STATISTICAL BASIS ESTIMATES OF THE AVERAGE LIVE WEIGHT IN STAGES ANIMALS OR BIRDS ACCIDENTAL SAMPLE WEIGHING AN ARBITRARY SINGULAR

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For the best cost of production management requires an automated estimate of the average herd animal body weight or poultry with a given reliability and with a given accuracy with a random sampling of any individual weighing herd. This is important for subsequent precise control technology and process meat and poultry products.

The purpose of research - the creation of new technological solutions for the evaluation of the average body weight of broilers herd.

Materials and methods of research. As a result of the proposed scientific and technological solutions is set to a predetermined value of the signal reliably estimate the average live weight of the animal or bird to all the flock of livestock in the workplace or in the space of its habitat. The essence of the proposed statistical signal processing selectively weighting herds of livestock animals is explained as follows. With decreasing marginal sampling error Δ significantly increases the required sample size n, which is proportional to the square of the variance $\sigma 2$ and t-test t. If the confidence level is set, then immediately on the value of the function of the Laplace becomes known value of the specified argument of Laplace. Target values allowable sample error immediately gives setpoint limit error (absolute, i.e. in units of a random variable, in this case in kg). The value of the standard deviation of a random variable determined by the dimension in kg. Therefore, to determine the required sample size n can be only after the determination of the standard deviation σ. Using the value of the coefficient of variation evaluation of V *, equal to the ratio estimates the

standard deviation σ * to the assessment $m_{ср}$* the expectation M_x, we obtain the final formula for determining the required sample size estimation:

$$n^* = (\sigma^{*2}t^2)/(\Delta_{\%}^{*2}m_{ср}^{*2}) = (V^{*2}t^2)/\Delta_{\%}^{*2}, \quad (1)$$

From the expression for the limit errors $\Delta_{кг}$ (absolute, i.e. in units of a random variable, in this case in kg) required sample size estimation:

$$n^* = (\sigma^{*2}t^2)/(\Delta_{кг}^{*2}), \quad (2)$$

where Δ% * - estimate of the relative error of measurement of the average body weight of the individual herd,%; σ * - estimate the standard deviation of live weight of the individual herd on the evaluation of the expectation of a live weight of the individual herd $m_{ср}$ * kg; n - number of individuals weighing any livestock or poultry, rel. U .; V * - evaluation of the coefficient of variation,%.

Equation (1) is used to convert the respective signals in the proposed method and apparatus for obtaining a reliable signal estimation error of measurement the average body weight of the individual herd. Livestock or poultry technologist sets the confidence level and the allowable relative or absolute measurement error of the average body weight of the individual herd livestock of this type and age. In other words, given by the required accuracy of the determination of this value, the value of which depends directly on the accuracy of the control technology of cultivation and accompanying this technology many technological processes.

This error corresponds to the desired sample size, that is the lowest possible number of weighings individuals to obtain results with a given confidence. As soon as the number of random time weighing random single individuals become equal and exceed the calculated value of the required sample size, there is reliable information on the average body weight of the individual herd animals or birds. Therefore only during continuous cultivation technology herds of animals or birds precision automated estimate of the average herd of live weight of an animal or bird in a discrete time random sampling of individual fish weighing allows the management of the herd livestock cultivation find

profitable trade-offs between cost of feed and livestock weight gains. As well as between energy consumption for heating, other processes and settlement losses resulting productivity of livestock in their price terms. In this case, the necessary statistical processing of measured and calculated signals of live weight special stage.

The results of research. Individual herds of livestock during normal processes occurring cultivation technology comes to gruzopriëmnuyu platform electronic scales. Signal is generated bodyweight random individuals. At this signal as a whole is already possible, but with a very great approximation (a big mistake), to judge the average body weight of individuals around the herd livestock: to accurately assess the need to weigh all the special stage. However, it is technically not possible because of excessive loss of livestock as a result of stress associated with the intervention of personnel, or special additional equipment to the environment of the animals or poultry. Also great performance (labor, energy, deductions for capital investments, etc.) and capital costs.

