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# CONSTRUCTION TYPES OF TECHNICAL EQUIPMENT FOR DOSING, WEIGHING, PACKAGING AND PROCEDURES USED IN MILLING UNITS

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## ABSTRACT

*The paper presents several types of technical equipment for dosing, weighing, packaging and the procedures used in the milling units. The weighing systems take into account several important criteria for their design, namely: how the weight or mass of the load is offset and how the result is transferred.*

## INTRODUCTION

The majority of weighing systems in the milling industry work either electronically or electromechanically (fig.1).

The automatic grain scales for grain harvesting ensures the grain reception, automatic recording of the weighed quantities and the further passage according to the morphological scheme of the mill [1,3,6,19]

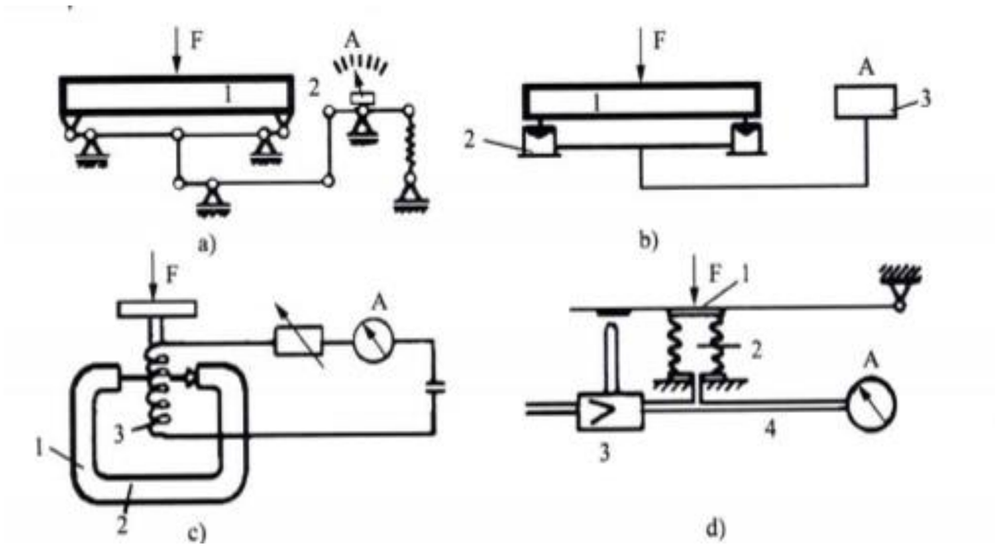


***Fig.1. Principles of weighing materials by offsetting the load force F (A - represents the value of the weight)* [19]**

a - mechanical (1 mechanical weighing device, 2 - mechanical transfer and display), b - electromechanical (1 - mechanical platform, 2 - electronic weighing cell, 3 - electronic signal processor and display), c - electronic - electronic weighing cell, 2 - magnetic field generator, 3 - bobbin), d - pneumatic or hydraulic (1 - load platform, pneumatic or hydraulic, 2 - weighing, pneumatic or hydraulic weighing, 4 - manometric display)

The automatic weighing machine cup (1) has a special shape with its center of gravity on the left or right of the support point (2) when the cup is empty or full of cereals. The cup (1) is suspended in the prism (5) of the lever (6) which, by means of a prism suspension system, binds to the weighing platform

(7), forming a lever with two equal arms, the left-hand cup and the weighing platform on the right.

When the cup is filled with grain, it is dropped and the weighing platform climbs and when the cup and weights are in balance, the flap (8) automatically closes the slit of the fuel pallet (4) and cuts the access of the product into the cup, [2, 6, 7, 10].

