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HYDRAULICALLY CONTROLLED SEPARATION UNITS FOR WET DISPERSE SYSTEMS

Ivan SEVOSTIANOV, Doctor of Technical Sciences, Professor, Mitarbeiter Labor und Konstruktion, Hebold Systems GmbH
Cuxhaven, Niedersachsen, Germany

СЕВОСТЬЯНОВ Іван, д.т.н., професор, співробітник лабораторії та конструкторського відділу Hebold Systems GmbH
федеральна земля Нижня Саксонія, Німеччина

The article is devoted to the problem of ensuring effective cleaning of grain materials at minimal electricity consumption, which is relevant for wartime conditions and unstable energy supply. Based on elements of probability theory, a mathematical model of the sieve separation process for sieves with slots of variable size has been developed and the dependence of cleaning efficiency on the design parameters of the sieve and the speed regime has been theoretically substantiated. The relationship between the live cross-section coefficient of the sieve cloth and the specific energy consumption of the process has been analytically established: it is shown that an increase in the live cross-section coefficient from k_l = 0,50 to k_l = 0,95 reduces the specific electricity consumption from 0.35-0.55 to 0.18-0.28 kWh/t. The condition for automatic self-cleaning of sieves with slots of variable size was derived, which eliminates the need for a separate cleaning device and provides savings of 0.08-0.15 kWh/t. The theory of gravitational aspiration of the grain flow was developed: an expression for the ejection velocity of air in a vertical channel was obtained and it was shown that at a productivity of 10 t/h and a free fall height of 1.0 m, an air flow velocity of ≈ 0.94 m/s is achieved, sufficient for the separation of light impurities without external energy consumption. It is substantiated that the use of string screens with a live cross-section coefficient of 93-99% in combination with a gravitational aspiration zone allows reducing the total specific electricity consumption from 0.75-1.20 to 0.18-0.35 kWh/t (savings of about 74%). The concept of a minimum-energy grain cleaning machine based on four functional blocks is proposed: a string screen, a lightweight vibrating screen, a gravitational aspiration zone and a LiFePO4 battery power module with a capacity of 10-20 kWh, suitable for power supply from battery stations or photovoltaic panels in conditions of power outages.

Keywords: *grain cleaning machine, blackout, energy saving, sieve separation, aspiration, variable-sized slots, string sieve, gravity blowing, probability theory, mathematical model.*

Eq. 4. Fig. 9. Ref. 9.

1. Problem formulation

The separation of wet dispersed systems is a widely encountered and technologically important class of processes in the food processing, manufacturing, and related industrial sectors. These processes span a diverse range of applications, including the production of fruit and vegetable juices, jams, and purées; the extraction of sunflower and olive oils; the pressing of fat from meat cracklings in meat processing operations; the separation of whey from curd mass in cheese production; the fractionation of cocoa liquor into cocoa butter and press cake; and the dewatering of wet dispersed waste streams generated by food manufacturing facilities – such as distillery stillage, brewery spent grain, sugar beet pulp, and coffee or barley slurry [1, 2]. These processes are fundamental to ensuring product quality, maximizing raw material utilization, and reducing the volume of waste requiring further treatment or disposal.

Despite their widespread industrial importance, the aforementioned separation processes are characterized by substantial energy consumption and comparatively low processing throughput. These limitations have driven considerable research and engineering activity directed toward the improvement of the equipment employed in their implementation. The principal directions of such development efforts include enhancing energy efficiency and increasing productive capacity, as well as improving operational reliability, reducing material consumption, simplifying structural design, and lowering the overall capital and maintenance costs of the working machinery [1, 2].

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2. Analysis of recent research and publications

Figure 1 presents the schematic of a hydraulic press designed for juice extraction from vegetables and fruits, as well as for oil production [1]. The primary advantages of this equipment are its structural simplicity and high operational reliability. However, its main drawbacks include a considerably long working cycle duration and the inability to consistently achieve low final moisture content in the pressed product, since the middle layers of the material within the press mould remain insufficiently loaded during compression. To compensate for this shortcoming, the raw material is placed into burlap or polyester fabric packets approximately 50–80 mm thick prior to loading into the press mould, and intermediate steel plates are employed to improve uniform compression throughout the material volume. The inherent inefficiency of the loading scheme in this press design necessitates increasing the hydraulic system pressure to 80 MPa or more during the working process [1], which leads to a significant rise in energy consumption and places considerable demands on the hydraulic components.