Therefore, the measured generated, compared and other signals (material objects of information characteristics of processes) in the material activities for the proposed method are subjected to mathematical statistical processing of other relevant generated signals. Produce discrete in time, at the time of sunset on the load platform scales, weighing a random sample of any particular stage in the technology of growing herds of animals or birds, set an alarm technologically minimum number of weighings required. According to regulations of broiler poultry birds weighed amount of a sample of all the many thousands of livestock poultry premises equal to one hundred broilers. Set the signal maximum permissible error of measurement of the average body weight of the individual herd animals or birds, a predetermined signal confidence probability that the signal estimate of the average herd of live weight of an animal or bird in the confidence interval signals random sampling weighing any particular stage. Generates an argument of Laplace. Determine the signal events' placing individuals on gruzopriëmnoy weighing plate and form a signal event weigh, measure the number of events weighing single special stage and form a

signal of arbitrary number of weighings special stage. Measure the live weight of any particular stage, form the signal measured in body weight of any particular stage and stored received signals measured bodyweight arbitrary special stage. Generates an estimate of the expectation of live weight individuals. Generates an estimate of the mean square deviation of live weight of the individual herd. Comparing the generated signal evaluation required sample size with the generated signal arbitrary number of weighings special stage. Depending on the comparison result or continue the process of statistical signal processing individuals weighing arbitrary value in excess of said first signal value of said second signal. Or cease statistical signal processing weighing process arbitrary individuals with equal values of these said signals and values in excess of a second of said signal values said first signal and the additional condition of equality and rises above the number of random values weightings given signal technologically required minimum number of weighings.

The last action is carried out at an additional condition of equality and rises above the number of random values weightings given signal technologically required minimum number of weighings. Using the received signals estimation of the average live weight of the individual herd animals or birds, estimates the standard deviation of live weight of the individual herd, estimates the coefficient of variation in body weight individuals herd, a predetermined signal measurement error estimates the average body weight of the individual herd to fairly inform staff of agricultural premises management or enterprise. This is necessary in the implementation of management actions operators with the technical means to ensure the technology of growing stock, as well as to supply the signals to the appropriate measuring, control and operating inputs automated process equipment management technology growing population.

An additional condition is reached or exceeded a predetermined minimum number of technology weighing has a simple explanation. Let the first two random weighing gave the same result. This means that only two experiments

only once an estimate of the expectation of the average body weight of the individual herd livestock. At the same time, and the variance (power) deviation of the random variable of live weight from its assessment the average rating (from evaluation of the expectation), and the actual standard deviation of the random variable estimation of live weight from its assessment the average rating (from evaluation of the expectation) vanish . Then zero and the coefficient of variation, and this depends on the coefficient of variation of the signal of the desired sample size. Received the value to the desired sample size is formally equal to zero. Then it is possible, it would seem, immediately stop the process of selective weighting, have not even begun to him. However, this conclusion is fundamentally wrong. Continued weighing and follow their results show that the reliability of the signal evaluation of the required sample size is related to the magnitude of the signal and estimates the standard deviation, and the magnitude of the signal sampling error estimates for weighing. Therefore, the task of technology required minimum number of weighings and has a deep theoretical and practical sense.

The first device operates as follows (Fig. 1). Scales with gruzopriëmnoy platform and electronic output (electronic scales) 1 issued a steady signal bodyweight weighed randomly coming to gruzopriëmnuyu platform random individual herds of animals or birds. From the output of the third signal generator weighing an arbitrary number of special stage (can be: sawtooth generator, phantastron, line triggers a pulse counter, etc.) 7 device receives the signal of an arbitrary number of weighings special stage. The first dial the number of mandatory minimum for weighing 2, the second setpoint signal allowable sampling error of measurement of the average body weight of the individual to step 3, the third setpoint signal confidence probability that the signal estimate of the average herd of live weight of an animal or bird in the confidence interval of a random sampling of signals weighing arbitrary special stage 4 and the first argument of the function generator signal Laplace 5 form the corresponding signals.

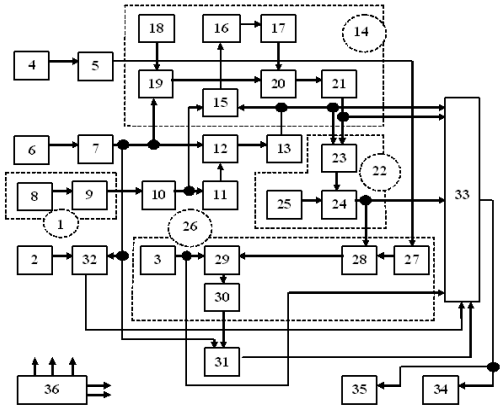

Fig. 1. Functional diagram of an estimate of the average herd of live weight of an animal or bird with a random sampling weigh any special stage on the required sample size:

1 - scales with gruzopriëmnoy platform and electronic output (electronic scales); 2 - first dial the number of mandatory minimum for weighing; 3 - the second setpoint signal maximum permissible error of measurement of the average body weight of the individual herd of animals or birds; 4 - the third setpoint signal confidence probability that the signal estimate of the average herd of live weight of an animal or bird in the confidence interval signals random sampling weighing any individual of any particular stage; 5 - the first argument of the function generator signal Laplace; 6 - the second signal generator weighing events; 7 - the third signal generator weighing an arbitrary number of individual herds; 8 - signal meter live weight single special stage, 9 - the fourth signal generator measured live weight of any particular stage; 10 - the first memory block of received signals measured by live weight of any particular stage; 11 - adder signal measurement of live weight of any particular stage; 12 - divider resulting sum signal to a signal of an arbitrary number of weighings special stage; 13 - the fifth signal generator estimates the average body weight of the individual herd animals or birds (or signal generator evaluation of the expectation of a live weight of the individual herd animals or birds); 14 - the sixth signal generator evaluation standard deviation of live weight individuals herd; 15 - the second calculation unit and generating signals stored signals measured differences in body weight arbitrary special stage and signal

evaluation of the expectation of a live weight of the individual herd animals or birds and storing the calculated and generated signals; 16 - the third block in the construction of the square (second) level and storing the received signals squared differences of signals; 17 - the fourth block summation of squared differences of signals received signals; 18 - the fourth setpoint signal corresponds to a unit amount of weighing; 19 - the fifth block of the difference signal arbitrary number of weighings special stage and the number of signal units weighing any particular stage; 20 - the first divisor sum of squares of differences of signals received signals on the signal difference signal arbitrary number of weighings special stage and the number of signal units weighing any particular stage; 21 - the sixth block of the square root; 22 - seventh signal generator evaluation coefficient of variation in body weight individuals herd; 23 - the second signal splitter estimates the standard deviation of live weight of the individual herd on the signal evaluation of the expectation of a live weight of the individual herd; 24 - the first element of the multiplication result of dividing the signal to a value of one hundred percent; 25 - the fifth setpoint signal values in one hundred percent; 26 - eighth signal generator estimating uncertainty of measurement of average live weight of the individual herd; 27 - sixth setpoint signal argument of Laplace; 28 - the second element of the multiplication of the signal estimation coefficient of variation in body mass of birds flock to the signal on the argument of Laplace; 29 - the third divider; 30 - element in the construction of the square (second) degree; 31 - the first comparison circuit formed by the signal evaluation required sample size to the number of the generated signal of arbitrary weightings special stage, the element taking the square root of the number of signal arbitrary weightings special stage; 32 - the second comparison circuit signal number of random weighing a predetermined signal technologically minimum number of mandatory weigh-in; 33 - driven key to enable the further passage of the device signals reliable estimates; 34 - display unit; 35 - measuring, control and operating inputs automated process equipment management technology growing livestock and the corresponding process; 36 - unit managing device

Blocks, named as the sixth generator 14, the seventh and eighth driver 22 shaper 26, form the corresponding signals from the known mathematical statistics proportions. When comparing the respective signals in the first comparison circuit 31 and the second comparison circuit 32 at their outputs in some moments, and then there are the signals that control the timing of the start time and then reliably inform staff about the options being weighed livestock. These two signals are fed to the control inputs of controllable switch 33. The coincidence circuit is provided in the two-way key input circuit 33, and in order to save space in the description in Fig. 2 is not shown. On the display unit 34 and measuring, control and operating inputs automated processing equipment 35 by the control unit operation of the device 36 is fed highly accurate information on the parameters of a sample weighing animals.

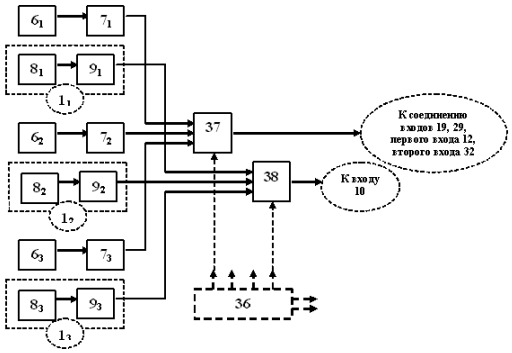

Fig. 2. Additions to the functional circuit (see. Fig. 1) of the device at several electronic scale installed in the workplace or in the area of livestock data (shown in the three elements of electronic scales 11, 12, 13 and three elements of the second generators 61, 62, 63 and Third formers 71, 72 73):

8_1, 8_2, 8_3 - signal meter live weight of single individuals flock; 9_1, 9_2, 9_3 - the fourth signal conditioners measured bodyweight arbitrary special stage in various areas of local habitat livestock in the production area; 36 - the block of management of the device, providing the summation of signals of arbitrary number of random specimens weighing of livestock in different areas, accumulation, storage and summation of random signals weighted bodyweight arbitrary special stage all controlled electronic scale local habitat zones,

excluding overlapping to come in at the same time Number weighing device signals and signals in body weight, producing their respective division in time and their corresponding time delays; 37 - block forming the sum signal of arbitrary number of weighings special stage on several electronic scales in various local areas in habitat livestock premises; 38 - block forming the total signal measured bodyweight arbitrary special stage on several electronic scales in different local areas habitat livestock in the production area