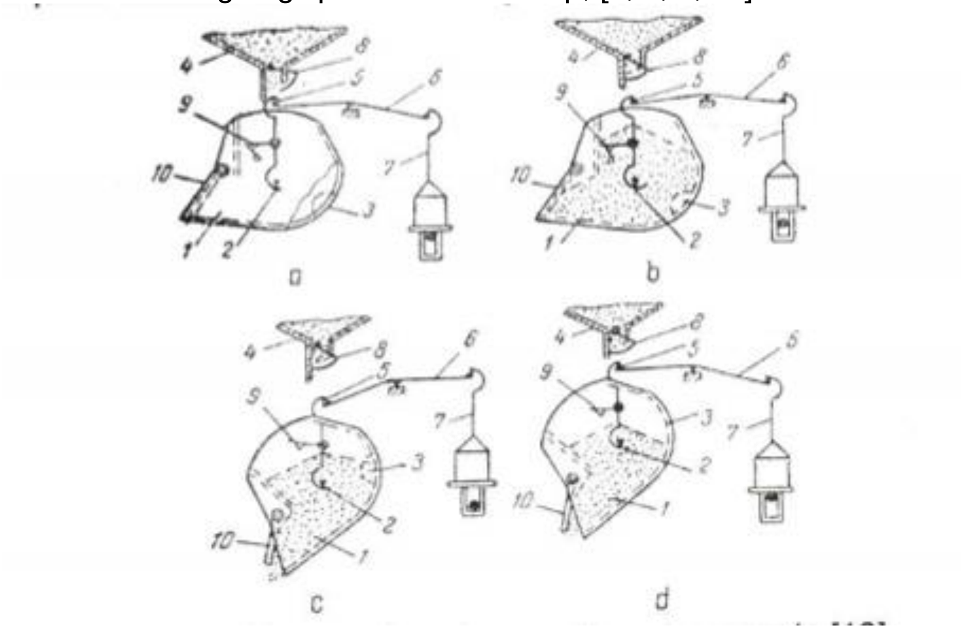

***Fig.2. Automatic grain weighing machine [7]***

1 - cup, 2 - support point, 3 - counterweight, 4 - slot, 5 - prism, 6 - lever, 7 - platform with weights, 8 - clapper, mechanism, 9 - vacuum cleaner, 10 - cover.

Due to the inertia, the bowl filled with cereals escapes under the control of the stop mechanism (9), it rotates around the point (2), counter-clockwise under the action of the grain weights, the lid opens and the product falls gravitationally. When the cereals are evacuated, the weighing platform (7) begins to descend and cause the bucket to lift and when the cup is completely empty, the center of gravity moves to the right of the point (2), returns to the initial position, turning clockwise, open the flap (8), the grains enter the cup and the cycle resumes, [11,15, 7]. On the weighing platform, weighs are equal to the capacity of the bucket, which can range from 5 kg to 1000-1500 kg. each overturning of the cup is automatically recorded as a number of overturns or weights.

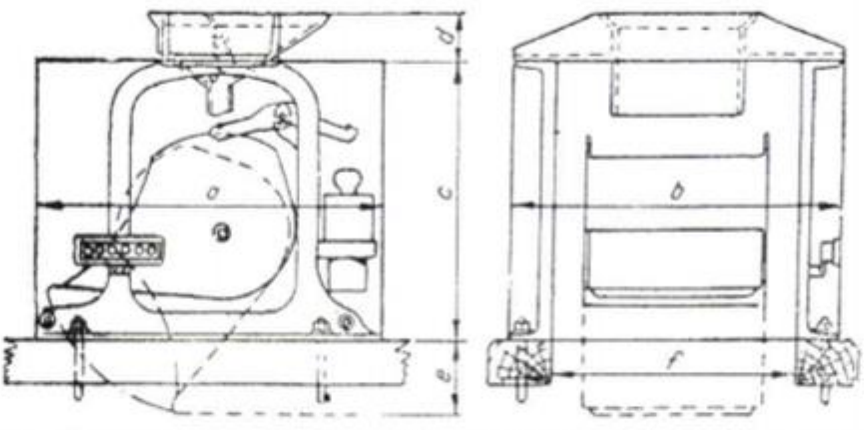

***Fig. 3. Schematic diagram of Chronos automatic scale [7]***

## MATERIAL AND METHOD

*The feed grain scale for CFC-3* is used in cereal mills for the management of the product being processed.

The scale is introduced into the technological flow, weighing the facade in bats. The technical equipment manages the total amount of grain introduced into the mill and highlights the instant flow of grains being processed. It can be mounted in the wheat mills on the grain flow or on the grinding stream. The technical equipment also has a serial output for entering the data into a central computer.

*The CFC cerea*l (fig. 4) flow scale consists of: the weighing pan, the flap material flap, the drain flap, the electropneumatic drive, the strain gauge weighing system, the electric and electronic equipment box (including the programmer) located on. This equipment works by weighing the material inserted into the cuvette, which is then added to the previously weighed weighing.

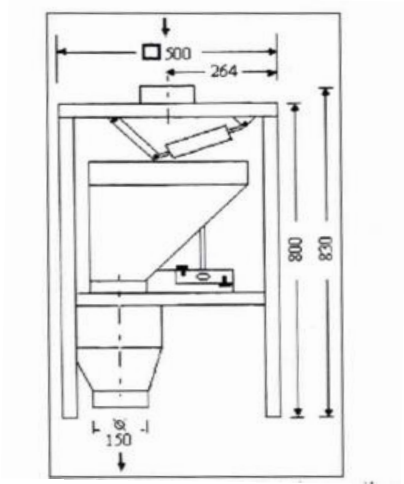


***Fig.4. Flow chart of the CFC 3-5-7 t / h cereal flow management system* [16,17]**

The death rate is permanently displayed. The counting is in kg, up to 999 999 999 999 kg, with a zero resumption. The weighing accuracy is better than 0.05%. The machine also allows the flow rate to be adjusted.