Figure 2 presents the schematic of a roller press [1], which features a more complex construction and lower operational reliability compared to the previously described machines. Furthermore, achieving the lowest attainable values of final product moisture content (20–25%) on this equipment requires a substantial reduction in processing throughput, creating an inherent trade-off between product quality and productivity that limits its practical applicability in high-capacity industrial settings.

The belt press shown in Figure 3 offers a processing throughput ranging from 6 to 16 tonnes per hour of raw material, enables an increase in liquid yield of up to 80%, and reduces the working cycle duration to as little as 4 minutes [1]. However, a notable disadvantage of this machine lies in the substantial mechanical loads imposed upon its executive elements – belts made from polymeric perforated fabric or woven mesh – resulting in accelerated wear and frequent replacement requirements, which increase operating costs and reduce overall equipment availability.

Figure 4 illustrates a screw press intended for continuous high-throughput operation [1]. While this design offers advantages in terms of process continuity and productivity, it incorporates a structurally complex, difficult-to-manufacture, and rapidly wearing executive element – the screw conveyor (3). An additional limitation of this equipment is the relatively high final moisture content of the product following pressing, which reaches 74–76% in the dewatering of wet dispersed food production waste streams [2], rendering further drying or mechanical dewatering necessary in many applications.

Decanter centrifuges (Figure 5) represent a comparatively high-throughput solution for the separation of dispersed systems; however, they are characterized by considerable structural complexity and demanding operational requirements. The final moisture content of the product discharged from these units is no less than 74%, which necessitates subsequent mechanical dewatering or thermal drying stages, thereby increasing the overall energy consumption and capital expenditure associated with the processing line.

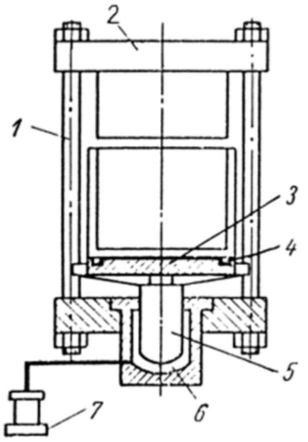

Fig. 1. Diagram of a hydraulic press:
1 – guide columns; 2 – fixed plate; 3 – traverse; 4 – channel for collecting squeezed liquid; 5 – plunger; 6 – working cylinder; 7 - pump

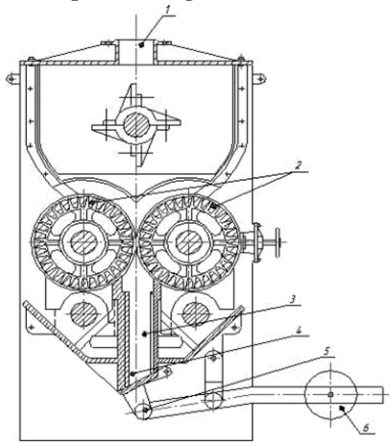

Fig.2. Scheme of a roller press:
1 – loading pipe; 2 – drums; 3 – chamber for the pressed product; 4 – passage slot; 5 – cover; 6 – weight

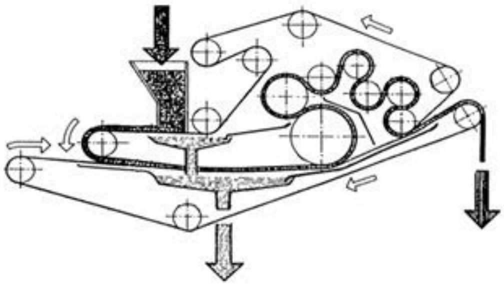

Fig. 3. Diagram of the PVK-12 belt press

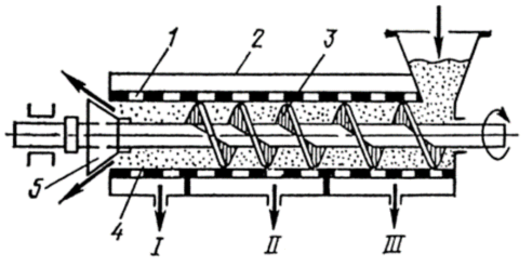

Fig. 4. Schematic of a screw press:
1 – perforated cylinder; 2 – housing; 3 – screw; 4 – pressure chamber; 5 – cone