The second device operates as follows (Fig. 2). Scales with gruzopriëmnoy platform and electronic output (electronic scales) 1 provide a steady signal bodyweight weighed randomly coming to gruzopriëmnuyu platform random individual herds of animals or birds. From the output of the third driver in the device 7 receives the signal of an arbitrary number of weighings special stage. The first dial 2, the second dial 3, the third dial 4 and 5 form the first driver corresponding signals. Increasing the number of scales is intended to not only increase the number of weighings. Scales of more than one piece, you can place a workplace or living on the territory of the weighing of livestock that will be further considered and heterogeneity of bodyweight special stage: in fact in different areas of habitat grown livestock conditions can vary quite strongly. This and the presence of drafts, and local (local) and other thermal radiation from the unplaced equipment, different distance line feeding system from its beginning to the feeding herd animals, etc. The presence of a few well chosen technology seats, equipped with weights, significantly increases the accuracy of the estimation of live weight individuals around the herd. Becomes a more complete assessment of uniformity and livestock largest coefficient of variation. Block 36 also eliminates overlapping to come simultaneously from different scales in the number of weighing device signals and signals of live weight, makes them appropriate division of time and their corresponding time delays.

Electronic scales are installed on a concrete floor or other livestock or poultry facilities, such as the house 39, and towers over particleboard or other

bedding litter 40, near the nipple drinkers in the production area for the cultivation of animals or birds, such as chickens (Fig. 3). Placed next to other neighboring troughs, in order to attract additional livestock to an electronic instrument, the duration of the process of sample weighing disconnected from the supply in these fluids to drink livestock. For more inclined surfaces between the floor and the litter and the load surface gruzopriëmnoy platform electronic scales designed to facilitate call it heavy animals, such as broilers in the final stage of their growth.

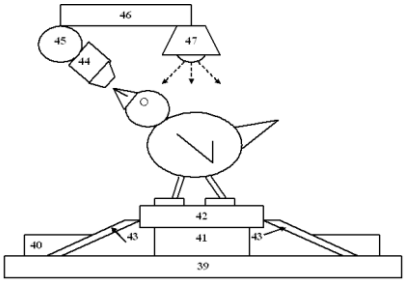

Fig. 3. The general scheme of construction of scales with gruzopriëmnoy platform and electronic output (abbreviated: electronic scales) near the nipple drinkers in the production room for growing broilers with batteries installed additional light to attract fish poultry:

39 - the concrete floor of the house; 40 - chipboard litter; 41 - support of the structure of the balance; 42 - gruzopriëmnaya platform scales; 43 - inclined surfaces between the floor and the litter and the load surface gruzopriëmnoy platform electronic scales in a lateral surface of a truncated cone with circular-shaped horizontal gruzopriëmnoy weighing platform, or as a side surfaces of truncated pyramid with the corresponding polygonal shape gruzopriëmnoy horizontal platform scales; 44 - Nipple drinkers; 45 - section installed in the house water supply for drinking broilers; 46 - mounting plate to a water pipe fittings photomask; 47 - light unit for additional attraction to individuals of livestock gruzopriëmnuyu platform electronic scales

These sloping surfaces may take the form of the lateral surface of a truncated cone with a circular form horizontal gruzopriëmnoy weighing

platform or type of side surfaces of the truncated polygonal pyramid with the corresponding polygonal shape horizontal gruzopriëmnoy weighing platform. Mounted near the electronic balance light unit is designed to attract additional individuals on livestock gruzopriëmnuyu the pan 47 due to the flashing light from the light source to excite the additional interest in an individual close to him and at the same time to climb on the load gruzopriëmnuyu platform. Thus further increasing the number of individuals weighing to accelerate the measurement of live weight and increased accuracy sample estimate of average body weight of the individual herd livestock. Near the weights there drinkers, drinkers neighbors at the time of weighing disconnected from water, just extra light or flashing its light additionally mounted luminaire. Approach to gruzopriëmnoy site lightweight additional ramps. This is extremely important, for example, heavy broiler crosses in the final stage of cultivation. Heavy bird climbs very reluctant to normal the load platform, which rises above the level of particleboard litter.

Conclusions

Technology selective weighting is moving towards the fullest possible reduction of systematic error of measurement of live weight individuals around the herd livestock or poultry. This ensures a given accuracy statistical evaluation of numerical parameters of the process of weighing automated sampling of animals and birds.