OIL PRESSES FROM OILSEEDS

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Abstract: The article describes a brief history of the development of vegetable oil production and in particular presses that are used. Compared screw presses and hydraulic. Described M8-MSHP press for the final extraction of vegetable oil (produced Chisinau JSC "Alimentarmash"). The design procedure of the performance of the scheduled for press a M8-MSHN - press for a preliminary extraction of oil from oil seeds, including and rapeseed.
Key words: vegetable oil, press, pressing.

Introduction

Cultivation of oil plants and derived oils dates back to ancient periods of human history. Egyptians in the Nile Valley, about 2 thousand years BC bred flax to produce flax fiber from it and an oil. In ancient times to extract oil from oilseeds used stones and bowls. In the III-II centuries BC appeared press and grinders for olives. Lever press was powered by weight. [1]. Around 1600 appeared wedge press (wedges scored, hence the term - "oil pressing" operations) in Europe. In 1750 invented Roller mechanism. In 1795 in England, was invented by a hydraulic press with manual transmission [2], in 1818, it has been used in the production of vegetable oil to the preparation of material on fire braziers, and in 1830 - with a steam broiler. Accessories - rollers, pumps, grills, filters, etc. - have changed a little in the next century, while the hydraulic floor press [1]. All kinds of hydraulic presses have many shortcomings. This is the frequency changing of the-consuming press felts, the complexity of hydraulic pressure system, with a large losses in oilcake, poor sanitation, poor working conditions. First opebasic equipment - press - has changed significantly. In 1880, the U.S. began to use rated screw press was build in the United States. American Process Company (APC) established in 1900, made screw press for extracting oil from high oil contained row materials. Screw and barrel in the press were conic. Press was equipped with a special device that presses the spring to adjust the outlet (for seed cake). [2]. At the same time, Andersen in Cleveland (USA) created the design of the press, which was different from machines made by APC in cylindrical form of press shaft and the pressing cage, and the presence of a cone with a spring to adjust the value of the outlet.

In our press there is collapsible design of pressing cage, made of a set of bars with gaps through which oil flows, screw shaft is made not as a continuous surface over the entire length, and from four separate sites screws with breaks in between. This provides additional pressing of a product. However, the press Andersen was unproductive and that limited its uss. [2]. Later, in the press that was made by company Krupp, which Andersen sold the patent, this issue has been improved (in particular - they added two pans). The subsequent development of a screw presses led to a number of types of these machines. For the purpose of pre-pressed oil, so called forpresses who have big sizes pressing screw diameter by up to 247 mm, and a relatively high rate of screw shaft (up to 26-37 rev / min). These machines produce a cake with a large residual oil (approximately 12-18%), while providing better performance. For the extraction of oil after the first pressing were created

forpress of final pressing, with different reduced diameter augers (maximum diameter up to 190 mm) and lower their speed (5-18 rev / min). Thus achieved an increase in pressure on the intermediate product, which gives a more complete extraction of the oil.

Screw press is currently the most advanced equipment for extracting oil. In comparison with hydraulic - the screw press provides continuity of a process, increases the yield of oil from seeds, automates workflow, greatly facilitates the work of staff, excludes the use of press felts, dramatically improving the health of manufactory.

Materials and Methods

JSC "Alimentarmash" (Chisinau food machinery factory) is specialized in the production of equipment for the production and processing of vegetable oils from oil seeds: sunflower, canola, soybean, etc. for continuous extraction of oil from rapeseed. Screw press M8-MSHP of final oil extraction with with specially designed gaps in pressing cage is produced by JSC "Alimentarmash" [3].