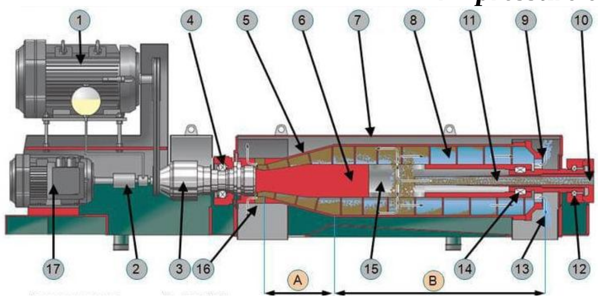

Fig. 5. Scheme of a decanter centrifuge:
1 – drum motor; 2 – coupling; 3 – gearbox; 4 – drum bearing; 5 – drum; 6 – screw; 7 – housing; 8 – separation zone; 9 – adjustment ring; 10 – product feed; 11 – feed pipe; 12 – drum bearing; 13 – clarified liquid outlet; 14 – screw bearing; 15 – distributor; 16 – solid phase discharge; 17 – screw motor

Figure 6 presents the schematic of an installation designed for multi-stage dewatering of wet dispersed food production waste [3]. This configuration represents a more advanced approach to the separation process, wherein the material undergoes successive dewatering stages rather than a single compression cycle. The multi-stage principle allows for a progressive reduction in moisture content at each consecutive stage, thereby enabling the achievement of significantly lower final moisture values in the processed product compared to single-stage pressing equipment. By distributing the mechanical load across multiple sequential operations, the installation reduces the peak pressure requirements at any individual stage, which contributes to lower energy consumption per unit of processed material and decreases the mechanical stress imposed upon the working elements. Furthermore, the staged approach provides greater flexibility in process control, allowing operators to adjust the parameters of each individual stage in accordance with the specific rheological properties and dewatering characteristics of the processed material. This is particularly advantageous when handling wet dispersed waste streams of variable composition and moisture content, such as those generated by food manufacturing facilities operating with seasonal raw materials.

The installation provides preliminary dewatering of the waste material within the press mould 19 of the hydraulic press, followed by liquid removal during the passage of the material through the conical constriction 20, in the screw press 28, and within the closed press mould 7 under the influence of a static compressive force generated by the hydraulic cylinders 1 and the combined masses of the counterweights 2, the traverse beam 3, and the punch 5. Additional dewatering is achieved through vibratory impact loading applied by means of vertical reciprocating displacements of the plungers 23 of the hydraulic impulse drive of the installation, operating at frequencies of up to 150 Hz and amplitudes of up to 2 mm [4]. This combination of static compression and high-frequency vibratory impact loading creates favourable conditions for the intensive expulsion of liquid from the dispersed material, as the dynamic component effectively disrupts the capillary and adhesive forces retaining moisture within the solid matrix, thereby enhancing the overall dewatering efficiency beyond what is achievable by static pressing alone.

According to the results of theoretical calculations and experimental investigations [2], the final moisture content of distillery stillage, brewery spent grain, and coffee slurry following vibratory impact dewatering on the experimental prototype of the installation does not exceed 20–25%, with a processing throughput of dewatered waste material of 20–25 tonnes per hour and a specific energy consumption of 2.7 kWh per tonne. These performance indicators represent a considerable improvement over those achievable

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with conventional single-stage pressing or centrifugal separation equipment, particularly with respect to the final moisture content and specific energy consumption. However, significant drawbacks of this installation are its high structural complexity and substantial material consumption, which result in elevated manufacturing costs, increased equipment mass and overall dimensions, and greater demands on installation, maintenance, and repair operations.

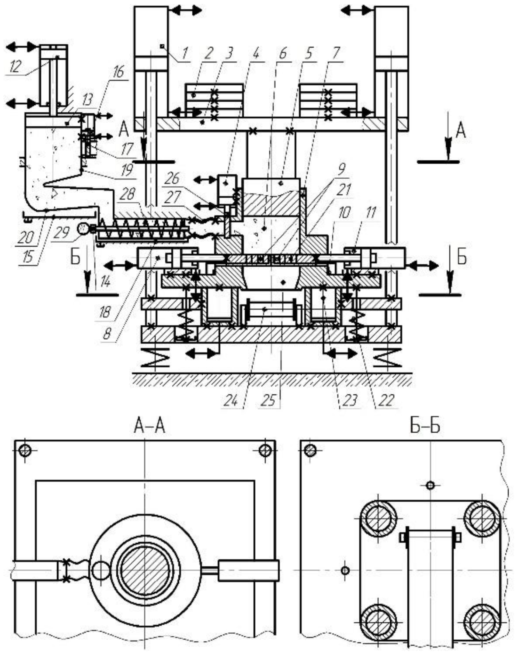

Fig. 6. Scheme of the installation for multi-stage dehydration of food industry waste:
1, 4, 8, 11, 12, 16, 23 – hydraulic cylinders; 2 – inertial loads; 3 – movable traverse; 5 – punch; 6 – portion of waste; 7 – press mold; 9, 17, 26 – dampers; 10, 15, 18 – tanks; 13, 19 – hydraulic press; 14 – coupling; 20 – diffuser; 21 – channels; 22 – springs; 24 belt conveyor; 25 – hole; 27 – rubber-fabric sleeve; 28 – screw press; 29 – electric motor

