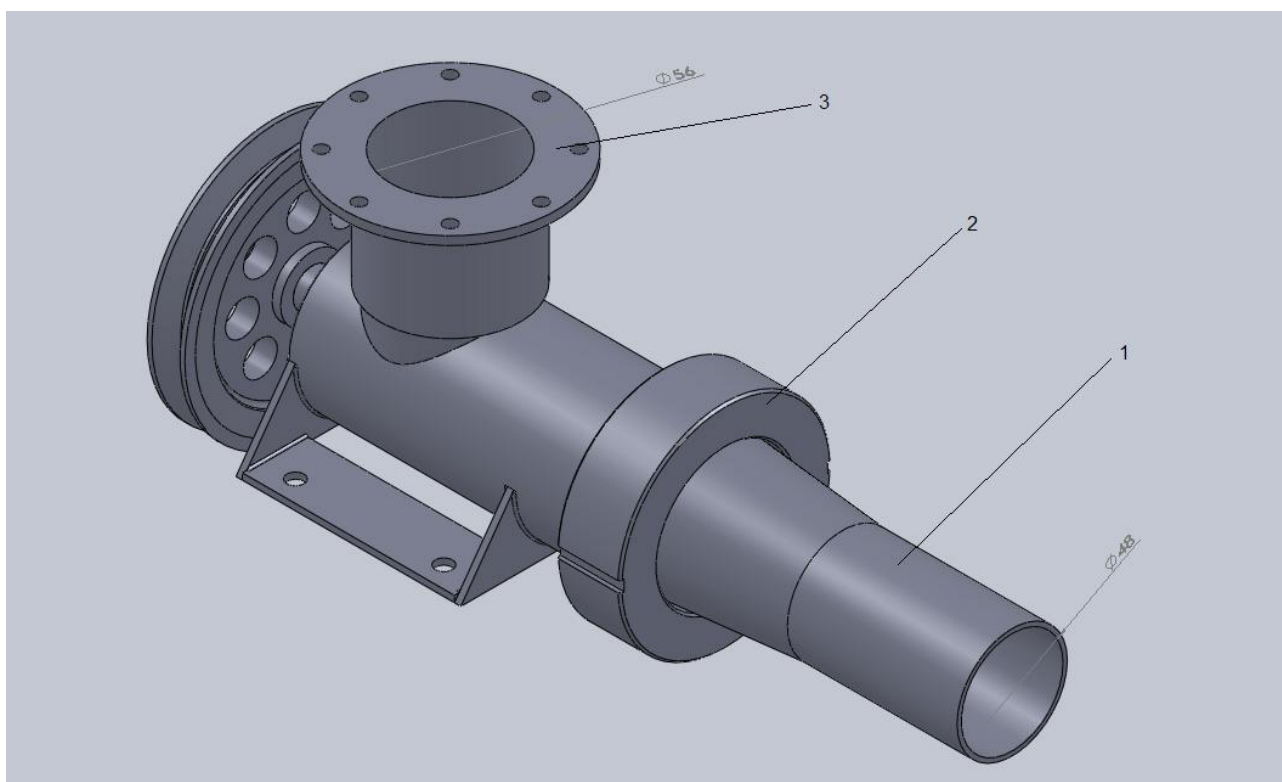
The dimensions of designed machine are 348 x 120 x 138 mm.



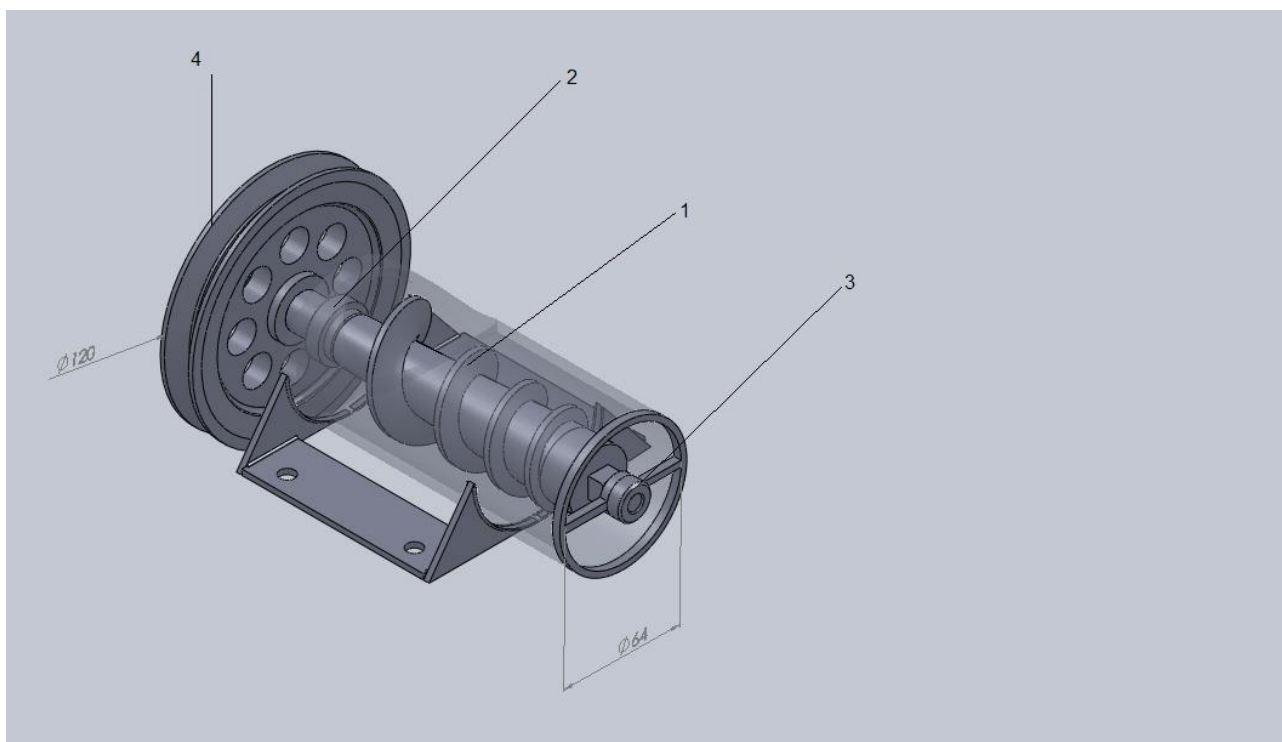
**Fig. 5.** General view of manual piston press for briquettes from tobacco residues:  
1 - plate; 2 - drive lever; 3 - lever with support