*Dosing and weighing systems*. Discontinuous gravimetric dispensers perform portions of materials and products in quantities of well-defined weights, called doses or portions. Following the dosing mode, there can be two types: with addition material in the bunker (fig. 5) and with material extraction from the bunker (fig. 6).

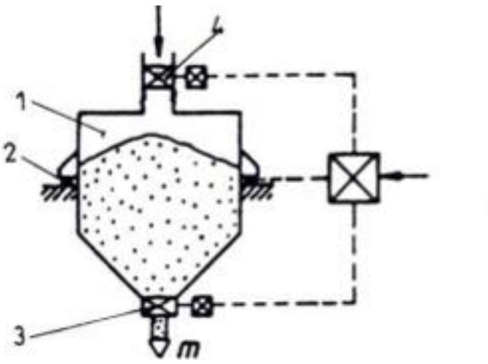


***Fig.5. Gravimetric discontinuous bulk dosing systems for bulk materials by addition of material* [19]**

1 - material hopper, 2 - weighing cell, 3 - material emptying device, 4 - device for opening and closing material supply for dosing

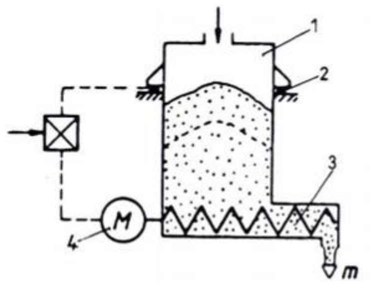


***Fig. 6. Gravimetric discontinuous bulk dosing systems for bulk materials by addition of material*** **[19]**

1 - material hopper, 2 - weighing cell, 3 - material transfer conveyor, 4 - conveyor auger drive motor.

The construction form of weighing devices of weight-grading systems can be: on a direct support or on a hybrid support with a lever system. Direct-weighing systems have a feed system mounted directly on a weighing platform without weighing, [11,12, 15].

Bulk weighing devices incorporate a lever system that transmits the weight of the respective mass to the weighing cell. The constructive-functional diagram of a discontinuous gravimetric dispenser (fig. 7 a) with the addition of material equipped with the electronic weighing cell (with tensiometric sensors), which is usually part of automatic or semiautomatic bulk material dosing (granular, pulverulent) is presented in fig. 7, b.

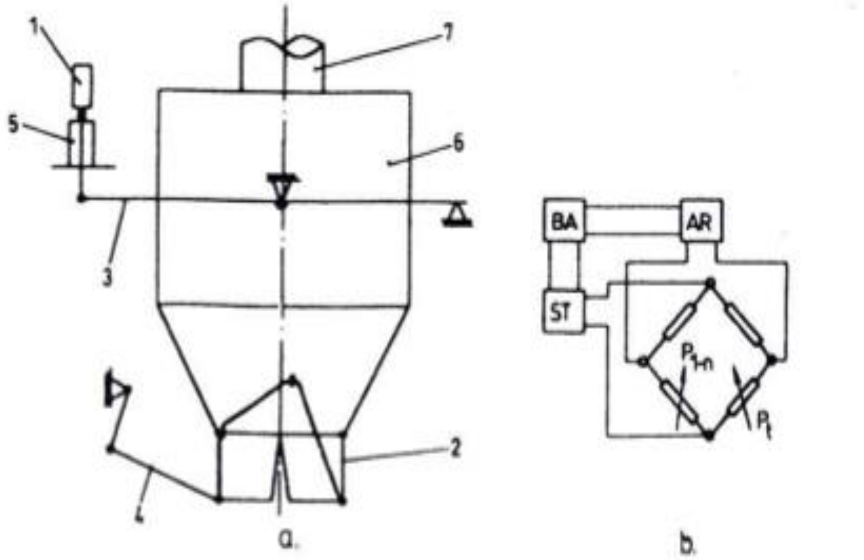


***Fig. 7. Schematic diagram of discontinuous bulk material dispenser*** **[19]**

a - constructive diagram of the weighing cell, b - electronic weighing cell diagram

1 - electronic weighing cell, 2 - support, 3 - weighing mechanism of the bunker weighing with material, 4 - dispenser control mechanism for emptying the dosed material, 5 - closing and opening cups for emptying the material dose, 6 - material hopper, 7 - feed line with material

BA - balancing supply cell with tensometric sensors, AR - amplifiers with relay, ST - voltage stabilizer, Pt - tensometric sensor for measurement of grain size.

With the help of the remote programmer, the dose (s) of material at which the deck is unbalanced is determined. The active tensometric transducer Pt, mounted on the measuring bridge, tracks the force of gravity acting on the scale of the bunker 6. As the material feeds the hopper, the bridge tends to balance. When the deck is balanced, the amplifier relay disconnects the P1 transducer and connects the P2 transducer (so different amounts of material can be measured). The indicator, receives the signal from the Pt transducer at a distance and via a current servomotor.