The same observations apply to the installation for two-component spatially complex vibratory impact dewatering of wet dispersed materials investigated in reference [5]. This equipment, while demonstrating promising dewatering performance characteristics, similarly suffers from considerable design complexity, which limits its practical applicability in industrial settings where simplicity of construction, ease of maintenance, and cost-effectiveness are important operational requirements.

3. The purpose of the article

The objective of the present study is to develop and investigate improved equipment for the separation of heterogeneous dispersed systems incorporating a hydraulic drive mechanism, which must ensure a final moisture content of the processed material within the range of 20–25%, adequate processing throughput, and a simple and reliable constructional design.

The formulation of this research objective is driven by the identified limitations of existing separation equipment, as outlined in the preceding analysis. The target final moisture content of 20–25% represents a demanding performance criterion that only a limited number of currently available machine designs are capable of achieving, and those that do typically involve considerable structural complexity, high material consumption, or significant energy expenditure. The requirement for adequate processing throughput reflects the practical demands of industrial-scale food production facilities, where continuous or high-capacity batch operation is essential for economic viability. Finally, the emphasis on structural simplicity and operational reliability addresses the well-documented shortcomings of existing high-performance separation equipment, which frequently suffers from accelerated wear of working elements, demanding maintenance requirements, and elevated capital and operational costs. The simultaneous satisfaction of all three criteria – low final moisture content, sufficient productivity, and constructional simplicity – therefore constitutes a challenging yet practically important engineering problem, the solution to which forms the central focus of the present investigation.

4. Results and discussion

Fig. 7 shows a diagram of our proposed installation with a hydraulic drive.

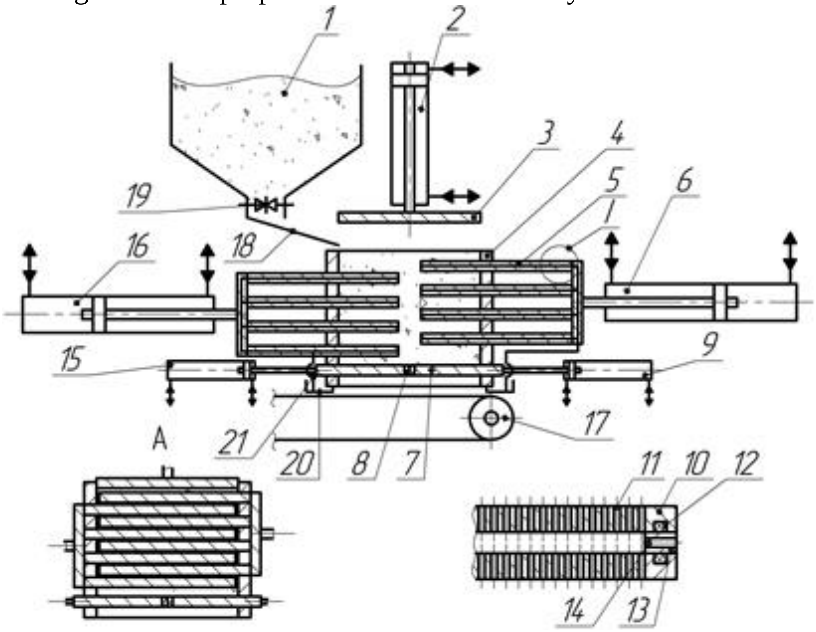

Fig. 7. Improved hydraulically driven unit for separating heterogeneous disperse systems: 1 – tank; 2, 6, 9, 15, 16 – hydraulic cylinders; 3 – punch, 4 – mold; 5 – plates; 7, 19 – dampers; 8, 12 – seals; 10 – plates; 11, 14 – holes; 13 – frame; 17 – belt conveyor; 18 – tray; 20 – pallet; 21 – flexible hose