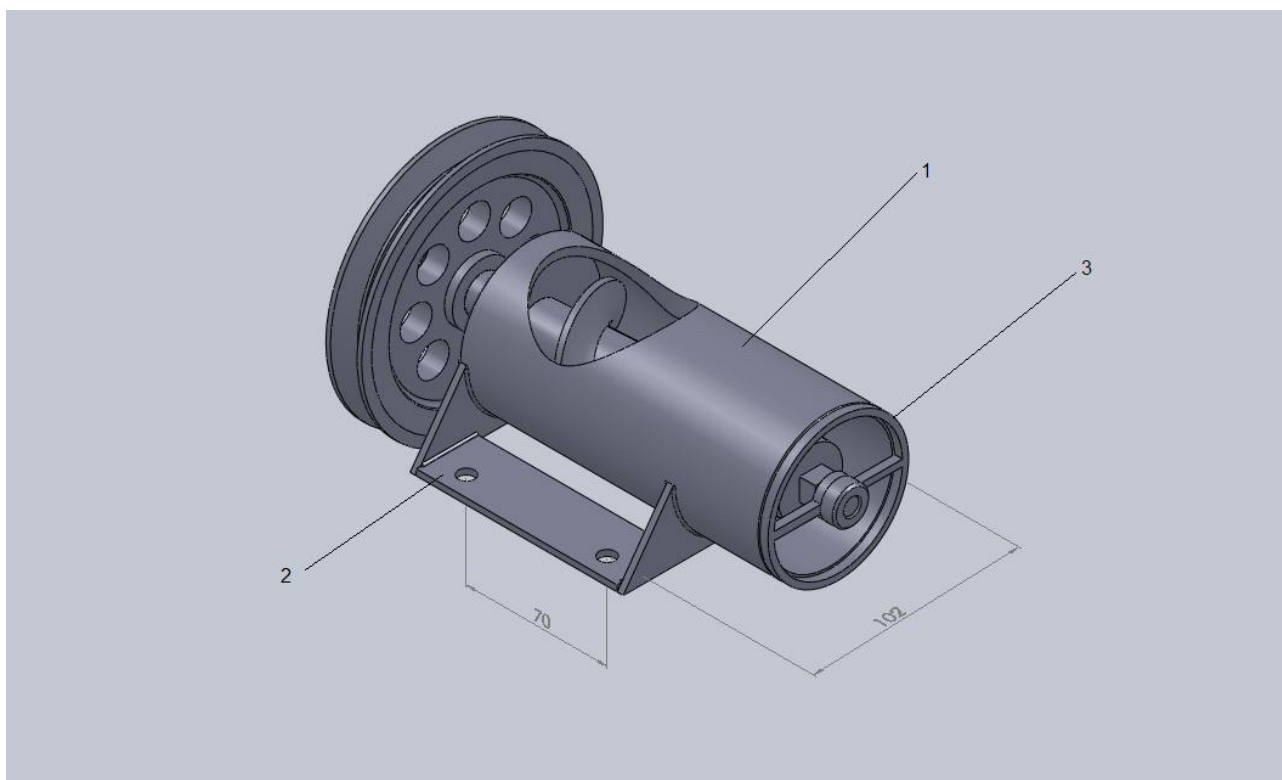
**Fig. 6.** Kinematic scheme on extruder press for briquettes from tobacco residues:  
1 - screw conveyor with variable pitch; 2 - body of extruder; 3 - hole for charge;  
4 - pressure chamber; 5 - guide-way part; 6 - bearing; 7 - mainstay



**Fig. 7.** General view of extruder press for briquettes from tobacco residues:  
1 - funnel; 2 - nut; 3 - hole for charge



**Fig. 8.** Drive of extruder press for briquettes from tobacco residues:  
1 - screw conveyor with variable pitch; 2 - front leg; 3 - rear leg; 4 - drive pulley



**Fig. 9.** Attaching the an extruder press for briquettes from tobacco residues:  
1 - housing of extruder; 2 - fixing plates; 3 - rear leg

### CONCLUSIONS

1. Designed are two machines for briquetting of tobacco residues.
2. The designed machines meet all the requirement of technical specification.
3. The designed machines will apply to small farmers for satisfy the personal needs of heating.

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<http://spisanie.info/broj2>  
<http://finansirane.eu/>