## RESULTS AND DISCUSSIONS

The schematic diagram of a gravimetric dosing scale according to the diagram in figure 6 is shown in fig. 8, [15,17, 19].

Feeders mounted directly on a weighing platform without compensation are referred to as direct support systems, whereas the weighing hybrid weighing systems incorporate a lever device that transfers the force of that mass to the cell for weighing (fig. 9).

Advantages of hybrids are the number of weighing cells that can be reduced to one instead of three for each system, a weighing cell can be used for a large nominal load by adjusting the compensation levers, and the weighing weight of the plate and assembly the feed can be partially or completely compensated so that a small cell weighing range can be used to increase weighing accuracy.

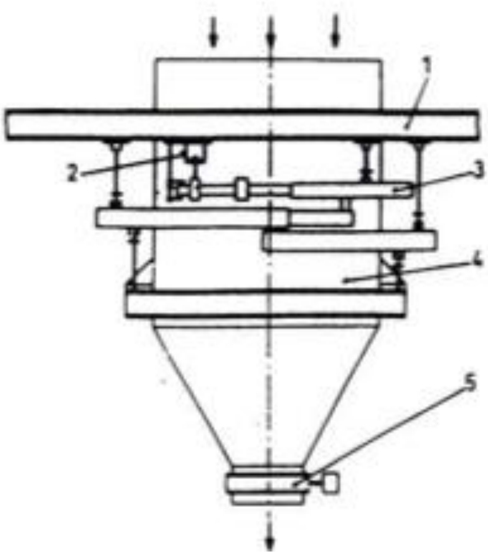


***Fig. 8. Schematic diagram of the discontinuous dispenser with a weighing cell without compensation [19]***

1 - weighing plate, 2 - measuring cell, 3 - mechanism with load handler levers, 4 material bunker, 5 - device with clamp for evacuating the dosed material.

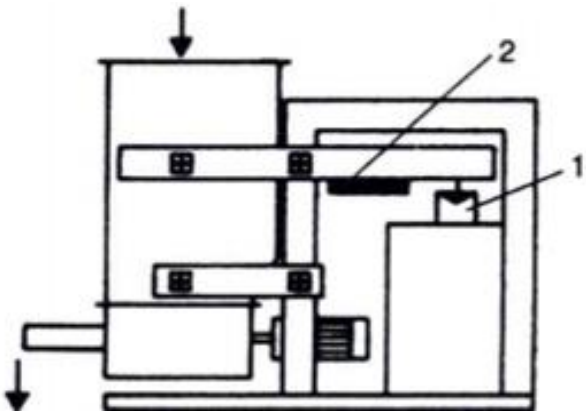


***Fig. 9. Hybrid construction with continuous weight lifter dispenser with single weighing cell* [19]**

1 - weighing cell, 2 - weight

**The dynamometric cells** to be measured are extensometric, magnetoelastic and inductive cells. They can be compression, traction or bending. The extensometric band uses an elastic steel body on which the tensiometric transducer known as the brand or captor is applied. The elongation of each longitudinal element of the elastic body is transmitted directly to a threadlike end, in which the piezoresistive effect is pronounced. The relative elongation of the elastic body is proportional to the force of the press, according to Hooke law. In order to obtain high precision, the cells to be measured are executed for narrower measuring ranges for each of these domains coexisting with an elastic body of some material, with dimensions and shapes studied.

In general, the accuracy of the best performance measurements - Schnek, Siemens, Philips - is within ± 0.1 0/00. Practically, the extensometric cell has an unlimited duration of operation, without degrading a 200% load overload load. The numerical display of the results of the weighing shows the following advantages over the analogical display: security for external disturbances, rapid visualization and perception of information, convenient interpretation of information and elimination of subjective reading errors.

Obviously, material management is achieved by taking over the results of automatic weighing. For this purpose, processing devices are provided consisting of: specialized calculating elements, printing devices, integrated accounting machines. The documentation obtained through the registration can be unitary - affected by a single weighing - and collectively - affected by successive weighings, with the registration of the extracted quantities, the number of the bunker from which the extraction was made, the recipe code, the date of weighing. Fig. 10 shows a 3-piece compression tensometric weighing module with programmable logic.

***Fig. 10. BSP-125K Extraction-Weighing Module*, [12]**

## CONCLUSIONS

The development of weight loss dispensers as reverse weighing and dosing devices has made significant progress in gravimetric dispenser technology. Through this method, is possible to apply very cohesive or sticky material with different leakage characteristics, with good long-term water quality even for small quantities ranging from 30 kg / h to several grams per hour. It is therefore possible to carry out continuous processes by adding small amounts of additives, stabilizers and catalysts.

## ACKNOWLEDGEMENT:

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