The processed material is fed periodically in batches from the hopper 1 into the press mould 4. The feeding is carried out via the chute 18 upon opening of the electromagnetically actuated gate valve 19. Once the press mould has been filled, the hydraulic drive of cylinder 2 is activated, by means of which the punch 3 descends and hermetically seals the press mould from above (the punch sealing elements are not shown in the schematic). The hydraulic drives of cylinders 6 and 16 are then engaged, and their pistons advance toward one another. As a result, the pressing plates 5, connected to the pistons of cylinders 6 and 16, move toward the interior of the press mould and interleave with one another (see View A in Figure 8). This action causes the batch of material within the press mould to be compressed, thereby expelling the liquid phase from the solid matrix. The expelled liquid flows out through the small perforations 11 in the pressing plates 5 (see also Detail I in Figure 8). Each pressing plate consists of two flat panels 10 separated by a frame 13 fitted with sealing rings 12. The perforations 11 in the plates are covered on the outer surface by a metallic filter mesh (not shown in the schematic). The expelled liquid phase thus passes through the mesh and perforations 11 into the interior cavity of the plates 5, from where it is discharged through outlets 14 and flexible hoses 21 into the collection tray 20. Analogous small perforations, covered on the inner surface with a metallic filter mesh, are also provided in the walls of the press mould 4 (not shown in the schematic), through which the liquid separated from the material batch drains into the collection tray 20.

Upon completion of the separation process, the pistons of cylinders 6 and 16 and the associated pressing plates 5 are retracted in opposite directions until the plates 5 have fully withdrawn from the press mould 4. The hydraulic drives of cylinders 2, 9, and 15 are then activated. By means of cylinders 9 and 15, the gate valves 7 are displaced in opposite directions, thereby opening the lower cross-section of the press mould 4 (the end faces of the gate valves 7 are equipped with seals 8). The working stroke of cylinder 2 is initiated, which drives the punch 3 downward to eject the batch of separated material from the press mould onto the belt conveyor 17. The punch 3 is subsequently raised to its upper position, the gate valves 7 are closed, and the pressing plates 5 are returned to their initial position as shown in the schematic. The gate valve 19 is opened and the next batch of material to be processed is fed into the press mould 4, whereupon the described cycle is repeated.

The principal advantage of this design is its structurally simple, rational, and reliable construction, incorporating a hydraulically actuated drive of proven practical performance, which offers compact overall dimensions and delivers high specific power output. The design of the installation ensures uniform loading of the material batch throughout the volume of the press mould and provides effective drainage and removal of the expelled liquid phase from the processed material.Figure 8 presents a further improved hydraulic drive installation configuration for the separation of heterogeneous dispersed systems.

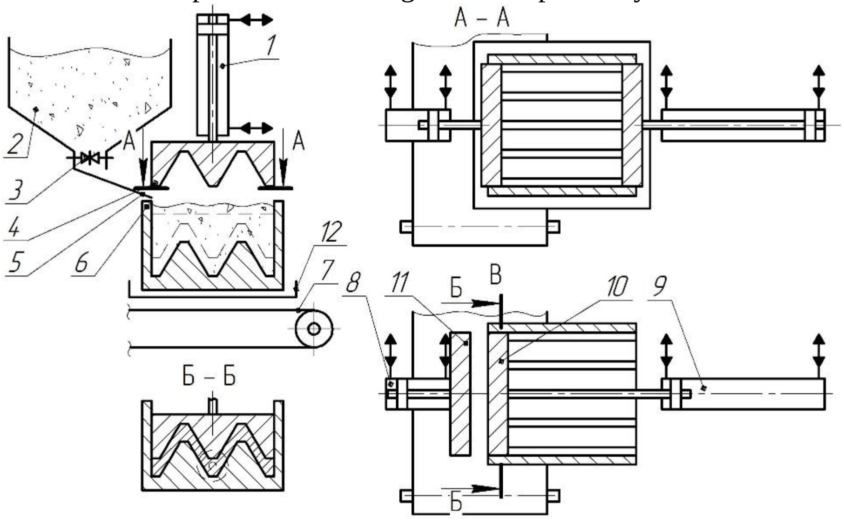

Fig. 8. Scheme of an improved hydraulically driven unit for separating heterogeneous disperse systems: 1, 8, 9 – cylinders; 2 – hopper; 3 – damper; 4 – punch; 5 – tray; 6 – press mold; 7 – belt conveyor; 10, 11 – plates; 12 – pallet