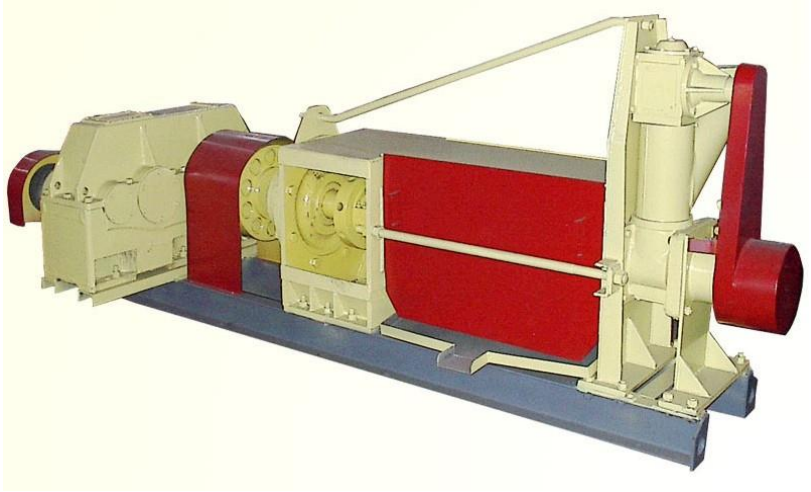

Fig.1. Screw press M8-MSHP for extraction of oil

Press (Fig. 1) consists of a frame, motor, gearbox housing with a screw shaft and cone mechanism pressing cage and feeder. The frame is the basis the press, and is a framework that relates to the foundation of the press. The lower surface of the frame rests on the foundation and attached to it by means of anchor bolts.

The feeder is designed to press the pulp in unified pressing cage. It consists of a screw-level, drive, chain drive, a pair of bevel gears, vertical and horizontal shafts. Pressing cage inside which rotates a shaft with a set screw units, consists of two halves connected by pins, and is divided into four pressings.

Each half of pressing cage is a modular framework of clamps and connecting bars. Themselves cage camera assembled from planks, between which the output gap clearance for the pressed oil. The gaps in the cells in the following order:

The first camera - 0.7 mm;
The second camera - 0.5 mm;
Third camera - 0.25 mm;
The fourth camera - 0.15 mm.

In assembled cage camera there are two halves with packed knives (in the slots), intended to cut the pressed material.

Screw shaft with the inserted ring rotates in bearings mounted in the housing press. Screw moves pressing the product along the inside of the pressing cylinder. For the control of thickness of outcoming cake there is a cone mechanism, which consists of a cone, the connecting plug, clutch, flywheel and the guide bushing sleeve.

Transmission of torque from the motor to the gearbox is done via a V-belt transmission with a gear ratio 1:1,87.

Torque is transmitted from the gearbox to the screw shaft through a sleeve-bolt coupling.

Transmission of torque from the screw shaft to the shaft through the feeder chain transmission with a gear ratio 2,92:1, and a pair of bevel gears with a gear ratio of 1:1.

Rotation speed - 12 rot/min (including motor speed of 1000 rot/ min.) The pressure inside the pressing is quite significant and reaches $4 \cdot 10^6$ Pa or higher.

The principle of work of the press is as follows. Prefabricated source material - rapeseed, cleared of ferromagnetic impurities, crushed and heated to a certain temperature (up to 60 ÷ 65 ° C) - served in the feeder press, and then moved to screw press.

The press of continuous mechanical separation of liquid and solid parts of seed pressure created by the special design of the screw shaft and pressing cage during the passage of the material. There are tapered rings and cone at the end of the press for managing the row material. The thickness of seed cake can be the increased or decreased by adjusting the annular gap between rings and cone.

Pressed oil goes through the gaps between the plates of pressing cage and flows on a special tray. Seed cake coming out of the press through the annular gap between the cone and the conical ring, crushed special knives into small piecess.

Technical characteristics of the press M8-MSHP (processing rapeseed)

Productivity, tons / day - at least 7;
Residual oil (single pressing),% - not more than 12;
Installed power, kW - 11;
Overall dimensions, mm, not more - 3380h1150h1370;
Weight, kg, not more than - 2250.

Results and discussion

At present JSC "Alimentarmash" started prototyping oil presses brand M8-MSHN (Fig. 2), which performance will be two times larger than the press-M8 MSHP. Press M8-MSHN is planned to be used in the lines for the production of vegetable oils by pressing twice as pre-press oil extraction - forpress.