The processed material is fed periodically in batches from the hopper 2, through the open electromagnetically actuated gate valve 3 and along the chute 5, into the press mould 6. Once the press mould has been filled, the material feed from hopper 2 is interrupted and the hydraulic drive of cylinder 1 is activated, which drives the punch 4 downward and compresses the batch of processed material within the press mould 6. The liquid expelled from the material batch exits through small through-perforations in the punch 4 and the press mould 6, which are covered on the inner surface with a metallic filter mesh (not shown in the schematic), and drains into the collection tray 12. Upon completion of the working process, the punch is raised by cylinder 1 to the position shown in cross-section B–B of Figure 8. The hydraulic drive of cylinder 8 is then activated, which withdraws the lateral wall-plate 11 from the press mould 6 and opens the latter (see also View C in Figure 8). By means of cylinder 9 and wall-plate 10, the batch of separated material is ejected from the press mould onto the belt conveyor 7 (see also View C in Figure 8). Following this, the punch 4 is raised to its upper initial position and the plates 11 and 10 are returned to the positions shown in cross-section A–A of Figure 8. The gate valve 3 is opened and the next batch of material to be processed is fed from hopper 2 into the press mould 6, whereupon the described separation cycle is repeated.

The principal advantages of this design are its compact overall dimensions, high operational reliability, and a reduced number of hydraulic drive units compared to the previously described configuration, as well as the provision of intensive and uniform loading of the processed material throughout the entire volume of the press mould. The projections on the working surfaces of the press mould and the punch promote intensive movement of the dispersed material particles in multiple planes during loading, ensuring their uniform redistribution throughout the mould volume and facilitating the effective expulsion of liquid from the interstitial spaces between particles. This surface geometry feature represents a significant constructional refinement, as it addresses one of the fundamental limitations of conventional flat-surface pressing equipment – namely, the tendency for non-uniform stress distribution within the material batch, which results in inadequate dewatering of the central regions of the pressed volume and consequently elevated final moisture content in the discharged product.

A further improved installation for the separation of heterogeneous dispersed systems is presented in Figure 9.

The material to be processed is fed in batches from hopper 1 through the open electromagnetically actuated gate valve 7, along chute 8, into the press mould 10. Once filled, the press mould is sealed from above by punch 3, the drive of which is provided by hydraulic cylinder 2. The hydraulic drives of cylinders 5 and 15 are then activated, and their pistons execute a counter-directional motion. In doing so, the pressing plates 10 and 16, connected to the piston rods of the hydraulic cylinders, compress the batch of material within the press mould and carry out the separation process (see also View B in Figure 9). The liquid expelled during this operation drains through small perforations in the plates 10 and 16, which are covered on the inner surface with a metallic filter mesh (not shown in the schematic). Each of the plates 10 and 16 consists of two flat panels

21 and 23 (see Detail I in Figure 9), separated by a frame 20 fitted with sealing elements 21. The liquid flowing through perforations 17 is thus collected in the internal cavity 18, from where it exits through outlet 19 via flexible hose 25 and drains into the collection tray 24.

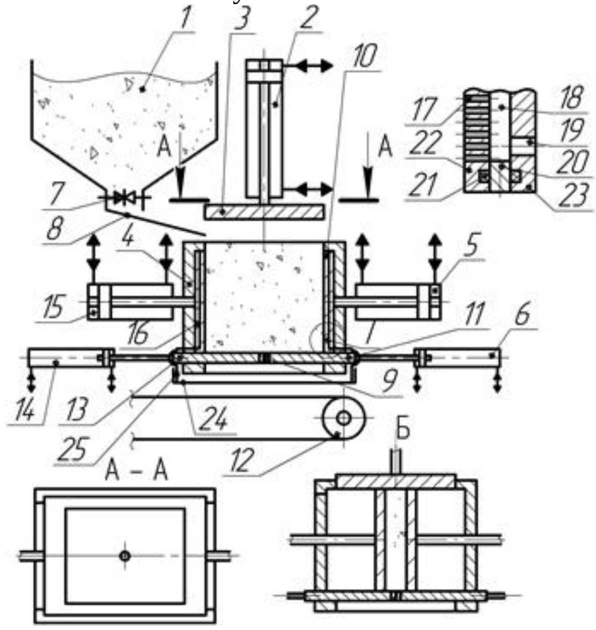

Fig. 9. Scheme of an improved hydraulically driven unit for separating heterogeneous disperse systems: 1 – tank; 2, 5, 6, 14, 15 cylinders; 3 – punch, 4 – mold; 7, 11, 13 – flaps; 8 – tray; 9, 21 seals; 10, 16 – plates; 12 – belt conveyor; 17, 19 – holes; 18 – cavity; 20 – frame; 22, 23 – plates; 24 – pallet; 25 – flexible hoses

Upon completion of the separation process, the plates 10 and 16 are returned to their initial positions by means of cylinders 5 and 15. Gate valves 11 and 13, actuated by auxiliary hydraulic cylinders 6 and 14, are then opened, whereupon the dewatered batch of processed material is ejected by punch 3 onto the belt conveyor 12.

Where additional dewatering of the material batch is required, a supplementary compression stage is performed with gate valves 11 and 13 in the closed position and plates 10 and 16 returned to their initial positions, during which the batch is compressed within the press mould in the horizontal plane by punch 3. Following this supplementary compression stage, the batch is discharged from the press mould in the manner described above. To initiate the next separation cycle, punch 3, plates 10 and 16, and gate valves 11 and 13 are returned to their initial positions, gate valve 7 is opened, and the press mould is again filled with the material to be processed.

The principal advantages of this configuration are its structural simplicity, the possibility of implementing the design on the basis of commercially available standard hydraulic machines and components, as well as the provision of conditions for maximally complete mechanical separation of the dispersed system throughout the entire volume of the press mould and across multiple loading planes. In the authors' assessment, this design offers the broadest technological versatility for the implementation of various loading modes and compression schemes during the processing of a wide range of heterogeneous dispersed systems, making it particularly well-suited for industrial applications involving materials of variable composition and rheological properties.

The following section presents the analytical relationships for determining the principal operating parameters of the installation shown in Figure 9. It is assumed that the material being processed is coffee slurry with an initial moisture content of 90–95%, which, owing to its low concentration of dispersed solid particles, may be classified as a Newtonian fluid [6, 7]. The pressure differential generated by plates 10 and 16 during compression of the material batch within the press mould is determined by the following expression [7]:

$$\Delta p = \frac{\Delta V \cdot E_p}{V_n}, \tag{1}$$

ΔV – changing the volume of the mold 4; V_n – initial mold volume (before the start of portion compression); Δp – increase in pressure due to change in volume; E_p – bulk modulus of water – liquid phase of coffee sludge [7].

Change ΔV in time we find as

$$\frac{d\Delta V}{dt} = 2 \cdot S_n v_ц = 2 \cdot l_n h_n v_ц = 2 \cdot l_n h_n \frac{l_ц}{t}; 0 \le t \le t_p, \tag{2}$$

where S_n – slab area 10; l_n, h_n – its length and width; $v_ц$ – average speed of the cylinder stroke 5; t_p, l_n – duration and length of the cylinder stroke.

The flow rate of liquid removed from the processed material flowing out of the mold is found as

$$Q_p = 2 \cdot \mu_o \frac{\pi \cdot d_o^2}{4} n_o l_n h_n \sqrt{\frac{2 \cdot \Delta p}{\rho_в}}, \tag{3}$$

where μ_o – the flow rate of hole 17 in plate 22 (see external element I in Fig. 9) [7]; d_o – hole diameter; n_o – number of holes per unit area of the plate 22; $\rho_в$ – density of water.

Power N_p, necessary for the working stroke of the plates 10, 16, from which the power of the pump of the hydraulic drive of the cylinders 5, 15 is calculated, can be calculated as

$$N_p = 2 \cdot S_{nop} v_ц \Delta p, \tag{4}$$

where S_{nop} – cylinder piston area 5.

5. Conclusion

1. Based on the results of the conducted analysis of the design configurations of known equipment for the separation of heterogeneous dispersed systems – including hydraulic, screw, belt, and roller presses, decanter centrifuges, and installations for vibratory impact dewatering of wet dispersed materials – it has been established that each of the aforementioned machine types possesses inherent shortcomings and requires further improvement. In particular, hydraulic presses fail to ensure uniform compression of the processed material batch throughout the entire volume of the press mould, which leads to insufficiently complete separation of its components. Furthermore, the working process of this category of equipment is characterized by high energy consumption, low processing throughput, and inadequate levels of mechanization and automation, all of which limit its practical applicability in modern high-capacity industrial production facilities.

2. Taking into account the identified limitations of existing equipment and the current requirements of industrial production, the authors propose improved configurations of hydraulic drive installations for the separation of heterogeneous liquid systems. The proposed designs are characterized by a simple and reliable construction, consist of unified and commercially available hydraulic machines and components, ensure uniform compression of the processed material throughout the entire volume of the press mould, and provide high processing throughput. These characteristics collectively address the principal deficiencies identified in the reviewed equipment and represent a meaningful advancement in the engineering of separation machinery for wet dispersed systems.