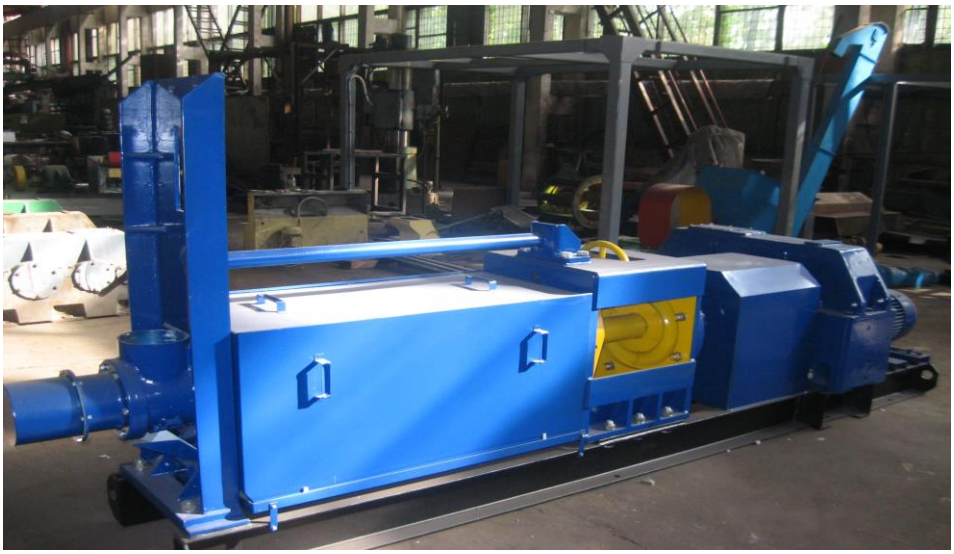

Fig.2. Press oil brand M8-MSHN

In the lines of a two-step extraction is used only M8-MSHP, and for the primary extraction is used motor speed n_1 = 1000 rot/min, and for the secondary - speed n_2 = 750 rot/min, and also with different clearances in pressing cages.

The gap between the slats of pressing cage depends on which step is executed - preliminary or final extraction of oil, and which row materials is used. In case of pre-pressing the gap between the bars slightly more than in the final pressing [1]. The gap between the slats of pressing cage, is decreased towards the exit of compressed material. The greater the pressure in the press, and it is more in the case of the final pressing and increases in the direction of the exit baling material, the less should be a gap between slats. The overall change of the gap from 0.8 to 0.15 mm.

To determine the performance of screw press, you need to determine the nature of the movement in pressing cage. Picked up by the incoming pulp rotating screw shaft, and by friction between cage chgamber and pulp, as well as the presence of thread turns it tends to move in a spiral.

Special knives between halves cage drum, as well as "jagged" the inner surface of pressing cage provide movement of a pulp mainly along the screw shaft. G.V.Zarembo research [4] have shown that some parts of pulp still rotates with a screw shaft.

If for some reason lots of mash begins to rotate with the shaft (in case of breakage of teeth blades, profuse discharge of oil and high ductility of the gel pulp), the work of press is upset, it does not create pressure and drastically reduced its productivity. Thus, the main movement in the pressing intermediate mash is linear, ie is the same as in the normal transport auger, so the performance of the press (with some degree of accuracy) is determined by transportation facilities screw shaft.

To determine the performance of screw press for seeds (kg / h) apply the formula:

$$Q = 4710\, D_3^2\, L\, (1-\Psi)\, \rho_n\, n\, (1-K_v) / B_m\,, \qquad (1)$$

where :

D_3 - volume mass of pulp, kg/m^3;

L - length zeernoy pressing, m;

Ψ - fill factor is different for the different presses. For M8-MSHN Ψ = 0,07. It determined by calculation, as the ratio of the coil to the volume of pressing cage;

Pn - volume mass of pulp, kg/m^3;

n-number of screw speed, min^{-1};

B_m -out of fiber (%).

Coefficient of return can be determined only by experiment. His presence proved by the following facts:

a) actual time of passage of pulp in pressing cage is always higher than the calculated;

b) shape of thread wearing (during using wear is more at the front face of the coil);

c) by changing the position of the adjusting device at the outlet of the press - performance of the press changing;

d) during using of the press its performance decreases due wear.

Conclusions

From the above relation (1), the following important conclusions for practice:

1) Performance is most dependent on the diameter pressing cage camera;

2) To increase performance, you should raise the ρn (in particular through increasing compaction pulp at the entrance to the press);

3) Reset ratio should be reduced (by keeping the coil and knives in a working state);

4) Increase n - a significant factor in increasing productivity.

Design capacity M8-MSHN - 15 tons / day (rape seed), ie one M8-MSHN replaces two M8-MSHP.

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