3. The paper also presents the analytical relationships for determining the principal operating parameters of one of the proposed installations, namely: the pressure differential generated within the press mould during the separation process, the flow rate of the liquid expelled in the course of the operation, and the power required for the execution of the working process. These relationships may be employed in further theoretical and experimental investigations of the proposed equipment, as well as in the development of a systematic methodology for its engineering design and parameter calculation, thereby providing a foundation for the practical implementation and industrial scaling of the proposed technical solutions.

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ГІДРАВЛІЧНО КЕРОВАНІ РОЗДІЛЬНІ УСТАНОВИ ДЛЯ СИСТЕМ ВОЛОГОГО ДИСПЕРГУВАННЯ

Розділення вологих дисперсних систем є одним із найбільш поширених і технологічно важливих класів процесів у харчовій, переробній та суміжних галузях промисловості. Дані процеси охоплюють широкий спектр застосувань, включаючи виробництво фруктових та овочевих соків, джемів і пюре, отримання соняшникової та оливкової олії, віджимання жиру з м'ясної шкварки на підприємствах м'ясопереробної промисловості, відокремлення сироватки від сирної маси у виробництві сиру, розділення тертого какао на масло і жом, а також зневоднення вологих дисперсних відходів харчових виробництв – зокрема спиртової барди, пивної дробини, бурякового жому, кавового та ячмінного шламу. Ці процеси відіграють визначальну роль у забезпеченні загальної ефективності виробництва, якості готової продукції та економічної доцільності відповідних промислових операцій.

Разом з тим, зазначені процеси характеризуються значною енергоємністю та відносно низькою продуктивністю, що зумовлює проведення масштабних науково-дослідних та інженерно-конструкторських робіт, спрямованих на підвищення ефективності обладнання, що використовується для їх реалізації. Основними напрямками таких удосконалень є підвищення енергетичної ефективності та продуктивності робочого процесу, а також збільшення експлуатаційної надійності, зниження матеріалоємності, спрощення конструкції та зменшення загальної вартості робочих машин.

Критичний аналіз наявного обладнання для розділення дисперсних систем виявляє суттєві обмеження в усіх основних технологічних категоріях. Традиційні гідравлічні статичні преси не забезпечують достатньо низької кінцевої вологості переробленого продукту та не здатні задовольнити вимоги щодо необхідної продуктивності сучасних промислових підприємств. Вібраційне пресове обладнання, попри певні переваги, нерідко відрізняється значною конструктивною складністю, низькою експлуатаційною надійністю, а також створює інтенсивні шум і вібрації під час роботи, що негативно впливає як на умови праці, так і на довговічність обладнання. Шнекові преси з електромеханічним приводом, незважаючи на загальновідомі переваги у забезпеченні безперервності робочого процесу, не дозволяють досягти необхідного ступеня розділення компонентів дисперсної системи. Крім того, їх робочі елементи є конструктивно складними та піддаються прискореному зношуванню, що призводить до збільшення витрат на технічне обслуговування та скорочення терміну служби.

У відповідь на зазначені технологічні недоліки авторами запропоновані удосконалені конструктивні схеми гідравлічних пресів для розділення вологих дисперсних систем. Запропоновані конструкції призначені для забезпечення високих показників ефективності робочого процесу при збереженні простої, міцної та надійної конструкції. Крім того, у статті наведені аналітичні залежності та методики розрахунку основних робочих параметрів запропонованого обладнання, що створює теоретичну основу для його інженерного проектування та практичного впровадження.

Ключові слова: *гідравлічний привід, дисперсна система, процес розділення, продуктивність, енергоспоживання.*

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INFORMATION ABOUT THE AUTHORS

Ivan SEVOSTIANOV – Doctor of Technical Sciences, Professor, Design Engineer of the Laboratory and Design Department, Hebold Systems GmbH (Cuxhaven, Lower Saxony, Germany; e-mail: ivansev70@gmail.com, https://orcid.org/0000-0001-8965-9810).

СЕВОСТЬЯНОВ Іван – доктор технічних наук, співробітник лабораторії та конструкторського відділу (конструктор), Hebold Systems GmbH (м. Куксгафен, федеральна земля Нижня Саксонія, Німеччина). e-mail: ivansev70@gmail.com, https://orcid.org/0000-0001-8965-9810).